

# *Alfa Romeo 147*

*Custom subwoofer built guide*



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In this guide I will try to describe, how I built my subwoofer. This is not a detailed DIY guide and it definitely doesn't describe the best way how to build a subwoofer for 147 but you might find it useful in some way.

When I started to plan building a subwoofer I had one main objective - To have the subwoofer as small as possible providing still very good sound quality (contradictory requirements, I know). Because of this I made this plan:

- To build a sealed box as ported or band-pass box usually needs much bigger volume.
- To use 20cm (8") speaker as larger speakers require bigger box and more powerful (and physically larger) amplifier.
- To fit the subwoofer in the boot, behind the rear left wheel and to make use the space as well as possible – I was going to build fiberglass box

Note:

This subwoofer was my first work with fiberglass. If you have some experience, your result will be probably much better. If you don't have any experience, try to get some info first. But as I made this subwoofer at the first try, so you will be probably able to do it as well. ☺

### **Step by step.**

First, I made the fiberglass part of the box (back part). I wanted the box to fit perfectly into the boot and I could find only one way how to do this – to laminate it directly on the boot walls. To do this I had to isolate the walls and make a separating layer to protect them.

If you make something dirty with fiberglass resin, it is almost impossible to clean it. If you don't want to destroy your boot upholstery, you have to cover everything you think you can damage (that's everything you can touch ☺).

I used painter's paper tape (masking tape), 5cm thick, that I stucked directly on the boot walls in more layers. I was afraid that the tape might soak the resin and stick permanently to the wall so I used a layer of aluminum kitchen foil. And than one more layer of paper tape. It turned up as unnecessary precaution, but better to be safe than sorry.





At the end of masking, my boot looked like this. I still recommend covering the boot and everything you might touch with old newspapers, or some foil. I put some blankets around the rear headrests as well as I tried to separate car interior from the boot, because of the smell of fiberglass resin.



This is everything I used for laminating:

- glass-fibre cloth
- two compound fiberglass resin with hardener
- scissors
- paint brush
- pair of chirurgical gloves (not shown in the picture)

During the actual work I wasn't able to take any pictures. It is not very clean work, I had my gloves dirty of the resin and I didn't want to damage my camera ☺. The process is quite simple. I painted the paper tape with the resin, attached the glass-fibre cloth and painted it again till it was well soaked. I repeated this process till I had four layers of glass-fibre cloth. The resin is drying very quickly when it is mixed with hardener, you can use it only for about 10-15 minutes at 20 °C. Then it starts changing into a gel and can't be spread by painting any more.



This is how my fiberglass box looks like while drying. Three hours later, I could easily take the molding out and to my surprise I could peel most of the paper tape down quite easily.



This is the result of what I was able to do in one afternoon.



With electric saw I cut the sides to have (more or less) straight edges.

Between this picture and the next one, there is some time difference as I forgot to take pictures of all the steps. As the edges of my moulding were not exactly straight and didn't hold the shape I needed, I had to make a frame, cut from one piece of MDF and nailed to the fiberglass. At the places of missing side walls I fitted carton paper to make a mould and laminated it. You can see the result.



Please ignore the red metal reinforcement I used. I accidentally broke the MDF frame and I had to strengthen it till the resin dries out. I removed the reinforcement later.



This is the back part of the box. You can ignore the surface finish, it looks very bad in the pictures but it is not that bad for the touch and needs a lot of sandpaper work anyway.

Notes:

- Laminating makes very bad smell. It is better to do it in open air and not in closed garage. Consider that when you laminate the box directly in your boot, your car will be full of this smell for some time.
- When you cut or grind laminate, the dust is very annoying. If you don't use gloves and mask for your face, your skin will itch you half day 😊.
- The resin usually has two components. When you mix them you have to spend it quite fast. Don't prepare 0,5 or 1 liter of the mixture as you will not have time to use it all.
- Buy more paint brushes and buy the cheapest ones. When you make a pause during laminating, or you want to finish something next day, or you need to repair something, you always need a new brush. The used one gets stone-hard after few minutes and can't be cleaned.



I sprayed the inside of the box with spray used for underbody (chassis) protection. If you are very serious in car audio you can use so called “noise-killer” spray available in audio shops, but according to the information on my spray, this one has the same composition (asphalt and bitumen) for 1/4 of the price.

