BANOVA®

VERSION 08/2017

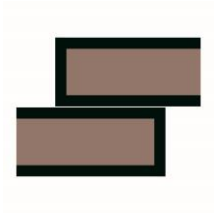
Easy manufacturing. With BANOVA®.

This is a compilation of recommendations and practical solutions for fastening and processing of BANOVA®. Standard solutions were collected from various market segments and applications, where they were tested and approved in daily use. This collection will be continuously updated with recent fastening and processing technologies.

We understand the following information as a support to the craftsman to make a quick and precise choice for fastening solutions and processing technologies for the use of BANOVA®.

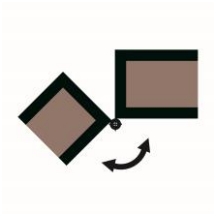
Corner Connection

Connections of the panel edge to a surface between BANOVA® and other materials



Face Connection

Face to face connections to components with BANOVA® inside



Hinges

Application of movable hardware

Processing

Techniques and parameters for BANOVA® processing

Planning

Tables and formulas for planning with BANOVA®

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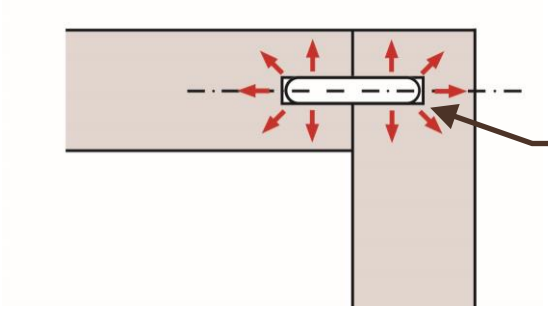
Bonded joint with wood dowel

Fast drilled and inserted in an industrial process. The standard connection with wood dowels is efficient due to a high drilling performance and a perfect bond in the panel core.



Easy and quick positioned and assembled. The glue penetrates deep into the wood structure during the assembly of the edge joint. Therefore the bonding performance with liquid glue is notably better in BANOVA® than in common wood based panels.

Advantages

- Invisible, durable joint
- Fast and simple standard joint made with manual drilling tools or on fully automated drilling stations
- Components are directly positioned at the right spot, which allows a fast assembly
- Highly versatile application also in combination with connecting fittings for interior components and furniture

Source

Your regional hardware supplier

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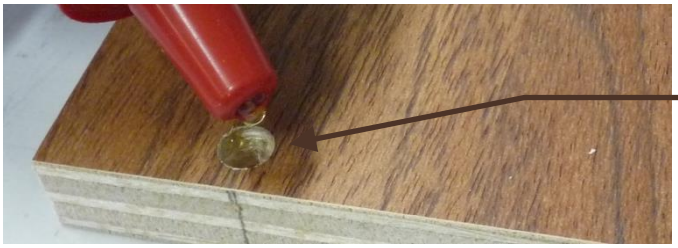
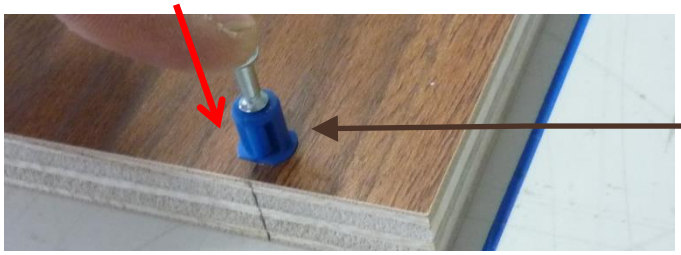
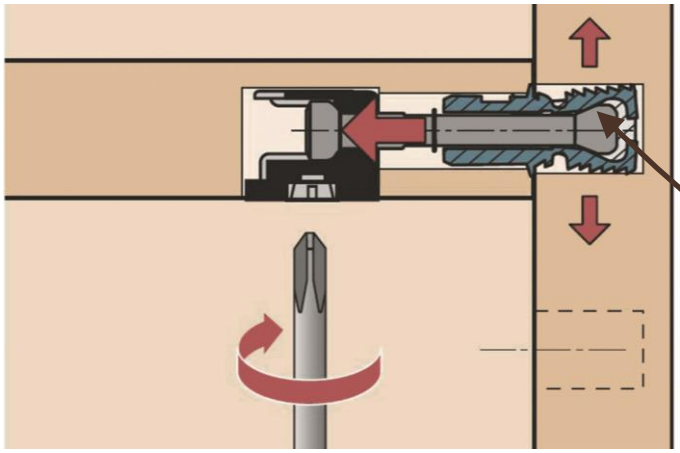
Cam Fitting for Furniture– *Rastex Rapid*



Drilled like a standard wood dowel with little PU mounting adhesive into the hole for a durable joint.



The plastic dowel is manually mounted and the components are positioned directly at the right spot likewise to the assembly with wood dowels.



Easy and quick assembly, with a single turn of a screwdriver the plastic dowel expands and the glue is pressed deep into the wood structure of the panel core. The deep anchorage of the glue in the wood structure is the relevant advantage compared to common wood based panels.

Advantages

- Full prefabrication on automated drilling machines or with CNC machinery
- Easy mounting of components with a screwdriver
- Economic shipment of furniture components as flat pack. Connectors are mounted just before assembly
- Durable connection due to perfect bond into the wood pores

Source

www.hettich.com

Dowels:	Rapid S DU 324 / DU 325
Cams:	Rastex 15

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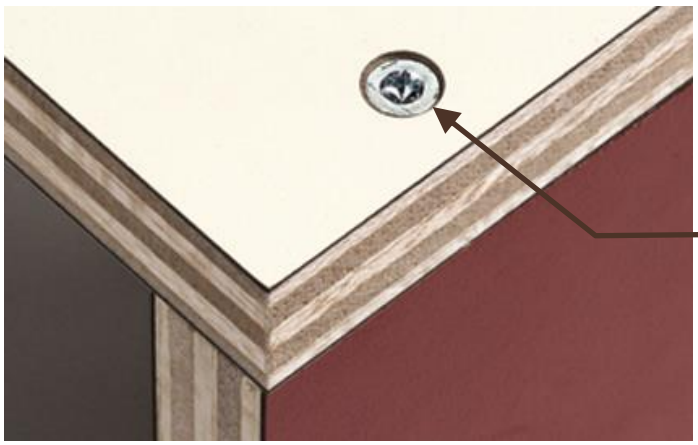
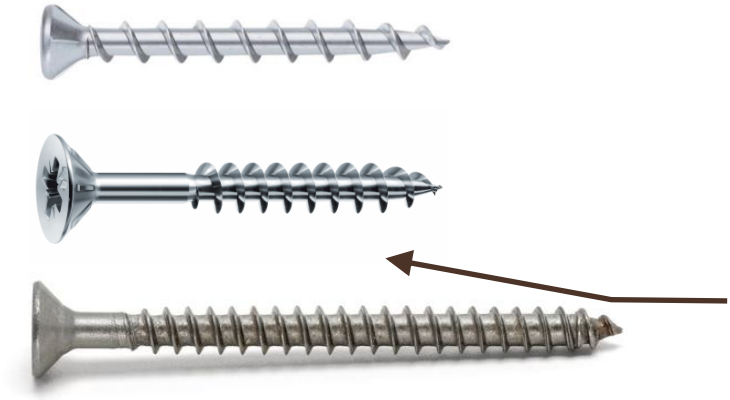
Direct Screw



The perfect corner connection without pre-drilling.
Thanks to the solid panel core long and strong screws are directly applied without the risk of panel splitting.
The screw is also used in combination with dowels for positioning and liquid glue or double-sided tape for enhanced resistance and vibration constraint.



