Ch 6 - Laminating the Stems

The stems of the boat are made up by laminating strips of timber, usually larch, over a mould made up from the patterns supplied as part of the kit.

The stems can also be made up from sawn and half-checked timbers, but this method demands a higher level of skill. It is recommended that you do not attempt this method unless you have a skilled boatbuilder on your team.

The stems are deliberately made over-length, and will be cut back to the correct size after they have been glued.

Tools
The main tools you will need at this stage are large clamps, and lots of them.

Preparing the Timber
The first step is to prepare the timber for laminating. You will need approximately 28 lengths of timber 2¼” x 5/16” and 6’6” or more long. This should all be clear of knots and sapwood. The timber should be fine sawn for maximum adhesion. Planed surfaces will reduce the porosity of the timber, and should be lightly sanded with 60 Grit paper across the grain.

The job will be a great deal easier if all laminates are exactly the same width. There is an allowance given for cleaning up the piece after gluing.

Making the Jig
The simplest way to make the jig is to contact a club who have already built a boat and ask them for a loan!

You will need an 8 x 4 baseboard preferably 18mm thick - MDF, OSB, or cheap plywood. 12mm may be adequate if it is braced underneath with timber lengths.

Take the 6mm plywood patterns for the Inner stems, and lay them out on the baseboard, making up the full width of the stems.

Using offcuts from the building frame timber, lay pieces approximately 3” long against the Inner Stem Pattern, and mark their position on the baseboard. The length of the blocks are dictated by the size of the clamps you have available. The total moulding on the stems is 4½”. You need to be able to fit this and the blocks into the clamps you have available. Ideally you will need at least four 8” clamps to glue each stem piece. You will also be able to use many more smaller clamps between the main blocks.

Work Out the springback allowance, and then screw them to the baseboard from underneath with at least two heavy duty screws.

The springback is calculated using the formula \( Y = \frac{X}{N^2} \) where \( Y \) = amount of springback and \( N \) = number of laminations, and \( X \) = amount of deflection. The diagram below illustrates the variables.
The amount of springback is related to the number of laminations, the more you have the less springback you will get. Using 10mm laminates an allowance of about half an inch inside the line of the stem curve was about right, thinner, and therefore more, laminates will need less allowance at the expense of more wood.

Finally, to prepare the jig for the job, ensure that all areas where the stem timbers will come into contact with the jig are covered in polythene or packing tape.

**Glues**

Either Epoxy or PolyUrethane (PU) glues can be used for the stems. PU is recommended as there are no gaps to fill, and is much easier to clean up after it has set. PU can also be used on green (unseasoned) timber which will bend more easily. If using epoxy, the timber must be dry.

**Gluing Inner Stems**

This picture shows the blocks secured to the base board, covered in packing tape to prevent the stem being glued to either the blocks or board.

The start end is secured with a hand clamp, and we are in the process of pulling in the middle with an 8" G clamp with clamp pad in place to protect the stem.

This stem used four laminates which gave a huge springback - use more laminates with yours!

Make sure that you have all your clamps laid out ready for use. It is advisable to have clamp pads made up from scrap ply or MDF. Though this job can be done working alone, it is much easier with two or three people.

For the inner stems, you will need 6 laminates.

Lay these on a surface protected from the glue, and evenly spread the glue over the whole face. Epoxy will need a very thin wetting out application, followed by a very sloppy microfibre mix. PU needs a reasonably generous layer, but in both instances, do not over-apply the glue.

Make sure that one end of the laminate bundle is even, and move it to the forefoot end of the jig. Starting at this end means that we have the main length available to lever it around the areas of maximum curvature.
Leave a few inches protruding beyond the first block, then clamp the laminates securely.

Bend the laminates around to the next block, and clamp this up until there is a couple of millimetres gap between the inner lamination and block, repeating the process at each block until you reach the last.

Using a mallet and a piece of hardwood, make sure that the upper edge of the laminates are as even as possible.

Tighten up the second clamp, and apply a couple more clamps in between the first and second block, tightening them up so that the glue is evenly squeezed out, but not so tight that all the glue will be squeezed out.

Repeat this process at each clamp.

Leave the Inner stem for at least 24 hours - more if gluing with epoxy in cold weather - before releasing the clamps. It is recommended that you do not release the clamps until you are ready for gluing the Outer Stem.

**Gluing Outer Stems**

The process of gluing the outer stems is exactly the same as the inner stem, with the exception that the Inner Stem now becomes part of the jig.

When releasing the clamps on the Inner Stem, there will be some springback with the natural elasticity of the timber. Providing this is no more than about ½", the boat will still go together.

Clean up the Inner Stem, sanding the Inner & Outer faces smooth, and removing any sharp edges from epoxy on the sides. Do not plane it down to the 2” thickness until the Outer Stem has been laminated.

Once the rough cleaning is finished, completely cover it in Packing Tape ready to be used as part of the jig for the Outer stem.

Place the Inner Stem against the jig, prepare your clamps, and repeat the procedure.

**Final Steps**

Once the glue on the Outer Stem has set, release the clamps and remove all the stems from the jig.

Sand the faces of the stems. Plane the sides of the stems to bring the “siding” or thickness down to two inches. This is easiest done using a planer-thicknesser, but hand held electric planes and belt sanders have been successfully used, with
the proviso that they are both extremely aggressive and should be used with great caution.

Take the Inner Stem patterns, and use the marks to transfer the plank strike lines to the face of the inner stems.

The photograph here shows transferring the strike marks from paper plans. The principle remains the same using the supplied patterns.

The Outer stem needs to be braced to prevent it opening out. Clamp the Inner and Outer stems back onto the jig, and screw a batten across the ends of the outer stem to stop it “relaxing” while you are planking the hull. This should be done on both sides so that it does not set into a warped shape.

If you are ready to start gluing the hog and planking, mount the inner stem and get on - if not, the Inner Stem should also be similarly braced until you are ready to move on this stage.