This is the detail of the spray can I used. This kind of material of various brands and colors is available in any car shop.





As the subwoofer walls have to be as rigid as possible and resistant to vibration with good sound damping properties, I decided to paint it from the inside with bitumen underbody coating. Though it is quite thick material, I was still able to paint it with a normal brush. Though it dries very quickly for the touch in thicker layer it is quite delicate. Because of this I let it dry for a week.





I had some rest of Dynamat sound damping I used previously during my audio installation, so I decided to stick a layer of Dynamat too. It was not exactly necessary but it won't harm either 😊.

If you heat up Dynamat a little with a hairdryer it is very easy to work with and adapts to almost any curves of the box.





Connectors' installation is simple. I drilled two holes in place where I considered the connectors most convenient. I soldered copper wire to the connectors and installed them. I used  $2 \times 5 \text{mm}^2$  twin-lead cable as the wire should be as thick as possible to reduce resistance. I sealed the connectors inside of the box with bitumen sealant so that they resist vibrations. As I didn't want the cable to just lay at the bottom of the box, I stuck it into a layer of bitumen.





When you build a subwoofer, you have to know its volume to choose appropriate speaker for the enclosure you have. Or you can choose the speaker first, and build an enclosure with an appropriate volume to its characteristics. When building a box, it is easy to calculate the volume, but with curved custom shape, it is almost impossible. As I wanted to know the volume of the box I have built I could come to only idea: fill it up with water ☺.





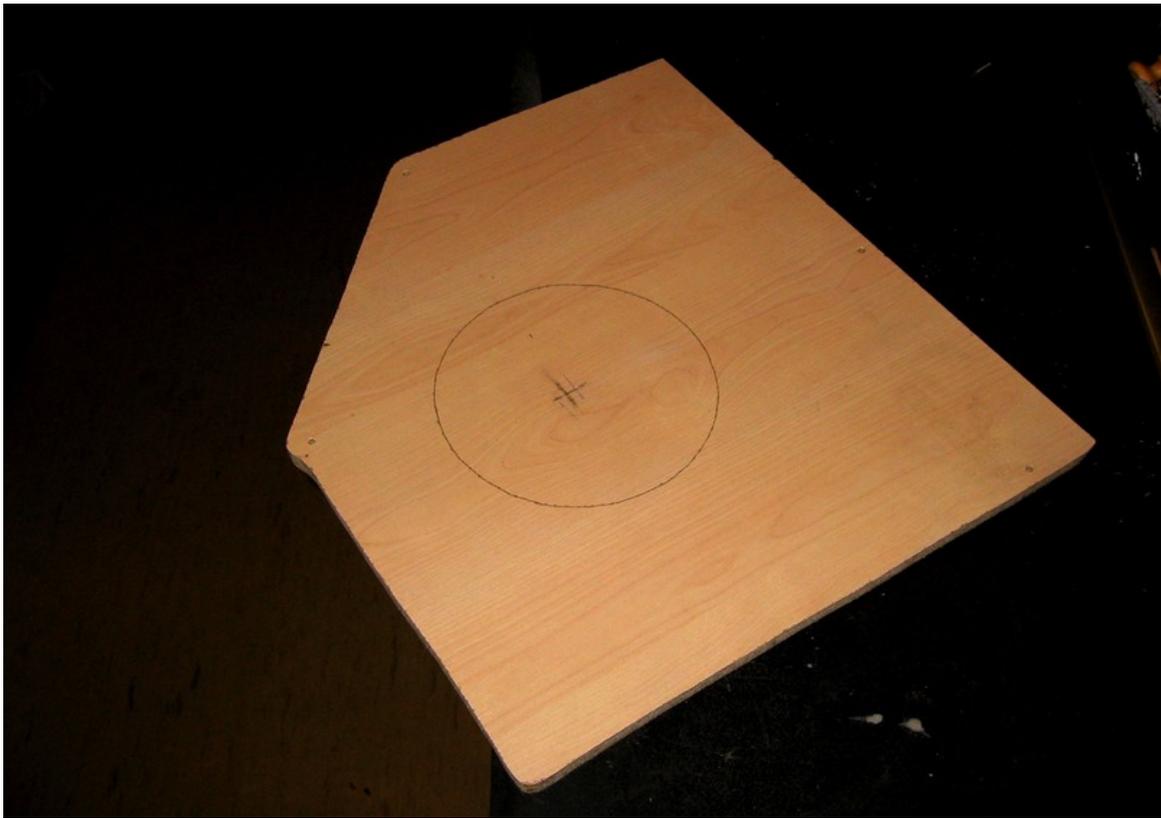
Filling the box with water has one more advantage. You can easily find if the box has some leaks or if it is completely tight. My box had two minor leaks. They were so small that they probably wouldn't influence the sound anyway, but it was good to know about them. No big deal, I just had to reseal the inside of the box. I was anyway planning to paint the box with one more layer of fiberglass resin.

The volume of my box is 16,5 liter. I am planning to put some sound dampening material inside and installing a speaker will further reduce its volume as well.

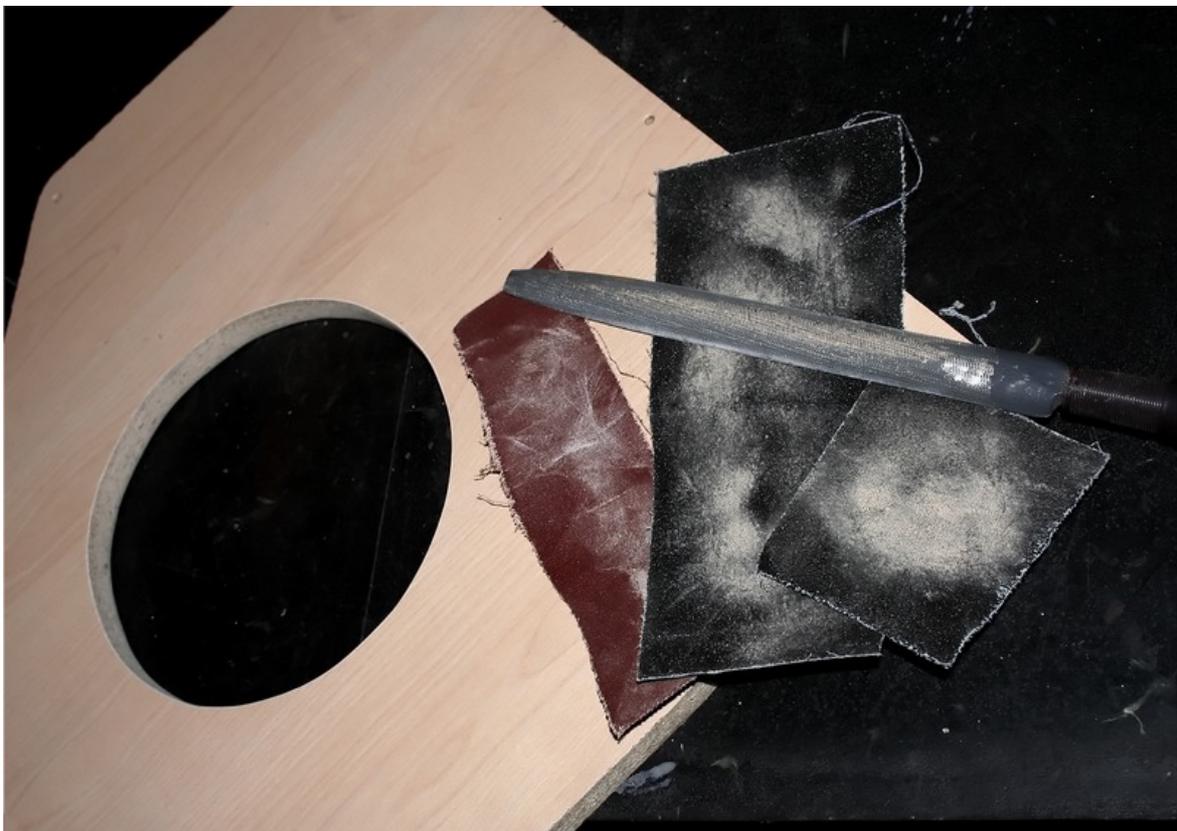
After the inside of the box was sealed I installed sound deadening material. You can choose various kinds of material and you can find on internet forums long arguments which one is the best. Considering the shape of my box, used materials, the fact that it plays in the boot I don't think I would be able to hear the difference between simple foam and special synthetic wool for speakers 😊. I chose ANS foam (whatever ANS means) made by Sinus Live, mainly because I found it in the shop near my house. It is easy to cut and glue.

I needed the frame of the box to lay flat on the front part of the box and it was slightly twisted. I had to put a layer of fiberglass body filler on some places and to grind the frame plane. You can see stains on the frame where I had to smooth it.





I made the front of the box out of 20 mm thick MDF board. It was not difficult, as I had only to draw the outline of my box on the MDF and cut it out by electric saw. Then I cut the hole for the speaker. Even though in this stage I didn't have the speaker, I had chosen the type I wanted and downloaded the technical specification from the manufacturer's website. So I knew the hole had to be 180 mm in diameter.

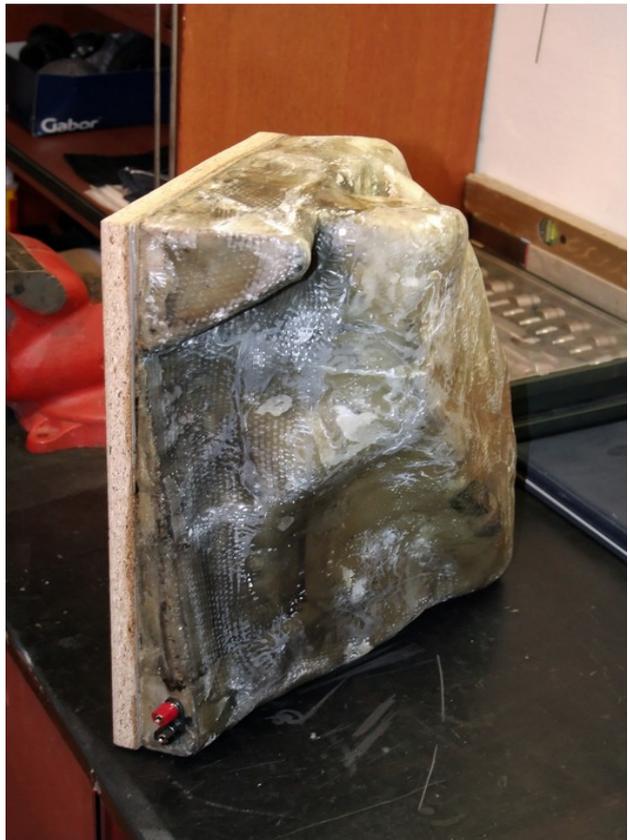




I connected the front and back of the box using universal transparent silicone and 13 screws. The good thing is that the box is completely sealed now, but it can not be disassembled in the future. After it is smoothed and upholstered it is even impossible without destroying it. But for me it is not a problem as this was the plan. It would be much more difficult to build a box that could be opened.



My work is at least starting to look like a box 😊. Not a nice one, but this can be still improved. I have to smooth the surface roughness with a filler. I used fiberglass filler for places where I needed thicker layer as the glass fibres inside the filler make it very resistant and it doesn't crack. For thin layers and final finish I used polyester fillers as they are easier to smooth with a sandpaper.





Just some more pictures before the grinding....

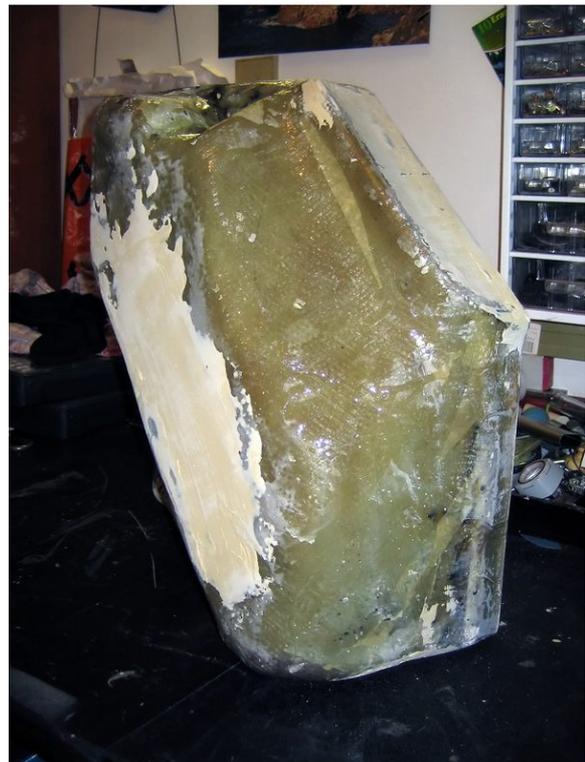




Another close-up of the fiberglass body filler I used on the back of the box that has to be smoothed.

