



A variety of different types of medium-density fiberboard (MDF) are available from nine companies that manufacture the material (above). Although it has been used in industry for 28 years, MDF is just now becoming more available to consumers and small shops. The difference in density (right) is obvious when comparing MDF, leftside, to common particleboard, right side.

A Woodworker's Guide to Medium-Density Fiberboard

Get the most from its glass-flat surfaces and razor-sharp edges

by Jim Hayden

Medium-density fiberboard, or MDF as it is more commonly known, is the newest of the furniture-quality wood composites. Because of its dense, uniform composition and flatness, it has surpassed plywood and particleboard as the sheet good of choice for fine work and more routine uses.

Pre-finished faces are flat as the slate on a pool table, which along with its dimensional stability makes it an excellent substrate for veneer. The edges machine

well, with no chipout, and MDF accepts a full range of joinery and fasteners.

But if you have never seen a 4x8 or 5x8 sheet of MDF or have never even heard of MDF, you have plenty of company. MDF has been an industrial product for its entire 28-year history, with most shipments earmarked for furniture factories and cabinet producers. Only recently has it become more available to retail consumers and small shops. Once you have some MDF in your shop, you may find, as I have, that

it is also good stuff to make some of your jigs, fixtures and templates.

Whether you use it for jigs or the substrate for fine veneered furniture, there are some special tricks and tips for using MDF. I'll share what I've learned from my own experience and from research done for the National Particleboard Association (NPA), which includes eight of the nine MDF companies, as well as from the reactions of woodworkers who regularly use MDF in the cabinet shop of the Arthur M. Sack-



Museum quality MDF—
These display cases at the Freer Gallery of the Smithsonian Institution show off some of MDF's versatility. The case above shows the crisp edge-holding ability of MDF in a painted piece. The case on the right makes use of walnut veneered MDF with solid-wood moldings.



ler and Freer Galleries in the Smithsonian Institution (see the photos at left).

Machining MDF

Because it's homogeneous (see the inset photo on p. 51), MDF machines better than plywood or particleboard, and even some natural woods. There are no layers or chips, brittle edges, knots or grain. I routed all 15 types of MDF made in the United States, courtesy of the nine MDF companies (see the photo on p. 51). The boards share a sameness in meeting industry standards: They match in density and superb flatness. They differ because the trees harvested near the plants differ. The wood chips, shavings and sawdust (or residuals) from the local sawmills and plywood mills are the raw material of MDF. Also, the companies use proprietary formulas, thus adding a few minor, and in some cases, a few major differences, such as formaldehyde content.

I've used two brands of MDF regularly during the last five years. I'm impressed with the consistently smooth surface of the sheets. MDF starts out as a low-density, 15-in.-thick slab 18 ft. long. A 3/4-in. board is compressed at 800 lbs. pressure, then 50,000 lbs. pressure to almost final thickness. Sanders, in a series of grits, take over and finish off with 120- or 150-grit, sanding and burnishing to precisely 3/4 in.

Sometimes I measure new sheets. I find their thickness to be scrupulously maintained. However, extreme heat and humidity changes, such as daily changes encountered with outdoor storage, will cause a permanent thickness increase. But the thicker boards, 3/4 in. and 1 in., will take some abuse in storage (i.e., stored on edge) and not warp.

Sawing—A 50-tooth combination blade is suggested for rough-cutting large sections of MDF on the tablesaw. But I make so many things out of cutoff pieces that I go right to my finish-cut blade. That used to be a 60-tooth triple-chip. I loved that blade; with a pair of hold-downs and my pride and joy, shopmade, European-style adjustable splitter, a piece of MDF would slide down the fence and exit the blade with a new edge so smooth that I had to stroke it. Then I bought the other blade manufacturers recommended for MDF, a 60-tooth thin-kerf alternate top bevel (mine is a Freud TFLU88). It seemed to cut even cleaner than the triple-chip, and material moved more easily through the blade because of its semi-thin kerf (nominally .090-in.). Its teeth angles fit the NPA's specs for a blade to saw cleanly top and

bottom surfaces of overlaid panels. They are a 15° hook, 15° top bevel and a 10° alternate face bevel.

I use 6-in. blade stiffeners for a slightly finer cut, and I made a zero-clearance insert to keep the dust down where it belongs. I'll talk more about MDF dust problems and solutions later.

My friends in the cabinet shop have good results using the tablesaw to kerf MDF sheets, so they can be bent into curved forms, as shown in the photo at right.

