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PROJECT  
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HandBook

# Build a compact electric guitar

# speaker cabinet isolation box

Sept 2016

We are going describe how to build an isolation box optimised for a 1 x 12 sized speaker cabinet (cab). For many of us recording at home, space is a primary issue, therefore building a box that is no bigger than necessary will be best.

We decided to design a cube shaped box big enough to accommodate a Fender Bassbreaker 1 x 12 extension cab (W 49.5 cm x D 23cm x H 45cm) plus a front address microphone, such as the Shure SM57, pointing a couple of inches away and directly at the speaker cone. The box would need to be small enough to fit through a standard interior house doorway.

The design we arrived at is as compact as possible whilst still retaining good sound isolation properties. Every centimetre counts so even the speaker cab jack plug is right angled.

We hope you find this guide useful, and if you do, please recommend us to others.

Thanks for reading.  
*The Project Studio Handbook Team*

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# Sound isolation materials

Our box comprises an outer shell constructed from 18mm MDF panels, and is lined inside with a layer of rock wool, and a thin additional barrier layer of plywood to protect the cab, the microphones and the engineer from coming into contact with the rock wool.

The thickness of each side is 18mm (MDF shell) + 30mm (rock wool layer) + 5mm (plywood layer).



*A view from the top showing the three layers of the left hand panel - from right to left; 18mm (MDF shell) + 30mm (rock wool layer) + 5mm (plywood layer)*

An alternative barrier could be made from thin MDF sheets, or by wrapping the rock wool in fabric, but we had some ply to hand so that's what we used. Also, using a variety of materials aids absorption and diffusion.

We decided to secure the inner rock wool and plywood layers to the outer MDF shell by simply passing screws through the plywood and rock wool and into the MDF, thereby sandwiching the rock wool between the two layers of wood.

# Access to the interior

Because the outer MDF panels are secured together with easily removable wood screws (no glue or steel brackets), you will be able to remove any panel to gain access to the interior. Having all the panels secured with screws affords the box a greater degree of acoustic isolation and if you decide to place head amps on top of the box, the design will allow you to gain access through the front or side panels.

All you have to do is leave off the bottom screws (which will not be easily accessible) from your choice of panel. In fact you can follow the construction guide below and then decide later which panel you will use to gain access to the interior.

Of course this means our design does not have a dedicated hinged "door". However, hinges and latches can easily be added to any one of the panels.



*One of the 50mm wood screws holding our box together*



*The finished box with the front panel removed (and the top panel loosened)*

# Dimensions

In order to make the wood cutting simpler we designed a box which is not exactly cube shaped. It is made from 6 pieces of 18mm thick MDF. Four of the panels are exactly 64cm square (the top and bottom panels and two of the sides) and the remaining two side panels are 64cm by 60.4cm. You can get these cut to size by any timber merchant capable of cutting within a 1mm accuracy, good enough for our needs. MDF is dense and affordable, does not splinter, and incredibly easy to drill and sand.



*The completed outer MDF shell*

Once the inner rock wool and plywood layers have been installed, these dimensions allow for 2cm of space behind and to the sides of the cab, and 28cm in front of it where the microphones will be positioned. You will need to measure your cab carefully and adjust the overall dimensions to suit. If your cab is slightly smaller than ours you could just go with our dimensions but if it is bigger you will need to increase the dimensions accordingly.

