

TechNotes.3

BOATBUILDING TECHNICAL BULLETIN

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Wood is the oldest boatbuilding material. Yet, this does not mean it is outdated today.

New technologies have revolutionised the construction of wooden boats and structures and the material is clearly seeing more than a revival today.

Wooden boats used to be built by assembling a skeleton of timber frames onto a thick keel piece. Planks were then bolted over and the structure was made waterproof by caulking the gaps. Boats built that way were considered excellent until the advent of modern fibreglass construction. Traditional wood construction however never solved the problems of flexibility, leaks, rot, heavy maintenance, not to mention the fact that timber can lose up to 45% of its strength when wet.

Wood-epoxy technology is a well proven and long lasting solution, the first wood-epoxy built Meritt sportfishers (1956) are still in a perfect condition nearly half a century later.

WHY USING EPOXY WITH WOOD?

The Resoltech epoxy systems cure all the problems found in traditional wood construction: by encapsulating all wooden parts in a film of epoxy, the wood fibres are stabilised at a constant moisture level, thus keeping their strength, which allows for a reduction in sections and thicknesses and **saving weight**. In fact, wood-epoxy boats are lighter and stiffer than standard fibreglass boats.

The epoxy system is not only a protective coating: it is also an adhesive that is stronger than the timber it joins. This way,

WOOD EPOXY TECHNOLOGY



resoltech
ADVANCED TECHNOLOGY RESINS

Formula Wood, a comprehensive range of high performance epoxy systems and reinforcements, formulated exclusively for wood construction.



there are no more weak points and the structure is very **rigid**. Assembling timber is **faster**, since epoxies do not require the high pressure cure resorcinol glues need. It also enables less skilled people to obtain perfect results.

Sheathing a hull is also **easy**: you can use the same epoxy system to sheathe the hull and deck with either a woven fabric or a multiaxial, depending on its structural involvement. No more leaks.

By mixing additives, the epoxy system becomes a filler, to fair and surface **finish** the boat. It also acts as a good protection for the life time of the vessel. You can choose to paint or varnish the boat surface.

The Resoltech wood-epoxy systems are also ideally suited to repair work and modifications. They also provide the best protection against osmosis.

CONSTRUCTION TECHNIQUES

COLD MOULDING

This technique was pioneered around World War 2 when resorcinol glues became available. Boats, airplanes and other structures were made this way.

A plug is made of temporary frames that can also include some permanent bulkheads. Some stringers are fitted onto the frames. Planking is usually made of at least 3 layers of thin plywood or veneer at

45°. Staples are usually used to keep the planks in place while the epoxy cures. An alternative is to use a vacuum bag, which requires a whole layer to be bonded at once. The structure is usually sheathed with a woven E glass fabric of at least 300g/M2.

HARD CHINE PLYWOOD

This is a quick solution to build powerboats and sailing yachts up to 50 feet. Frames or bulkheads are assembled onto a jig. The traditional way is to glue stringers onto each chine, although today some builders butt-join the plywood panels on the chines and then laminate stripes of double bias E glass onto each chine. Plywood panels must be scarfed together.

Sheathing follows the same procedure as for cold moulded boats.

STRIP PLANK

This technique produces boats that combine strength, stiffness and a reduced weight. It is really a compromise between wood and fibreglass construction, taking advantage of the best of both solutions.

This time, temporary frames, usually made of chipboard, are lined up at least every 0.60m onto a jig. Planks are then temporarily fitted over the frames, using nails that can easily be removed. The edges of the frames are usually covered with a plastic tape to ensure no glue will join them to the planks.

Planks can be made of red cedar, pine, tropical timbers if you are building in a tropical country, or engineered products such as DuraKore, which are made of two skins of thin plywood over a balsa core.

Once all planks are bonded together, all nails are removed and the outer surface is faired using a grinder, then a planer and sanding boards for the fine work. It is important to fair the planks prior to laminating the outer skin since it will dramatically reduce the time spend fairing later as well as the amount of filler needed.