Edge-shaping and routing—When I saw or rout an edge, rabbet or dado for joining, I get sharp edges with MDF. The edge surface looks and feels smooth. When rubbed counter to the cut direction, it feels slightly fuzzy or scratchy, depending on the brand of MDF, but the piece is ready for glue-up and assembly. My contoured router cuts (cove, roundover and Roman ogee) are clean and smooth, with crisp edge profiles, as shown in the photo at right. The edge surface is a little rougher than on straight cuts, but that disappears with normal light sanding for finishing. When routing or shaping, feed MDF about 25% slower than wood for maximum edge smoothness.

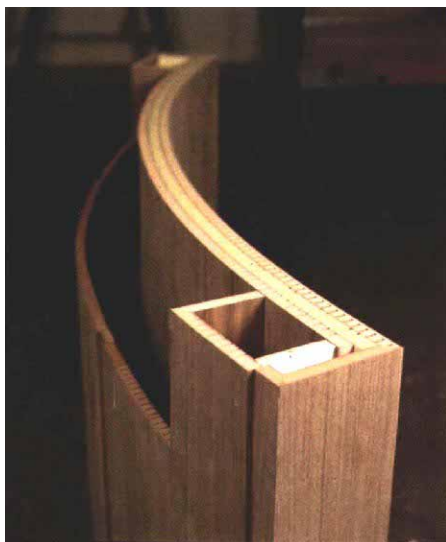
MDF does have its limits. Sharp protruding contoured edges aren't a good choice. And being 10% urea-formaldehyde or other glue, MDF does wear down cutters faster than wood.

MDF sawdust is fine resin-coated particles of wood dust, light enough to become airborne and settle on everything in sight. Building a router table/tablesaw extension with vacuum attachments has virtually eliminated floating dust and cut down on my set-up time (see the photo at left on the following page). I use a high-quality dust mask, the Dustfoe 66, which I purchased from Highland Hardware (1045 N. Highland Ave. N.E., Atlanta, Ga. 30306; 800-241-6748) and have installed vacuum setups on all my machine tools.

I wanted the same low-dust environment for freehand routing, so I built an acrylic and MDF safety guard/vacuum hookup that bolts into T-nuts epoxied on the underside of my router base plate. It is almost 100% effective with MDF dust.

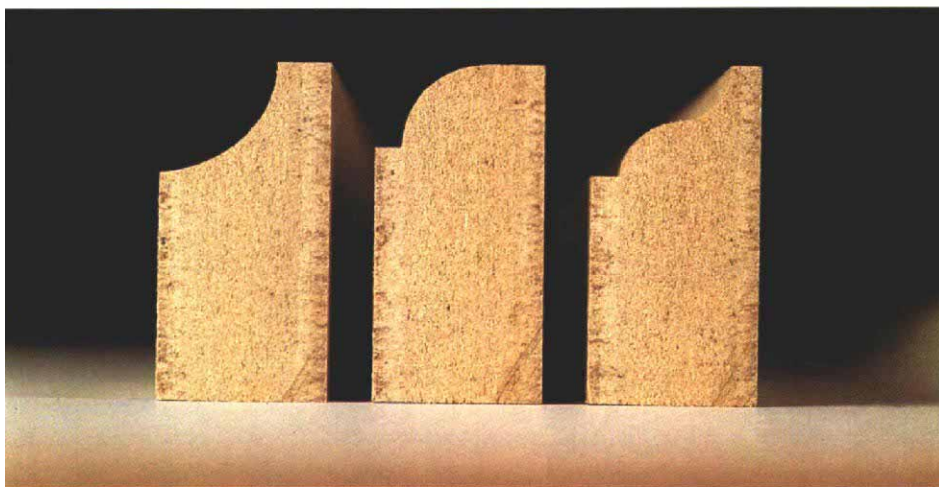
Successful sanding—Other advice to the contrary, don't sand an MDF panel before attaching an overlay. Scuff-sanding can cause a weaker glue bond. I just make sure my work table and the panel faces are nice and clean, then proceed.

Flat and contoured edges should be sanded before finishing to remove the nap. A belt sander is a good choice for flat



Kerfs for a curve—Woodworkers at the Sackler Gallery cabinet shop in the Smithsonian Institution kerf-bend veneered MDF to make a curved museum bench.

Crisp profiles—Medium-density fiberboard excels in maintaining sharp edge profiles. Shown here are, from left, examples of cove, roundover and Roman ogee, all created with a router.