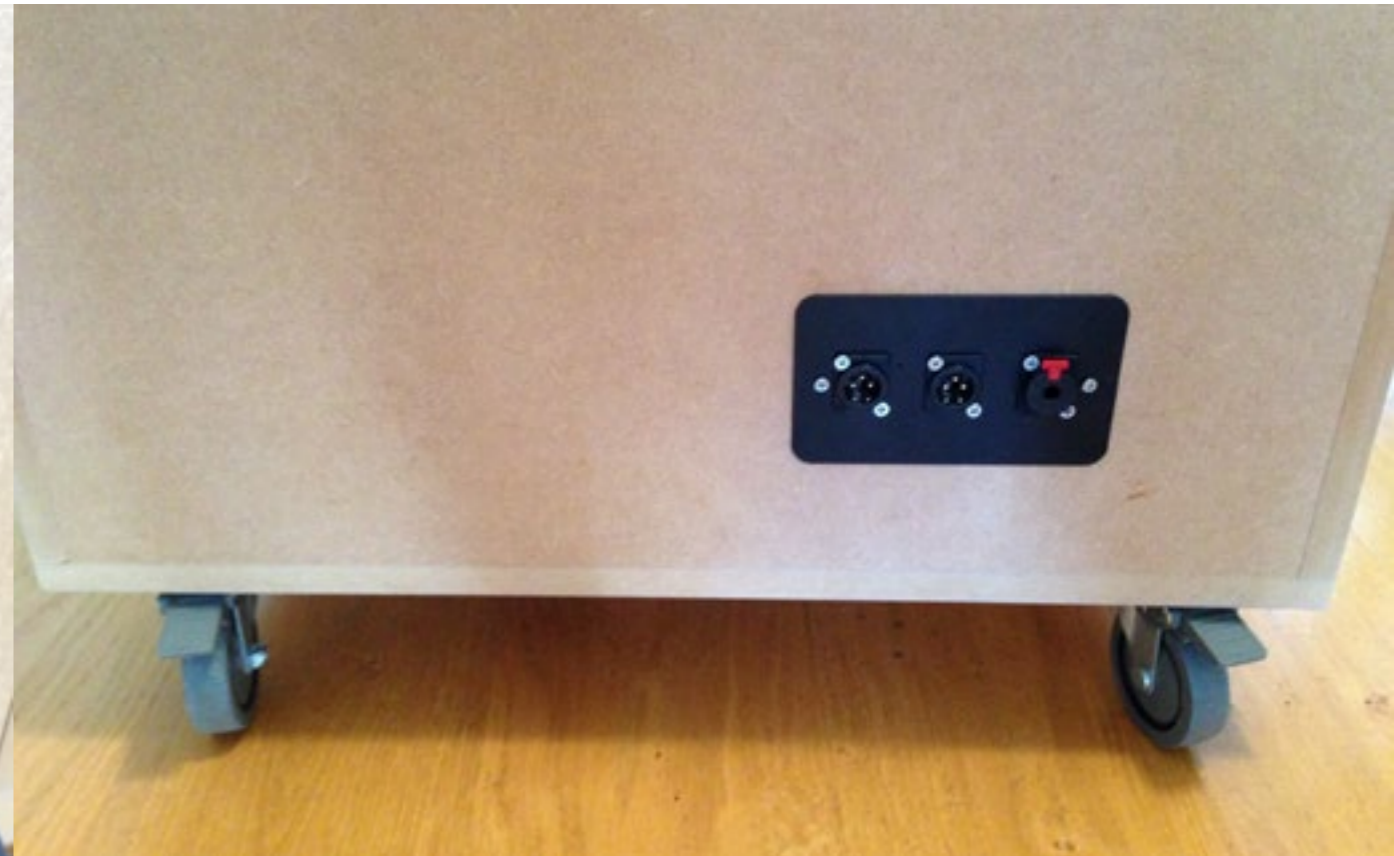
Our dimensions make the box a little taller than required, but vertical space is not usually the issue that floor space is, and perhaps having a little extra space to let the cab breathe is no bad thing. There is enough room inside to accommodate the layers of rock wool and plywood, and of course the cab, mic's and mic stands. The inner dimensions of our outer MDF shell will be a few millimetres larger than W 60cm x D 60cm x H 64cm. A convenient consequence of adopting these dimensions is that standard high density slab (rock wool) comes in W 60cm x L 120cm x D 3cm panels and as we shall see this will help minimise the number of cuts we need to make.

# Audio connections

We may want to use two mic's simultaneously so we will specify our wiring accordingly and install a panel with appropriate connector sockets and cables for the speaker and two mic signals.



*Audio connections panel sockets*



*Audio connections panel positioned towards the bottom of the box*

# Before you start your build

We recommend that you read through this entire guide first before starting your build. You may find you want to make some changes and adapt the design to your own needs. For example, you will need to scale up the dimensions if the cab you intend to use is bigger, or you need more space for larger microphones. Also, the inner rock wool and plywood layers do not have to be installed in the arrangement and order we have specified. You may prefer a different arrangement.

## Safety and disclaimer

It goes without saying that you should wear gloves when handling the rock wool and work outside or in a well ventilated room. Also, wear protective glasses when drilling and cutting. Project Studio Handbook takes no responsibility for any injuries caused during this build. You undertake it at your own risk.

# Required parts

The following is a list of materials required for the build ..