We suggest standard screws with a deep screw thread that anchors profoundly into the wood structure of the panel core. The strength of the connection is optimized by increasing screw length, diameter and especially head diameter.

Advantages

- Quick and efficient assembly
- Immediate fixation and no waiting time for further processing
- High flexibility in design and construction of individual furniture
- Broadly approved fastener

Source

Your regional hardware supplier
www.wuerth.com Würth *FBS* or screws for particleboard
www.spax.com *Spax* screws for particleboard
www.sfs.biz *ferronorm* screws for particleboard
www.bossard.com screws for particleboard

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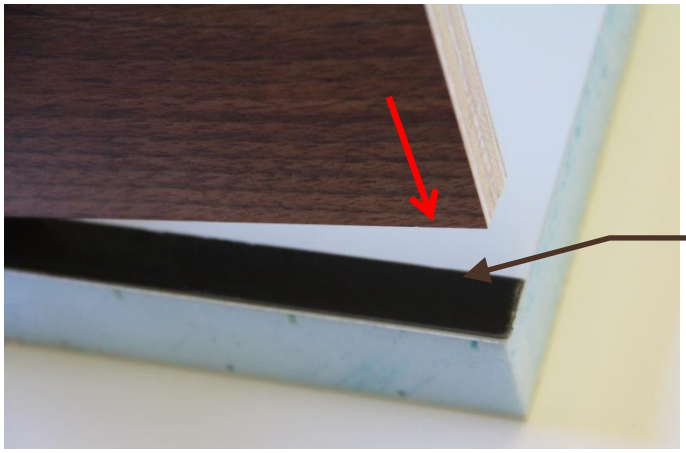
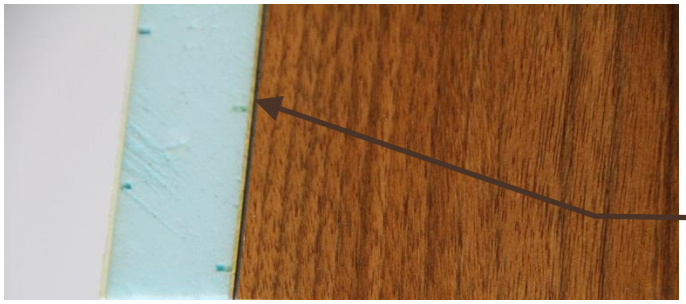
Double Sided Adhesive Tape – Easy Bonding



Double sided adhesive tapes are perfect for all connections between laminated or coated surfaces. Due to the large bonding area this connection method is significantly more efficient than punctual fasteners. It is furthermore easy and quick to apply and compared to the use of liquid adhesive any contamination is easy to avoid.



The durable elastic bond with double sided adhesive tape is preferred for mounting of parts and components with high stress or vibration impact. A typical application is the fixation of furniture elements to a floor or a wall where the cabinets contribute to the stiffness of the vehicle structure.

Advantages

- Invisible and durable connection
- Clean application without risk of contamination
- More efficient work flow due to immediate bond after joining of the parts (no curing time)
- Easy to combine with positioning aids as for example wood dowels, cam fittings or standard screws

Source

www.aftc.eu – SilverTapes
www.3m.com – 3M™ VHB™

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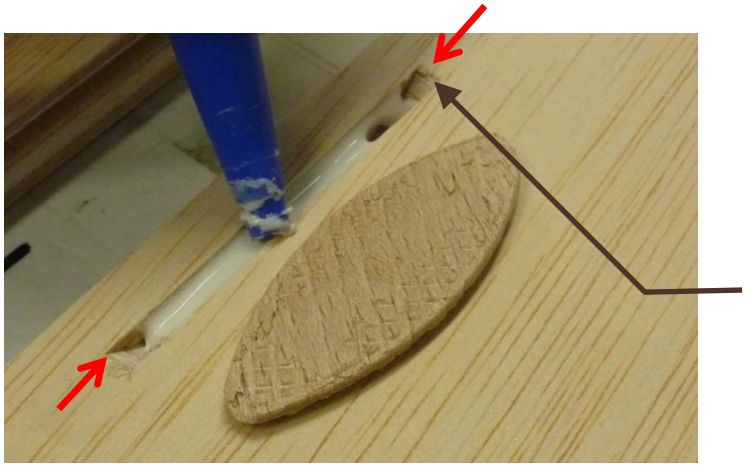
Adhesive Bond with Lamello - Bisquits

Wood biscuits are highly effective as connection for individual furniture of small lot sizes. Manufacturing is simple from milling with power tools to mounting with an adequate glue dispenser. The biscuit shaped notches are milled from the craftsman in a very flexible, but highly accurate way.



The shape makes the strength of this connector. Since it requires only partial notches of an organic biscuit shape, the panel structure is not weakened as it would be by a thorough notch. Nevertheless, the surface of the lamello provides a great bonding area that anchors in the panel core. At the stage of assembly, the lengthwise orientation of the connector allows a slight shift and quick alignment of the components.

Advantages

- Invisible and durable connection
- Fast and easy standard connection made with the help of power tools or CNC equipment
- Simple aids for glue application makes it easy to avoid contamination with adhesive
- Highly flexible and versatile use also in combination with various furniture connectors

Source

Your regional hardware supplier
www.lamello.com

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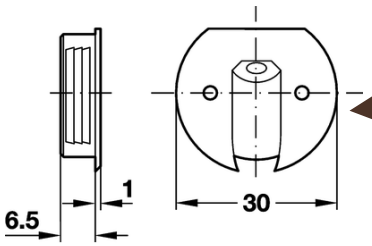
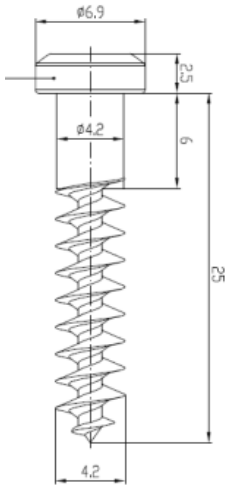
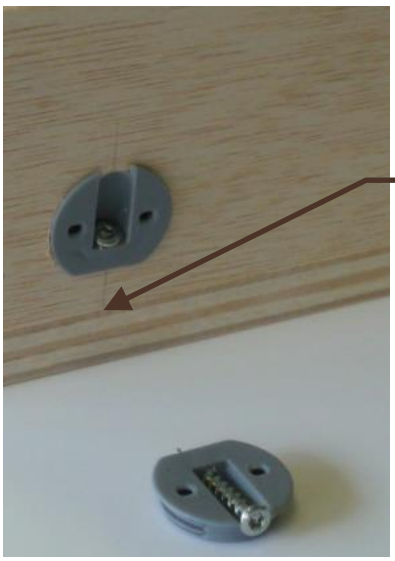
Furniture connector for RV with ecosyn® PXL



Easy insert of standard furniture connectors to press fit.





Free mounting or defined positioning with dowels.
Specific screw design of ecosyn® PXL screws ensure maximal vibration resistance and avoid overwinding.
No pre-drilling in panels needed.

