37 POWER TOOLS – DRILLS, PLANES, ROUTERS

Safety Basics

- Make sure that electric tools are properly grounded or double-insulated.
- Never remove or tamper with guards or other safety devices.
- Study the manufacturer's instructions before operating any new or unfamiliar electric tool.
- Regulations require that ground fault circuit interrupters (GFCIs) be used with any portable electric tool operated outdoors or in wet locations.
- Before making adjustments or changing attachments, always disconnect the tool from the power source.
- When operating electric tools, always wear eye protection.
- Make sure that the tool is held firmly and the material properly secured before turning on the tool.
- Ensure workers are protected from exposure to hazardous sound levels when operating tools in confined spaces or for prolonged periods. The new Noise regulation (381/15) requires that employers assess any noise hazard in the workplace to determine the appropriate protective measures. If an assessment determines that hearing protection devices (HPDs) are appropriate to control the hazard, the employer must arrange for adequate training and instruction in the use and care of HPDs.

Drills

Types

With suitable attachments, the drill can be used for disk sanding, sawing holes, driving screws, and grinding. However, when such applications are repeatedly or continuously required, tools specifically designed for the work should be used.

Trim carpenters will generally select a 1/4 or 3/8 inch trigger-controlled variable speed drill (Figure 37-1). Simply by increasing pressure on the trigger, the operator can change drill speed from 0 to 2,000 rpm.

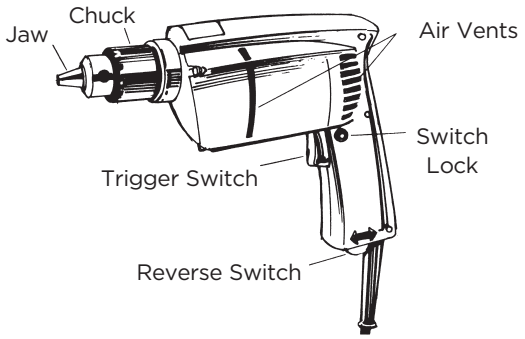


Figure 37-1: Light-Duty Drill

Carpenters working in heavy structural construction such as bridges, trusses, and waterfront piers will usually select the slower but more powerful one- or two-speed reversible 1/2 or 3/4 inch drill (Figure 37-2).

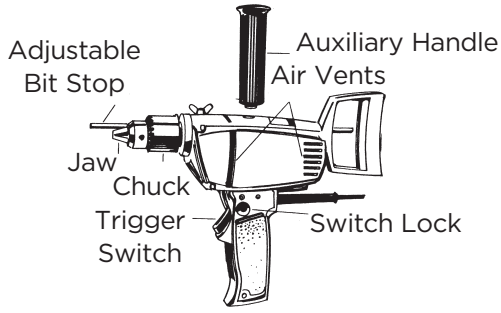


Figure 37-2: Heavy-Duty Drill

Size of the drill is determined by the maximum opening of the chuck. For instance, a 3/8 inch drill will take only bits or attachments with a shank up to 3/8 inch wide.

For drywall screws, a drywall screw gun should be used. The driving bit should be replaced when worn. Select a gun that can hang from your tool belt so it does not have to be continuously hand-held.

There are many rechargeable types of drills that are commonly used in the workplace. Although not as powerful as the plug-in variety, they can be quite versatile. While rechargeable drills do not have the electrical hazards of a 120-volt plug-in drill, overcharging the battery can cause them to overheat and reduce their capacity. It is wise to keep an alternate battery pack charging at all times.

Attachments

Attachments such as disk sanders and buffers can help prevent fatigue and undue muscle strain. A right-angle drive attachment is very useful in tight corners and other hard-to-reach places. (See Figure 37-3.)