Using screws in MDF		
Screw size	Pilot hole	Minimum edge*
#6	3/32 in.	1/2 in.
#8	7/64 in.	5/8 in.
#10	1/8 in.	1 in.
*Minimum sheet thickness for driving screws into an edge without splitting.		

edges, as is an abrasive wheel for contoured edges. Use a sequence of 100- to 150-grit, or 120- to 180-grit. It's a light sanding, not a dust raiser. Some shops prefer hand-sanding.

Sanding also is the process that can raise the most of MDF's extra-fine dust. At our cabinet shop in the Smithsonian, the helmet-type powered air-purifying respirator is used (see the photo at right on p. 54).

Joinery and glue choices

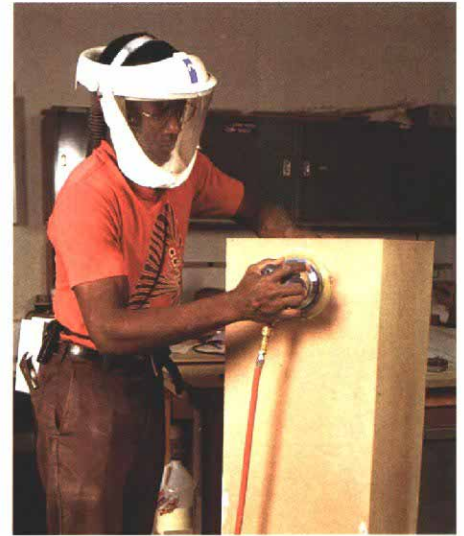
MDF machines and glues well, giving it literally a sharp edge over plywood and particleboard in joint-making. "We do a lot of

case work with Medex MDF, using miter joints," explains a cabinetmaker at the Smithsonian. "I have to be careful handling the Medex edges. They are so sharp I've cut my fingers several times."

The furniture and cabinet industries use dowels extensively in MDF case work. Drawers are often made with 7/16-in. dovetailed or rabbeted MDF sides. Independent furniture and cabinetmakers seem to be sold on biscuit joinery for MDF. If you use dowels, spiral and grooved dowels are recommended over plain dowels by eight of the nine MDF companies.

The joints that work well with MDF (as shown in the photo on p. 55) include: loose-tenons (spline-tenons), dovetails, sliding dovetails and finger joints. Spline or biscuit miters, lock miters, miter and rabbet joints, simple miters, rabbets, dados, and butt joints with biscuits or dowels also work well.

Adhesives—A high solids or gap-filling glue is ideal for MDF. I use modified (yellow) polyvinyl acetate (PVA) or Titebond II



Dealing with dust—A worker in the Sackler Gallery cabinet shop (above) at the Smithsonian Institution avoids the fine dust produced by MDF by wearing a Racor powered respirator while finish-sanding a display cabinet.

Shop-built attachments handle MDF's dust on the author's router table (left). Built as an extension of his tablesaw table, the router table houses a shop vacuum and sound baffling, which makes for quiet, dust-free operation.

when assembly time permits. Otherwise, it's white PVA, the same as I'd use for wood. Contact cement, epoxy and urea resin work well when needed. A factory method is to use a hot-pressed rigid resin to bond an MDF core and hardwood veneer. Under low pressure at 250° for less than three minutes, the thermosetting glue doubles the panel's stiffness. I would rate urea resin and epoxy as the best thermosetting glue candidates, but it's best to make your own tests on scrap for any set-up before the final glue-up.

Hardware and fasteners

A straight-shanked screw with deep, wide, sharp threads is best for MDF. I use Robertson square drive, particleboard and sheet-metal screws. (On the West Coast, a savvy MDF user recommends Twinfast particleboard screws.) The fine-threaded sheet metal or self-tapping screw is also good. And drywall screws make handy temporary holders for MDF projects.

Do not use tapered wood screws. Screw threads cut MDF fibers and resins. While regular wood springs back, MDF distorts. The distortion and tapered screw shape combine to make for poor fastening.

There's a limit to the screw size an edge will take without splitting (see the chart on p. 53). Use longer (not larger) screws in the edge for increased strength. More

screws add strength, up to 4 in. apart.

Drill pilot holes in the edge, so the board won't split, and drill them to the depth the screw will be inserted, plus about 1/4 in. It's also a good idea to drill pilot holes in the face plane. See the chart on p. 53 for common screw sizes and correct pilot holes.