The outer skin is usually made of one layer of either double bias or triaxial E glass. This way, the wood fibres run at 0° while the glass fibres run at +/-45° or even +/-45 and 90°.

Overlaps can be recessed in the plank to further optimise the fairing process. The multiaxial fabric is laminated over the planks. The same process applies to the inner skin after turning the hull over, although with less need for a fair surface.

METAL BONDING

The Resoltech epoxy systems allow to bond metals such as steel and aluminium onto a composite structure. It is the optimal way to fit deck hardware and other parts.

THE PRODUCTS

Resoltech supplies a comprehensive selection of materials for wood-epoxy construction. These have been formulated to ensure a low toxicity to the users, high mechanical properties and durability, moisture resistance and compatibility with all types of timbers (even "oily" ones) and reinforcement fibres.

● **MULTIPURPOSE SYSTEM: 1020**

A high performance epoxy system suitable for bonding, coating, filling, sheathing, laminating and more.

● **FILLING COMPOUND: 2040**

A ready made compound to be used for fillet joints and as a bonding paste.

● **CLEAR VARNISH: 1030**

A clear, UV stabilised epoxy varnish to coat wood panels or planks.

● **WATER BASED COATING: 1010**

A revolutionary system that is not sensitive to moisture and can be diluted with water! Ideal to repair damaged or "rotted" wood.

● **SURFACE FINISHING FILLER: 8020**

An easy to use and sand finishing filler.

● **HIGH-BUILD SURFACER: 3010**

A system containing solvents used for surface finishing hulls and all surfaces, can be rolled or sprayed. Easy to sand.

● **ADDITIVES**

These are powder to mix with 1020 (or any other epoxy system) to modify its properties for bonding, filling or simply avoid drainage when laminating on vertical surfaces.

COLLOIDAL SILICA: a thixotropic agent, used in combination with another additive.

MICROFIBRES: used to thicken a mix for bonding or filleting purposes.

GLASSBUBBLES: used to produce lightweight and easy to sand fillers.

REINFORCEMENTS

For sheathing:

EP200: a 200g/M2 plain weave E glass that is easy to drape, for smaller boats.

EP300: a 300g/M2 plain weave E glass for larger boats.

DOUBLE BIAS: available from 300 to 900g/M2 depending on the boat size.

TRIAXIAL: available from 600 to 1,400g/M2, depending on the boat size.

Other products available for specific applications.

TECHNICAL NOTES

BASIC RULES FOR WORKING WITH EPOXY SYSTEMS

Mixing resin and hardener must be very accurate and the mixture must be thoroughly stirred. Failure to do so will result in lower mechanical properties and possibly lack of cure.

The additives should be added after the resin and hardener are mixed.

You should mix small amounts at the time to avoid reactions in the pot and to reduce waste.

Always sand a surface of hard epoxy prior to laminating or bonding over it.

Protect yourself: wear gloves, proper clothing and dustmasks when sanding.

Always carry out a small test when unsure, it saves time and materials.

REPAIRING A DAMAGED HULL

The Resoltech epoxy systems are ideally suited to wooden boat repairs, either of classic, cold moulded or plywood construction. It is not possible to give precise instructions in view of the very different types of repairs that may occur; these are simply guidelines.

The damaged timber or plywood should be carefully cleaned up and dried. Any salt deposits should be cleaned. Replace the damaged planks or plywood area and bond to the structure. Glass over the outside and coat on the inside. A good surface finishing job will ensure the repair cannot be noticed. The Resoltech wood-epoxy systems are also used to repair fibreglass hulls.

SHEATHING A HULL

The hull should be cleaned, degreased (using solvents such as acetone or equivalent) and free of dust. Small holes or gaps should be filled first to ensure the whole area is smooth. All epoxy coated areas MUST be sanded prior to further coating.

