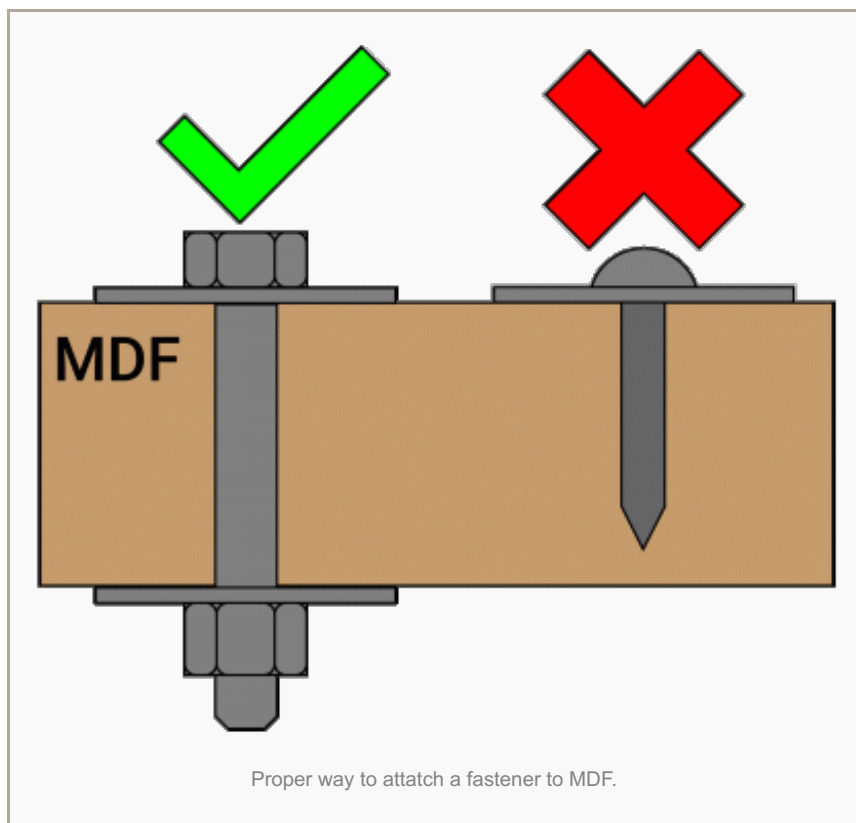


# Materials to Know: Medium Density Fiberboard

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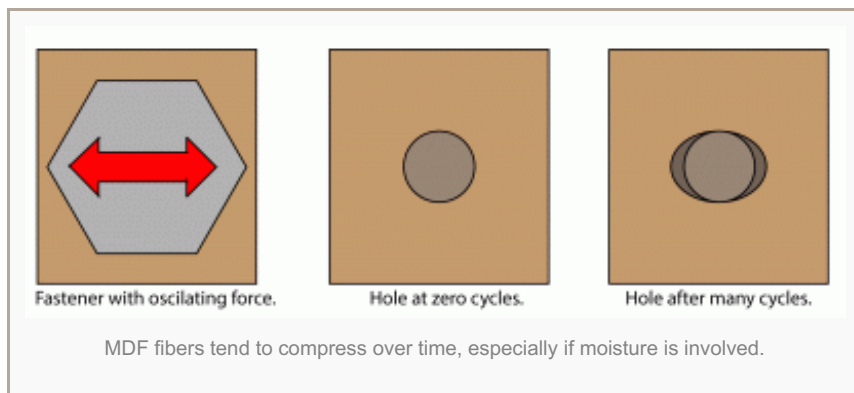
April 14, 2016

MDF is the cheapest and flattest wood you can buy at local hardware stores. It's uniform in thickness, and easy to work with. It's no wonder that it shows up in a lot of projects. MDF stands for Medium Density Fiberboard. It's made by pressing materials together along with some steam, typically wood, fibers and glue. This bonds the fibers very tightly. Sometimes MDF is constructed much like plywood. Thinner layers of MDF will be made. Then those layers will be laminated together under glue and steam. The laminated MDF is not as good as the monolithic kind. It tends to tear and break out along the layers, but it's hard to tell which kind you will get.



