The Lightweight Balsa Wood Family

BANOVA® PRiNT
BANOVA® PLUS
BANOVA® SUPERFLEX

Fabrication Manual

3A Composites

May 2018

Foreword

Thank you for choosing a 3A Composites product for your graphic display applications.
We have compiled this Fabrication Manual based on our Fabrication Guide, which is divided into the following sections:

Corner Connections

Face Connections

Hinges

Processing

Planning

Appendix I: Material Safety Data Sheet

This Fabrication Guide was created to incorporate the most common fabrication methods that are used with 3A Composites' line of graphics display products. Not all fabrication methods are compatible with each product, but this format was kept for consistency purposes. **The term "the substrate" is used throughout this guide and is meant to apply to all members of the substrate family unless noted otherwise.** Those fabrication methods that do not apply to a certain product are stated with a short explanation and a recommendation for an alternative product that fits that application method.

This manual also contains Appendix I which provides a Material Safety Data Sheet section. 3A Composites is not responsible for the performance of any of these products when used independently or with any 3A Composites product.

The date of the last revision is shown on the bottom right hand corner of each page. Please make sure you have the most current version by going to GraphicDisplayUSA.com and selecting the document library.

If you have any further questions about our product or about how to use this manual, please feel free to contact us at 1-800-626-3365.

PLEASE NOTE:
TRIALING IS RECOMMENDED TO ENSURE SUITABILITY FOR THE PROPOSED APPLICATION AND FABRICATION BEFORE FULL-SCALE COMMERCIALIZATION.

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Introduction to Banova

BanovaUSA.com
GraphicDisplayUSA.com

Banova® material is extremely lightweight plywood with natural Balsa plies and high grade veneer surfaces. Banova® stands for high-quality, lightweight sheets for use in interior designs and displays such as point of purchase displays, exhibits and kiosks, interior signage as well as structural signage. Additionally, Banova's unique properties lend itself to very unique OEM industrial applications, such as mobile home interiors and furniture, etc.

The sheets are natural balsa wood facers and high-grade veneer surface with a textile core. Banova® material is available in 9mm, 10mm, 12mm, 15mm, 18mm, 25mm, 30mm and 4mm thicknesses in 4' x 8' sheets. Consult the Banova® website for the most current products at BanovaUSA.com.

3A Composites cultivates several thousand hectares of FSC Certified balsa wood farms in Ecuador (FSC-C019065).

Banova® can substitute for:

- 9mm, 10mm, 12mm, 15mm, 18mm, 25mm, 30mm, 40mm MDF, Particleboard, Standard Plywood
- Thick gauge plastics
- Laminated Boards
- Thick gauge PVC
- Foam Boards

The Banova® Graphic Display Product line consists of:

- **BANOVA® Print**
- **BANOVA® PLUS**
- **BANOVA® SUPERFLEX**

BANOVA® Print

BANOVA® PLUS

BANOVA® SUPERFLEX

Why Choose Banova?

The Lightweight Balsa Wood Family

BANOVA® Print combines the lightweight, rigid, and renewable characteristics of balsa wood with a proprietary surface treatment engineered specifically for enhanced printing properties.

- NEW! PRO surface treatment engineered especially for enhanced printing properties
- Bright White surface with excellent ink adhesion
- Extremely light weight; allows for large-sized design elements, simpler handling, and easier intall
- Very good weight-specific stability
- FSC Certified - (FSC-C074317)

BANOVA® PLUS is the world's lightest plywood made of balsa veneers. It is highly versatile due to various thicknesses, processing options and the possibility to combine with numerous face laminates.

- Extremely versatile - can be combined with various face laminates to enhance specific properties
- Uniform surface qualities and outstanding flatness
- 50 - 70% lighter than conventional plywood solutions
- 30% faster cutting speed with standard lasers due to low density of balsa wood
- PVC & Formaldehyde free
- Natural wood from sustainable, FSC certified farms

BANOVA® SUPERFLEX is a combination of a textile core layer and highly flexible wood veneers. Its tight bending radius, maximum strength, and light weight make this material ideal for bending & creating curved components.

- Wide range of applications thanks to easy shaping and processing
- Excellent finish on both sides when formed into an 'S' shape
- Outstanding surface quality when bonded on a membrane press
- Easy manufacturing and handling without special tools or machines
- Very good weight-specific stability
- PVC and Formaldehyde free
- Natural wood from sustainable, FSC certified farms

Applications

- Visual communications
- Advertising campaigns
- Window Displays
- Shop-fitting
- Wall-mounted Signs
- Post & Panel Signage
- Routed Sign Faces
- Point of Purchase Displays
- Cart/Kiosk Mfg.
- Transportation Applications
- Screen Printing
- Interior Signage
- Custom Exhibit Booths
- Murals

Application & Fabrication Guides

APPLICATION GUIDE

	POP Display	Exhibits & Kiosks	Framing	Framing - Archival	Signage - Interior	Signage - Exterior	Signage - Structural
Banova®	●	■			■		

Trialing is recommended to ensure suitability for the proposed application before full-scale commercialization