Advantages

- Resolvable joint for free positioning
- Outstanding pull-out and vibration resistance of ecosyn® PXL screw (>40kg per 10mm of screw thread)
- Convenient joint which provides high cost efficiency and maximal flexibility in furniture assembly
- Highly versatile use also in combination with dowels, adhesive or double-sided tapes for positioning and assembly

Source

ecosyn® PXL screw: www.kvt-fastening.de/
Press fit furniture connectors: www.haefele.com

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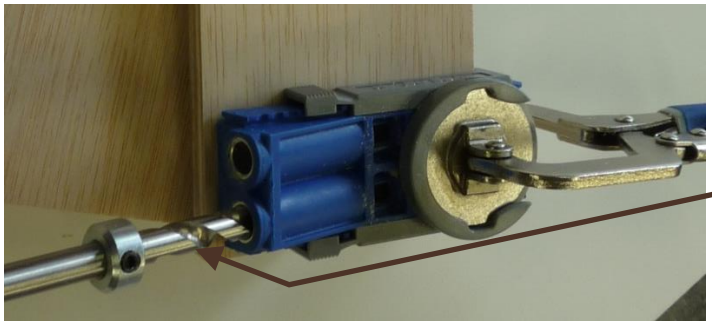
Pocket hole screw joint



Fast and flexible drilled by hand with simple drilling jig or automated on a CNC router.

Easy and quick assembled and connected. Combination with dowels, wood bisquits, adhesive or double-sided adhesive tape

Advantages

- Fast and flexible application in various connecting positions
- Great performance due to transverse screwing (>25kg per 15mm of screw thread)
- Screw positioning is possible directly at the panel edge. Several screws can be combined on a small area.

Source

www.kregtool.com

Tools, screws and jigs from your local hardware supplier

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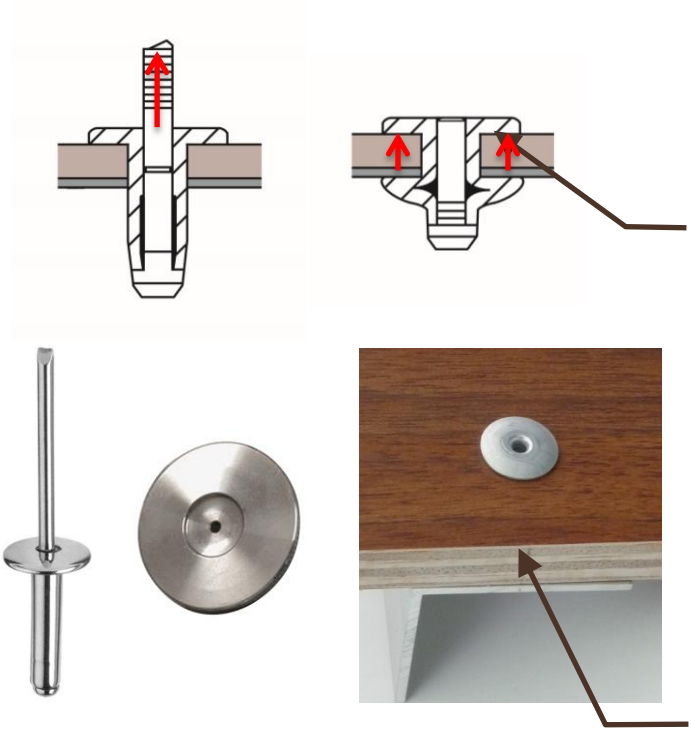
Mounting by Rivet



16mm rivet with appropriate setting tool

Mounting of panels to metal frames with rivets is simple and provides high process stability. The accurate and reliable mounting procedure is secured by using a big headed rivet in combination with the adequate rivet setting tool. The rivet head is evenly set with minimal tolerance and without tapering into the panel surface as often seen when mounting with screws.

The form-locking connection with rivets is unobtrusive but nevertheless efficient since the load is firmly supported by the surface of the flat rivet head. Single suspensions are made by positioning a perforated metal sheet or a large washer behind the panel and set the rivet through the panel into the back support.

Advantages

- Visible but unobstrusive fastener
- Form-locking connection
- Predrilled panels can be used as mounting jig for predrilling into the sub-structure
- Only removable with drilling tools
- Flexibility of later positioning of single suspensions

Source

www.gesipa.com
www.mbe-gmbh.de/

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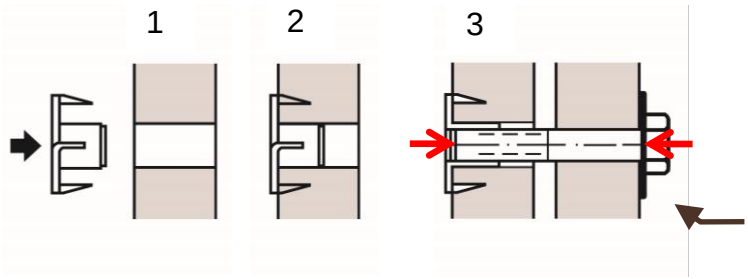
Bolt Fastening into Tee Nut



The tee nut is driven into a predrilled hole from the back of the panel and some versions are also bonded to the back face for fixation and twist locking. Bolts are set from the face to obtain an end-to-end connection between two components.
The load distribution on the surface and in the panel core allows punctual fixations for high loads with durable resistance.

There is a big range of different shapes and models of tee nuts available on the market. However, once mounted, they look all the same from the front: Only a bolt or a hole is visible as mounting point.

Advantages

- Fastening into metal thread enables for countless mounting and replacement
- Distribution of high point loads by form closure
- Exact positioning of inserts by automated drilling and fastener mounting
- Especially recommended also for dynamic loading

Source

Your regional hardware supplier
www.rampa.com
www.kvt-fastening.com
www.jetpress.de; www.jetpress.com

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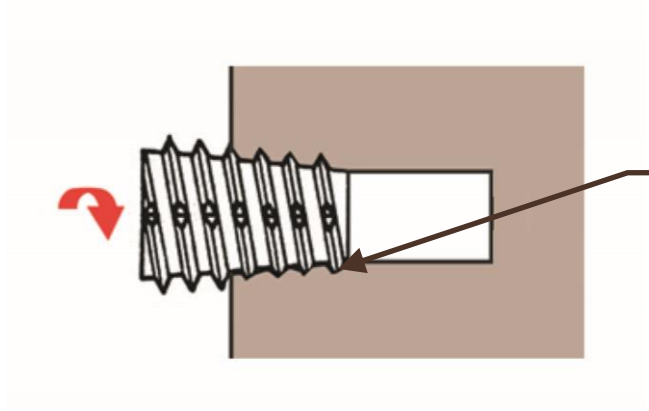
Screw Nut Insert



Screw nut inserts are positioned into the surface or the edge as defined support points for metric bolts. Highest performance is obtained by little additional mounting adhesive that penetrates into the wood and adheres to the nut thread.

Various sizes and designs are available for specific uses. For the adequate performance in the light BANOVA® panel we suggest the choice of nuts with deep thread and maximal possible diameter for optimal load distribution in the panel. It is crucial, that the thread cuts into the wood and builds up compression in the pre-drilled hole by its own shape. Therefore the holes must be drilled with a smaller diameter than used in dense hardwoods.