50mm wood screw

1. Four pieces 18mm MDF 64cm x 64cm (top, bottom, front and back)
2. Two pieces 18mm MDF 64cm x 60.4cm (sides)
3. Sixty 50mm wood screws
4. Four medium to heavy gauge casters (consider the combined weight of the box, the mic's and mic stands, and any head amps you're going to place on top)
5. Sixteen small wood screws to secure casters
6. Four panels of W 60cm x L 120cm x D 3cm rock wool / high density slab
7. Two pieces of 5mm plywood approx 60cm x 60cm (top and bottom interior)
8. One piece of 5mm plywood approx 57cm x 60cm (back interior)
9. Two pieces of 5mm plywood approx 57cm x 57cm (sides interior)
10. One piece of 5mm plywood approx 57cm x 53cm (front interior)
11. One steel connector panel/plate with three D chassis cutouts
12. Two D chassis male XLR sockets, with (M3?) self tapping screws or alternatives
13. One D chassis quarter inch jack socket with (M3?) self tapping screws or alternatives
14. Screws to secure the connector panel to one of the MDF panels
15. Two 1 metre lengths of balanced mic cable
16. One 1 metre length of speaker cab cable
17. Two females XLR plugs (for the mic outputs)
18. One quarter inch right angled jack plug (for the speaker cab input)
19. Solder

NOTE: You may wish to measure the interior of your MDF shell and refine the dimensions given above for the plywood in order to try and achieve the snugest fit possible.



# Required tools

The following is a list of tools required for the build ..

1. Tape measure and pencil
2. Set square (optional)
3. Drill
4. Wood drill bit with slightly smaller diameter than the 50mm screw diameter



5. Counter sink wood drill bit
6. Large wood drill bit (to help cut out the hole of the audio connections panel/plate)
7. Jig saw (to cut out the hole of the audio connections panel/plate)
8. Hammer
9. Electric screwdriver
10. Fine and course sandpaper
11. Gloves (to handle the rock wool)
12. Craft knife (to cut the rock wool)

13. Wire strippers and cutters

14. Soldering iron

# Constructing the outer MDF box shell

Start by assembling the finished outer box. You can do this without brackets or glue using 50mm wood screws. It is imperative that you pre-drill all the wood screw holes with a drill bit that is only slightly smaller than the diameter of the screw itself if you are to avoid splitting the MDF. You may want to test this with some MDF off-cuts. Try joining two pieces at right angles.

1. With a pencil, mark your 64cm x 64cm MDF panels "top", "bottom", "front" and "back", and mark the 64cm x 60.4cm MDF panels "side left" and "side right".
2. Assemble the box loosely into its finished state the correct way up on a flat surface using stools or other objects to support the front, back and side panels. The front, back and side panels are "sandwiched" between the top and bottom panels. You will work on the top panel first. You can leave the bottom panel aside for now if you wish.



*The loosley assembled outer MDF shell*

3. Carefully align the top panel with the back panel. You should be able to do this by eye. Ensure the back panel is standing vertically. If you have difficulty use a set square.
4. Set your drill bit in your drill so that it is the exact length of one of the 50mm screws.



5. Drill and counter-sink 3 holes through the top panel and down into the back panel. The two outer holes should be 7cm from the corners. Because we are using 18mm thick MDF we must drill the holes precisely 9 mm from the edge of the top panel. Use your weight to hold the top panel down so that it and the back panel don't become unaligned as you drill.



6. Screw down the top panel using three 50mm screws and check that you have not split the back panel and that the join is strong. If you have split the back panel you will either need to drill at a better angle or you will need a wider drill bit.

7. We are now going to fix the two side panels into their finished positions by first screwing them to the back panel. Use a hammer to gently tap the left side panel into place so that it is flush with the top and back panel.



8. Drill and countersink 3 holes through the back panel and into the left side panel and then secure the panel with screws. Ensure the screws are tight and there is no gap between the side and back panel.



9. Now secure the top panel to the left side panel with three screws in exactly the same way as we secured it to the back panel. We now have three panels securely fixed together. They should stand without needing support.





10. Set aside the front panel and secure the right side panel exactly as you have just secured the left side panel.



11. Flip the box over onto its back panel and secure the bottom panel to the back and two side panels with 9 screws. We now have access through the front panel to the interior.

