

## Transom, Stringer, and Sole Repair

Before planning a repair, comprehensive troubleshooting is recommended. A soft sole may hide rotten stringers. Rot in a transom may extend to the stringers. Decide what you will replace but be ready to discover hidden damage and a full repair. We will describe a complete replacement of transom, stringers and sole. If only one of those parts needs replacement, disregard our instructions for the others. The repair entails removing the bad parts and replacing them with new components made of superior materials. We will describe the materials then the method step by step and finish with some basic scantlings (material specifications).

### MATERIALS:

You will invest plenty of time in this repair, do not use inferior materials. For the core of transom, stringers and sole, use either true Marine Plywood or Marine Foam. For fiberglass, use directional glass like Biaxials and Epoxy resin. For all practical purposes, epoxy is waterproof. It will not allow water to penetrate the core. Epoxy is also stronger and, most important, it has excellent bonding qualities. Polyester will not bond well to old polyester, but epoxy will.

Marine plywood BS 6566 or BS 1088 is a much better choice than marine fir. Fir plywood has some voids and is probably what you had in your boat, let's not repeat the mistake. All plywood and wooden parts should always be epoxy coated to saturation on all sides. All plywood and wooden parts must be primed with epoxy before application of the fiberglass. Failure to properly prime may result in resin starvation.

Better than plywood, but more expensive, is marine foam. Those foams are used to build the hulls of large yachts. They come in different types and densities: the transom foam has high compressive strength, but the type used for the stringers and sole has more tensile and flexural strength. To use foam instead of plywood requires much more fiberglass and resin and this affects the cost of the repair materials. A repair made with marine foam cost almost twice what a plywood cored repair does. Of course, a foam core eliminates any risk of rot. Heavy composite materials are not recommended as cores. They are heavy, and this will reduce performance and increase full consumption. They are often brittle and subject to mechanical fatigue. Expensive too. The same remarks apply to poured in transom putties.

The scantlings for your boat may be quite different than from what you see here. Contact [orderdesk@e-boat.net](mailto:orderdesk@e-boat.net) for more information.

### TRANSOM:

Let's start with the transom. If we have a transom with a rotten core, there are several ways to handle the repair but only one good one. The best way is to get full access to the transom either by grinding down all the inside fiberglass skin or simply cut the whole thing out. Do not try to remove the rotten plywood from in between the two fiberglass skins. It is impossible to do properly and to pour a putty in between will produce a very heavy and brittle transom. Most prefer to remove only the inside skin. This leaves the outside skin and gel coat intact.



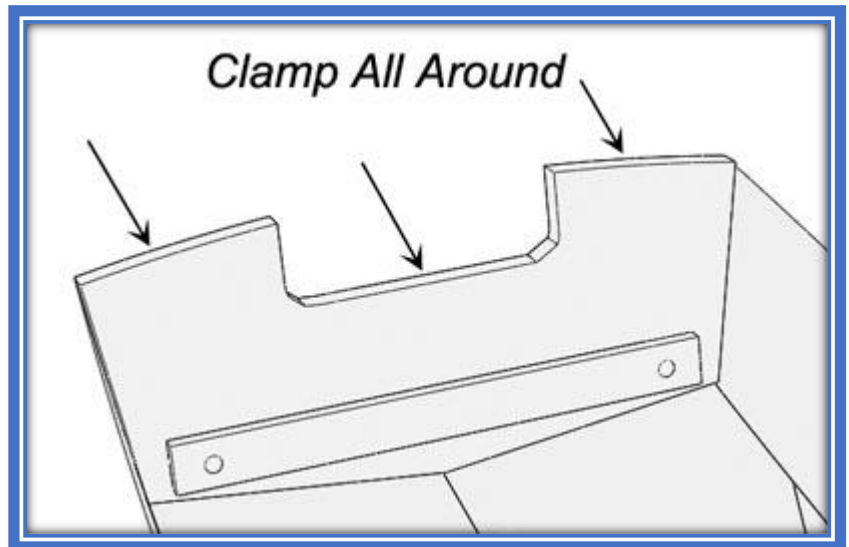
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Grind down all the wood to the bare fiberglass. Extend the grinding to the hull sides and bottom at least 8". Grinding is done with a high-speed grinder and aggressive disks, around 40 grit. The goal is to have a clean solid surface to which the epoxy will bond. All oily contamination must be removed with a diluent like acetone, lacquer thinner, or styrene. Diluent residues must be washed off before applying epoxy.

