ICDLI

International Committee of the Decorative Laminates Industry

Compact formed parts

Manufacturing, processing and application

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 “Compact formed parts” provides information on forming, machining and application of these workpieces.
This technical bulletin is an update and an expansion for the document issued in April 1991 covering the same topic.

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.

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:

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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**.

The structure of compact formed parts either corresponds to that of HPL compact sheets as per EN 438-4 and EN 438-6 or is similar to it. The components are made from the same materials as all HPL as per EN 438 and can contain adhesive layers depending on the forming processes.

Compact formed parts with sturdy, two-dimensional shaped edges are self-supporting elements.

Like compact sheets, compact formed parts have a decorative colour on one or both sides, with a smooth or structured surface and sealed cut edges. They allow new design solutions and attractive shapes, also as combinations with standard compact sheets (see leaflet “Processing HPL compact sheets”). Furthermore, the shaped edges achieve significant mechanical stiffening of the element which can be used structurally.

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* 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. Manufacturing processes

2.1 Manufacturing of compression-formed compact sheets in high pressure moulds

Decorative paper with melamine resin and kraft paper with phenol resin are cured in moulds such as in an S-shaped or L-shaped with defined dimensions using heat and high pressure.

This produces compact sheets with all properties of type CGS/EGS as per EN 438. Any required parts can be cut from these self-supporting formed elements with decorative surfaces on both sides and even uniform thickness (fig. 1).

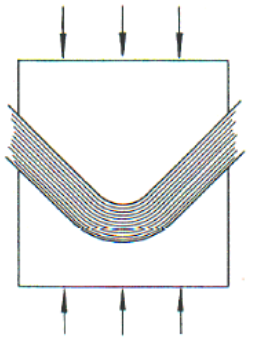

Fig. 1: Compression forming

2.2 Subsequent forming of postforming-modified compact sheets with strip recess

In the area of the subsequent bend, separating strips are inserted during manufacturing to limit the thickness of the compact sheets to under 4 mm on one side. The thickness depends on the desired radius. In the thinner sheet areas, postforming in stationary bending units is possible under heat. After cooling down in a clamping unit, the parts remain formed (fig. 2). The mechanical strength of the rounded areas is determined by the remaining wall thickness.

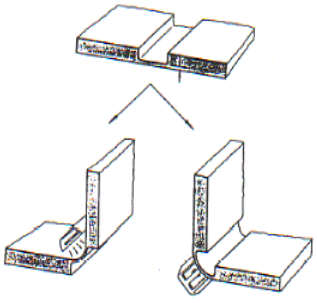

Fig. 2: Process with strip recess

2.3 Forming of postforming modified compact sheets with profiled edges

The modified compact sheet is routed on one side in the areas to be formed to about 1 mm wall thickness, depending on the desired radius, (fig. 3) and formed under heat in stationary bending systems, similar to a postforming sheet.

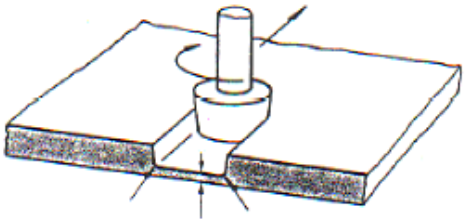

Fig. 3: Routing of a compact sheet for postforming

The remaining hollows are filled with curing resins while still in the clamping device or strengthened by inserting mating parts (fig. 4). Excessive overheating must be avoided during the routing process to avoid endangering the postforming properties.

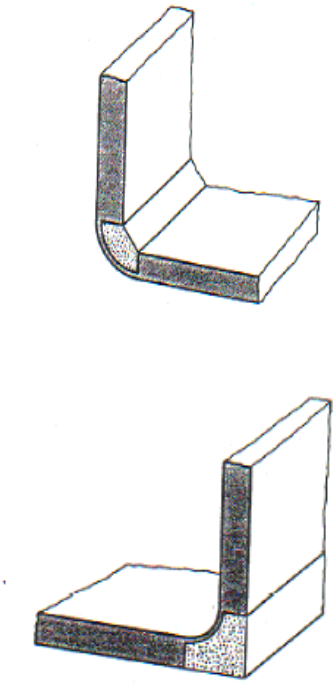

Fig. 4: Filling in routed parts

2.4 Manufacturing of formed parts from postformed HPL and compact sheets

The compact sheet is routed before adhesion in the areas to be formed later on (fig. 5) or filled with a spacer strip (fig. 6). Another option is to join two compact sheets as a carrier at the intended angle and to rout off the shaped edges. An HPL sheet is adhered to the surface prepared in this way (fig. 7).

Lateral, convex shaped edges can then be produced according to the different processes. After routing on the rear side or removing the spacer strips, the concave shaped edge is produced. Adhesion of the non-absorbent parts requires previous sanding and the use of solvent-free two-component adhesives.

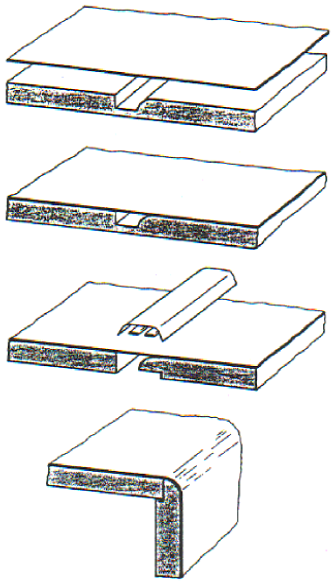

Fig. 5: Compact sheet with routed sections

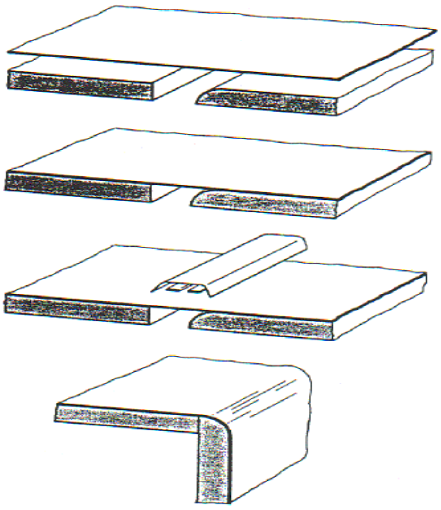

Fig. 6: Compact sheets made from pre-routed parts

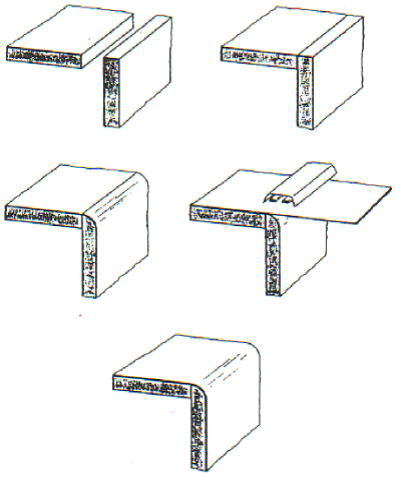

Fig. 7: Joined compact carrier sheets

2.5 Manufacturing of compact formed parts from individual HPL layers

HPL sheets with a thickness up to 1 mm are layered with kraft sheets sanded on both sides to produce sheet packages in the desired thickness and then joined in clamp moulds using solvent-free two-component adhesives (fig. 8). This technology follows the manufacturing process for laminated wood from individual veneers. Adhesion of the non-absorbent HPL layers with sealed joints places high requirements on the manufacturer. This allows the production of formed parts with decorative surfaces on both sides, even thickness and radii from about 100 mm.

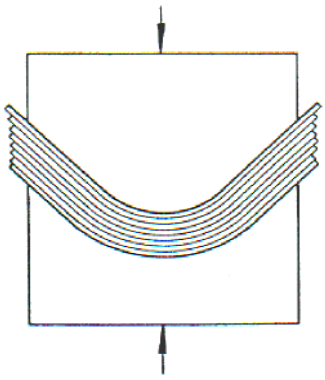

Fig. 8: Compact formed parts made from individual HPL layers

2.6 Manufacturing formed parts from compact sheets with integrated thermoplastic slip and adhesive layers

For forming, the area from the desired binding point to the edge is heated and the entire sheet is formed in a stationary bending unit. This softens the thermoplastic layers, allowing the HPL kraft layers to move against one another to create the desired bend.
After cooling down in the clamping device, they create a permanent bond again. These formed parts with decorative surfaces on both sides have the same thickness in the shaped and in the flat area.

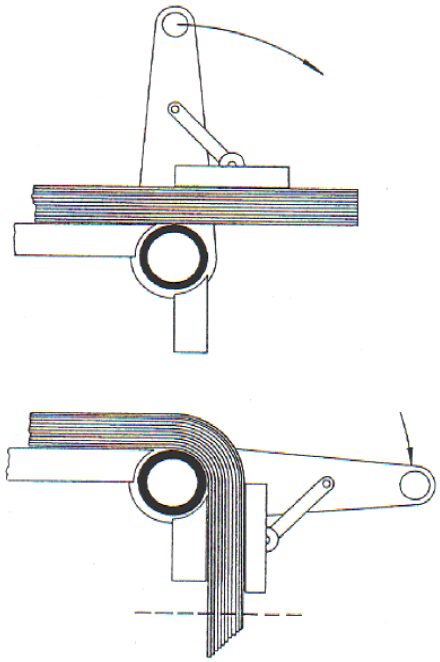

Fig. 9: Forming process using the integrated sliped layers

2.7 Shape examples

Depending on the manufacturing process, formed parts with a decorative surface on one or both sides are produced, with rounding radii between usually 10 and 50 mm. Larger radii are also possible. The workpiece length is limited by the delivery formats or the bending units. The forming options largely depend on the manufacturing process (see table in chapter 3) and have to be agreed with the manufacturer of the element. The examples in figures 10 – 12 are not a complete list.

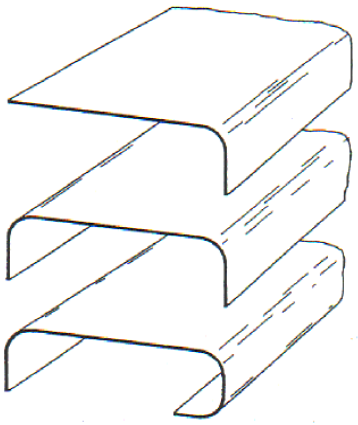

Fig. 10: L-shape and U-shape

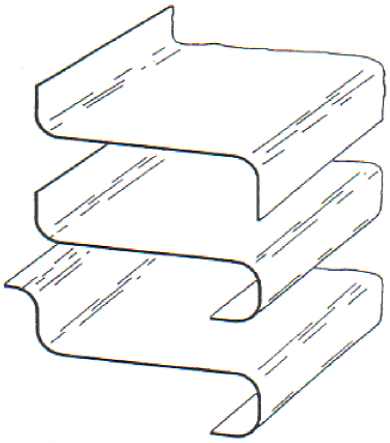

Fig. 11: S-shape

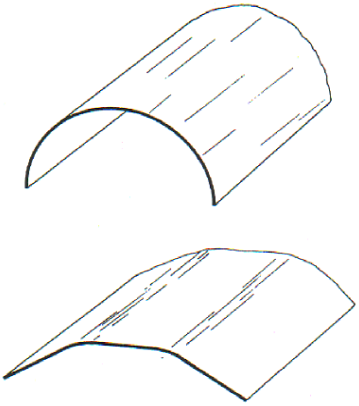

Fig. 12: Special shapes

3. Typical characteristics of the formed parts according to the individual manufacturing processes

The following tables provide an overview of the properties for the manufacturing processes described in section 2:

Structure and design of the compact formed parts	Manufacturing process					
	2.1	2.2	2.3	2.4	2.5	2.6
HPL surface properties per EN 438	+	+	+	+	+	+
Filling the routed shaped area with resin		+	+			
Additional adhesive layers				+	+	+
HPL on both sides	+			+	+	+
Wall thickness evenly thick and the same colour across the entire profile	+				+	+

Forming options	Manufacturing processes					
	2.1	2.2	2.3	2.4	2.5	2.6
Shape type L	+	+	+	+	+	+
Shape type S	+	+	+	+	+	+
Shape type U		+	+	+	+	+
Triple rounding		+	+			+
Large curves			+		+	+
Folding angle, acute: 60°		+				+
Folding angle, right angle: 90°	+	+	+	+	+	+
Folding angle, obtuse: 120°		+	+		+	+
Folding angle, obtuse: 135°		+	+		+	+

The compact sheets formed according to 2.1 to 2.6 have the same properties and areas of application as unformed compact sheets.

4. Machining

The basic machining process is described in the leaflet “Processing HPL compact laminates”. Some special requirements must be observed for machining due to the rounding of the compact formed parts. Care has to be taken especially when handling large parts in order to avoid damage.

4.1 Longitudinal edges

The longitudinal edges can be machined with saws and routers.

4.2 Transverse edges

Machining of the transverse edges requires great precision to achieve perfect cut edges especiately in the shaped areas on both sides and to avoid chipping in the covering layer.

Special saws and routers allow accurate tracing of the rounded contours with precise control of the exit angle. If these machines are not available, saw cuts without chipping on both sides can be achieved by swivelling the element along (on auxiliary slides), slow feed rates and changing the immersion depth of the saw blade. This requires some practice. Re-sanding and chamfering increase the visual quality of the edge.

4.3 Cutouts and fastenings

Cutouts are produced with compass saws or routers using templates. The corners always have to be rounded for inner recesses or cutouts. The inner radius should be as large as possible (>= 5 mm).

Please refer to the leaflet “Processing HPL compact laminates” for fittings and fastenings.

5. Application

Due to the excellent material properties, compact formed parts can be used indoors virtually without limitations. To make the best possible use of the options, obtain advice from the manufacturer. This particularly applies to areas with very high requirements for the material.

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

5.1 Interior construction and furniture

The varied options for shaping allow equally attractive solutions for furniture design and interior work, e.g for wall panels, handrails, wall protection, light strips or window sills.

The folded edges provide significant mechanical stiffening so that compact formed parts have the advantage of economical use of self-supporting, rounded structural elements, e.g. in shower rooms or as changing cubicles.

As the roundings greatly reduce the risk of injuries, compact formed parts are suitable as self-supporting, protective panel elements for columns or corners as well as for washbasin panels.

Technical panels can also be very attractive as compact formed parts, e.g. panels for concrete support beams in public swimming pools, cable conduits, panels for electrical / plumbing installation boxes or fuse boxes.

In the traffic and transport industry, compact formed parts are also used for dividing walls, fillings for staircase handrails or bus entryways.
In sports and leisure, compact formed parts have proven successful as benches in changing rooms.
Other applications can be found in hospitals as work tables, beds, laboratory tables, night tables or patient cabinets as well as in shop fittings.

5.2 Outdoor application

HPL compact formed parts are ideal for use in areas exposed to moderate outdoor conditions which 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 formed parts, although without affecting the suitability for use.

Note:
Compact formed parts for applications requiring third party certification or manufactures approval are not covered by this leaflet.

6. Cleaning and maintenance

HPL compact formed parts require no special care. The leaflet “Cleaning of HPL surfaces” provides details about cleaning and care.

Appendix: Application examples