It is usually more efficient to mark and pre-cut the glass. The surface should be primed with epoxy first as some of the resin will soak into the timber. A second coat should be applied prior to unrolling the glass. Position the glass carefully (no crimps) and let it wet out. Operate the same way for all pieces of fabric. A last coat should be applied over the glass and no white patches should appear. Let the resin cure slightly and then apply a "hot coat" of 1020 with some glassbubbles (the surface must still be tacky to ensure a good bond).

The surface can be sanded (usually the next day) for the finishing process to begin.

THE PERFECT BOND

Bonding timber requires clean surfaces. Pre-coat both areas with 1020 and add a thicker mix of 1020 with silica and microfibres. Press both surfaces together, pressure is not required and gaps up to 2mm will not create any problems as long as they are filled up with the epoxy mixture.

FILLET JOINTS

Fillet joints are a very effective way to fit bulkheads and interior components. The parts must be held in position, a fillet is then applied on both sides. The "paste" used is either 2040 or 1020 mixed with additives (silica and glassbubbles). It is important to clean the edges prior to the epoxy curing, as it takes a much longer time to sand once hard. If the bulkhead is structural, it may be necessary to laminate some glass over the fillet. Radiuses vary between 20 and 50 mm.

SCARFING

Scarfig is a wonderful technique that enables timber or plywood to be joined with continuous mechanical properties. Basically, the edges to be joined are cut at a deep angle of at least 8 times the thickness, to provide for a higher bonding area and therefore continuous strength.

For plywood, you must take great care to avoid damaging the edges as they will be very thin. The angle must be constant; it is best using an electric planer or a steel grinder fitted with a very coarse disc and finish the scarf with a finer disc. Accuracy is important.

The parts are then assembled using epoxy mixed with some microfibres (see previous details about bonding). You must ensure the parts are properly lined up and that there is enough pressure to compress the epoxy paste and let it flow.

Once cured, grind and sand until the joint is fair and smooth. It is possible to join plywood to make full length panels for a boat.

SURFACE FINISHING

Finishing a structure such as a boat hull is done using the same materials. On a sheathed hull, it is best to apply a "hot-coat" right after laminating, basically a layer of epoxy with glassbubbles that fills the fabric gaps. An alternative is to use peel-ply.

A wooden hull is usually quite fair and only requires a minimum amount of filler. Apply a coat of light-weight filler (8020 or 1020 with glassbubbles) all over and sand the next day.

Final fairing is done using a high-build surfacer such as 3010, which can only be applied in thin coats (up to 1mm) by rolling or spraying.

This surfacer is easy to sand and a couple of coats are usually enough. Pin holes can be filled using the surfacer mixed with glassbubbles. You must use the same product all over as mixing different fillers may create hard spots that will be difficult to fair.

Epoxies are related to polyurethane paints and are therefore an excellent support for these.

Working this way provides an excellent finish in a reasonable amount of time.

COSMETIC MATTERS

You may want to keep the wood visible in some areas. You should then use the 1030 clear epoxy varnish. Please note that 1020 will turn yellow in the sun, while 1030 is formulated to keep its clarity. Thin glass should be used instead of thick fabrics for this purpose.

METAL BONDING

Deck hardware can be bonded onto the deck. Aluminium and steel require some preparation first. For steel, simply abrade the surface and degrease it thoroughly. It is also possible to use some etching chemicals to prepare the metal surface.

Aluminium needs more preparation since it tends to corrode instantly when in contact with air. A very effective technique is to first degrease and abrade the aluminium surface, then sand it using wet sanding paper with a mix of epoxy instead of water. This way, the aluminium surface will be protected from the air and will not corrode.

TECHNICAL DATA

Please read the technical data sheets of all products you will be using and ensure your staff is also familiar with them. Data sheets are available for download on www.resoltech.com.



PHOTOS:

Bohème 43, cruising catamaran. France.

40ft Powercat, Pacific Marine, Malaysia.

37' Trimaran, Rowsell+Morrison UK.

Jolie Môme, Chantier Les Clapotis, Switzerland.

The above list of products and services is not exhaustive. Please check with the sales department should you be unable to find the product or service you need. Resoltech reserves the right to amend this list without prior notice.

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TECHNOTES



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