Table of contents

1. Introduction

1.1. Purpose of the manual

This manual presents the properties of the Strumber material and the recommended methods for its processing, joining, finishing, and storage. Its purpose is to facilitate correct and safe use of the material in the production of furniture, flooring, and decorative elements.

Strumber is a wood-like material serving as an alternative to sawn timber. As with various traditional wood species, it requires appropriate selection of tools, techniques, and finishing products in order to optimize work with the material.

1.2. About Strumber

Strumber is an innovative material manufactured from pressed hemp straw or flax, combined with a plant-based adhesive. It constitutes an ecological alternative to solid wood and wood-based panels, offering high dimensional stability, attractive appearance, and repeatable physical and mechanical properties.

Thanks to a unique production technology, entire stalks of annual plants can be processed, making Strumber a fully renewable and non-emissive material.

1.3. Intended use and scope of application

Strumber has been developed for a wide range of applications within the wood-processing industry and related manufacturing sectors. Due to its structure and properties, the material is suitable for the production of interior construction and finishing elements, including:

- furniture manufacturing,
- solid wood flooring and floor panels,
- stair treads and balustrades,
- worktops and countertops,
- wall and ceiling decorations,
- accessories,
- wooden toys.

Strumber is particularly recommended wherever an ecological alternative to solid wood is required, while maintaining the aesthetics of a natural material alongside consistent

mechanical parameters. The material works well with traditional woodworking methods, enabling easy integration into existing production processes.

1.4. Limitations of use

Strumber is not intended for applications requiring resistance to outdoor environmental conditions, such as exterior structural elements or façade cladding.

Brushing of the material surface is not recommended. This process leads to excessive fiber pull-out and significant surface degradation.

In its raw state, Strumber is sensitive to moisture. Excessive exposure to moisture may damage the material structure. Surface protection prior to final use is therefore strongly recommended.

2. Features and properties of the material

2.1. Available material densities

Strumber is manufactured in the following density variants: approximately **500 kg/m³, 550 kg/m³, 750 kg/m³, and 900 kg/m³**. Densities of 500–550 kg/m³ correspond to softwood species such as pine or spruce. A density of 750 kg/m³ is comparable to hardwood species such as beech or oak. The 900 kg/m³ variant is similar to exotic hardwoods. Density selection should be determined by the intended application of the final product.

2.2. Product range

Strumber is available in several formats, enabling its use across different technological processes and production profiles.

Available product variants:

Solid beams

- dimensions: 170×170×2550 mm,
- base format used for further cutting into boards, furniture components, strips, and custom-sized elements.

Planks

- cut from beams to a thickness of 40 mm,
- intended for the production of panels or door infill elements.

Blanks (friezes)

- cut from beams according to order specifications.

Three-layer boards

- format: 2500×1250 mm,
- thicknesses: 18 mm, 22 mm, 36 mm,
- layered construction provides dimensional stability and enables production of worktops, fronts, and large-format elements.

Veneers

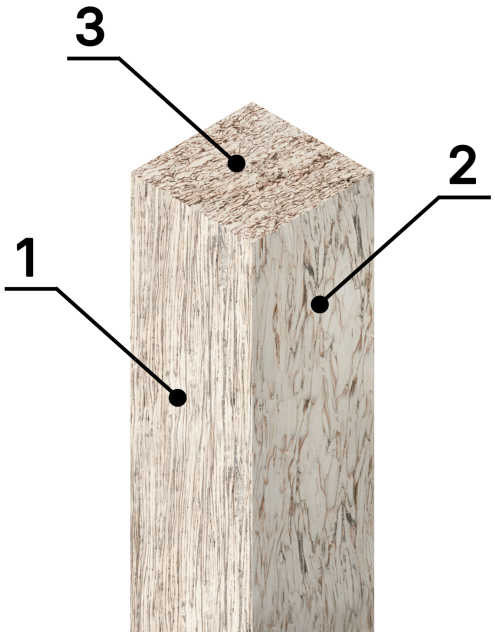
- thickness ≥ 6 mm,
- intended for laminating carrier panels and producing lightweight decorative elements.

Each format retains the characteristic properties of Strumber, allowing consistent finishing and joining of elements within a single project.