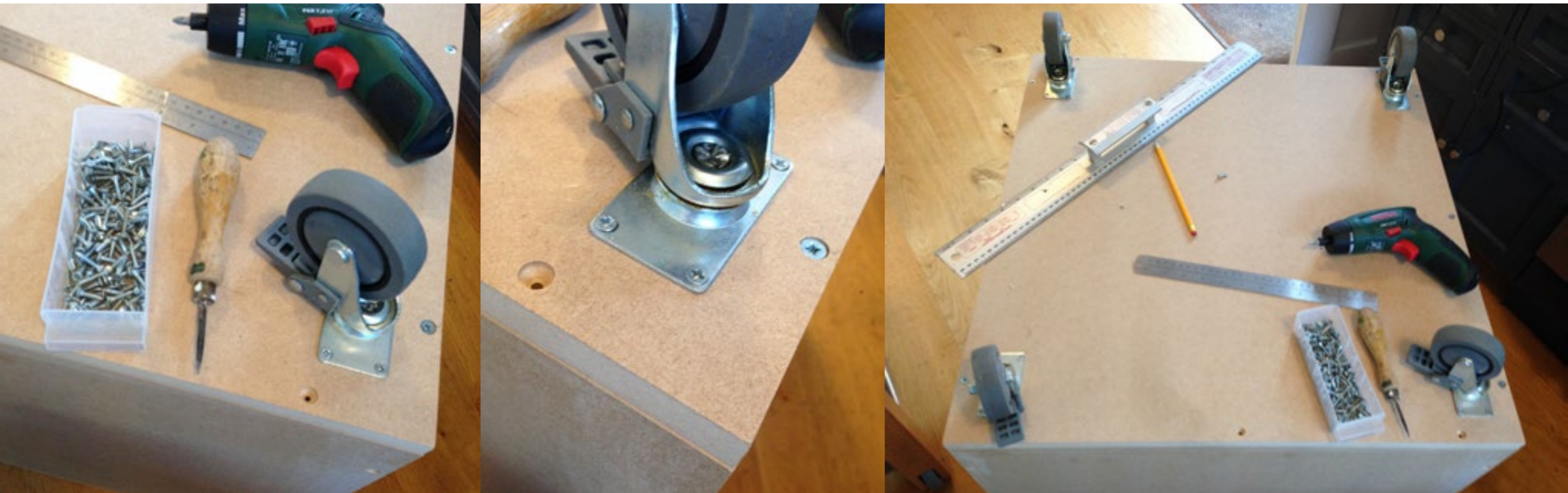


12. Put the front panel in place and as with the back panel drill the six holes required to secure it to the side panels. Secure it with six screws.



13. Flip the box back over onto its bottom panel (the right way up) and drill and counter-sink the three holes in the top panel that will secure it to the front panel. Secure it with three screws. Flip the box over on to its top panel and do the same for the bottom panel.

14. You have completed the assembly of the outer box shell. Next, secure the four casters to the bottom panel.



15. Flip the box back over onto its casters and use a fine sandpaper to finish any rough edges. Congratulations, your basic outer box and the hardest part of the construction is complete.

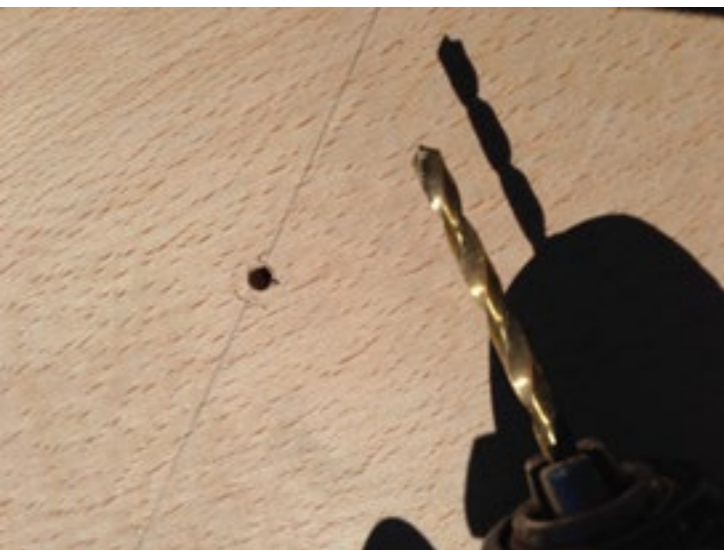
Because MDF is extremely porous and disintegrates on contact with liquids you may decide it is best to paint or varnish the exterior before proceeding. We prefer two coats of water soluble clear satin varnish. Sand with fine sandpaper between coats and you will achieve a smooth finish.