- ○ Short-term application life
- ● Medium-term application life
- ■ Long-term application life
- □ Applications such as workzone signage, canopies, pylons, and column covers

FABRICATION GUIDE

	Mounting	Repositioning Vinyl	Digital Printing	Screen Printing	Painting	Knife Cutting	Saw Cutting	Routing	Die Cutting/Punching	Embossing	Forming Curves
Banova®	◇		◇[1]	◇[1]	◇	◇	◇	◇	◇		

Trialing is recommended to ensure suitability for the proposed application before full-scale commercialization

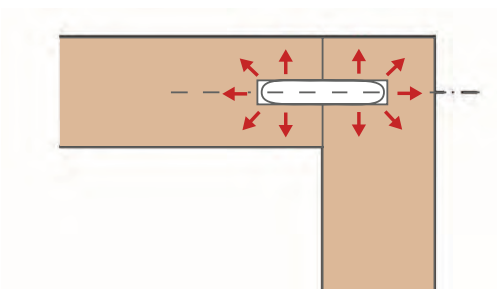
1 Due to porous nature of balsa wood, ink will absorb into surface resulting in less vibrant colors; Banova® Print is recommended for these fabrication methods

Section I: Corner Connection

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.

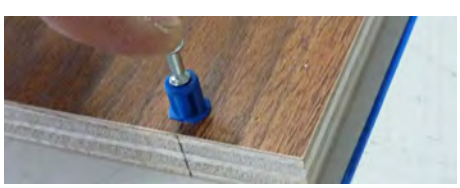
Easily and quickly positioned and assembled. The glue penetrates deep into the porous wood structure during the assembly of the edge joint. Therefore the bonding performance with liquid glue is notably better in BANOVA® than in common wood based panels.



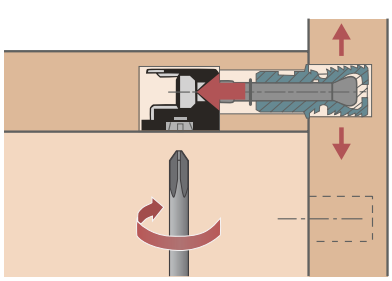
Cam Fitting For Furniture

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.



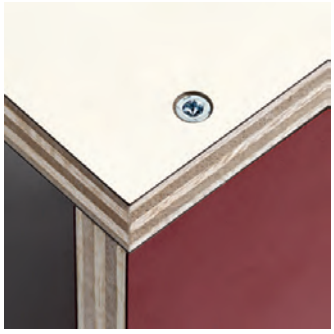
Easy and quick assembly, with a single turn of a screwdriver the plastic dowel expands and the glue is pressed deep into the wood structure of the porous panel core. The deep anchorage of the glue in the wood structure is the relevant advantage compared to common wood based panels.



Section I: Corner Connection

Direct Screw

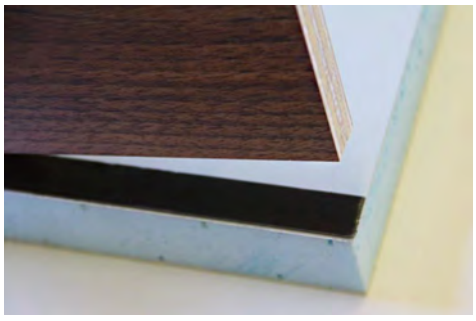
The perfect corner connection without pre-drilling. Thanks to the solid panel core, long and strong screws are directly applied without the risk of panel splitting. The screw is also used in combination with dowels for positioning and liquid glue or double-sided tape for enhanced resistance and vibration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

Double Sided Adhesive Tape

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's easy and quick to apply, and contamination is easy to avoid compared to the use of liquid adhesive.



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.

Section I: Corner Connection

Adhesive Bonding With Lamello

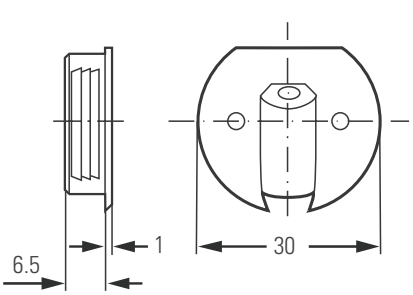
Wood biscuits are highly effective as connection for individual furniture of small lot sizes. Manufacturing is simple, from milling with power tools to mounting with an adequate glue dispenser. The biscuit shaped notches are milled from the craftsmen in a very flexible, but highly accurate way.

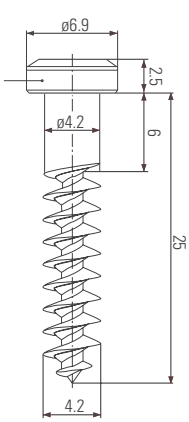
The shape creates the strength of this connector. Since it requires only partial notches of an organic biscuit shape, the panel structure is not weakened as it would be by a thorough notch. Nevertheless, the surface of the lamello provides a great bonding area that anchors in the panel core. At the stage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

Furniture Connectors

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.

Easy insert of standard furniture connectors to press fit.