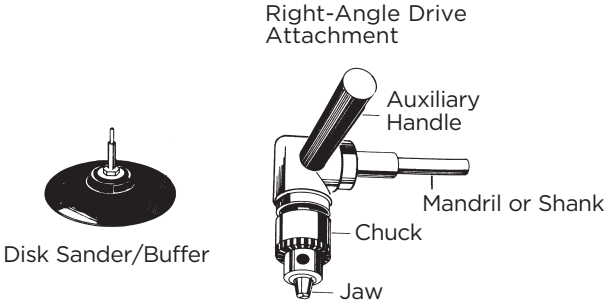


Figure 37-3: Drill Attachments

Cutting and drilling attachments must be kept sharp to avoid overloading the motor. Operators should not crowd or push the tool beyond capacity. Such handling can burn out the motor, ruin the material, and injure the operator in the event of a kickback.

Some attachments, such as hole saws, spade bits, and screwdrivers (Figure 37-4), require considerable control by the operator. If the operator does not feed the attachment slowly and carefully into the material, the attachment can suddenly stop, causing the drill to rotate and severely twist or break the operator's arm. Stock should be clamped or otherwise secured to prevent it from moving. This will also enable the operator to control the tool with both hands and absorb sudden twists or stops caused by obstructions such as knots or hidden nails.

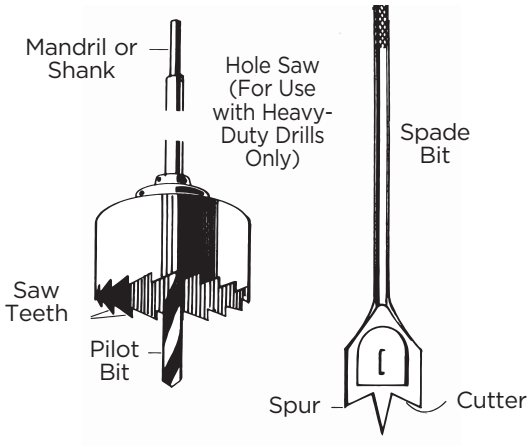


Figure 37-4: Drill Attachments that Require Control by Operator

Operators must be aware when they're getting to the end and restrain the drill just before the bit or cutting attachment emerges through the material, especially when oversized spade bits are used. Sides of the bit often become hooked on the ragged edge of the nearly completed hole and make the drill come to a sudden stop that can wrench the operator's arm.

At the first sign of the bit breaking through the material, the operator should withdraw the drill and complete the work from the other side. This will produce a cleaner job and prevent the material from cracking or splintering.

The same result can be obtained by clamping a back-up piece to the material and drilling into that.

Select the bit or attachment suitable to the size of the drill and the work to be done. To operate safely and efficiently, the shanks of bits and attachments must be straight, true, and free of gouging.

Make sure that the bit or attachment is properly seated and tightened in the chuck.

Some operations require the use of an impact or hammer drill. For instance, drilling large holes in concrete or rock with a carboloy bit should be done with an impact drill (Figure 37-5).

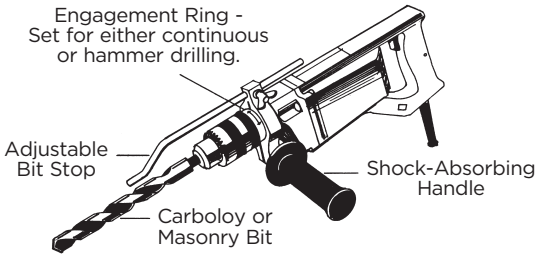


Figure 37-5: Impact or Hammer Drill

Follow manufacturer's instructions when selecting and using a bit or attachment, especially with drills or work unfamiliar to you. If possible, choose a drill with a builtin anti-vibration feature or wear vibration-dampening gloves. This will help you avoid white finger disease.

Working with Small Pieces

Drilling into small pieces of material may look harmless, but if the pieces are not clamped down and supported, they can spin with the bit before the hole is completed.

If a small piece starts to twist or spin with the drill, the operator can be injured. Small work pieces should be properly secured and supported. Never try to drill with one hand and hold a small piece of material with the other (Figure 37-6).