2.3. Visible structural types

Strumber features a longitudinal fiber arrangement within the beam, influencing its machining behavior and giving it a distinctive aesthetic character. From a single beam, three different visual structures can be obtained, expanding design possibilities and allowing the appearance to be matched to the final application:

1. Linear structure (LS) — longitudinal cutting
2. Irregular structure (IS) — longitudinal cutting
3. Cross-section structure (CS) — transverse cutting



2.4. Material moisture

Standard handheld resistance (pin-type) moisture meters and simple capacitance meters do not provide reliable readings for Strumber, as the material does not exhibit a stable correlation between moisture content and electrical parameters. This results from its fibrous structure and the presence of binder. Measurements taken with such meters may therefore be inaccurate.

During routine production control, the moisture content of Strumber material is monitored using an industrial analyzer based on **RF (radio frequency)** technology. This method measures the dielectric properties of the material and enables determination of moisture content throughout the entire volume of the product, rather than only within the surface layer.

RF technology provides fast and stable moisture measurement for each production batch under industrial conditions. The measurement is performed in real time on the production line, ensuring reliable control of moisture parameters in Strumber products.

3. Safety when working with Strumber

3.1. General information

Strumber is not classified as a chemically hazardous product. In solid form it is safe during normal use.

3.2. Ventilation requirements

During cutting, milling, and sanding operations, fibrous dust similar to wood dust is generated. This dust may cause:

- mechanical irritation of eyes and skin,
- coughing and temporary irritation of the respiratory tract.

Adequate dust extraction must be ensured, and work should be carried out in well-ventilated areas.

During machining, the following are required:

- general ventilation and local dust extraction,
- exhaust systems at machines (CNC routers, saws, sanders).

3.3. Personal protective equipment

During processing, the use of the following is recommended:

- safety goggles,
- work gloves,
- dust mask with filter in case of insufficient ventilation,
- protective work clothing.

Personal protective equipment must comply with applicable EN standards for eye, respiratory, and hand protection.

3.4. Fire and material behavior at elevated temperatures

Strumber is a combustible material. In the event of a fire, carbon oxides and smoke typical of lignocellulosic materials may be released.

Recommended extinguishing agents:

- water mist,
- dry powder and foam extinguishers,
- dispersed water stream,
- sand.

During firefighting operations, respiratory protective equipment should be used.

4. Transport and storage

4.1. Storage conditions

Strumber material should be stored in:

- dry and well-ventilated indoor areas,
- a temperature range of 10–25°C,
- conditions protected against moisture, precipitation, and direct sunlight.

It is recommended to store the material on stable, level surfaces, using spacers or pallets that allow air circulation.

Elements that have undergone preliminary processing should be stored under the same conditions as raw beams. Short-term loose storage is permitted; however, surfaces should be protected against dust, contamination, and moisture.

4.2. Protection against deformation

To prevent material deformation:

- store beams and components in a horizontal position,
- protect against point loads,
- ensure uniform support along the entire length,
- avoid storage near heat sources and areas of increased humidity.

The material should remain in its original factory packaging until machining begins.

4.3. Transport and storage

During transport:

- use covered means of transport,

- secure elements against movement (straps, spacers, wedges),
- protect against rain and excessive humidity,
- avoid overloads that may cause cracking or deformation.

It is recommended to:

- maintain stable storage conditions prior to production,
- acclimatize the material in the processing area for at least 24 hours,
- monitor potential dimensional changes before further processing.

5. Mechanical processing of Strumber

Regular maintenance of cutting tools is essential to maintain high processing quality and extend tool life. Cleaning and protection procedures should follow the recommendations of manufacturers of saw blades, milling cutters, planer knives, and drill bits.

Strumber can be processed using most standard woodworking cutting tools. Before starting production, trial cuts on sample material are recommended.

5.1. Cutting

The diameter of the saw blade should be matched to the type of element being processed.

- beams 170×170 mm — Ø450 mm blade,
- planks, blanks, boards, veneers — Ø300 mm blade.

Material cutting

Strumber can be cut using standard circular and band saws. Proper tool selection is critical for cut quality and process efficiency. When using circular saws, the application of a scoring blade is recommended to obtain a clean and precise bottom edge.

Circular saws blades for longitudinal cutting — beam breakdown

Longitudinal cutting refers to cutting along the fiber direction. It applies to both linear and irregular longitudinal surfaces.