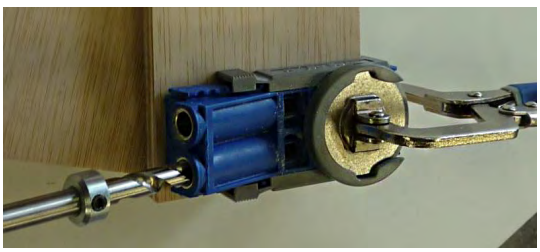




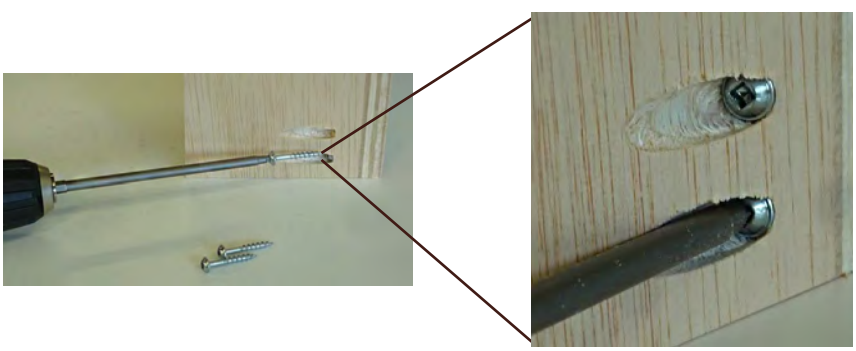
Section I: Corner Connection

Pocket Hole Screw Joint

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

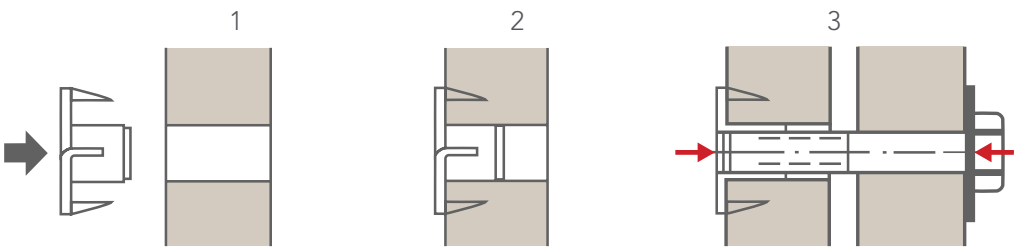


Easily and quickly assembled and connected. You can combine it with dowels, wood biscuits, adhesive or double-sided adhesive tape.



Section II: Face Connection

Bolt Fastening Into Tee Nut

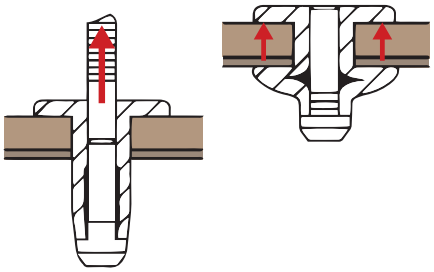


The tee nut is driven into a pre-drilled hole from the back of the panel, and some versions are also bonded to the back face for fixation and twist locking. Bolts are set from the face to obtain an end-to-end connection between two components. The load distribution on the surface and in the panel core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

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

Mounting By Rivet

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.



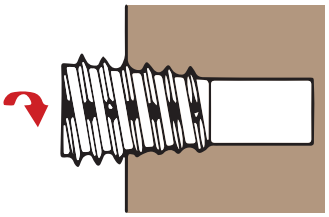
The form-locking connection with rivets is unobtrusive but nevertheless efficient since the load is firmly supported by the surface of the flat rivet head. Single suspensions are made by positioning a perforated metal sheet or a large washer behind the panel and set the rivet through the panel into the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

16mm rivet with appropriate setting tool

Section II: Face Connection

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 with a small amount of 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-weight Banova® panel we suggest the choice of nuts with deep thread and maximal possible diameter for optimal load distribution. It's 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.

Wood Insert For Direct Screwing

The wood insert is bonded with a common wood glue or specific mounting glue into the pre-drilled 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.

Section II: Face Connection

Clip Connector

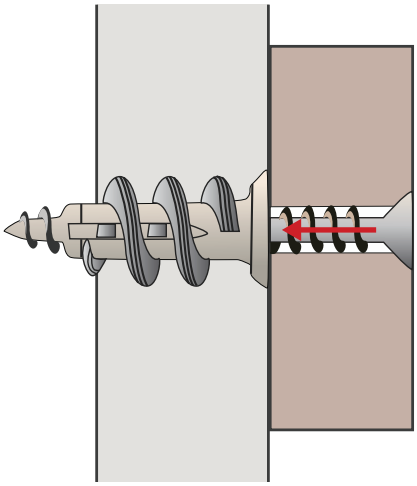
The distinctly deep plastic thread cuts deep into the solid panel core, and thus provides permanent mechanical anchorage.

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

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-weight 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 a bolt head.