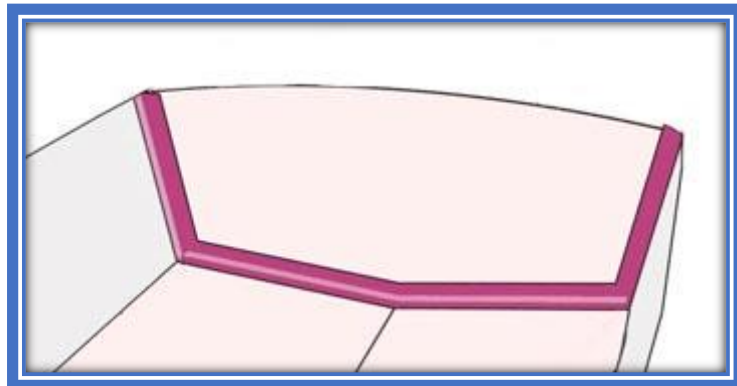
With the old transom removed, the next step is to cut your core, plywood or foam. In the case of plywood, it will be made of several layers epoxy glued. You make epoxy glue from epoxy mixed with a filler, in this case wood flour (woodflour). Better yet, use premixed epoxy glue (Gelmagic). Do not change the thickness of your transom but if it looks too thin, consult with us and we will tell you what the industry standard is for your engine size.

Your core, laminated plywood or foam, will be bedded in epoxy putty. Putty can be made from mixing wood flour in the epoxy until a thick peanut butter consistency is reached or use a pre-made putty (EZ Fillet). If you left the outside fiberglass skin in place, you will need a way to apply good pressure to the core all around. If you did cut out the whole transom, disregard what follows. There are several ways to do this. The high-tech way is vacuum bagging. This is out of the scope of our discussion: if you know vacuum bagging, you don't need a description. If you don't know vacuum bagging, stick to simple methods, don't try to learn vacuum bagging on such a job!

Boat building factories use either vacuum bagging or enormous clamps to press the transom core in the hull. There is no need to fabricate those clamps. You probably have number of holes in your transom: scuppers, motor well drain, holes for trim tabs etc. If you don't have enough holes in the transom, drill some, they are easy to fill later. We will use those holes for clamps made from 2x6's and threaded rod.



Use enough putty and enough pressure to insure good contact everywhere but beware of excessive pressure. Epoxy has great gap filling properties and work best with a small gap. This is not a wood glue and a perfect fit is not necessary, quite the opposite. Do not push all the resin putty out of the contact area or the bond will not