Recommended parameters for longitudinal cutting with a Ø300 mm circular saw:

Saw type	Cutting blades with carbide teeth
Number of teeth	≥18
Tooth geometry	Straight tooth
Feed limiter	No
Carbide width	Carbide wider than the saw body
Blade with heat and vibration dissipation	Yes
Internal chip evacuation	x2
External chip evacuation	x2
Blade material	Reinforced steel
Blade coating	Gas-based coating that minimizes material adhesion and reduces friction
Rake angle	18 degrees
Hook angle	15 degrees
Recommended blade rotation speed	approx. 5000 rpm

Example of a saw blade verified in internal tests as effective for longitudinal cutting:
FABA circular saw blade from the PI-503 EVO2 series

Circular saw blades for cross-cutting and longitudinal cutting (universal saw blades)

Cross cutting applies to cutting across the linear surface and along the cross-section surface of the beam. Blades with alternating flat and trapezoidal teeth improve cross-cut quality. Incorrect blade selection may result in material burning and fiber tear-out.

Recommended parameters for cross-cutting with a Ø300 mm circular saw:

Saw type	Cutting blades with carbide teeth
Number of teeth	≥28
Tooth geometry	Alternating beveled tooth
Feed limiter	Yes
Carbide width	Carbide wider than the saw body
Blade with heat and vibration dissipation	Yes
Internal chip evacuation	x2
External chip evacuation	x2
Blade material	Reinforced steel
Blade coating	Gas-based coating or technical anti-adhesive, anti-corrosion, heat-reducing coating
Rake angle	15/18 degrees
Hook angle	15 degrees
Recommended blade rotation speed	approx. 5000 rpm

Example of a saw blade verified in internal tests as effective for both longitudinal and cross-cutting:
FABA circular saw blade from the PI-508V EVO2 series

FREUD circular saw blade from the LG2A series

Practical notes

The FREUD circular saw blade from the LG2A series provides high-quality finishing cuts. It delivers smoother cutting results and is recommended for panels and finishing elements, particularly for edging and trimming operations.

Scoring blades

When cutting finishing surfaces, the use of a scoring blade on a panel saw is recommended. It ensures a clean bottom edge of the cut and reduces the need for additional finishing in later production stages. When working with a scoring blade, blades with less dense toothing should be used, or the scoring depth should be reduced to avoid scorching the edges of the material.

Example of a saw blade verified in internal tests as effective for scoring cuts:
ITA TOOLS circular saw blade from the P36.125020024.000 series

Band saws

Due to Strumber's increased hardness and high density, straight cutting with band saws, both longitudinally and transversely, requires blades designed for solid wood and materials with increased cutting resistance.

Very good results have been achieved using a Centauro Supercut 80 band saw equipped with a Lenox Woodmaster blade with the following parameters:

- width: 54 mm,
- thickness: 0,9 mm,
- kerf: 1,3 mm.

The increased blade width and thickness provide stable cutting guidance, reduce blade wandering, and ensure dimensional repeatability.

Blade tension should be set according to the blade manufacturer's recommendations (for Lenox Woodmaster: 260 MPa), taking into account the specific machine design. Insufficient tension may cause instability, while excessive tension reduces blade lifespan.

5.2. Planing and thicknessing

Planing of Strumber should be carried out in accordance with the fiber direction in the beam. Sharp knives with stable geometry are recommended to achieve an even and clean surface.

Recommendations for jointing operations:

- machine along the fiber direction,
- use sharp knives, preferably carbide or spiral knives,
- avoid excessive material removal in a single pass, recommended depth 0,5–1,0 mm,
- apply uniform feed and stable material support.

For jointers and thickness planers, regular cleaning around the cutterhead is recommended due to the tendency of the material to generate fine fibrous particles.

Thicknessing should be performed with stable material feeding and an appropriately selected feed speed to prevent surface waviness. Recommended allowance: 2 mm, feed speed: 6–10 m/min, depending on required surface quality.

In internal tests, Tersa system knives were successfully verified:

- Tersa Tersotri 105040110 L110 (jointer),
- Tersa NS120 Globus (thickness planer).

5.3. Drilling

Drilling Strumber requires tools that ensure clean entry and exit while minimizing fiber tear-out. Due to the hardness and fibrous structure of the material, drills designed for solid wood and wood-based materials are recommended.