Section III: Hinges

Mounting Hardware - Standard Screws

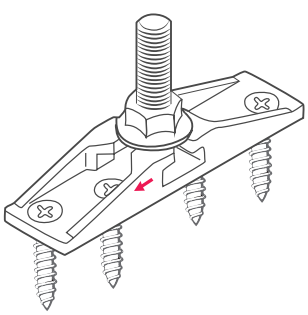
Standard screws are not only used for easy assembly of furniture, but also to mount hinges and other fittings. A rule of thumb is to use 4-6mm strong screws with a length of 3-4 times the thickness of the panel that has to be joined.

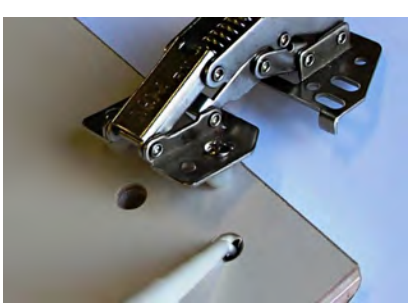
Average screw extraction forces were tested with standard ferronorm screws into the surface of a 15mm panel. The panels should not be pre-drilled.

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® PLUS core and HPL decorative faces has a total weight of 38kg (10.4kg/m2). This low weight is easily supported by standard hardware and can be mounted with two standard screws. Concealed edge bands or other special inserts aren't required. The hardware is less loaded, and the door is easier to move but still solid.

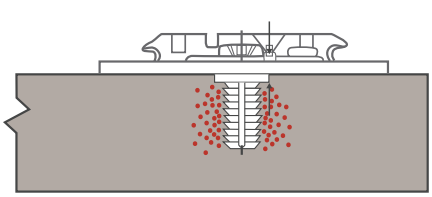




Flap Hinge For Press Inject

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.

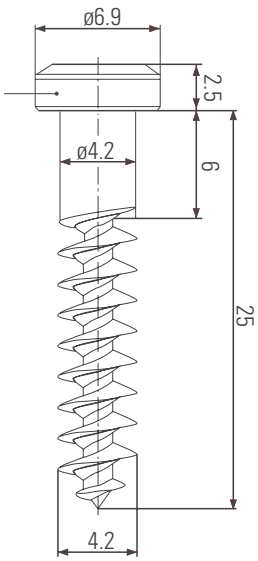
The strength of the described connection is shown after curing as a rigid and durable joint between the door and its hinge, which results in high resistance against dynamic loads. The adhesive penetrates deep into the porous panel core and provides firm and durable anchorage - better than in dense wood-based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



Section III: Hinges

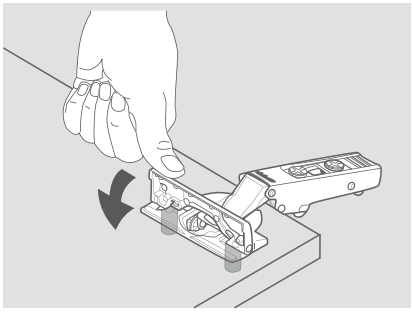
Mounting Hardware - Ecosyn® PXL Screws

The ecosyn® PXL screw 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.



Concealed Hinge

This hinge is not just quickly mounted; it also anchors tightly into the panel core by the expansion of the plastic dowels in the pre-drilled holes. Lighter components also reduce stress to the hinges caused by vibration and dynamic impact. As a result it reduces the number of hinges needed and allows for the design of 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 a durable hold against vibrations.

Section IV: Processing

General Processing Guides

Banova® is a solid wood material and can be processed as such.

Reduced processing forces also allow clamping and pressing of panels in the production process (<2.5kg/cm2). 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 overall.

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 glue used is unfilled. This provides a long service life of any tungsten carbide and polycrystalline diamond tipped tools.

Section IV: Processing

Contour Milling & Nesting

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 (Identification No. 180972)

- Feed speed v_f = 3m/min in parallel feed
- Tooth feed f_z = 0.063mm

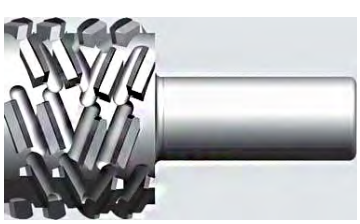
Contour Milling

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 in materials with fiber content.

Tool Details

- Symmetric or 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 (Identification No. 180972)

- Feed speed vf = 3m/min in parallel feed
- Tooth feed fz = 0.125mm

Dowel & Pattern Drilling - 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 (Identification no. 178695 bis 178704)

Recommended Parameters

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

Dowel & Pattern Drilling - 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
- Right and left spiral available
- Long service life of tungsten carbide cutters (HW)
- Protection of hole edges during return stroke provided by the back-guide
- Diameter = 4, 5, 6, 8, 10, 12, 13, 14, 15, 16mm (Identification no. 166107 bis 167199)

Recommended Parameters

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

Section IV: Processing

Cylinder Boring

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
- Right and left spiral available
- Diameter = 15, 16, 18, 20, 22, 25, 26, 30, 35, 40mm (Identification no. 003303 bis 182260)