Screws in the face should be at least 1 in. away from corners, and edge screws should be 3 in. from corners. A slow drill speed or dull bit will burnish the pilot hole wall and cause crumbling. Run a sharp bit at high speed (3,000 rpm for industrial applications). You'll get a clean, accurate hole with top pull strength.

There's a "turns" trick to make sure you don't over-torque and strip the panel threads. A three-quarter turn past flush on the face is maximum torque. A three-eighths turn past flush on the edge is the limit there. Even with a properly sized and countersunk pilot hole, the screw will break away beyond these points.

My friends in the cabinet shop sometimes use pneumatically driven ring-shank coated nails or coated staples on glued joints to save clamping time. If you do that, be careful not to drive edge staples with their legs parallel to the surface, or you may get splitting.

Hinges—After trying all sorts of hinges, I found the best hinges for MDF attach face

to face. When hinges are installed, MDF may "pyramid," or develop a bump around hinge screws. To prevent the pyramid and to ensure the hinge is flush, drill a partial countersink along with the pilot holes.

Laminating, veneering and finishing

Good bonding strength, dimensional stability, flatness and other qualities previously mentioned make MDF an ideal substrate for numerous materials, including high-pressure laminates and veneers. Crossbanding is unnecessary with even the thinnest veneers.

Either veneers or paint can be used to finish edges. A painted edge may work well with laminated, veneered or, of course, painted face planes. It involves a typical edge-finishing process. Careful sanding is followed by one or two coats of sealer. Burnish smooth each coat of sealer before applying the final topcoat.

Quick-drying sanding sealers, auto-body primers and even white PVA glues diluted 20% can be used as edge sealers.

Sealing in formaldehyde may be a factor in finish selection. The level of formaldehyde in untreated MDF may remain above ambient levels for several years.

High-pressure laminates offer almost total sealing, matching factory applied thin

and thick vinyls. After that comes alkyd oil primer and oil enamel paint combined, two coats of polyurethane, and latex-ammonia combined with two coats of latex wall paint. (The latex-ammonia types will raise the grain.) Ironically, the effective alkyd oil finishes contain formaldehyde, but it normally off-gases in two weeks.

Finishes that are less effective sealers include: oil base or lacquer sealer plus a top coat of varnish or lacquer; two coats of lacquer or oil primer; lacquer sanding sealer plus one or two coats clear lacquer; quick-drying lacquer sanding sealers; and shellac or varnish applied without a sealer.

Despite their other merits, finishes that will not effectively seal in formaldehyde in MDF include: two coats of regular latex paint, penetrating oil sealer, stains, waxes or linseed oil.

There are treated low-formaldehyde MDFs, such as Plum Creek, and formaldehyde-free brands, such as Medite II and Medex (exterior grade), to consider. I asked the Sackler and Freer cabinet shop supervisor, Cornell Evans, for his impressions of Medex. "Medex has no formaldehyde and is fire-rated. It is lighter and harder than (regular) MDF," he said. "It glues better and takes paint better. We use it for case work. It has sharp edges, is water repellent and is much less dusty (than other MDFs). There is no fine sawdust when cutting. We use 5/8-in. Medex in place of 3/4-in. MDF."

Finding and buying MDF

Standard MDF costs about 60% less than seven-ply birch plywood and about 40% more than particleboard. And formaldehyde-free, water-resistant Medex-type MDF is about triple the cost of particleboard, but it is still 15% less than top-quality birch plywood.

Locating and buying medium-density fiberboard is sometimes difficult because so much of it goes directly to industry. In the summer of 1990, several MDF companies began test-marketing their products around the country.

California is a big test market. The Medite Corporation based in Medford, Ore., is placing 3/4-in. Medite in 20 Home Depot stores there. (Try Home Depot elsewhere for other brands.) J.E. Higgins, a chain of small lumberyards, has MDF in their yards in Los Angeles, San Francisco and Sacramento.

Some chains have MDF in selected stores across the country. The stores include: Handy Dandy, Channel and Lowes. Sequoia Supply in Columbia, Md., distributes Plum Creek MDF to lumberyards in parts

of Maryland, Virginia and Pennsylvania.

If you know of mills that cater to woodworkers, call them. If you must special order, local independent dealers are your best bet. A chain that has particleboard but no MDF may be able to order some for you from its particleboard source, but you will pay top dollar.