Recommended tools:

- knot drills (e.g. Forstner, Bormax) — ensure clean hole edges and stable guidance in the material,

- brad-point drills with peripheral cutters — reduce tear-out when drilling through-holes.

5.4. Milling

Strumber has a longitudinal fiber structure, which makes milling along the fiber direction significantly easier and results in higher surface quality. Correct cutting direction is essential. The tool should cut in a direction that compresses the fibers, stabilizing the structure and minimizing tear-out. Milling against the fibers may reduce edge quality and cause surface damage.

In practice, when machining edges (e.g. milling a countertop edge), operators should follow principles analogous to solid wood processing: correct tool feed direction, proper relationship between cutter rotation and feed, and adequate machining allowance. For cross-section milling, the use of templates and guiding fences is recommended to maintain stability and limit tear-out.

Due to the fibrous nature of the material, multiple passes along the same toolpath may be required to remove raised fibers (alternatively, fibers may be removed by sanding).

Compression cutters are recommended, as they counteract fiber tear-out. Tools with a higher number of cutting edges perform better at lower speeds and higher feed rates, reducing the risk of fiber burning.

Example cutters verified in internal tests:
PCD spiral shank cutter: ITA TOOLS DTE.16.035.16.0SR

Solid carbide compression cutter: N-pol V802.120.025.080XB

1. Recommended cutters:

- compression cutters 2+4 or 3+3 with chip flutes,
- diameter 6–12 mm for precision machining,
- diameter 16 mm for pocket milling.

2. Cutting edges

- spiral edges facilitating fiber evacuation,
- friction-reducing coatings (e.g. X-tremeBlue, diamond).

3. Operating parameters

- speed: 18,000–20,000 rpm,
- feed rate: 8–12 m/min.

For spindle moulders, positive results were achieved using the ITA Tools DGM.125030035.3RA5 cutter head, providing stable operation and good edge quality.

5.5. Sanding

Sanding is a critical stage of Strumber finishing, ensuring a smooth surface and proper preparation for oiling, lacquering, or staining. Due to the fibrous structure and the tendency of fibers to rise after the first finishing coat, sanding should be performed in multiple stages.

Recommended abrasives:

- corundum-coated sanding papers and belts,
- cloth or paper backing.

Internal tests showed the best results when using corundum belts with XA167 grit type.

Recommended grit sizes:

- 100 — initial sanding, surface calibration, removal of minor irregularities,
- 120 — surface leveling prior to finishing and intercoat sanding.

Process recommendations:

- sand along the fiber direction to avoid visible scratches,
- maintain uniform pressure and stable feed to improve surface consistency,
- perform intercoat sanding after applying the first finishing layer (oil, hardwax oil, lacquer).

For wide-belt sanding machines, the following configuration is recommended:

- grit 100 on the first sanding head,
- grit 120 on the second sanding head.

This setup provides a surface ready for finishing application.

6. Bonding and assembly

6.1. Gluing

Bonding of Strumber elements can be carried out using technologies commonly applied in the woodworking industry. The material shows good compatibility with polyvinyl acetate (PVAc) adhesives, provided that appropriate application methods and process parameters are maintained.

If adhesives other than PVAc are planned, preliminary tests on a sample piece of the material are strongly recommended.

For Strumber, the use of **PVAc adhesives with a minimum water resistance class D3**, intended for interior applications, is recommended. Such adhesives provide good adhesion, joint stability, and compatibility with the fibrous structure of the material.

The optimal adhesive consumption range is 0,25–0,5 kg/m^2, ensuring uniform coverage and a strong, stable, and durable bond.

Adhesive application

Due to the fibrous structure of Strumber, brush or roller application is not recommended. Adhesive adhesion causes fibers to stick to application tools, which hinders even spreading, reduces joint quality, and slows down the technological process.

Recommended application methods:

- pressure applicators,
- gravity-fed or pneumatic spray guns for water-based adhesives,
- bottle dispensers with slot nozzles.

In serial production, pressure application systems with properly selected roller or nozzle geometry are recommended. Optimization of process parameters, such as working

pressure (2–5 bar) and adhesive viscosity, allows for stable production conditions, high bond quality, and efficient adhesive usage.