Recommended Parameters

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

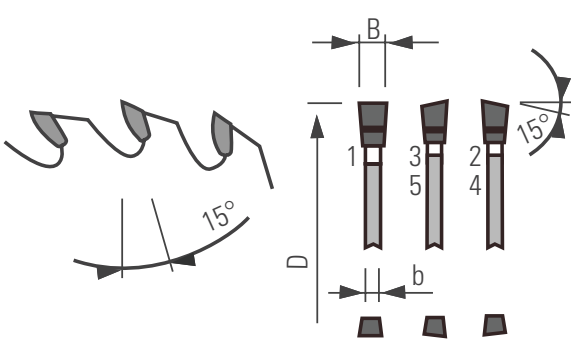
Sizing With A Circular Saw

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
  (Identification no. 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 vf with scoring device = 10-30m/min
- Feed speed vf without scoring device = 8m/min with nearly chip free edges

Section IV: Processing

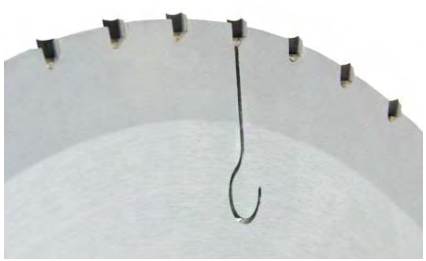
Panel Trimming & Sizing

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 (Identification no. 459439)
- Tooth number = 60, Hohlrücken (HR)
- Revolution speed n = 4,500 min^{-1}
- Feed speed v_f with scoring device = 10-30m/min
- Feed speed v_f without scoring device = 8m/min with nearly chip free edges

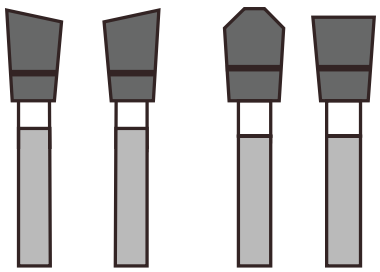
Panel Sizing - Alternate Top Bevel + Flat + Inverted + Hollow Ground

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 vc = 80 - 100m/s
- Feed rate per tooth fz = 0.05 - 0.2mm
- Parallel feed
- High feed rates with scoring device

Surface Finishing - Sanding on Wide Belt Machine

Application

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

Section IV: Processing

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		☆☆	☆☆	☆☆☆	☆☆☆	☆☆☆
Aluminum	0.4 - 1.0mm			☆	☆☆☆		☆☆☆
GFRP	0.8 - 2.0mm			☆	☆☆☆		☆☆☆

☆☆☆ Preferred ☆☆ Suitable ☆ Possible

Parameters to Laminate Surface

- 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 does require 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 current 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.

Common Wood Adhesives - Processing Parameters

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 & humidity
» Glue Spread:	120 - 160 g/m^2
» Open Working Time:	Maximum 15 minutes bei 20°C
» Pressure:	2.5 kg/cm^2
» Press Panel Temperature:	100°C
» Cycle Time:	4 minutes pressing time
» Conditioning:	Minimum 6 hours in bulk with cover panel on bottom & top

WHITE GLUE PVAc

» Adhesive:	Collano DW 2018
» Surface:	Veneer, HPL, wood-based panels
» Bonding Quality:	D3 according to EN204
» Emission Class:	NAF - no added formaldehyde
» Area of Application:	Interior application with short exposure to water & humidity
» Glue Spread:	100 - 200 g/m^2
» Open Working Time:	8 - 10 minutes
» Pressure:	2.5 kg/cm^2
» Press Panel Temperature:	60°C
» Cycle Time:	5 minutes pressing time
» Conditioning:	Minimum 24 hours in bulk with cover panel on bottom & top

Common Wood Adhesives - Processing Parameters

EMULSION-POLYMER-ISOCYANATE EPI

» Adhesive:	Akzo Nobel EPI 1911
» Catalyst:	Akso 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/m2
» Open Working Time:	10 minutes
» Pressure:	2.5 kg/cm2
» Press Panel Temperature:	65 - 70°C
» Cycle Time:	4 minutes pressing time
» Conditioning:	Minimum 6 hours in bulk with cover panel on bottom & 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/m2
» Potlife:	20 - 35 minutes of 100g at 20°C
» Pressure:	2.5 kg/cm2
» Press Panel Temperature:	20 - 50°C
» Cycle Time:	90 minutes pressing time at 20°C