MDF is great, but it has a few properties to watch for. First, MDF is very weak in bending and tension. It has a Modulus of Elasticity that's about half of plywood. Due to its structure, short interlocking fibers bound together by glue and pressure, it doesn't take a lot to cause a crack, and then, quickly, a break. If you'd like to test this, take a sheet of MDF, cut it with a knife, flip it over, and hit the sheet right behind your cut. Chances are the MDF will split surprisingly easily right at that point.

Because of the way MDF is constructed, fasteners tend to pull out of it easily. This means that you must always make sure a fastener that sees dynamic loads (say a bearing mount) goes through the MDF to the other side into a washer and bolt. MDF also tends to compress locally after a time, so even with a washer and bolt it is possible that you will see some ovaling of the holes. If you're going to use screws, make sure they don't experience a lot of force, also choose ones with very large threads instead of a finer pitch. Lastly, always use a pilot hole in MDF. Any particle board can split in alarming ways. For example, if you just drive a screw into MDF, it may appear to go well at first. Then it will suddenly jump back against you. This happened because the screw is compressing the fibers in front of it, causing an upward force. The only thing pressing against that force is the top layer of laminate contacting the threads. The screw then jumps out, tearing the top layer of particle board apart.



## Moisture and Glue

The biggest issue with MDF is its tendency to absorb any and all moisture. Unless it is kept perfectly dry, it will expand and eventually disintegrate. MDF, can and will mold if left damp as well, so keep that in mind. Don't use it in constructions that stay near food or animals.

This tendency to absorb moisture makes it difficult to glue MDF. If you are laminating two sheets together, the standard wood glue like Titebond will work. Look at the edge of the board and see if there is any curvature. If there is, face the concave surfaces of the two laminates together, and spread a light coating of glue (if you use too much glue, the MDF will swell). Press them together and weight the assembly until dry.

Another recommended adhesive for laminating MDF is a spray adhesive like 3M Super 7. These adhesives don't adsorb into the material as much. Silicone or acrylic adhesives also do well, as they're not really "wet" (though some silicones may have the curing agent pulled out of them). These are the adhesives you'll find backing melamine trim and sheet for finishing MDF. If you want to glue the edge of the MDF it becomes harder. The edges tend to be more absorbent and may wick away the glue and swell. It is not a trustworthy joint.

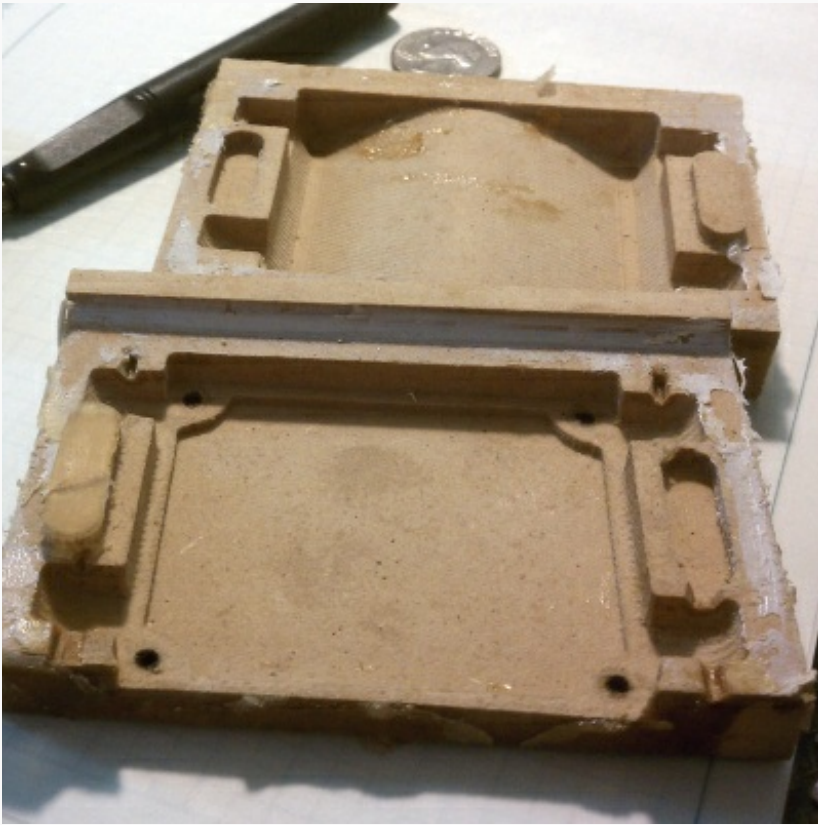
## Mechanical Joiners

If you are using a joint such as a biscuit joint or dowel, make sure to get the kind that expand when they come into contact with the moisture from the glue. These work fairly well in MDF constructions because both the dowel and the MDF expand when wetted. This forms a fairly good friction fit plus some glue bonding. Watch out for dowels and biscuits in edge joints again, as MDF splits very easily.