6.2. Mechanical fastening

Strumber can be mechanically joined using standard techniques applied to solid wood and wood-based materials. The best results are achieved when using fasteners that provide stable guidance and controlled penetration.

Technical recommendations:

- use screws with deep threads to facilitate penetration into higher-density material,
- select fastener length to ensure joint stability without risking material splitting,
- avoid fastening too close to edges; maintain a minimum distance of 20 mm from the edge when using screws.

6.3. In-house manufacturing of layered boards

Sandwich panels made from Strumber must be produced exclusively in multi-layer configurations with cross-oriented fibers, which effectively compensate for internal stresses within the material.

Linear layouts (parallel fiber orientation) do not provide sufficient dimensional stability and are not recommended, as they promote warping and surface cracking.

Layer configuration:

- three-layer construction — preferred for large-area elements (worktops, furniture panels),
- two-layer construction — permissible only for small formats and auxiliary components.

The cross-section structure (CS) may serve a decorative function only and should not be used as a load-bearing layer. Structural layers must be made from linear (LS) or irregular (IS) structures, with the IS structure exhibiting higher mechanical strength.

Thickness and stability:

- minimum thickness of a single layer: 6 mm,
- optimal single-layer thickness range: 6–12 mm,
- minimum total panel thickness ensuring stability: 18 mm (e.g. 3×6 mm or 2×9 mm).

Gluing and pressing:

- bonding must be performed over the entire surface area of the layers,
- PVAc adhesives of at least D3 class are recommended,
- adhesive application should be carried out using pressure methods to ensure uniform coverage,
- pressing should be maintained until full adhesive curing, with uniform pressure across the entire surface.

Combining Strumber with other materials

Strumber can be freely combined with other wood-based materials such as plywood, OSB, MDF, HDF, and particleboard, depending on the intended application and required performance parameters. Carrier materials should be selected based on stiffness, dimensional stability, and load resistance, while maintaining the principle of full-surface bonding.

Technological notes:

- thin Strumber veneers with a thickness of 4–6 mm must be bonded to a stable substrate without exception,
- every new sandwich panel configuration should be verified through a technological trial prior to implementation in serial production.

7. Repairs and renovation

Defects and surface imperfections may be repaired using standard wood fillers. Shades close to the natural color of the material are recommended.

Example filler verified in internal tests:
Vidaron Wood Filler – H02 Birch

The use of other fillers is permitted; however, prior to application, a test on a small Strumber sample is required. The test should include filling, drying, sanding, and visual evaluation after applying the selected finishing system.

8. Surface finishing

Strumber behaves similarly to solid wood when used with woodworking finishing products. Selection and application of finishing systems should therefore follow the instructions provided by the manufacturers of the respective products.

Correct application in accordance with manufacturer guidelines, as well as appropriate working conditions, are critical to achieving repeatable surface quality.

The finishing system should be selected depending on the intended use of the product and the desired visual effect. The material readily accepts both water-based and oil-based products, and its natural porosity promotes even absorption of stains and finishes. Due to fiber raising after the first application, intercoat sanding is required.

8.1. Oils

- Recommended: oils for worktops and working surfaces.
- Application: foam roller or soft cloth.
- Apply 2–3 thin coats, with mandatory intercoat sanding (grit 120).

8.2. Hardwax oils

- Apply in thin layers and spread thoroughly.
- Excessive application may cause discoloration.
- Intercoat sanding is required.

8.3. Stains

- Work well with the material due to its high absorbency.
- Apply evenly; remove excess before drying.
- After staining, apply an additional oil or lacquer topcoat.

8.4. Lacquers

Strumber can be finished with all types of lacquers commonly used in woodworking, including water-based, acrylic, and polyurethane systems, as well as UV-cured coatings, which are fully compatible with the material. The selection of a lacquer system should correspond to the functional requirements of the product and the available technological equipment.

Lacquers may be applied manually, by spraying, or by roller coating. Due to the natural porosity of the material and possible fiber raising after the first coat, careful surface preparation is required.

9. Waste management

Waste generated during the processing of Strumber (offcuts, dust, trimmings) may be handled in a manner analogous to waste from wood-based materials.

The material is fully biodegradable; however, waste handling must comply with the regulations applicable in the given location and with the operational profile of the manufacturing facility.