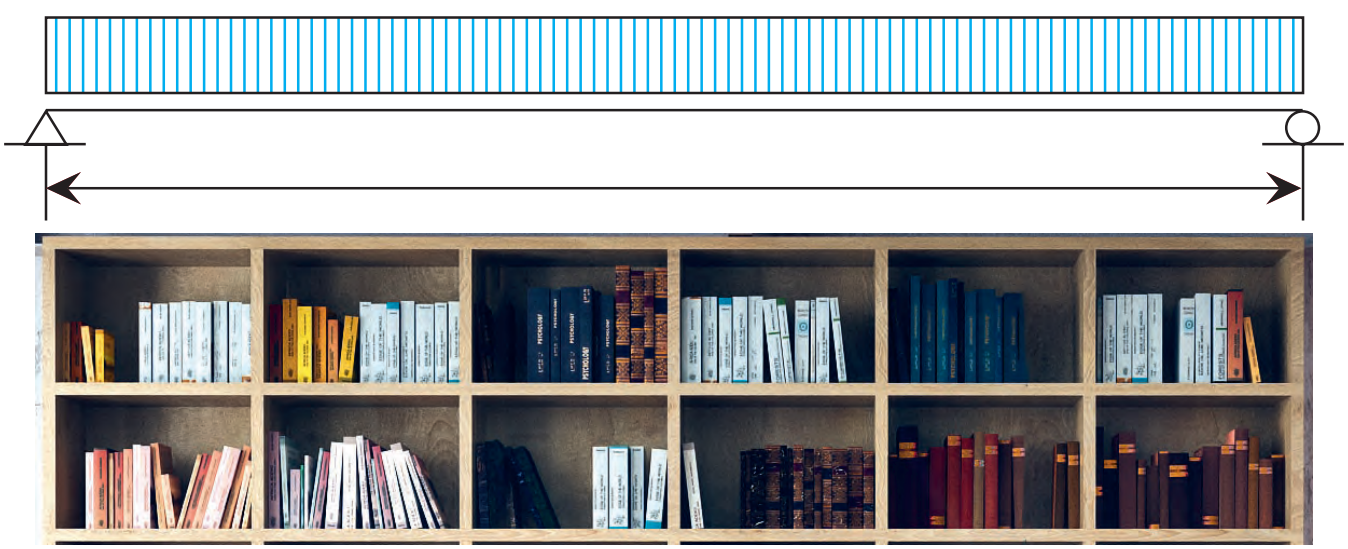
Definition of Panel Thickness

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 & 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 the following tables were calculated with known section values and characteristic material values. The tables are used as a guideline, but do not conform to a full static proof. Design details and external influences such 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.

q (distributed load)



Example Using Tables

Table Usage Instructions

1. Choose a table depending on defined load 50, 100, 150, or 200 kg/m2.
2. Choose span of 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/m2 — BANOVA® PLUS - lengthwise

	Panel Thickness (mm)							
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/m2 — BANOVA® PLUS - lengthwise

	Panel Thickness (mm)							
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

Example Using Tables

Table Usage Instructions

1. Choose a table depending on defined load 50, 100, 150, or 200 kg/m2.
2. Choose span of 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 150 kg/m2 — BANOVA® PLUS - lengthwise

	Panel Thickness (mm)							
Span (mm)	12	15	18	25	30	40	50	l/300
400	0.9	0.4	0.2	0.1	0.2	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/m2 — BANOVA® PLUS - lengthwise

	Panel Thickness (mm)							
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

Defining Panel Thickness Using Stiffness

Banova® is commonly used to create a relevant weight reduction. Often the product is applied slightly thicker to make the component stiffer and lighter than the existing component. 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 & Definitions

Modulus of Elasticity (Em 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/mm^2)						
	(kg/m^3)	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.

Defining Panel Thickness Using Stiffness

Use And Calculations

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 while being three times lighter. Apart from that, the following formula is applied to compare different products of different panel thicknesses:

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

Material 1: Poplar Plywood

Thickness:	t1	15mm	
MOE:	e1	3500 N/mm2	
Weight: m1		0.015 m x 420 kg/m3	= 6.3 kg/m2

15 mm BANOVA® PLUS has a bending modulus (MOE) of 2600 N/mm2, which means it is less stiff than poplar plywood of the same panel thickness. There is now the option to use the next gauge thicker to obtain an elevated panel stiffness.

Material 2: BANOVA® PLUS

Thickness:	t2	18mm (approved after calculation below)	
MOE:	e2	3000 N/mm2	
Weight: m2		0.018 m x 230 kg/m3	= 4.14 kg/m2

