

# openShell

*Author:* Tom Featherstone. *Email:* tom@hippo1.gotadsl.co.uk

## **Introduction.**

Large and small drum companies alike are protective over their drum shell building methods, there's usually little more information than a small photo of a mould or jargon such as "Vertical Low Timbre", "Built-In Bottom" and "Enhanced Sound Edge"

In the following article I will attempt to provide a detailed, step-by-step guide to building a ply drum shell.

The aim of this guide is not to provide competition with drum shell producing companies but to aid people with the desire to produce their own shells, and hopefully avoid issues I had when developing this method.

## **Building the mould.**

You will require the following tools:

- Router
- Saw (or Jigsaw)
- Drill
- Small, thin plywood. (12" x 6", 5 or 6mm thick, that's ¼ inch)
- ¼" Straight router bit
- Bolts to mount router to plywood

You will require the following materials:

- Thick MDF sheet (8mm or greater, that's ½ inch or more)
- PVA wood glue
- Bendy/Neatflex MDF
- 4 or 8 L brackets
- Bolts, washers, nuts and wing nuts
- Door hinges

Bendy/Neatform MDF is known as Bendy MDF in the UK and can be bought from B&Q among others; it's known as Neatform MDF in the US and can be bought from [www.rockler.com](http://www.rockler.com) among others.

The size of the thick MDF sheet depends on the size of mould being made, for example a mould capable of producing 14" x 8" shells uses 3 18" x 18" sheets.

As a general rule you should have a gap no greater than 3" between stacked MDF sheets.

Additionally there should be at least 2" of wood on each side of the decided diameter (so a 14" diameter mould should be made from 18 x 18" sheets of MDF)

(Insert diagram)

The inside of the mould will be lined with Bendy MDF, this means when calculating the diameter of the hole to be cut, the thickness of the Bendy MDF must be taken into account.

**It is important to keep in mind that drum shells are undersized, a drum described as having a 14" diameter actually has a 13 ¾" diameter shell.**

Therefore, to calculate the required diameter to cut into the thick MDF, you must take the diameter of the required drum size (in this case 13 ¾") and add 2 x the thickness of the bendy MDF.

Now we must create a circle jig for the router, this will allow us to cut perfectly round circles in the MDF for our mould. The circle jig is essentially a drafting compass, where instead of drawing a circle. It cuts one.

Mount the Router to one end of the plywood, this typically requires a few bolts but the number and size of bolt depends on the brand of router.



*Router mounting holes drilled into plywood.*



*Router mounted to plywood.*

While mounted, use the router to cut through the plywood with the straight bit; this gives the exact position of the router bit.

Now measuring from the far outside of the hole made by the router, mark half the length of the mould diameter and attach a screw at the point, this provides a pivot for the router to cut the MDF.

Mark the centre of the MDF and screw the circle jig to it, ensure that there is enough movement to allow the router to move in a circle around the pivot point.



*Centre marked on MDF sheet*



*Router mounted to pivot point on MDF.*

Now cut away

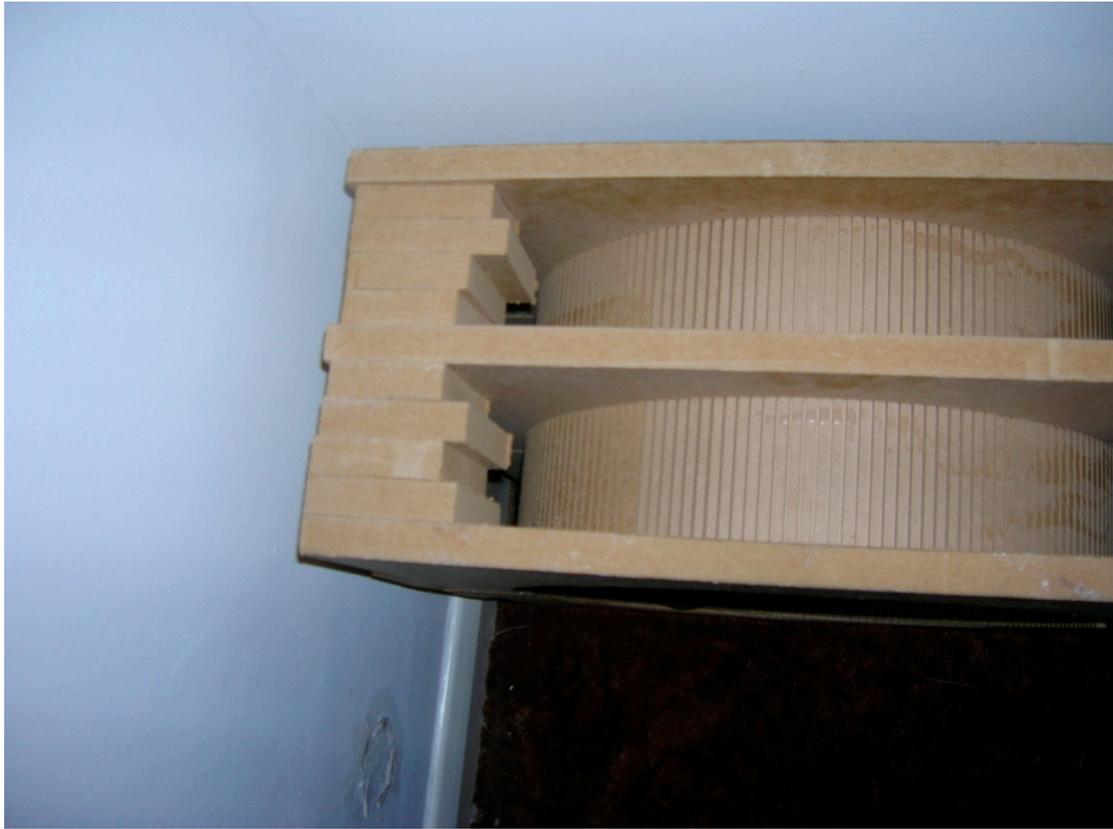
**Remember safety! Wear goggles, hand protection and a mask– routers spin very fast and are very dangerous tools, additionally the dust from MDF is carcinogenic.**