Advantages

- Fast drilling and insert from the visible panel side
- Countless mountings and replacements provided by metric metal bolts
- Equal distribution of high point loads into the panel
- Exact positioning of fasteners by automated drilling and mounting

Sources

Your regional hardware supplier

www.rampa.com

www.jetpress.de; www.jetpress.com

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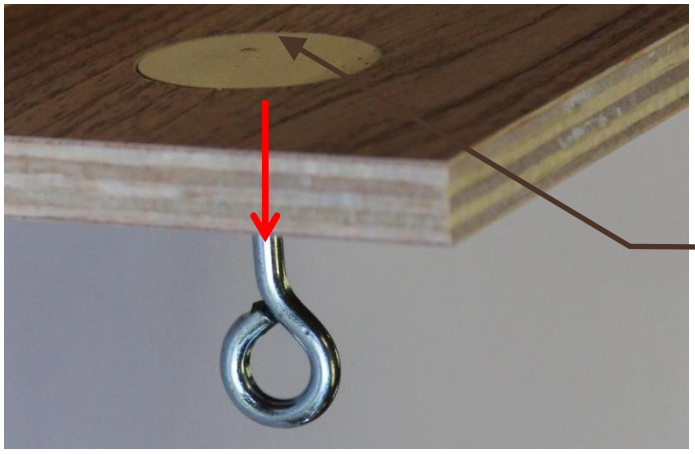
Wood Insert for Direct Screwing

The wood insert is bonded with a common wood glue or specific mounting glue into the predrilled hole and positioned evenly into the panel surface. The insert is used as a local anchorage for fasteners and supports high loads over the large bonding surface. Most efficient are inserts out of hardwood plywood.



Wood inserts are recommended to mount high point loads with common screws. For maximal efficiency the wood inserts are applied from the back side of the panel and screws are inserted from the front side which provides a highly reliable form closure.

Advantage

- Fastening in well-known wood material
- Reinforcement only at the required positions
- Manufacturing in manual or automated application processes

Source

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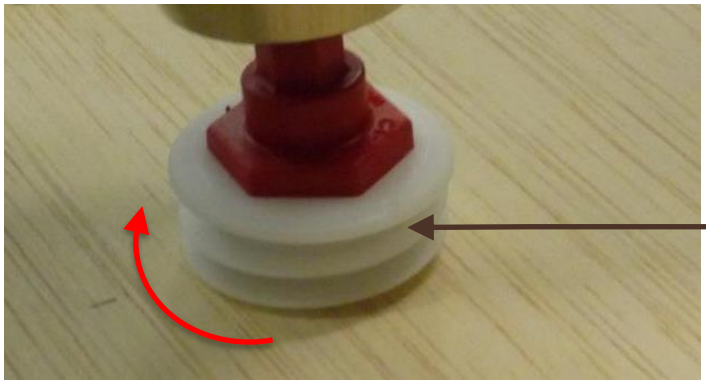
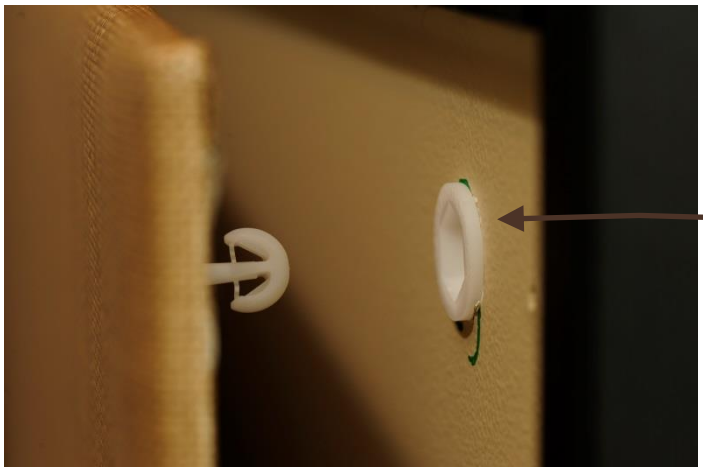
Clip Connector - *Fastmount*



The distinctly deep plastic thread cuts deep into the solid panel core, and thus provides permanent mechanical anchorage.



The big sized connectors resist dynamic loads in form of several mounting and dismounting as well as vibration impacts. Thanks to the BANOVA® lightweight and its form stability you will need fewer fasteners for panel mounting.

Advantages

- Invisible mounting
- Quick mounting and replacement with a simple click and without tools
- Reduces mechanical stress and vibrations between different components
- Allows high degree of pre-fabrication for interior modules (walls and furniture)

Source

www.fastmount.com

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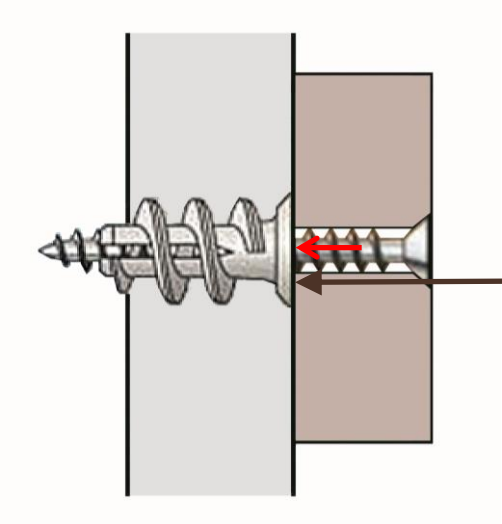
Lightweight Construction Anchor



The plastic or metal anchors are screwed into the panel surface or into the edge without pre-drilling. The deep thread of the anchor cuts well into the core, and provides a thorough hold in the light BANOVA®.

Lightweight construction anchors are offered from various suppliers in diverse forms and configurations. Mounting directly into the anchor is done with a defined standard screw, a metric bolt or with a nut onto an anchor with bolt head.

Advantage

- Fast and flexible mounting from the visible side
- Anchoring of high loads in the full thickness
- Simple definition of fastening points on a panel surface or edge
- High flexibility of anchor positioning – still possible at the very last manufacturing stage: Interior mounting

Source

Your regional hardware supplier
www.mungo.ch - MJP Metal Jet Plug
www.wuerth.com - Plasterboard Fixing W-GS
www.fischer.com – Plasterboard Fixing GK

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Hardware Mounting with Standard Screws

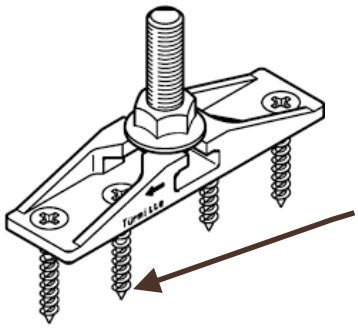
Standard screws are not only used for easy assembly of furniture, but also to mount hinges and other fittings. A rule of thumb is to use 4-6mm strong screws with a length of 3-4 times the thickness of the panel that has to be joined.

Average screw extraction forces were tested with standard *ferronorm* screws into the surface of a 15mm panel. The panels shall not be pre-drilled.

Average screw extraction force at 15mm screwing depth

Screw diameter	BANOVA® **PLY**	BANOVA® **PLUS**	BANOVA® **HDF**
6.0mm	28kg	46kg	35kg
5.0mm	28kg	37kg	35kg
4.5mm	24kg	34kg	30kg
4.0mm	24kg	34kg	30kg

Example for use:
With a standard screw 5 x 90 and a screwing depth of 60mm a maximal extraction force of 112kg is obtained per screw.
A sliding door of 3000 x 1200 x 40mm consisting of a BANOVA® PLY core and HPL decorative faces has a total weight of 38kg (10.4kg/m^2).
This low weight is easy supported by standard hardware and can be mounted with two standard screws. Concealed edge bands or other special inserts are not required. The hardware is less loaded, the door is easier to move but still solid.



Mounting hardware for sliding doors and hinges for swinging doors works well with standard screws.
Pre-drilling is no required since there is no spitting risk even when screwing close to the edge
Easy to fabricate a durable joint without edge bands or special inserts.

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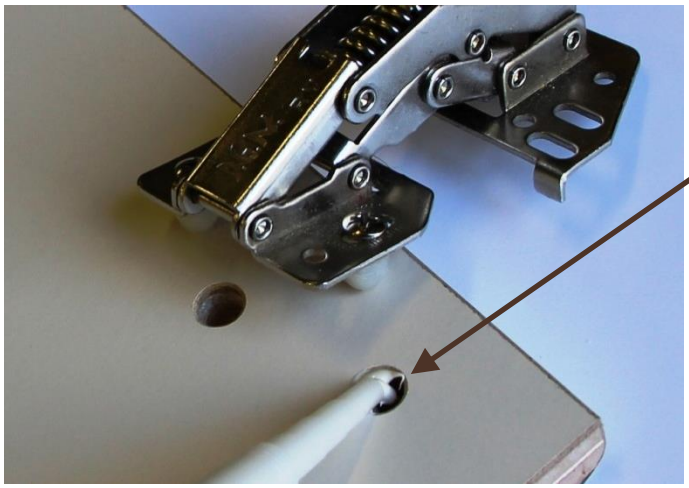
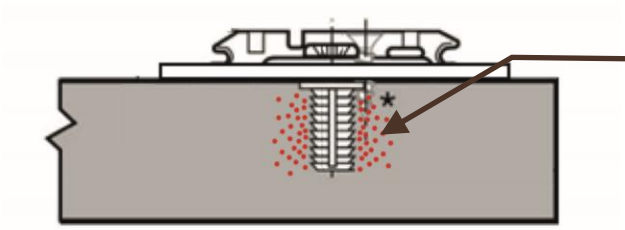
Flap Hinge for Press Inject



Hinges are injected into pre-drilled holes on the door edge. A durable firm hold of the plastic dowels against vibrations and dynamic movements is ensured by a small drop of mounting adhesive into the pre-drilled hole prior to hinge mounting.



The strength of the described connection is shown after curing as a rigid and durable joint between the door and its hinge, which results in high resistance against dynamic loads.
The adhesive penetrates deep into the porous panel core and provides firm and durable anchorage – better than in dense wood based panels as for example MDF.

Advantages

- Lower stress to hinges thanks to lighter and more form stable door
- Popular standard hinge with high acceptance level
- The process step of adhesive application is easy to be implemented in the standard procedure
- No risk of contamination due to clearly defined adhesive application into the pre-drilled hole

Source

www.dgnhinges.com/

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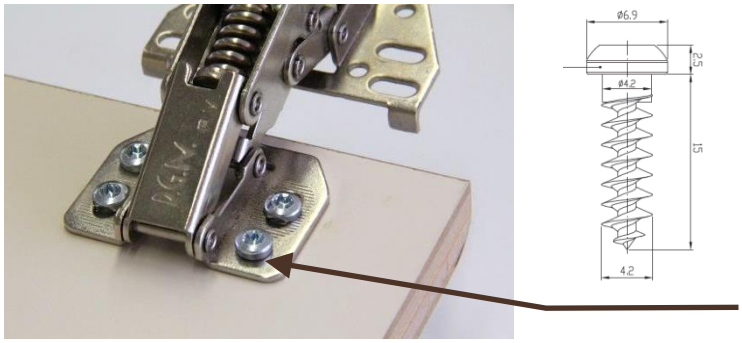
Mounting hardware with ecosyn® PXL screws



The screw ecosyn® PXL is very practical for screwing heavy loaded hardware like hinges to a door or a furniture side. This screw was specifically developed so that the screw thread cuts well into the wood and provides durable anchoring in the panel.
The special thread design provides maximal pull-out force from a very limited area

Advantages

- Cost efficient mounting without dowels, inserts or adhesive application
- Free positioning of hardware on the panel surface
- High process reliability due to adjustable tightening torque

Source

www.kvt-fastening.de/

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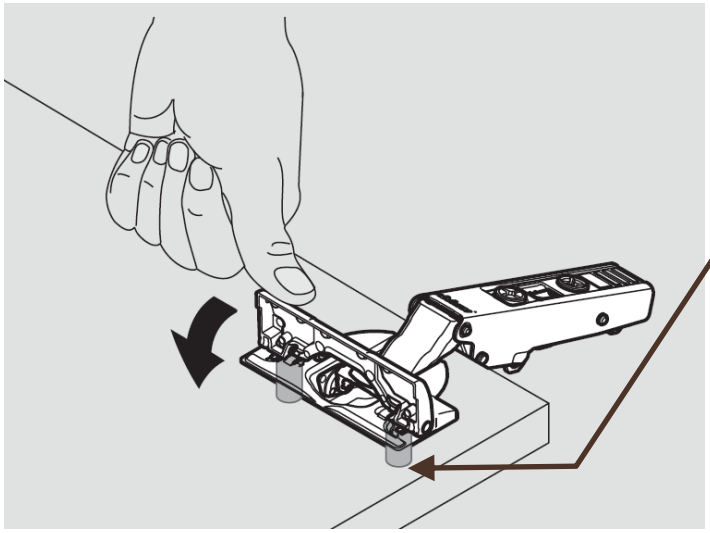
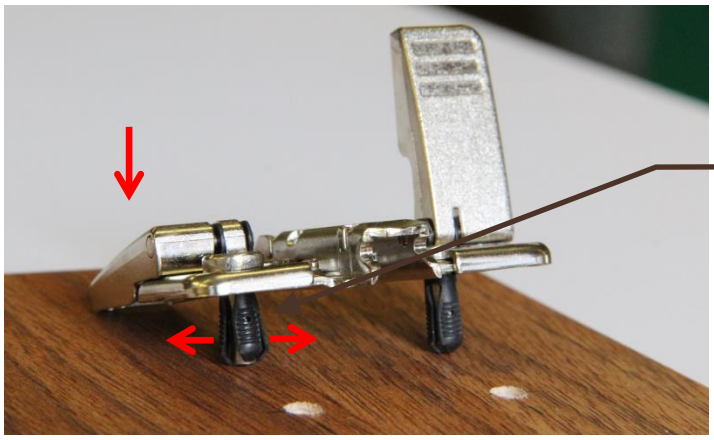
Concealed Hinge – *Blum Inserta*



This hinge is not just quickly mounted; it also anchors tightly in the panel core by the expansion of the plastic dowels in the predrilled holes. Lighter components reduce also stress to the hinges caused by vibration and dynamic impact. As a result it enables to apply less hinges or design bigger doors.



The mounting plate is also fastened by the expansion mechanism of a plastic dowel in the panel core. The accurate fit of the hardware in the standard holes ensures also durable hold against vibrations.

Advantages

- Quickly mounted – tool-free boss fixing
- Reduced load impact to the hinges due to light and stable doors
- Standard hinge with wide distribution and high varieties for special solutions
- Simple packaging and logistic as flatpack furniture (hinges separate to components)

Source

www.blum.com

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General Information and Processing Guide Values

- BANOVA® is a solid wood material and can be processed as such
- Reduced processing forces allow also reduced clamping and pressing of panels in the production process (<2.5kg/cm^2). At higher processing pressures and clamping forces there is a risk of surface damage.
- Best processing results were experienced with:
  - High cutting speed
  - Positive tooth geometry
  - Positive angle of cutting edge
- The low cutting resistance and homogeneous panel density allow higher feed rates and an increased processing performance over all.
- An efficient dust extraction is fundamental for best processing results and long service life of the tools. In practice, the light chips and dust from processing are easily extracted by suction.
- Dirt and foreign particles as stones, sand or metal parts are fully avoided in production and the used glue is unfilled. This provides a long service life of any tungsten carbide and polycrystalline diamond tipped tools.

Contour milling and nesting

Shank-Type Cutters VHW – Spiral positive / negative with shaft angle

Application

- CNC-Routers
- Smoothing and finishing of cutouts and contours
- Milling into surface with simultaneous feed z-axis and x- or y-axis

Tool details

- Shaft angle to both sides
- n_{max} = 30’000min^{-1}
- Diameter = 8, 10, 12, 16, 18mm

Recommended parameters

- Shank type cutter VHW – spiral positive / negative with shaft angle Z = 2+2
- Revolution speed n = 24’000min^{-1}

Diameter = 12mm (Ident. Nr. 180872)

- Feed speed v_f = 3m/min in parallel feed
- Tooth feed f_z = 0,063mm

Advantages in BANOVA®

- Easy milling into the surface with little cutting resistance
- High feed speed due to low cutting pressure
- Long service life of tools thanks to the tool friendly bond and homogeneous density distribution

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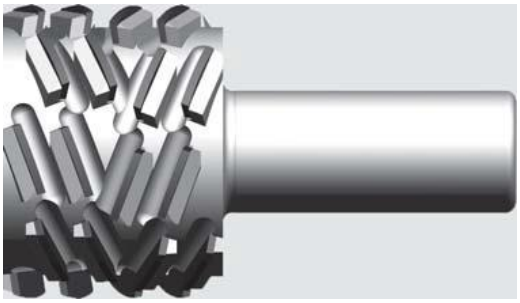
Contour milling

LEUCO P-System Shank-Type Cutters

Application

- CNC-Routers
- Smoothing and finishing of contours along and across the grain without fraying
- Processing of components with high end surface without graying especially also in materials with fiber content



Tool details

- Symmetric and asymmetric possible
- Extremely oblique shearing
- Long service life of PKD-cutters with extremely high cutting quality
- Diameter = 12, 48, 60mm

Recommended parameters

- P-System High-Performance Jointing Shank-Type Cutters CM, DP
- Z = 4+4
- Revolution speed n = 24’000min^{-1}

Diameter = 12mm (Ident. Nr. 180872)

- Feed speed v_f = 3m/min in parallel feed
- Tooth feed f_z = 0,125mm

Advantages in BANOVA®

- Perfect cutting edges
- High feed speed thanks to low cutting pressure and oblique shearing
- Long service life of tools thanks to the tool friendly bond and homogeneous density distribution

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Dowel and Pattern Drilling

Dowel Drill Bit HW – Topline

Application

- Portable boring machines
- Automatic boring machines
- CNC machining center
- Drilling of holes without fraying

Tool details

- Secure guidance by centering point
- Long service life of tungsten carbide cutters (HW)
- Right and left spiral available
- Diameter = 4, 5, 6, 8, 10mm (Ident. Nr. 178695 bis 178704)

Recommended parameters

- Revolution speed n = 4’500min^{-1}
- Feed speed v_f = 1.5m/min

Advantages in BANOVA®

- Chip-free hole edges
- High feed rates possible due to homogeneity and low density of panel
- Efficient chip conveying
- Long service life of tools thanks to the tool friendly bond, the homogeneous density distribution and no foreign particles in the panel

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Dowel and Pattern Drilling

Dowel Drill Bit HW - with back-guide

Application

- Portable boring machines
- Automatic boring machines
- CNC machining center
- Drilling of holes without fraying

Tool details

- Secure guidance by centering point
- Protection of hole edges during return stroke provided by the back-guide
- Long service life of tungsten carbide cutters (HW)
- Right and left spiral available
- Diameter = 4, 5, 6, 8, 10, 12, 13, 14, 15, 16mm (Ident. Nr. 166107 bis 167199)

Recommended parameters

- Revolution speed n = 4’500min^{-1}
- Feed speed v_f = 1.5m/min

Advantages in BANOVA®

- Chip-free hole edges
- High feed rates possible due to homogeneity and low density of panel
- Efficient chip conveying
- Long service life of tools thanks to the tool friendly bond, the homogeneous density distribution and no foreign particles in the panel

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Cylinder Boring

Cylinder Boring Bits HW - Z=2+2

Application

- Automatic boring machine
- CNC machining center
- Drilling holes for hardware insert without fraying

Tool details

- 2 rakers, 2 spurs and centering point
- Long service life of tungsten carbide cutters (HW)
- Right and left spiral available
- Diameter = 15, 16, 18, 20, 22, 25, 26, 30, 35, 40mm (Ident. Nr. 003303 bis 182260)

Recommended parameters

- Revolution speed n = 4’500min^{-1}
- Feed speed v_f = 1.5m/min

Advantages in BANOVA®

- Chip-free hole edges
- High feed rates possible due to homogeneity and low density of panel
- Efficient drilling and chip conveying
- Long service life of tools thanks to the tool friendly bond, the homogeneous density distribution and no foreign particles in the panel

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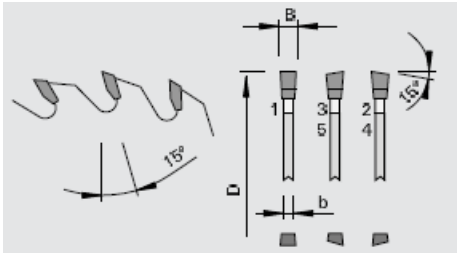
Sizing with circular saw

Sizing Saw Blade HW „G5“

Application

- Table saw
- Chop and miter saws
- Panel sizing saws
- For chip free sizing cuts as well as clipping and miter cuts



Tool details

- Tooth form: G5
- Long service life of tungsten carbide cutters (HW)
- Diameter 200 - 550mm (Ident. Nr. 192076 bis 192090)
- Noise-reduction thanks to laser ornaments

Recommended parameters

- G5 300 x 3.0 x 2.2mm
- Tooth quantity = 100, G5
- Revolution speed n = 4’500min^{-1}
- Feed speed v_f with scoring device = 10-30m/min
- Feed speed v_f without scoring device = 8m/min nearly chip free edges

Advantages in BANOVA®

- Chip free cutting edges without holes in the panel core
- High feed rates possible due to homogeneity and low density of panel
- High extraction performance of light chips and dust
- Long service life of tools thanks to the tool friendly bond, the homogeneous density distribution and no foreign particles in the panel

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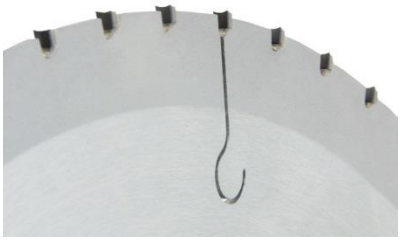
Panel trimming and sizing

Circular Saw for Panel Sizing DP-nn-System

Application

- Panel sizing saw for trimming and sizing of finished and raw panels



Tool details

- Polycrystalline diamond cutters - polished for long service life
- Various tooth geometries depending on use
- Small evacuation gap geometry for noise reduction
- Diameter 260 – 450mm

Recommended parameters

- NN DIA 303 x 2,5mm 60 (Ident. Nr. 459439)
- Tooth number = 60, Hohlrücken (HR)
- Revolution speed n = 4’500min^{-1}
- Feed speed v_f with scoring device = 10-30m/min
- Feed speed v_f without scoring device = 8m/min nearly chip free edges

Advantages in BANOVA®

- Chip free cutting edges without holes in the core
- High feed rates possible due to homogeneity and low density of panel
- Noise reduction thanks to special tooth geometry and low panel density
- Long service life of tools thanks to the tool friendly bond, the homogeneous density distribution and no foreign particles in the panel