# Inner layers construction

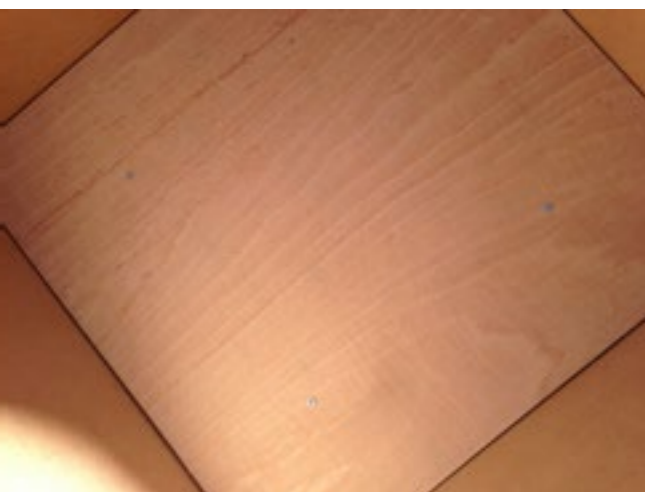
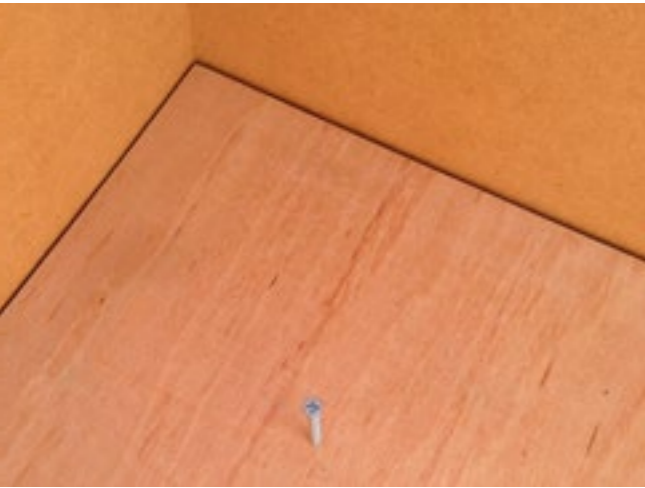
1. With the box the right way up on its casters, remove the top panel. Cut two 60cm x 60cm pieces of rock wool slab for the top and bottom interior of the box. If you have any kids call them now to come and watch the next step. Hold one piece of rock wool at the top of the box, then release it and watch as it slowly floats to the bottom.



2. Cut two 60cm x 60cm pieces of plywood. Drill four small pilot holes in each piece 20cm diagonally in from each corner. These holes need to be small enough for the 50 mm wood screws to pass through but not so big as to allow the screw head to pass through. The drill bit you used for the outer MDF box will be fine.
3. Sand the plywood to a splinter free touch smooth finish



4. Screw four 50mm screws a little way into the four holes of one of the pieces of plywood and lift it down until it is positioned centrally over the rock wool sitting on the bottom panel, then carefully screw it down through the rock wool and into the MDF. Do not over tighten the screws or you may split the plywood.



5. Turn back to the top panel now. Carefully position the remaining pieces of 60cm x 60cm rock wool and plywood centrally on top of the MDF panel, mark out your screw holes, drill the pilot holes, and then screw them together.