However, if you want a joint that counts with MDF, pick through-bolted joints. If you need a reliable right angle joint use a metal bracket with bolts and washers through the holes. There are other options too, but the rule of thumb is to keep the MDF in compression and as far away from tension as you can. Tab and slot joints and finger joints work well for this reason too.

## Coating and Covering

If you need to paint MDF, prepare to spend a significant amount of your time fighting MDF's tendency to absorb the paint. However, if you must, the most effective way with the least loss, is an oil based primer sprayed on in very light layers. This lets the paint dry and cure with minimal absorption. After a few layers the wood will be sealed and a regular water based latex paint will be very effective.



One of my MDF mold masters. It works, but nowhere near as well as tooling board. You can see how oil and resin have mercilessly absorbed into it.

I've tried to use MDF as masters for molds before. It can work. I had a few interesting problems at first where the MDF would absorb part A of a resin mixture but not part B. This led to a mold that looked like it was curing nicely, but would stay goopy forever. I found that an application of hairspray seemed to seal the MDF enough to apply mold release effectively, but I wouldn't guarantee any success. Also, MDF tears as it is machined. The first few pulls from the mold will have these fibers embedded in them. There's no real way to avoid this. [Tooling board is a better choice for this.](#)

MDF and similar particulate boards are used in industry. The typical way to finish these boards are to surround them with a layer of a completely different material. In speaker construction you'll often find MDF wrapped with carpeting, vinyl, or leather. In cabinetry and shelving MDF is usually covered in big sheets of adhesive backed melamine.

Note, there is an MDF made with an exterior glue. This one does not absorb so much moisture. It will be easier to paint, and more difficult to glue. It is more expensive though, and may not be worth the extra cost. It might be better to use a stronger, more uniform material such as Baltic Birch Plywood at that point, unless you need a specific property MDF provides.

## Milling

As far as machining MDF goes, there are a few options. However, before we get to those, it's important to note that MDF is very abrasive. The fibers used are usually not clean. There may be sand and other abrasive particulates in the blend. Your tools will dull, even carbide. On top of the abrasive properties, MDF will heat your bits up a lot. Prepare to see smoke pour out of drilling operations. Since it can't tolerate moisture, there's no way to cool the cutting operation, and you can pretty much kiss a bit goodbye after one job. There are some higher grades of MDF called molding grade, which are a little less abrasive, and more uniform for less heat. However, it all really still applies, and again you may not make the cost savings up.

Aside from that, everything works well on it before the tool dulls. Cutting, sanding, milling, drilling, works just fine. Watch out for blowout on the exits of your cuts. A drill bit is more likely to break out the back of the hole than drill cleanly through it. This can be combated with the standard techniques, such as placing a sacrificial wood piece behind. It is also a good idea to countersink both sides of a hole in MDF, especially if joining with screws. Make sure the cosmetic side of every cut is facing up. Don't discount hand tools when it comes to MDF, a standard cross cut saw will tear through the stuff.

MDF can be laser cut fairly well. As far as I know most MDF doesn't have caustic glue that would damage the laser's mirrors, but I would watch out for the exterior grade MDF. It usually chars terribly and every edge will require a wipe down with a rag. Otherwise prepare to get black dust on every thing. It takes a laser etch well.

MDF will remain a go to for most prototyping needs. It's flat and easy. These days I mostly use decent grade Baltic Birch for the things I used to get MDF for, but every now and then I'll still dig out a piece of the stuff for a quick project. I know there's a ton of experience with MDF out there. I'd love to know if I got something wrong. Also, the comments on the other [Materials to Know](#) have been absolutely fantastic. If you've got any experience to add, please do.

*Title photo By Elke Wetzig* [CC](#)