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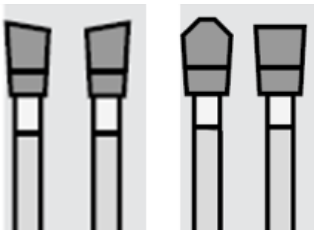
Panel sizing

Alternate Top Bevel (WS); Alternate Top Bevel + Flat (WS-F); Inverted V + Hollow Ground (DA-D)

Application

- Panel sizing is possible with standard tool and various tooth geometries



Tool details

- Tungsten carbide tipped tools
- Positive cutting angle

Recommended parameters

- Cutting speed v_c = 80 – 100m/s
- Feed rate per tooth f_z = 0,05 – 0.2mm
- Parallel feed
- High feed rates with scoring device

Advantages in BANOVA®

- Chip free cutting edges without holes in the core
- High feed rates possible due to homogeneity and low density of panel
- Long service life of tools thanks to the tool friendly bond, the homogeneous density distribution and no foreign particles in the panel

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Surface finishing

Sanding on Wide Belt Sanding Machine

Anwendung

- Thickness egalisation as preparation for industrial face lamination (continuous or cycle press)
- Thickness egalisation in crafts enterprises
- Surface finishing / surface preparation for liquid coating (colours & laquers) or glue application

Tool details

- Fabric or paper sanding belt
- Preferred sanding grain material silicon carbide (SIC)
- Sanding grit P100 - P120 for thickness egalisation
- Sanding grit P120 - P150 for surface finishing

Recommended parameters

Processing example: Thickness egalisation on a wide belt sanding machine in a craftmen's workshop:

- Sanding across the grain (1220 x 2440mm)
- Belt speed v_s = 20 - 30m/s
- Feed speed v_f = 8 - 10m/min
- Sanding thickness 0.2 – 0.4mm per passage
- Machine equipped with sanding roll in metal or hard rubber

Sanding tests must be run if higher requirements on surface quality apply.

Machine requirements

- Efficient dust extraction
- Steady running sanding belts without relevant vibrations
- Processing accuracy depending on individual requirements

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Surface lamination

Suitability of adhesive types on BANOVA® substrate

Surface	Face Thickness	Urea Formalde-hyde	White Glue	Emulsion-Polymer-Isocyanate	PU-Hotmelt	1-Comp. Polyurethane	2-Comp. Polyurethane
		UF	PVAc	EPI	PUR	1K-PUR	2K-PUR
Wood veneer	0.6 - 2.0mm	***	***	***	***		
Laminate HPL	0.6 - 1.0mm		**	**	***		*
CPL / MDO	0.2 - 0.8mm		**	**	***		
MDF / HDF	0.8 - 1.8mm		**	**	***	***	***
Aluminium	0.4 - 1.0mm			*	***		***
GFRP	0.8 - 2.0mm			*	***		***

***	preferred	**	suitable	*	possible

Parameters to laminate surfaces

The BANOVA® substrate is being laminated with common adhesive from the wood industry (see table above). The panels are delivered with evenly sanded surfaces, flat and ready to laminate. The untreated wood surface is porous and allows the adhesive to penetrate deeper into the surface compared to panels with a higher surface density. This provides an excellent bond, but requires also a higher glue spread as applied on heavy panels with dense surfaces.
The documented adhesives and processing parameters are collected from experience and provide a good overview about today's state of the art processes.
Documented production parameters must be checked and aligned with the current product data sheets of the adhesive suppliers and the bonding quality must be monitored by the manufacturer. We do not provide recommendations for specific products or adhesive suppliers.

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Processing parameters of common wood adhesives

Urea formaldehyde UF

Adhesive:	Sempadur P8
Surface:	Veneers
Bonding quality:	C3 according to EN12765
Emission class:	E1
Area of application:	Interior application with short exposure to water and humidity
Glue spread:	120-160 g/m^2
Open working time:	max. 15 min bei 20°C
Pressure:	2.5 kg/cm^2
Press panel temperature:	100°C
Cycle time:	4 min pressing time
Conditioning:	min. 6 h in bulk with cover panel on bottom and top

White glue PVAc

Adhesive:	Collano DW 2018
Surface:	Veneer, HPL, wood based panels
Bonding quality:	D3 according to EN 204
Emission class:	NAF - no added formaldehyde
Area of application:	Interior application with short exposure to water and humidity
Glue spread:	100-200 g/m^2
Open working time:	8-10 min
Pressure:	2.5 kg/cm^2
Press panel temperature:	60°C
Cycle time:	5 min pressing time
Conditioning:	min. 24 h in bulk with cover panel on bottom and top

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Emulsion-Polymer-Isocyanate EPI

Adhesive:	Akzo Nobel EPI 1911
Catalyst:	Akzo Nobel 1993 Härter
Surface:	Veneer, HPL, wood based panels
Bonding quality:	D4 according to EN 204
Emission class:	NAF - no added formaldehyde
Area of application:	Interior application with long exposure to water and humidity
Glue spread:	140-220 g/m^2
Open working time:	10 min
Pressure:	2.5 kg/cm^2
Press panel temperature:	65-70°C
Cycle time:	4 min pressing time
Conditioning:	min. 6 h in bulk with cover panel on bottom and top

2K Polyurethan 2K-PUR

Adhesive:	Collano A 2125 (Comp. A & Comp. B)
Surface:	Metal, GFRP, plastics, rubber, etc.
Emission class:	NAF – no added formaldehyde
Area of application:	Structural bond of sandwich panels
Glue spread:	200-400 g/m^2
Potlife:	20-35 min of 100 g at 20°C
Pressure:	2.5 kg/cm^2
Press panel temperature:	20-50°C
Cycle time:	90 min pressing time at 20°C

Source

www.akzonobel.com/wood/

www.collano.com/

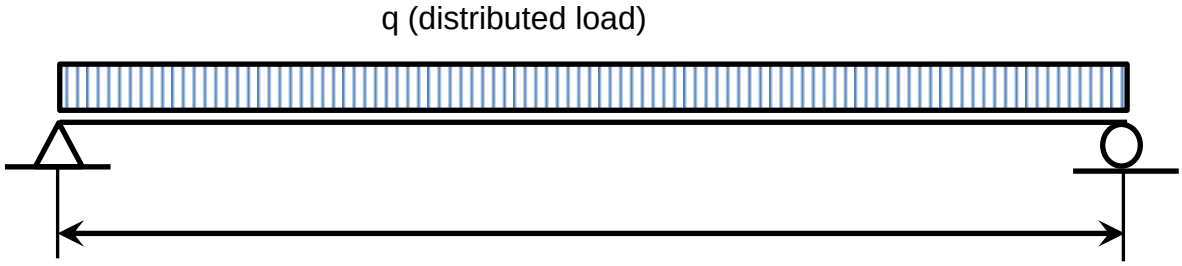
www.jowat.com/

Definition of panel thickness with tables

BANOVA® is mainly used in interior applications where stability and stiffness is important. From static perspective the panels are commonly loaded with bending forces found for example in the application of shelf boards.

General conditions and definitions

Static system:	Single-span beam as for shelf boards.
Loads:	Distributed load as applied with books and folders.
Limiting criterias:	At the defined load cases, deflection of the shelf boards becomes the limiting criteria. Shear and bending resistance are not limiting at the defined loads.
System limitations:	This documentation is a guideline to define the needed panel thickness depending on applied loads. The results in below tables were calculated with known section values and characteristic material values. The tables are used as guideline, but do not conform to a full static proof. Design details and external influences as moisture content or creeping are not considered in the calculations. The correct design and application is part of the designer's and manufacturer's responsibility.