Small commercial shops can buy from one of the 2,000 industrial wood products distributors in the United States. Would the industrial distributor welcome me if I showed up as an individual to buy one or two sheets? Probably not. But my 275-member Washington Woodworkers Guild has an agreement with one to sell to all our members, large orders or small. (Guilds have buying power. We have price discounts from several stores, wholesalers and manufacturers.) Don't overlook the fact that some sellers are willing to deliver sheet material.

If all else fails, write one or more of the MDF companies listed at right, and tell them everything you went through and how badly you want their product. If you have equally interested friends or belong to a guild with a genuine interest in MDF among its members, mention that also. No one is promising you instant results, but many letters from many woodworkers do a market make. □

Jim Hayden is an amateur woodworker and a professional photographer at the Arthur M. Sackler Gallery and Freer Gallery in the Smithsonian Institution, Washington, D.C.

Sources of supply

The following companies manufacture medium-density fiberboard. Contact them for the name of a distributor near you.

Georgia-Pacific Corp., Holly Hill, 133 Peachtree St., N.E., PO Box 105605, Atlanta, GA 30348

International Paper, Masonite Division, Spring Hope Plant Highway 64 and County Road 1306, PO Box 369, Spring Hope, NC 27882; Marion Plant Highway 301, PO Box 8, Sellers, SC 29592

Louisiana-Pacific Corp., Eufaula Mill, Route 3, Box 22, Clayton, AL 36016; Oroville Mill, PO Box 158, Samoa, CA 95564

Medite Corp., PO Box 4040, Medford, OR 97501; PO Drawer 1427, Las Vegas, NM 87701

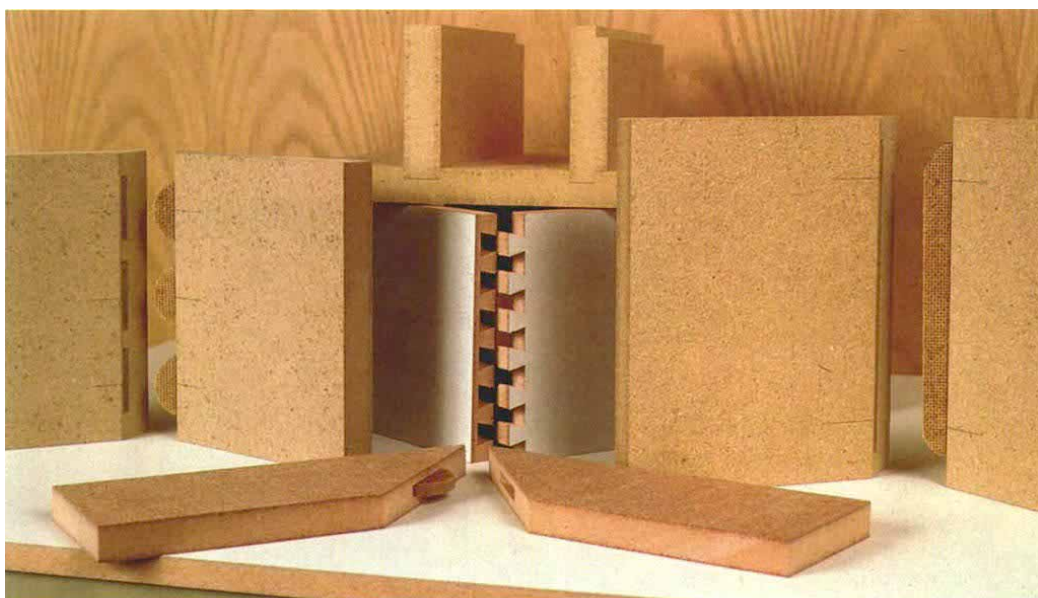
Norbord Industries, Inc., PO Box 26, Deposit, NY 13754

Plum Creek Manufacturing, L.P., PO Box 160, Columbia Falls, MT 59912

Sierrapine Ltd., product sales by Timber Products Sales Co., PO Box 269, Springfield, OR 97477

Weyerhaeuser Co., PO Box 290, Moncure, NC 27559

Willamette Industries, Inc., Bennettsville, PO Box 636, Bennettsville, SC 29512; Malvern, PO Drawer 190, Malvern, AR 72104



A wide variety of joinery is possible with MDF. Examples shown here surrounding a routed dovetail joint are, clockwise from left, biscuits, dado, rabbet and dado, spline miter and biscuited miter. The background is a sheet of factory-veneered MDF.