

## “DODEC” SPEAKER CONSTRUCTION

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If you have occasional need for a dodecahedral loudspeaker, and would build one yourself but for the compound mitre joints involved, this process could be for you.

The “stitch ‘n glue” process is well known to plywood boat builders. The outcome is definitely more certain to be successful from the outset than a compound mitre affair and it will definitely be stronger by several orders of magnitude. Strength and Beauty in the final product as with any project, are a fair measure of your input. In this case however, the skill levels demanded by compound mitre joints are not required.

Ingredients are: (a) hardwood plywood 9mm – 1 small sheet, (b) epoxy resin – 1litre at the most, (c) 50mm Fibre Glass tape – 1 roll, (d) micro-sphere filler – 55gm, (e) soft copper wire approx 1mm diameter, (f) very low cost paint brushes for applying epoxy (each will only be used once).

9mm plywood can be obtained at most hardware stores. System West have a comprehensive display at [www.sterndrives.com](http://www.sterndrives.com). I suggest 403 Micro-spheres, 105 Resin and 206 Hardener. The slow hardener gives time for the liquid epoxy to be absorbed into the surface of the plywood and form a strong bond. Polyester resin is not recommended. Most boat builder supply the hardware, and ships chandler shops can supply the glass tape, the epoxy resin and micro-spheres in small quantities.

The loudspeakers will be “front mounted” or secured to the exterior of the completed enclosure. It is therefore necessary to purchase the loudspeakers and measure the back of the mounting flange to ascertain the size of clearance hole required – the hole diameter must clear the tapered frame but support the flat portion of the flange.

Mark out a pattern pentagon from scrap 9mm or 12mm plywood. Start by scribing the circle for the speaker mounting hole with a compass. (In my case this was exactly 100mm). Using the same centre scribe a larger circle within which to construct your pentagon. Make sure there is a nice solid patch of “land” around the speaker hole and cut the pentagon out from the scrap ply. Drill a pilot hole (1/8in or 3mm) in the centre of the pattern. Do not cut the speaker hole out.

Use the pattern to mark out twelve pentagons on the 9mm sheet. Cut the pentagon faces to size and use the pattern as an overlay to pilot drill the centres of all twelve faces. Use a metal-cutting blade in a jig saw for this to obtain splinter free edges. Note that rebating the exterior edges is optional. I did this with a router set to about 1mm depth to a width of approximately 25mm. Drill two small holes (approximately 1.5 to 2 mm) along each edge of each pentagon.

Cut the copper wire into 100mm lengths and “stitch” the pentagons together through the 1.5mm holes near the edges. Assemble all but one face into the familiar ball shape. Keep the faces aligned at the inside edge and maintain an even gap or “V” in the exterior joints. A few gaps in the joinery are no problem at this stage.

Next mix a batch of about 10 table-spoons of epoxy and 2 of hardener (or whatever proportions are specified by the manufacturer), and add micro-spheres a little at a time until a wet putty consistency is obtained. Note that it is counter productive to mix a large batch of epoxy and hardener. The chemical reaction generates heat, which initiates premature curing of the epoxy. Please note the manufacturers material safety data sheets and apply whatever precautions are recommended for the sake of your health. Some people might contract dermatitis from epoxy and breathing the vapours might not be good for ones health.

Now plaster the “putty” into the gaps. I recommend both inside and outside for maximum strength. Fibreglass tape is weakened by sharp bends or kinks. Filling the inside of the joints in a smooth radius is recommended. Ensure the exterior gap is full. A photograph of an enclosure at this stage of construction is shown in Figure 1. Once the putty has set, cut out the copper stitches and sandpaper the interior and exterior joints to a smooth finish.

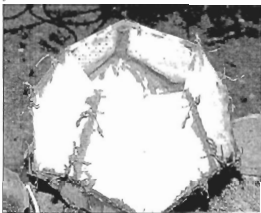


Figure 1. The speaker box, “stitched” with copper wire and “puttied” with epoxy resin. One face of the dodecahedron still has to be attached.

Cut about 30 fibreglass tape strips to the length of an inside edge of the DODEC and paint the inside joints with epoxy/hardener mix. The fibreglass strips are then applied length-wise along each joint. Paint epoxy over the strips to ensure they are well filled with epoxy. Any left-over resin should be mixed with micro-spheres and used to fill remaining holes and irregularities. It is preferable, in the opinion of this writer, to discard the brush once the epoxy has hardened it to a useless slab, rather than purchase epoxy thinner chemicals and clean the brush after use. Note: cut the fibreglass strips well before mixing the epoxy and hardener to avoid contaminating scissor blades with epoxy. Trim the final plywood pentagon to fit the last hole with a hand plane or sandpaper and putty it in place.

Once the epoxy has set in the last pentagon, sand the exterior joints to a smooth finish in readiness for the fibreglass tape process. Radius all edges with sandpaper and apply the epoxy and fibreglass tape along the joints, overlapping at the corner points. It is good practice to fill the tape with plenty of clear epoxy. Suspend the enclosure on a hook through a pilot hole to avoid permanent adhesion to any surface in contact with it.

Next use the pilot centres to cut the holes for the speakers. I obtained excellent results using a 100mm fixed diameter hole saw. A skilled operator with a power jig saw might obtain a similar outcome. Reach in through the speaker holes to putty the inside of the untaped joints of the last pentagon face to be glued in place. Sandpaper this last set of five joints to a smooth radius and apply epoxy and tape as elsewhere. If you have rebated the exterior edges of the faces plaster the rebated area with epoxy and micro-sphere putty to provide a smooth exterior. Sand the exterior edges to a smooth radius and finish with fine paper (approx 240 wet-and-dry paper).

Automotive exhaust pipe can be used as a mounting point. Speaker stands (35mm) are an odd size (for automotive exhaust installers) so I had a piece of exhaust pipe stretched at one end to make a snug fit on a speaker stand. Cut three slots with a hacksaw at approximately 120° intervals in the unstretched end of the pipe. Bend the tabs to fit one point of the box. A photograph of an enclosure at this stage of construction is shown in Figure 2. A socket fitting for an acoustic guitar should have appropriate mounting thread or flange to mount properly on the 9mm plywood enclosure.

All that is needed is a coat of paint and a set of speakers. I connected four series-connected sets each of three 8 ohm speakers (24 ohms) in parallel to form a 6 ohm load. Take care to ensure all loudspeakers are connected in the same polarity. I also added a switch to permit operation with just one loudspeaker, thus approximating, in rather vague terms, the acoustic behaviour of the human head. A completed loudspeaker is shown in Figure 3.

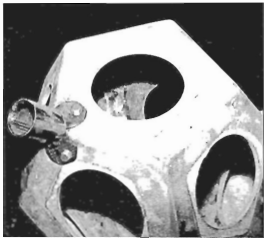


Figure 2. The completed raw speaker box, showing the taped joints and the fixing bracket.



Figure 3. The completed dodecahedral speaker box with speakers mounted.