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

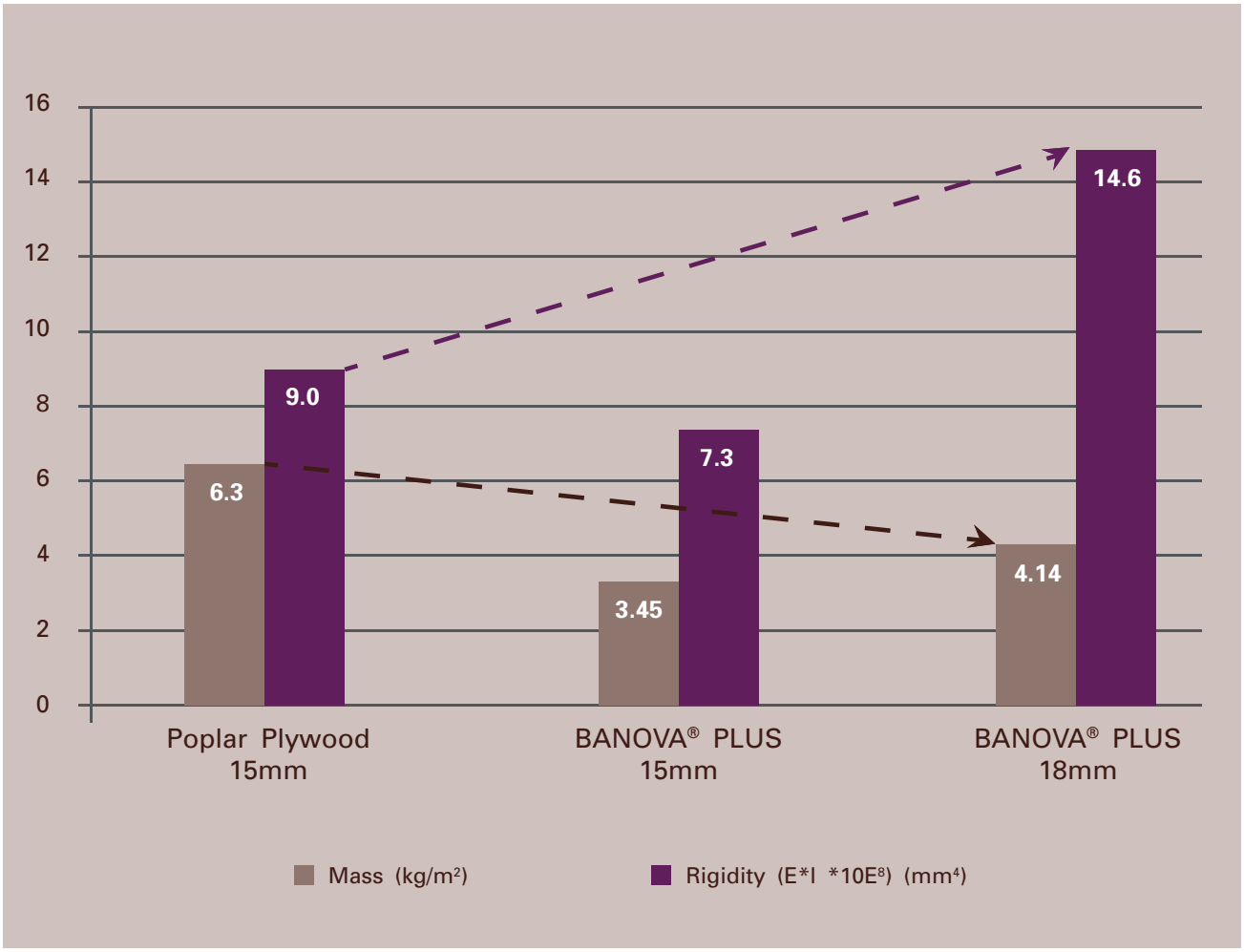
$$t_2\ (18mm) \geq \frac{t^1}{\sqrt[3]{\frac{E_2}{E_1}}} = \frac{15}{\sqrt[3]{\frac{3000}{3500}}} = 15.7mm$$

Weight Reduction: 2.16 kg/m2

Grown Light • Made Strong

Lighter and Stiffer

8mm Banova® PLUS is 30% lighter and 62% stiffer than 15mm poplar plywood!



Appendix I: MSDS

Safety Data Sheet for BANOVA® - According to Regulation (EC) No. 1907/2006
revised: 20.04.2017 I GM--SDS-017

1. Identification of substance / preparation and of the company
BANOVA®

Use of Substance / preparation:	BANOVA®: Lightweight interior panels
Company identification:	BANOVA Innovationes en Balsa S.A: San Camilo km 4.5 via a Valencia Quevedo Provincia Los Rios Ecuador

2. Hazards Identification

BANOVA® lightweight panel does not constitute any risk to public health and environment if it is used as intended. Fine dust is produced while sawing, milling, grinding and sanding, which may pose an inhalation and explosion hazard.

Once ignited, product will liberate Carbon Monoxide, Carbon Dioxide, and may "punk" until doused with water. Wood dust may cause dermatitis upon prolonged, repetitive contact or may cause respiratory sensitization and/ or irritation.

3. Composition / Information on Ingredients

Wood veneers, 1K-PU adhesive cured. glass fiber scrim (for bending plywood)

4. First Aid Measures

Inhalation of dust during processing:	Move person to fresh air; obtain medical attention if irritation persists.
Inhalation of gases in case of fire:	Move victim to fresh air and obtain medical attention.
Skin contact:	Wash with soap and water.
Eye contact:	Flush with water if irritation develops. If irritation persists consult a doctor.
Ingestion:	No special measures required. In case of prolonged discomfort consult a doctor.

5. Fire-Fighting Measures

Specific Hazards: Material is combustible, combustion products: carbon monoxide (CO), carbon dioxide (CO2), traces of hydrocarbons.

Suitable Extinguishing Media: Foam, water spray, extinguishing powder, carbon dioxide.

Extinguishing Media Not Suitable: Direct water jet.

Fire fighting respiratory apparatus and protective clothing should be worn.

6. Accidental Release Measures

No special measures required.

7. Handling & Storage

Handling: No special measures required. Avoid generation or accumulation of dust. Take precautionary measures against static discharges. Ground all equipment.