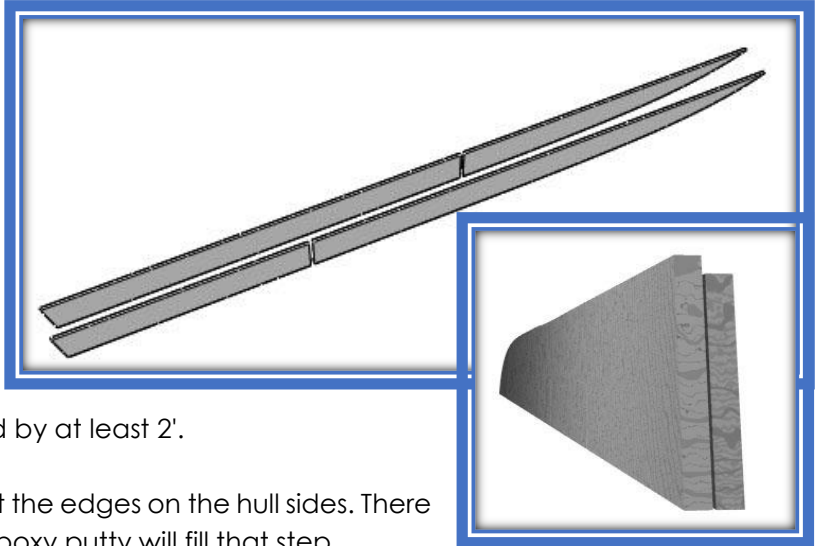
be strong. Allow the putty to cure and follow with fiberglass application. This is a two-step process: apply tape all around the perimeter, then cover the whole inside face of the transom with the specified layers of fiberglass overlapping the glass on the bottom and sides. The overlaps are important, they create small L or I beams that stiffen the boat and increase bonding area. It is also important to offset the edges of your fiberglass fabric and tape to avoid stress concentration.

Fiberglass, tape or fabric, will not take tight turns. You will need fillets or rounded corners to get good contact and avoid air bubbles. See our How-to files and tutorials at [bateau2.com](http://bateau2.com) to learn the basic use of fiberglass and resin. If you did cut the whole transom out, proceed with the outside fiber glassing.

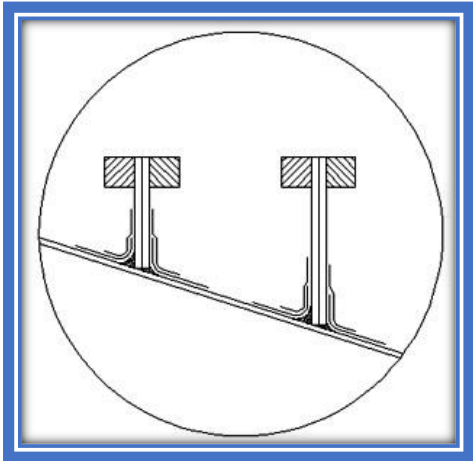
STRINGERS:

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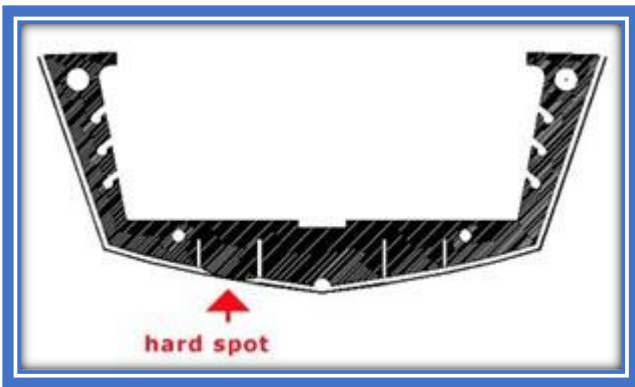
Measure your stringers before taking them out. Write down their depth every foot starting from the transom. You can also make a cardboard template to use to cut the new stringers from. Take the stringers out and grind the fiberglass down to the hull. Fabricate new stringers from plywood or foam core. Standard sheets of core material, plywood or foam, are usually cut from 4x8' panels. We cannot cut the stringers full length in one piece. Stringers are made of at least two layers with seams offset or staggered by at least 2'.



If yours is deep vee hull, you may want to offset the edges on the hull sides. There is no need to taper the edges, a step is fine. Epoxy putty will fill that step.



The stringers will be bedded in epoxy putty then fiber glassed to the hull with biaxial tape. Large stringers or foam stringers are completely fiber glassed. Plywood stringers are capped with cleats, one on each side. Cleats are typically 1" square pine stock found in the trim department of a home store.