*Mid-cut*

Now we must stack the sheets of MDF to create a mould, space each sheet by stacking squares of MDF between the sheets, gluing each one to the MDF underneath.

**To ensure each sheet matches the rest, I suggest placing the Bendy MDF inside the mould while the glue dries, the outwards force of the Bendy MDF will move the sheets to match up with the rest.**



*Stacking between the cut sheets of MDF*

Next the Bendy MDF has to be cut to fit and put inside the mould. To attach it, simply apply glue to the edge of the MDF sheets and place the Bendy MDF inside, you may need to clamp it in places.

Now you have a fully working mould, however in it's current form it is very difficult to get the completed shell out. Cut the mould in half, mount hinges on one side and L braces on the other to allow it to open.



*Completed mould with bolted L braces to open the shell. The hinges are on the opposite side.*

### ***Building the shell.***

To build a drum shell, you will require the following tools:

- The mould
- A car inner tube, or large inflatable gym ball to provide pressure
- Car tyre pump/compressor to pressurize the above.
- Another sheet of Bandy MDF to put between the shell and inner tube/gym ball to spread the pressure evenly from top to bottom of the shell.
- Stanley knife
- Tape measure.
- Flat surface
- Router (mounted to router table, will show how to build a table)

You will require the following materials:

- Non-backed veneer
- PVA glue
- 80 grit sandpaper
- Double sided tape

The amount of veneer required depends on the size of the drum being built and thickness of the drum. Veneer is typically 0.6mm thick. eBay is a good starting place for small quantities of veneer, I would suggest that you pick a cheap wood to start with; maple, birch and oak tend to be cheaper than more exotic woods such as walnut and cherry.

The veneer must not be backed with anything, which means it cannot be iron-on, felt backed, paper backed ECT.

Precision is the key to a good drum shell; you must cut each ply exactly to size with the Stanley knife before putting it into the mould. Be careful when cutting along the grain as the knife tries to follow the grain. You may find sharp scissors work better/

The length of each ply can be worked out as follows:

Ply 1 length = (diameter of mould – 2 x thickness of veneer) x Pi

Ply 2 length = (diameter of mould – 4 x thickness of veneer) x Pi

Ply n length = (diameter of mould – 2n x thickness of veneer) x Pi  
(Where n is ply number n)



*A veneer cut to size.*

Place the first sheet of veneer in the mould, you may need to open the mould slightly to prevent the ends of the veneer overlapping. Tighten the mould back up to ensure a snug fit between veneer and mould.

When putting the second ply in, apply PVA glue to the veneer already in the mould and glue to the side of the second ply that will face the first ply. This ensures enough glue and fills any holes. Don't worry about the excess; the pressure will squeeze it out. Now put the Bendy MDF in, followed by the inner tube/ gym ball and pressurize.



*Early mould pressurized. The candle provides a centre support and ensures the force from the inner tube acts out towards the veneer.*

Every other ply should have a vertical grain, this makes the drum stronger and prevents the shell ripping along the grain when cut or drilled. As trees aren't wide enough for a vertical grain ply to be made from just one sheet, you must join a few together (typically 4 or 5). They are glued in the same way as above.



*Vertical ply.*

Continue building up the shell until a sufficient number of plies are reached. I would suggest 8 0.6mm plies as a minimum.



*Shell taken from mould.*

Once the shell is removed from the mould, it must be 'squared up'. This can be done in two steps, the first is to take a Stanley knife and cut off the excess wood on the edges of the shell. This will make each ply level with the next.

To further square off the shell, tape 80 grit sandpaper to a flat surface and spin the drum shell on it, this will level off the edges until it is completely flat.



*Flat edge, clearly shows ply orientation.*

Finally, bearing edges must be cut. This can be done with a router table and 45 degree bit. If you don't have a router table, one can easily be constructed from a sheet of MDF mounted to a wooden base, the router is mounted to one end with bolts; very much like the circle jig before.



*Router table.*

When cutting edges, you should aim to leave a ply completely flat, this can then be rounded off with sandpaper afterwards. Adjust the height of the router bit accordingly, the bit has a wheel at the top which the shell sits against, preventing it from being cut all the way through.

Completed shells:

