

# PART TWO

## The Planning Phase

The planning is the most important part of the process and one of the keys to the perfect casing. This is where your most creative ideas can grow or be tossed out which is the whole idea of planning in the first place. What needs to be done is to find a balance between functionality, style and practicality. Not always the easiest task due to the massive constrictions bound to happen between your choice of style and the functionality possible with that choice. That is why you have to design from the inside out!



Components are the individual pieces of a portable, which usually include some form of battery, system PCBs (printed circuit boards), speakers, screen, controller board, memory cards, wiring, tact switches, button holders...so on and so forth. Getting these all to fit within a case could be a hard chore if the case was not designed for them! This is the biggest mistake that new modders make in that they try and design around the casing instead of the other way around.

Knowing the size of your components is a pivotal point between success and failure. So breaking your plan down to the size of every component will allow you to greatly enhance your chances of making everything fit into place. Thickness, Width and Length, knowing these numbers for each and every component can allow you to figure out where a component must go given the constraints of the casing or tells you what your constraints are. This gives you a much clearer view of what to expect with the real thing. Some people have gone as far as to make card board cut-outs of the components and play with the configuration in real time, while others have resorted to free means like Goggle Sketch-up and the not-so-free CAD systems to virtually place the components and get very detailed schematic designs.

Whatever method you use, scale/not to scale really doesn't matter. It's just getting the idea down on paper, knowing if it's going to work or not and if the style is unique, interesting, practical and fun. The more detailed, the better the finished product, but remember the plan is only as good as the person who executes it. Know your limits when you design, know the tools you're going to be using when you design it and don't over complicate a simple situation.

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## THE RIGHT TOOL FOR THE JOB

A craftsman there cannot be without the right tool and having them at your disposal can be an immense help. Though it really only takes minimal tools to actually make a casing look presentable, the right ones for your specific style can be a game changer. But first you must consider what kind of casing you're going to make before you can know which tools are necessary.

You can go about this two ways. One, you can take an inventory of the tools you already have at your disposal. You may look around and find you have a table saw, miter saw, a few files and lots of sand paper. With those three tools, a whole world of opportunity has opened up for Vacuum Forming and you could be best suited to use wood as your template molds.



OR



You can do a bit of research to find out what tools are needed to get a specific result, find out if you can acquire them within your budget and go from there. So say for example you found a portable that really turned you on to the hobby in the first place. You do some more in-depth research and sometimes you can find that the case was made out of some kind of kids toy or electronics casing.

You later find that all it really takes to accomplish these results was a rotary tool and sand paper. It could go the other way around though and means you'd have to buy several new tools to make it work, at which point you'd weigh your options.

Whichever way you choose, careful planning of what you have to work with vs. what you need to get the job done correctly must be taken into consideration. Be prepared though to either shell out a fair amount of cash for the right tool or be spending a lot of time trying to make something work with another. Eventually you'll acquire enough equipment to make things work easier and through trial and error you will learn of different uses for all kinds of different tools.

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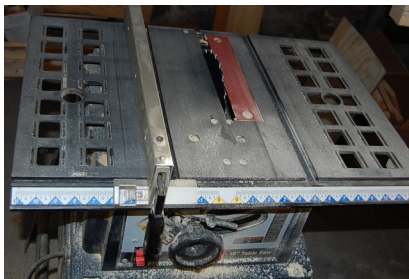
## BASIC TOOLS

This category is broken down into the most popular types of casings used in the field. Certain tools that work great in one case making style might not do a thing for another. So to help clarify, here are a few lists of tools that depending on your route can make all the difference in the outcome!

### Essential Tools for Wooden Mold Vacuum Forming (Necessity)

Now, when I say necessity, I mean that some kinds of casings will not be easily completed without them. I'm sure there would be ways of obtaining similar results through different means, but in terms of quality and a safety aspect, these tools are the best to use for the best results. Here is a list of tools required for wooden mould vacuum forming.

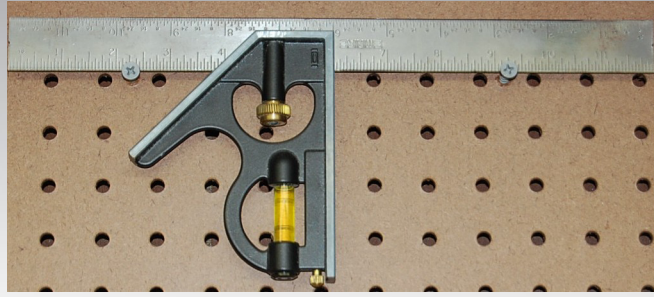
- 10"-12" Wood Chop Saw: Used for making square cross cuts
- 10" Table Saw: Used for ripping down the length of a board
- Table Mount Jig Saw or Band Saw: Used for curved cuts and corners
- 3/8" Drill/Driver, Corded or Cordless: Used for drilling holes and counter sinking
- Rotary Tool: Dremel or Similar w/sanding drums and cut wheels: Many uses
- Files: Round, Half-Round, Bastard, Flat and Square:  
Used for fine shaping/cutting/smoothing
- Measuring Tools: Tape Measures or Rules, Compass:  
Essential for design and production
- Utility and Putty Knives: Used for trimming and filling
- Heat Gun: Finish shaping when vacuum forming





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## Required (cont) & Optional Tools



### Optional Tools for Wooden Mold Vacuum Forming

- Air Compressor
- Palm or Disc Sander
- Thickness Planner
- Drill Press



### Tools for Clay Molds (Most Optional)

- Putty Knife or Spatula
- Rough Shaping Tools/Wood Chisels
- Piano Wire or High Tensile Fishing Line



We don't touch too much upon clay here mainly because of its fragility. Without a Kiln, the molds can often shrink as they dry and more often than not, their uses will be limited as they are either very brittle when hardened or too soft when not. The flip side is this method is much cheaper and easier to work with if you don't have the work space or the tools to work with wood or MDF.

This is just as important as having the right tools for the job. Working with the right materials will make the process much faster and much easier on you. But, not unlike the rest of modding world, there is not definitive way of making a case or what materials you choose to use. These are just a few that have been tested by a multitude of different modders and have been road tested for longevity and quality.

### Formable Plastics:

- **High-Impact Polystyrene:** For use in Vacuum Forming applications is the choice of DIY modders. Otherwise known as HIPS, the properties of the plastic allow for easy forming at relatively low temperatures. The plastic only really needs to be heated up to about 300 degrees F in order to become pliable enough to form. The other benefit is that it's cheap and readily available from a number of different online and local suppliers.
- **ABS:** This is what most commercial casings are made out of as it is a shapeable plastic that is easily press-fit or injection molded. Injection molding is probably one of the best methods for mass casing making, but requires equipment and techniques that are usually only found in factories equipped to deal with it. This is how you see the insides with formed in screw posts and things of that nature. Very professional and clean, but far too expensive for the average DIY hobbyist.
- **Acrylic:** Not as popular as HIPS as it is not as easy to heat or shape. Acrylic is a harder and more brittle material that although might be a bit stronger than HIPS, is much harder to work with. The one benefit to acrylic is in the event that the modder wants to use a clear material for a see-through effect, acrylic will not distort and cloud like any other transparent material would. But again, this takes lots of time and practice to get the feeling of and is much more expensive than HIPS.



# Part Three

## Materials

### Adhesives:

- **Wood Glue:** There are a lot of wood glues out there, but a few that top the chart are either Elmer's or Woodtite. These are just the standard, run-of-the-mill glues that if you're making a wooden template, could be required.
- **Super Glue:** Krazy Glue or Loctite 401 are two that I recommend. Loctite 401 Prism is probably the best adhesive to "tack" different parts of casing components to each other. It has about a 5 second work time, less if you're gluing HIPS to wood in which case you have less than a second before it bonds permanently!
- **ABS / PVC Cement and Plastic Weld:** The best choice in actually forming two pieces of plastic together permanently. These two actually melt the two surfaces together and when done, fuses to make an unbreakable bond. Though it's the best, use often takes three full days to dry and requires additional sanding. However, it is well worth the wait.
- **Hot Glue:** Used as only a temporary holding agent, hot glue is both messy and weak. Though it may work well for internal components, there is no real place for it on the case unless it's a temporary fix.
- **Tape:** Don't use it unless it's for temporary holding.
- **Epoxy:** There are many different kinds of adhesive epoxy, some that even double as a bonding agent and a filler. One way or another, you're going to need some form of it. Personally, I only like the single purpose epoxies, either used for adhesion or filling. Loctite makes a nice plastic epoxy that comes in a small syringe and plunger that's cheap and can be bought at any hardware store. JB Weld is also often used, although not highly recommend as its primary use is for metals fabrication.



### Fillers:

- **Wood Filler:** This is essential to when using wooden mold templates. Often times there will be screw holes protruding or gaps where two pieces of wood butt together. Vacuum forming can sometimes even imprint the grain of the wood into the casing, so having the surfaces absolutely flush and smooth is critical. Wood Filler accomplishes this nicely after application and sanding.
- **Plastic Fillers:** My personal favorites are made by The Urethane Supply Company, who's two-part epoxy products SMS Hardset Filler and SMS Flex Filler hold true. These seem to have the best flexibility and durability on the market. Designed originally as a replacement for Bondo in automotive applications, this stuff holds up, doesn't crack and stays just a little bit flexible even after drying. Hardset Filler works well for the big gaps and the Flex Filler is used for the touch-ups. The two part system sands down nicely and paints over well.

### Abrasives:

- **Sand Paper:** This item will be both your best friend and your biggest nightmare! Regardless of what phase in the case making process you are, you're always going to need it. Pick up a sheet/pack each of 60,80, 120, 240, 320, 480, 600 and if you're really going to get into it, 2000 to 6000 grit for wet sanding the final coats.
- **Sanding Drums:** A rotary tool is a requirement for this kind of work, the uses are beyond count. Getting a few different sized and different grit sanding drums for it will make your life much easier. Get it, use it!

### Hardware:

- This one is tough, only because there are so many different directions your case can go, all of which can have different hardware requirements. Now I'm not saying you can't go to your local hardware store, pick up a bag of drywall screws and then never have a use for them, but chances are, you're going to have to get the hardware that works when your project gets to the point that it's needed. It's going to be very dependent on your specific project needs. But I can tell you, 1-1/4" coarse thread drywall screws will be your best friend, not only throughout the case making project, but life in general! I've gone through thousands of them with everything I do that involves woodworking. Pick up a couple pounds; you'll be glad you did!