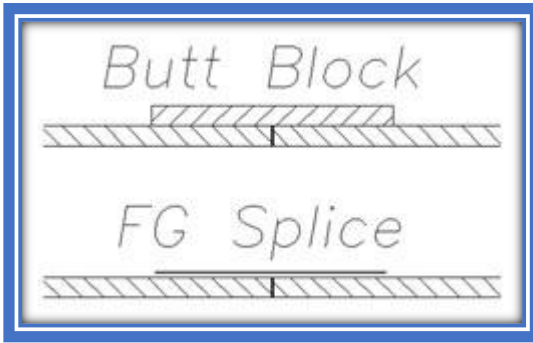
There are two points to pay attention to when installing the stringers in the hull. There should be no hard spots and the top of the stringers must be in the same plane. Hard spots are points where a part pushes hard on the hull. (This happens only with plywood stringers.) This picture shows a frame with hard spot. Hard spots concentrate loads and are dangerous. They can lead to cracks or hull failure. A stringer should distribute loads evenly all along its length. The ideal way to install stringers is a little bit above the hull. Builders should start with a stringer that follows the shape of the hull within a 1/4". They can use small pieces of foam to lift

the stringer from the hull and fill the gap with epoxy putty while building the fillet.

The second point to watch is the top of the stringers. They must be in the same plane or the sole will not make good contact with them. This is easy to check. Run a straight edge in diagonal over the top of the stringers. It should follow the marks of the old sole. Floor frames temporarily fastened to the stringers will help keep them in place during the tabbing. When cutting the stringers for chase tubes, try to leave at least 2" of the stringer on the bottom side. We have not discussed changes to the stringers but if you would like to have larger fuel-tanks or improve cockpit drainage, this is the time to do it by raising the stringers. Don't exaggerate, keep a good safe cockpit depth but one or two inches may make a significant difference.

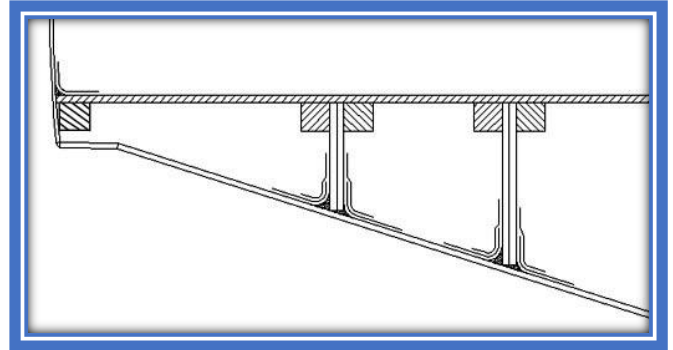
SOLE:

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The cockpit sole or floor is the easiest part to replace. Like the other parts, it can be made of plywood or foam. The standard 4x8 panels will require fiberglass splices for the fiberglass or butt blocks if you use plywood.

The sole is epoxy glued to cleats on the stringers in the case of plywood stringers or directly to the stringers if they are made of foam. Along the hull sides and bulkheads, the sole sits on a wooden or foam cleat. There is no need to bevel that cleat, epoxy putty will fill the gaps. The upper side of the sole is taped to the sides and bulkheads with one or several layers of biaxial fiberglass tape. Plywood soles are usually fiber glassed with woven cloth for protection and abrasion resistance.



Do not forget inspection plates, but it is not always necessary to include a removable fuel tank hatch.

### TOOLS:

By using the correct tools, your repair will be higher quality and take less time. For removing old parts, a sawzall will make short and clean work. An angle grinder with both cutting wheels and grinding disks will also be needed. For cutting out the new pieces (stringer, transom, and sole) you only need a jigsaw or small circular saw. For finish work, a high-quality orbital sander is needed. An assortment of clamps is also nice, but not necessary.

### CONSUMABLES/DISPOSABLES:

You will use a lot a disposable glove, mixing stick, mixing cups, wood chip brushes, roller covers (epoxy compatible). It is best to buy a lot of these at the beginning. There is nothing more frustrating than having to stop work because you are out of \$.30 brushes!