Storage: Store away from immediate and dangerous sources of ignition. Storage at a dry place is recommended.

8. Exposure Control / Personal Protection

Exposure Limit Values (for particles): Not otherwise regulated: PEL TWA = 15 mg/m3. Fiberglass dust (CAS #65997-17-3) for bending plywood: PEL TWA=10 mg/m3, TWA=5 mg/m3 for respiration

Exposure Controls: The use of gloves, protective goggles and dust masks (such as TC-21C-132 approved) is recommended for sawing, milling, grinding and sanding. Where use results in generation of dust from product, provide sufficient mechanical (general and/or local exhaust) ventilation or vacuum-assisted dust collection to prevent explosive concentrations of airborne dust from developing.

9. Physical and Chemical Properties

Physical state / form:	Wood, integral, solid
Colour:	Natural wood colour (light to dark brown)
Melting temperature:	Material does not melt
Decomposition temperature:	Greater than 232°C (450°F)
Flash ignition temperature:	Greater than 200°C (400°F)
Density:	150-300 kg/m3 (ISO 845)
Solubility:	Insoluble in: Water (<1%), salt water (<1%), organic compounds
Soluble in:	Strong acids and alkalis

10. Stability and Reactivity

General information:	Stable under normal conditions and usage
Conditions to avoid:	Temperatures above 200°C (400°F)
Explosive limits in air:	For wood dust clouds, 40 g/m3 (lower explosive limit)
Materials to avoid:	Strong oxidizing agents can cause ignition and subsequent burning. Avoid exposure to open flame or excessive heat.
Dangerous decomposition products:	Carbon monoxide (CO), carbon dioxide (CO2), traces of low molecular weight hydrocarbons and organic acids

11. Toxicological Information

Toxicological tests:	Natural product, not performed.
Skin contact:	Wood dust, depending on species, may cause dermatitis on prolonged, repetitive contact; may cause respiratory sensitization and/or irritation. The International Agency for Research on Cancer (IARC) classifies wood dust as a carcinogen to humans (Group 1, as of April 1995). This classification is based primarily on IARC's evaluation of the nasal cavities and paranasal sinuses associated with exposure to wood dust. IARC did not find sufficient evidence to associate cancers of the oropharynx, hypopharynx, lung, lymphatic and hemapoietic systems, stomach, colon or rectum with exposure to wood dust. The American Conference of Governmental Industrial Hygienists (ACGIH) classi fies hardwood dust as a confirmed human carcinogen (Class A1, as of May 1996).
Eye contact:	Dust may cause irritation.
Inhalation:	Dust may cause irritation of respiration tract.
Ingestion:	Low toxicity, LD50 > 2000 mg/kg

12. Ecological Information

Ecotoxicity:	Natural product, unlikely toxic
Mobility:	Not soluble in water, therefore effects on groundwater are unlikely.
Persistence and degradability:	Natural wood product, biodegradable by fungi and bacteria.

13. Disposal Considerations

Subject to legislation by local authorities, the product can be disposed together with domestic refuse and industrial waste. Waste and residues can be incinerated in a plant equipped with flue gas washing, together with domestic waste.

14. Transport Information

Railroad	RID	No restriction.
Road	ADR	No restriction.
Sea	IMDG Code	No restriction.
Air	ICAO-TI/IATA-DGR	No restriction.
UN-Classification		Not required.

15. Regulatory Information

BANOVA® lightweight panel / bending plywood and BALTEK VBC® do not require marking under the dangerous substances and preparation directives 67/548/EWG and 1999/45/EG. WHMIS (Canada): Not a controlled product. TDG (Canada): No label required.

16. Other Information

This issue of the safety data sheet replaces the issue released on 9th January, 2017. The information given in this material safety data sheet is accurate to the best of our knowledge, but without any guarantee. It is given in good faith based on the current state of knowledge and experience. It is issued in respect of safety requirements and does not purpose to provide information on the quality of the material.

Conclusion

This Fabrication Manual has been developed to assist fabricators to work with the substrate in the most efficient and effective manner. The tips and suggestions contained in this manual are the result of many years of combined experience by fabricators in the U.S., Canada, South America, Asia and Europe.

These fabrication suggestions and product specifications are based on information which is, in our opinion, reliable. However, since skill, judgment, and quality of equipment and tools are involved, and since conditions and methods of using the substrate are beyond our control, the suggestions contained in this manual are provided without guarantee. We recommend that prospective users determine the suitability of both the material and suggestions before adopting them on a commercial scale. 3A COMPOSITES USA, INC., DOES NOT MAKE ANY WARRANTIES, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR PURPOSE, WITH RESPECT TO ANY SAID SUGGESTIONS AND PRODUCT DATA. In no event shall 3A Composites USA, Inc., have any liability in any way related to or arising out of said suggestions and product data for direct, special, consequential or any other damages of any kind regardless of whether such liability is based on breach of contract, negligence or other tort, or breach of any warranty, express or implied.

Also, normal safety and health precautions practiced in any fabricating environment should be used when fabricating the substrate.

3A Composites USA, Inc.
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BanovaUSA.com