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Example to use tables

1. Chose table depending on defined load 50, 100, 150 or 200 kg/m^2.
2. Chose span 400 – 1200 mm in the first column of the table.
3. Green highlighted fields show combinations of panel thickness and span that result in a deflection below span/300. This is a widely accepted value of acceptance.

0.5	Average deflection in mm within defined limit.
2.2	Deflection just out of limit, but may be accepted depending on need.
	Deflection off limits, not appropriate.

Distributed load 50 kg/m^2 BANOVA® PLUS - lengthwise

	Panel thickness [mm]							Limit
Span [mm]	12	15	18	25	30	40	50	l/300
400	0.5	0.2	0.1	0.1	0.0	0.0	0.0	1.3
500	1.1	0.5	0.3	0.2	0.1	0.0	0.0	1.7
600	*2.3*	1.1	0.6	0.3	0.2	0.1	0.0	2.0
800		*3.6*	1.8	1.1	0.6	0.2	0.1	2.7
1000			*4.4*	2.6	1.6	0.6	0.3	3.3
1200				*5.4*	3.3	1.2	0.6	4.0

Distributed load 100 kg/m^2 BANOVA® PLUS - lengthwise

	Panel thickness [mm]							Limit
Span [mm]	12	15	18	25	30	40	50	l/300
400	0.9	0.4	0.2	0.1	0.1	0.0	0.0	1.3
500	*2.2*	1.1	0.5	0.3	0.2	0.1	0.0	1.7
600		*2.3*	1.1	0.7	0.4	0.2	0.1	2.0
800			*3.6*	2.1	1.3	0.5	0.3	2.7
1000				*5.2*	3.2	1.2	0.6	3.3
1200					*6.5*	2.5	1.3	4.0

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Distributed load 150 kg/m^2 BANOVA® PLUS - lengthwise

	Panel thickness [mm]							Limit
Span [mm]	12	15	18	25	30	40	50	l/300
400	0.9	0.4	0.2	0.1	0.1	0.0	0.0	1.3
500	*2.2*	1.1	0.5	0.3	0.2	0.1	0.0	1.7
600		*2.3*	1.1	0.7	0.4	0.2	0.1	2.0
800			*3.6*	2.1	1.3	0.5	0.3	2.7
1000				*5.2*	3.2	1.2	0.6	3.3
1200					*6.5*	2.5	1.3	4.0

Distributed load 200 kg/m^2 BANOVA® PLUS - lengthwise

	Panel thickness [mm]							Limit
Span [mm]	12	15	18	25	30	40	50	l/300
400	*1.8*	0.9	0.4	0.3	0.2	0.1	0.0	1.3
500		*2.2*	1.1	0.6	0.4	0.1	0.1	1.7
600			*2.3*	1.3	0.8	0.3	0.2	2.0
800				*4.2*	2.6	1.0	0.5	2.7
1000					*6.3*	2.4	1.2	3.3
1200						*5.0*	2.5	4.0

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Define panel thickness from existing panel stiffness

BANOVA® is commonly used to aim a relevant weight reduction. Often the product is applied slightly thicker to make the component stiffer and lighter than the existing. The approach of replacing existing components is explained below in a simple way. The calculations relate exclusively to the panel stiffness which is usually the limiting factor in interior panel applications. Full static proof may be calculated with the characteristic material data given in the technical data sheet. The correct design and application is part of the designer's and manufacturer's responsibility.

Background and definitions

Modulus of Elasticity (E_m oder MOE, bending modulus) is a material characteristic required to assess or calculate panel stiffness. The bending stiffness of a panel depends on its dimensions and the configuration. Wood panel fabricators often state the Modulus of Elasticity in their technical documentations with reference to DIN EN 310. These values can be used to compare different products and materials. The following table shows some MOE values of different kinds of wood panels in different thicknesses.

Product	AVG density	AVG MOE depending on panel thickness [N/mm²]						
	[kg/m³]	12	15	18	25	30	40	50
BANOVA® PLUS	230	2500	2600	3000	1900	1800	2000	0
Poplar plywood	420	3800	3500	3200	2800	2800	2500	n.a.
Particleboard	700	1600	1600	1600	1500	1350	1200	1050
MDF	700	2200	2200	2100	2100	1900	1900	n.a.

Use and calculation

MOE values of equivalent panel thickness can be used to compare products. For example at 12mm panel thickness BANOVA® PLUS is 1,13 times (=2500/2200) stiffer than MDF. At the same time BANOVA® PLUS is three times lighter than MDF.
Apart from that, the following formula is applied to compare different products of different panel thicknesses:

$$\frac{t_1}{t_2} = \sqrt[3]{\frac{E_2}{E_1}}$$

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Material 1	**Poplar plywood**	
Thickness t_1	15 mm	
MOE E_1	3500 N/mm^2	
Weight m_1	0.015 m x 420 kg/m^3	= **6.3 kg/m^2**

15 mm BANOVA® PLUS has a bending modulus (MOE) of 2600 N/mm^2, which means it is less stiff than poplar plywood of the same panel thickness. There is now the option to use the next higher thickness to obtain an elevated panel stiffness.

Material 2	BANOVA® **PLUS**	
Thickness t_2	18 mm (approved after calculation below)	
MOE E_2	3000 N/mm^2	
Weight m_2	0.018 m x 230 kg/m^3	= **4.14 kg/m^2**

Formula to calculate the required panel thickness with given bending modulus:

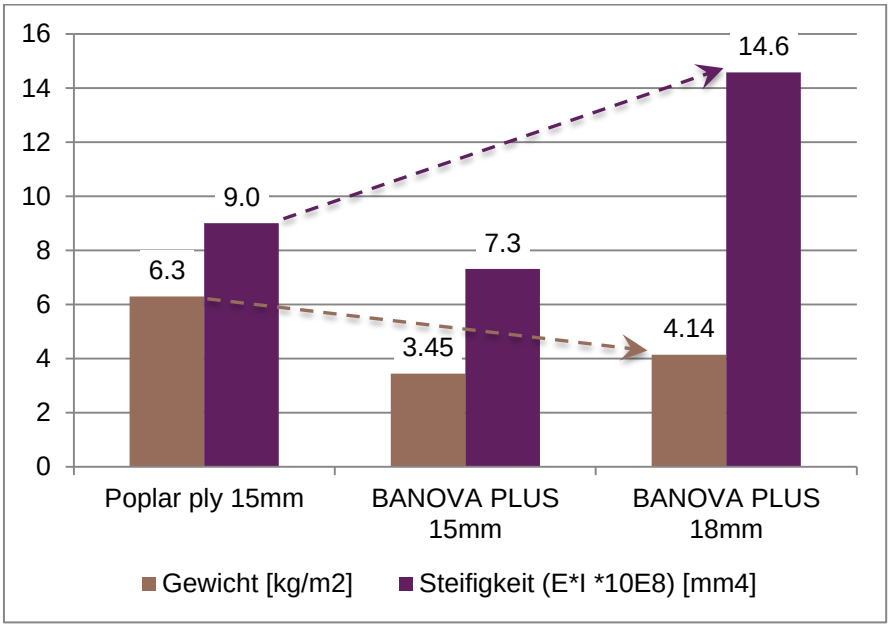
$$t_2(18\text{mm}) \geq \frac{t_1}{\sqrt[3]{\frac{E_2}{E_1}}} = \frac{15}{\sqrt[3]{\frac{3000}{3500}}} = 15.7mm \qquad \text{(OK)}$$

Weight reduction: = **2.16 kg/m^2**

18mm BANOVA® PLUS is

30% lighter and 62% stiffer

than 15mm poplar plywood



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