I don't have any pictures from the smoothing process as I didn't want to damage my camera with the fine dust. Anyway, I used only some sandpaper and a lot of patience ☺. Good idea is to work outside, as the fiberglass dust is a real pain.

This is how the box looks like ready to be upholstered. It doesn't look very attractive on the pictures because of various colors of the material used, sealants, body fillers, resin..... but this is not a problem. The objective was to have a smooth surface that fits into the boot. When the box is covered with carpet it will look completely different.





Covering the box with upholstery was time consuming, but it was the part of the job I enjoyed most. I started with the easiest surface – front of the box. There is not much one can do wrong with gluing a carpet on flat surface ☺



When the glue dried out I cut the hole for the speaker with a sharp knife.





Some more pictures from the process. There is only one experience for the future – Measure twice, cut once ☺





This was the most difficult part of the box to upholster because of its shape. It can hardly be covered with a single piece of carpet. I had to work with 4-5 smaller pieces I cut separately.





The lines where the carpet pieces meet are still visible, but I think that for my first time I did a pretty good job 😊.

Anyway, this part of the installed box is not visible so it doesn't have to be upholstered at all. I did it as I couldn't live with the feeling of unfinished job 😊.



You can see on these photos of the box corner with the terminals that even difficult curved areas can be covered with upholstery very neatly if you are careful.





This is the speaker I chose to install. I chose HERTZ ES200, 20cm (8") subwoofer speaker because of the already mentioned reasons. It has recommended 15 liter enclosure, and its power characteristic (200W RMS / 400W peak) responds perfectly to my Blaupunkt GTA 250 amplifier (160W RMS / 400W peak) in 1ch bridged mode. Its reasonable price of 75€ played its role too 😊.





Speaker installation is quite easy and you can't do much wrong. I soldered the wires to the speaker as I don't expect to take the speaker out often (if ever). Simple connectors can be used as well, but if they don't fit tight the vibrations might make them loose after some time.





This is how my box looks like in the boot. It doesn't take too much space, fits perfectly and even the carpet color is very similar to the boot lining ☺. The last remaining issue is how to clamp the box in the boot as otherwise it would fall in the first corner.



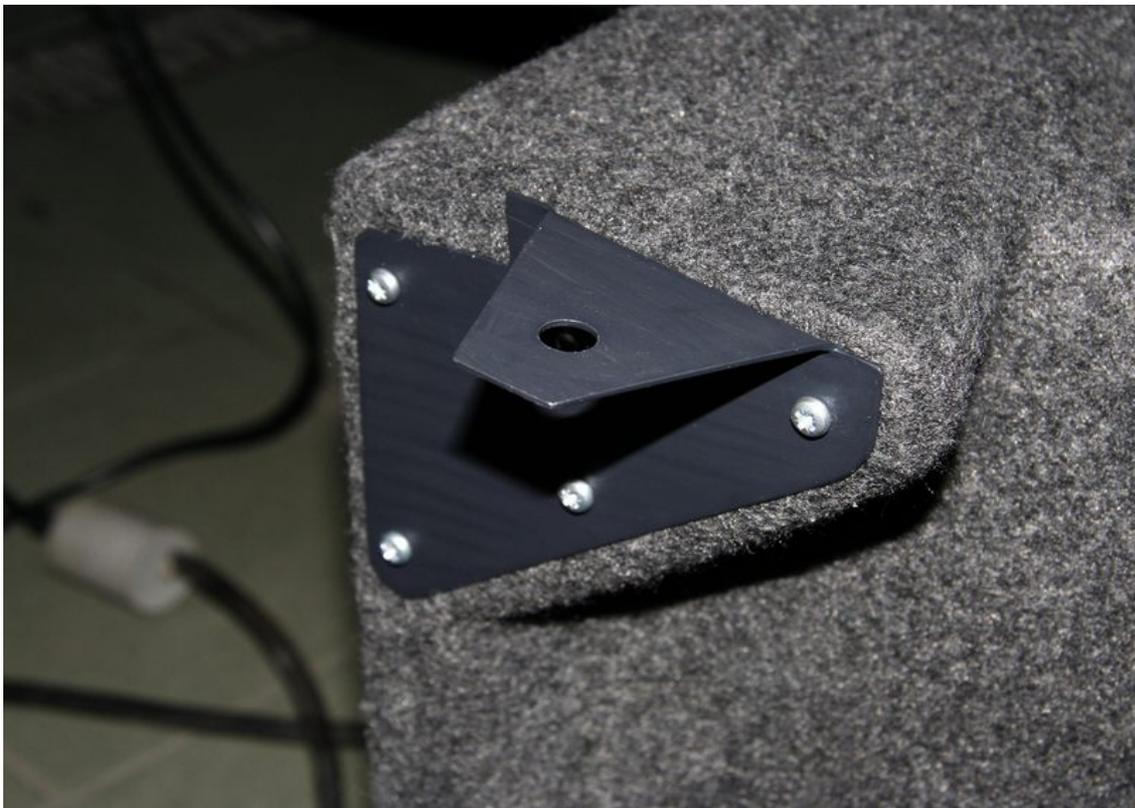


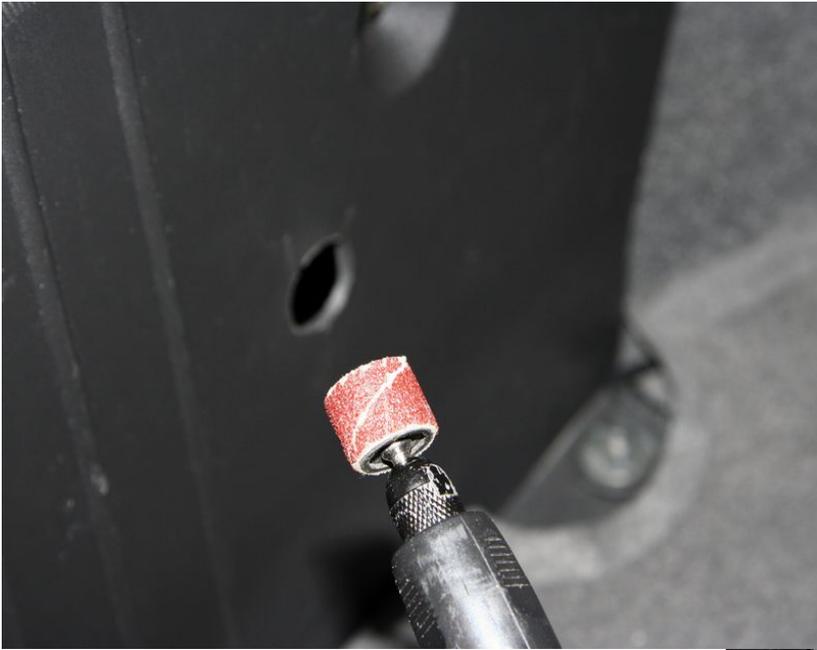
Here comes the part I consider the poorest designed part of my subwoofer ☹️, but I couldn't come to something better. How to fix the box in the boot? My aim was to make the box easily removable without need of any tool. In worst scenario I might be forced to change the spare wheel in a blizzard and in that case I don't want to fiddle with the box in my boot ☺️. As I didn't want to screw the box directly into the thin plastic trim in the boot (the screw thread wouldn't last frequent removing), I had to make some metal fixing point in the boot and their counterparts on the box.





Subwoofer mountings on place. One of them is screwed in wooden front panel, second one is held by screws in fiberglass on the box side. I used more screws, to lower the stress put on fiberglass material. I am sure that two screws would be enough to hold the box in place, but I have always tendency to come it strong.





I cut holes into the boot trim to host the screw nuts. I cut them a little larger, so that I had freedom to fit fixing points exactly on the spot where I needed them.

Afterwards I installed the fixing points. To be on the safe side, in addition to the screws I used some glue as well. As my subwoofer fits perfectly into the boot bay, two firm fixing points are more than enough to hold it without any movement during any kind of driving 😊





This is how my subwoofer fits in place. It is not extremely nice and spoils the look a bit, but in real life it is not that bad ☺. I would like to have better idea of how to hold it firmly, but I will probably stay with this system as it works fine.





*Finished !!!*



To make the subwoofer work a functional amplifier is obviously needed. But how to install and wire an amplifier is a story for different guide 😊.

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*This guide describes how I did the job. It may not be complete or some steps might not be described detailed enough. Use it for your inspiration, not as step by step guide.*

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