

BENDYWOOD® 1st TIME USER GUIDE

Please follow the instructions below.

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1. HOW TO WORK AND FINISH BENDYWOOD®

Bendywood® is steam-treated wood that is compressed along its length and subsequently dried in this compressed form. In order to maintain this compressed length, no water should be able to penetrate the wood. If it does get wet, the wood will expand in length and will also shrink again when it dries. The wood surface will roughen up, it will need to be sanded and varnished again. Therefore:

**DO NOT USE BENDYWOOD® OUTDOORS,
AS BENDYWOOD® IS NOT WATERPROOF.**

Since Bendywood® is compressed wood, it is more compact than normal wood. For this reason, we suggest to **comply with the following instructions** when **WORKING** Bendywood®:

Sawing and sanding:

- Saw and sand as with normal wood.

Planing and milling:

- **Only dry Bendywood® can be milled** (at a moisture content of about 8%), as moist Bendywood® can tear out.
- **Do not plane and mill against the grain:** first try on the surface planing machine in which direction the wood can be worked best.
- **Mill at a high rotation speed**, if possible at 12.000 rotations per minute. **Ideally use HSS-tooling**, in order to avoid tear outs.
- **Small profiles** are best milled on the edge of a board and subsequently cut off at the circular saw.

Gluing and jointing:

- **Do not use water-based glues**, only synthetic ones, such as **polyurethane adhesives** and **synthetic resin glues**.
- Pay close attention when Bendywood® needs to be glued/jointed in length, as it is the case, for instance, with handrails or with lippings around round table tops:
 - **Never use butt joints**, as they will open up in the long term. Only use "open" butt joints if indispensable and provide them with a "shadow gap".
 - **Always glue/joint by means of a diagonal cut:**



The length of the diagonal cut should equal 3 times the cross section of the parts that need to be glued/jointed

Staining and varnishing:

Do not use water-based products, only synthetic stains and varnishes, especially when it concerns thin sections. Thicker sections, such as handrails for instance, better endure water-based substances as long as these **are dried well immediately after their application**. A deep penetration of water should be avoided!

Final assembly of curved parts:

- **The optimum moisture content for bending tight radiuses is about 12%. Prior to the final assembly, Bendywood® should be well dried to about 7-8%.** As it has already been artificially dried during the production process, Bendywood® will not suffer any damage during this final drying process.
- **Important: Bendywood® will shrink in length as long as its moisture content decreases! Especially when mounting long handrails this needs to be taken into account!**

2. HOW TO BEND BENDYWOOD® AND MOISTEN IT IF NEEDED



Bendywood® should **always** be bent **around a mould**. To this end you can use clamps, presses, tension belts, etc. and then you should wait until the bent form has stabilized, best by drying it to 8% final moisture content. Pictures of moulds can be seen on our website under the rubric "[Bending moulds for Bendywood®](#)".

When loosening the bent part from the mould, the curve will slightly open up. Also see on our website under "[Spring-back after being taken from the mould](#)".

At a moisture content of about 12% Bendywood® can be bent:

- **up to a radius of 1 : 10 if not jointed in length (e.g. a 10 mm thick section up to a radius of 100 mm).**
- **up to a radius of 1:20 if jointed in length (e.g. a 10 mm thick section up to a radius of 200 mm).**

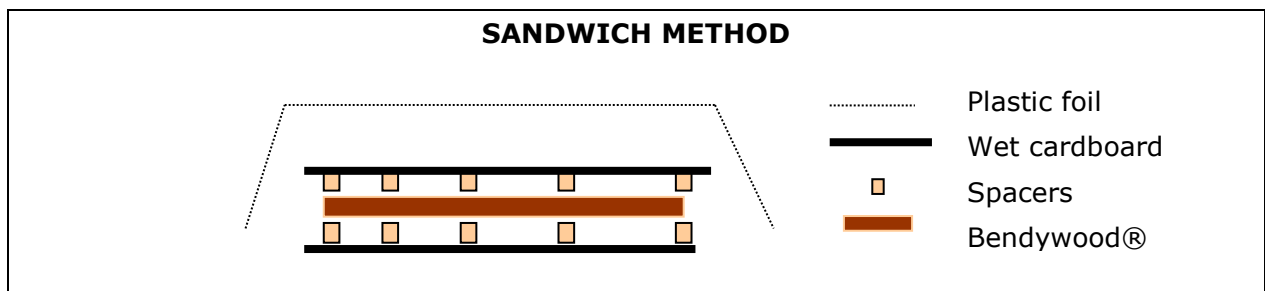
The dryer the Bendywood®, the more dimensionally stable it is.