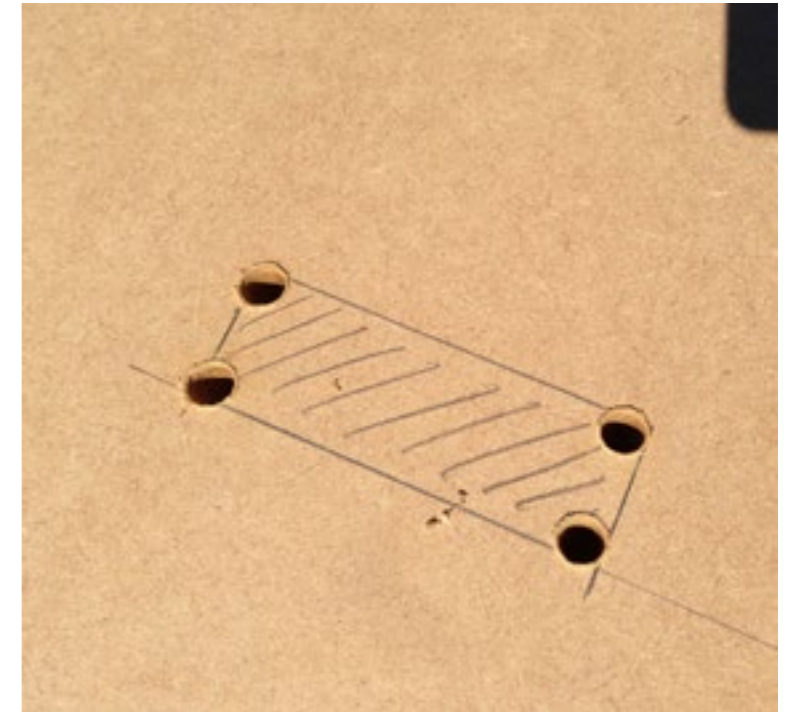
6. Turn the top panel over, position it and screw it into place, securing it with just three screws (one into each of the back and side panels). Don't secure the front panel from the top panel yet.

Next, remove the front panel and flip the box over onto its back panel ready to prepare the hole for the audio connections panel.





7. Decide which one of the rear, left side or right side outer MDF panels will hold your audio connection sockets. With a pencil mark out a cutaway hole, just big enough to accommodate the three audio sockets, at least 2cm above the level of the inner box bottom rock wool and plywood layer. Snug is best, we want as little sound leakage as possible.



8. Using the larger drill bit and the jigsaw, cut the hole. Don't worry if the hole is a bit rough looking, it will be invisible once covered with your external audio connection panel on the outside and the rock wool and the plywood inside. Sand any rough edges.



9. Measure and cut a piece of rock wool to sit snugly against the rear inner panel. Ensure there are no gaps around it. You may find it best to cut a piece a few millimetres bigger than is required. Push it down into place. Take care to vacuum clean up any rock wool fibres that may have come away.



10. Measure and cut another piece of plywood to cover the rock wool and again try to make it as snug as possible. Secure it with screws in the same manner as the other plywood pieces.



11. Repeat the above two steps to complete the rock wool and plywood layers for the left side panel and the right side panel.



12. It is time to complete the front panel. Screw the front MDF panel into place securely including the bottom panel screws. Remove the top panel and measure carefully the dimensions for your final front panel rock wool and plywood inner layers. Once again, you need them to fit snugly. Cut and screw them into place.

You may find that some of your plywood panels do not fit as snugly as you had hoped and leave a slight gap. Later you may decide to fill these with something like wood moulding, silicon, or rubber draft proofing. These improvements may have a noticeable effect on sound isolation. Leave this until your box is complete and you have tested it.



On the other hand, you may find the panel you will be using most for access fits a little too snugly, in which case you will need to sand the plywood down a little to make removal and refitting easier.

# Audio connections assembly

We are employing a panel with three audio connection chassis sockets. One quarter inch jack socket will receive the speaker signal from our head amp, and two male XLR sockets will return our microphone signals. Remember, the male puts the signal into the female.



1. Begin by screwing the three D chassis audio connection sockets to the steel panel.



2. Where your audio connection panel is located, drill three small holes through the rock wool and plywood from the inside just big enough to accommodate the three 1 metre lengths of speaker and mic cable. Pass the cables through.



3. Strip the cables at both ends and tin them with solder.



4. Solder the cables to their respective sockets on the audio connections panel and to the corresponding XLR and quarter inch jack plugs inside the box.



5. Finally, gently pull the cables through from the inside of the box and screw your audio connection panel to the MDF. You may find you need to cut away some of the rock wool from the outside to accommodate the sockets.

That's it. Congratulations, you're done! Time to test your box.

# Finishing touches

You may wish to experiment with some foam acoustic materials inside the box to see if they have any noticeable effect on the sound. You may find they attenuate high-frequency flutter echoes, but if you are placing your mics close to the speaker cones you may experience no noticeable difference.

Also, you may wish to add some form of grab handles to the panel you are using for access. We used four small steel kitchen drawer knobs.







If everything has gone to plan, by now you will probably be feeling pretty pleased, and so will your neighbours!

If you discovered any errors in this guide, or have improvements to suggest, we would love to hear from you. Please post at our Facebook page or YouTube channel.

Thanks very much for trying this guide.

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