

Carbon-plate Joiners

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Advantages

Prepreg carbon plate with mixed 0,15 degree fiber angles has much greater attainable material strength (about 400 ksi) than pultruded carbon rods. Joiners made from prepreg carbon plate are about 2x stronger than hard steel joiners of the same size. They are about 10x stronger than hardened steel joiners of the same weight.

Joiner Preparation

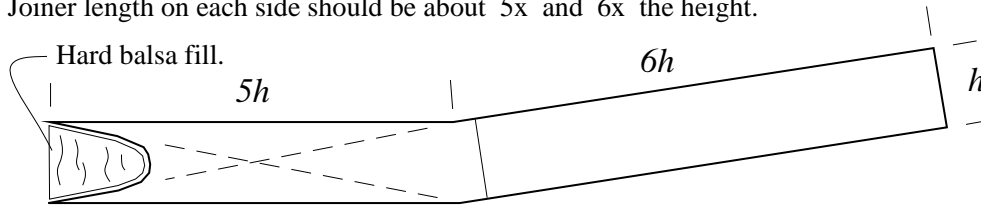
For 0,15 fibers, make cross-sectional area of joiner about 3x the total area of the spar caps.

For 0,90 fibers, make it about 5x the total spar cap area.

This will give comparable bending stress between joiner and caps.

Choose joiner height to allow for the glass bondline filler described below.

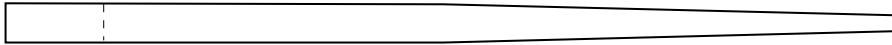
Joiner length on each side should be about 5x and 6x the height.



Cut back joiner's middle along diagonals on glued-in side. This greatly reduces bondline stress concentration at the end.

Strongly recommended:

Taper the plug-in side to about 1/3 width for easier fit, and to slightly better spread the load on the box.

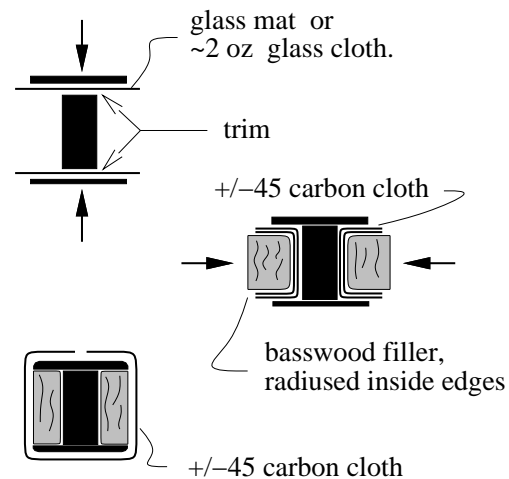


Joiner Bonding

Prepare surfaces for bonding by sanding. Use slow epoxy. Bond joiner between spar caps with glass mat or cloth to enforce a uniform bond line thickness which reduces stress concentrations. Clamp very lightly in proper position. Trim excess glass when epoxy is still somewhat rubbery.

On each side, apply two layers of 3 oz or one layer of 5 oz +/-45 carbon cloth, pushing it into position with vertical-grain basswood blocks. Clamp lightly to force out excess epoxy. Trim cloth and basswood flush with spar caps when set.

Round off cap edges slightly and wrap with 3 oz or 5 oz +/-45 carbon cloth, with seam on top of cap. Vacuum bag or wrap tightly with polyethylene. This wrap over the joiner region carries far greater shear loads than the shear wrap over the rest of the spar. Trim basswood and carbon cloth around the joiner even with the end rib plane.



Joiner Box Construction

Cover exposed joiner and adjacent spar with about 0.001" of cling wrap, avoiding any wrinkles. Wax the wrap. "Bond" the spar onto the covered joiner using the method above, but replace glass mat with +/-45 carbon cloth. Also, the cloth and basswood are all glued in one operation rather than two.

Pull out covered joiner when epoxy is partially set (a tapered joiner makes this easier). Pull out cling wrap. Trim and wrap with carbon cloth as above. Wrap very end of box with carbon tow to prevent bursting.