IMPORTANT:

Only humidify dry Bendywood® when you need to bend it to a tight radius.

Bending radii up to a radius of 1 : 30 can also be reached when the wood has a moisture content of 8%.

Should you be in need of raising the moisture content, the Bendywood® should be placed between two layers of moist cardboard. A few spacers should be positioned above and below the wood in order to avoid direct contact with the cardboards. Finally, the whole lot should be covered with a plastic foil and left at rest for 1 - 2 days and nights: in this way the moisture content is raised to about 12%, the ideal humidity for bending.



Using this technique (referred to as "Sandwich Method") the Bendywood® absorbs humidity from the air without getting wet.

ATTENTION:

BENDYWOOD® MUST NOT BE PLUNGED INTO WATER OR COME IN DIRECT CONTACT WITH WET MATERIAL.

The ingress of water will make the wood swell and – in case of jointed parts – it can cause the glued joints to open up.

3. HOW TO BEND BENDYWOOD® HANDRAILS

Bendywood® bending handrails are:

- in solid hardwood
- in full sizes / not in multiple layers
- already machined, ready for bending

Bendywood® handrails can be bent up to a radius of 20 times the profile's cross section. A 40 mm round profile up to a radius of 800 mm, for instance, and a 50 mm profile up to a radius of 1.000 mm.

In order to be able to bend up to these limits a wood moisture content of about 12% is indispensable.

BENDING JUST BY HAND:

- I. **Use the steps of the staircase as a bending mould for bending an exterior handrail, if sufficient space is available to do this:**

bend on the steps on the inside of the railing and mount on the railing, as the curve will slightly open up when the handrail is taken down from the steps.



II. Bending an ascending handrail around a flat mould: this is the easiest and best solution for spiral staircases!

See [video for a round handrail](#) and [video for a round handrail with flat bottom side](#).

NEW: such **already bent and ready-to-mount** bending handrails are now available on request:

- The transport costs are significantly lower than the costs for shipping long straight sections.
- It is possible to perform the upwards bending later, when mounting the bending handrail.
- It is also possible to combine normal wood with Bendywood®.
- **Also lengths up to 13 m are feasible, as special production.**
- Handrails with groove/plow are also possible.

This [video](#) shows you how such a handrail is installed upwards.


III. Bending an ascending handrail around an ascending mould / assembly support:

See [video](#).



In case it is not possible to use the staircase itself as bending mould, you can build a mould as shown in the above video and pictures. Keep the radius about 10% to 20% tighter than the requested final radius, as the bent handrail will always "open up" when taken from the mould.

BENDING BY USING A RING ROLLING BENDING MACHINE:

- **Solely the bending handrails with diagonal joints**  can be pre-bent with a ring rolling bending machine (**up to a radius of 1 : 30**), as only diagonal joints can endure the mechanical stress of a bending machine. A handrail with a diameter of 40 mm, for instance, can be bent up to a radius of 1.200 mm. **The final bending – if necessary – up to a radius of 1 : 20 should be carried out by hand around a mould or on the banister.** See [video](#).
- Tighten the bending radius progressively, letting the handrail run through the rollers of the bending machine not more than 3 times. Bear in mind that the ring rolling bending machine also rolls the wood and rolled Bendywood® will reach its limit of flexibility more quickly. Consequently, a 40 mm thick handrail, for instance, can only be bent up to a radius of 1.200 mm by machine, then you should continue by hand.

- The **bending handrails with normal joints**



CANNOT be

bent with a ring rolling bending machine.

HOW TO BEND NON-ROUND HANDRAILS UPWARDS ?

All handrails turn on their own axis when being bent upwards. This torsion is not visible in case of a round handrail, as a round profile always looks the same when turned. In case of **other profiles** or **round profiles with a groove/plow** it is necessary to compensate for torsion, so that the lower part of the handrail remains below.

It is best to proceed as follows: (in one operation cycle)

First of all bend the handrail horizontally. Then clamp it onto the banister (which ideally has a flat steel strip or similar) starting from above. The "turning" should be carried out using a long-arm clamp, which needs to be clamped onto the handrail at a distance of 1,5 m in order to have sufficient leverage. Turn and fix the handrail little by little until the entire handrail rests on the banister. A few days later – after it has stabilized – the handrail can be taken from the banister to be sanded, stained and varnished. **Proceed as soon as possible with the permanent fixing**, so that the handrail does not lose its bent form.

Thick sections (such as omega handrails or 60 mm thick round sections, for instance) need to be **cut in half**, after which both halves need to be bent, turned, glued and clamped onto the banister in one operation cycle. Always use glue with a long open time! In this regard also take a look at our website under:

- [Mould for bending a 60 mm bending handrail cut in half](#)
- ["Photos bending handrails"](#)

HOW BENDYWOOD® BENDING HANDRAILS ARE SUPPLIED ?

The round bending handrails (storing in diameters 40, 42, 45, 48 and 60 mm and in lengths up to 6 m) are **packed in cardboard tubes** and have a **moisture content of about 12%**: perfect for bending. **The handrails should only be unpacked just before you start bending.**



Pre-bent round bending handrails are fixed onto a transport mould and shipped in a flat cardboard box (about 220x220x15 cm).



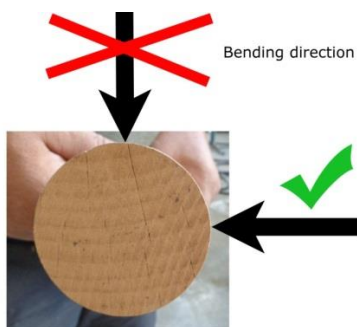
The raw square-edged bending bars (50x50, 80x50, 100x50 and 65x65 mm) on the other hand, used for producing customized handrails, are normally packed and have a **moisture content of about 8%**: perfect for milling.



The bending handrails are jointed in length and at a moisture content of 12% they can be bent up to radii of about 1 : 20. For example, a 40 mm round handrail can be bent to a radius of about 800 mm.

ATTENTION:

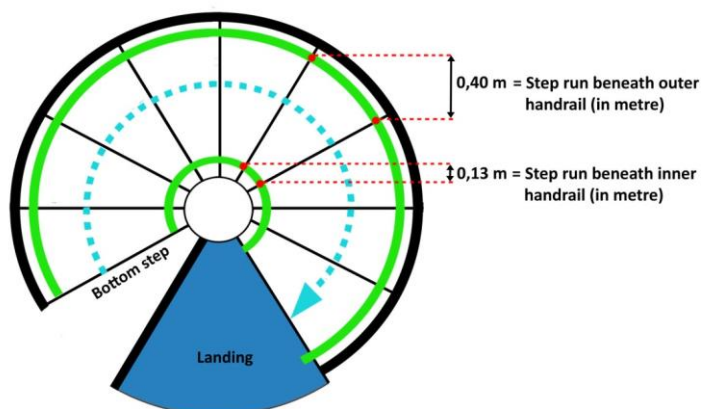
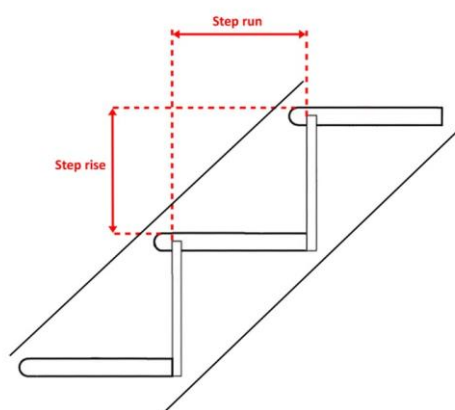
Only at a moisture content of about 12% a pliability up to 1 : 20 can be guaranteed. See part [2. How to bend Bendywood® and moisten it if needed.](#)



In case Bendywood® needs to be bent up to its limit, do not only pay attention to the moisture content, but also to the wood grain, **bending against the longitudinal fibre direction** and not across the grain.

FORMULA FOR CALCULATING THE LENGTH OF A SPIRAL STAIRCASE HANDRAIL:

$$Length = \sqrt{(number\ of\ steps \times step\ run)^2 + (number\ of\ steps \times step\ rise)^2}$$



EXAMPLE:

Assuming:

- 18 steps
- Step rise: 17 cm
- Step run beneath inner handrail: 13 cm
- Step run beneath outer handrail: 40 cm

$$Length\ inner\ handrail = \sqrt{(18 \times 0,13\ m)^2 + (18 \times 0,17\ m)^2} = ca. 3,85\ m$$

$$Length\ outer\ handrail = \sqrt{(18 \times 0,40\ m)^2 + (18 \times 0,17\ m)^2} = ca. 7,85\ m$$

4. HOW TO BEND BENDYWOOD® LAMINATION CURVES

SHAPES CONSISTING OF GLUED LAYERS of Bendywood® can be made using **thicker lamellas** in contrast to those consisting of glued layers of normal wood: this improves the quality and simplifies the production process. Bendywood®-lamellas are available from 2 mm thickness onwards, in widths up to 300 mm and in lengths up to 6.000 mm.

By gluing several layers of Bendywood® in a mould, it is possible to:

- **glue without counter-mould**, as the Bendywood® can be bent to shape onto a simple mould using clamps and small blocks of wood. Furthermore it is also sufficient to **sand only the layers' visible surface**, before bending and gluing them! Examples to this you can find on our website under the rubric "[Photos glue-laminated bending parts](#)".
- obtain **clean, hardly visible glued joints** if the individual layers are only bent to a radius of 1 : 20 (i.e. a 3 mm thick lamella, for instance, bent to a radius not tighter than about 6 cm). In case lamellas that are cut from the same wooden blank of Bendywood® are being used, bent parts with a **consistent colour and grain** can be produced, identical to bent parts in solid wood.
- obtain **dimensionally stable bent parts**, because the glue stabilizes the bent parts. Use glues with a long open time!

But also bent parts consisting of glued layers are subject to a certain degree of "**rebound**" when taken off the mould. Also in this case the parts need to be bent to a tighter radius than the final requested one in order to compensate for the opening. For example, 5 layers with 3 mm thickness bent and glued onto a 90° angle with radius 60 mm should be bent and glued onto a 88° mould, in order to obtain a bent part with an angle that remains stable at 90°.

5. HOW TO MOUNT CURVED BENDYWOOD® HANDRAILS

I. Provisional fixing:

After the bending Bendywood®-handrails should **only be fixed provisionally** to the banister, **so that they can shrink along their length**.

Handrails that are bent at a moisture content of 12% will shrink up to 0,5 cm per meter along their length until the moisture content is reduced to about 8%.

II. Final assembly:

Only after this the handrail can be taken off, sanded (if necessary), finished and permanently fixed.

Start **with a fix mounting point halfway its length** and mount the handrail from there towards the ends in such a way that it can still shrink a bit along its length, especially in the case of long handrails.

Please consider that a 6 m long handrail, for instance, will further shrink up to 1 cm (on its total length) within the first year after final assembly, especially when the place is well heated.

III. Mitre joints:

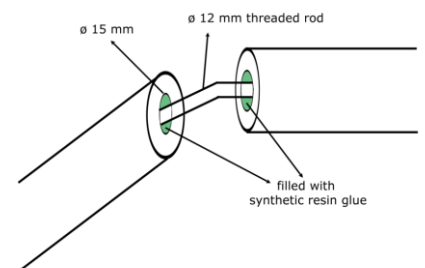
Mitre joints at the ends should be avoided: the risk that they will „open up“ in the long term is high.



In case mitre joints cannot be avoided, there are 2 options:

- **Mitre joints with synthetic resin glue and a threaded rod:**

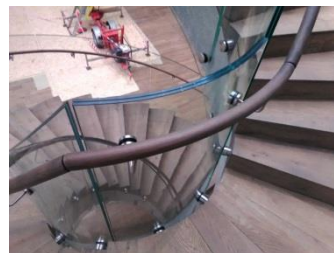
- Drill sufficiently big and profound holes into the handrail ends that need to be jointed;
- Fill these drill holes at both ends with a **synthetic resin glue** and insert a threaded rod, which diameter should be a bit smaller than the one of the drill hole;
- Press both handrail ends together with clamps and keep them in position until the glue has dried.



The use of a threaded rod as well as the use of synthetic resin glue are both absolutely necessary to prevent the joints from opening up.

- **“Open” mitre joints or “open” butt joints:**

Such joints are secure and in certain cases also decorative (when combined with glass elements, for instance).



Only in the following cases this problem doesn't occur:

- In case the handrail is bolted down to a continuous metal rail (from below) at small intervals of about 10-20 cm;
- In case the mitre joint is under tension: this occurs when bent parts (which always open up a little) exert pressure on the mitre joint.