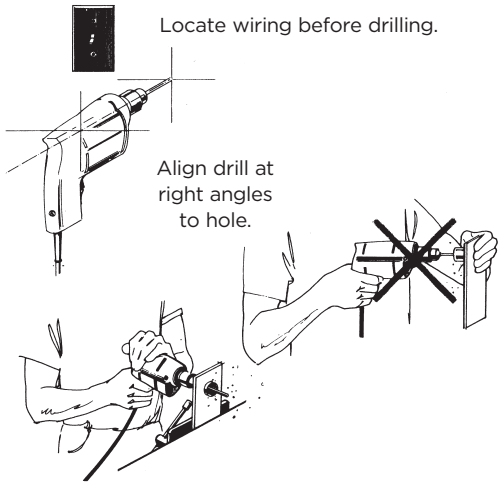


Figure 37-6: Right and Wrong Ways of Drilling Small Pieces

Drilling from Ladders

Construction work requires a heavy-duty ladder that meets the design, performance, test, and marking requirements of a Grade 1, Grade 1A, or Grade 1AA ladder (as per CAN/CSA Z11-12: *Portable Ladders*).

Standing on a ladder to drill holes in walls and ceilings (Figure 37-7) can be hazardous. The top and bottom of the ladder must be secured to prevent the ladder from slipping or sliding when the operator puts pressure on the drill. Where possible, use a scaffold or work from a platform ladder instead of an extension ladder or stepladder.

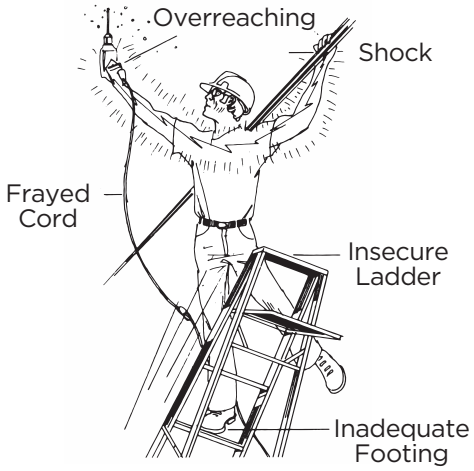


Figure 37-7: Drilling and Ladder Hazards

When drilling from a ladder, never reach out to either side. Overreaching can cause the ladder to slide or tip. Never stand on the top step or paint shelf of a stepladder. Stand at least two steps down from the top. When working from an extension ladder, stand no higher than the fourth rung from the top.

When drilling from a ladder, never support yourself by holding onto a pipe or any other grounded object. Electric current can travel from the hand holding the drill through your heart to the hand holding the pipe. A minor shock can make you lose your balance. A major shock can badly burn or even kill you.

Operation

Always plug in a corded drill with the switch **OFF.** Before starting to drill, turn on the tool for a moment to make sure that the shank of the bit or attachment is centred and running true. If it seems to be wobbling or if you feel a vibration, replace the bit.

Punch a layout hole or drill a pilot hole in the material so that the bit won't slip or slide when you start drilling. A pilot hole is particularly important for drilling into hard material such as concrete or metal.

With the drill OFF, put the point of the bit in the pilot hole or punched layout hole. Hold the drill firmly in one hand or, if necessary, in both hands at the correct drilling angle. (See Figure 37-6.)

Turn on the switch and feed the drill into the material with the pressure and control required by the size of the drill and the type of material.

Don't try to enlarge a hole by reaming it out with the sides of the bit. This may cause the bit to break and lodge in the hole being drilled or be projected outwards, which increases the risk of eye injury to workers nearby. Instead, switch to a larger bit to enlarge the hole.

When drilling deep holes, especially with a twist bit, withdraw the drill several times with the motor running to clear the cuttings.

Never support material on your knee while drilling. Material should be firmly supported on a bench or other work surface for drilling.

Unplug the drill and remove the bit as soon as you have finished that phase of your work.

When drilling into floors, ceilings, and walls, beware of plumbing and especially of wiring.

Large rotary and hammer drills can generate extreme torque and must be handled with caution.

Remember that the longer you work, the heavier the drill feels, particularly when working overhead. Take a breather now and then to relax your arms and shoulders.

Drilling Timbers

When drilling timbers with a self-feeding auger bit (Figure 37-8), do not underestimate the physical pressure required to maintain control of the tool. Such work calls for a heavy-duty, low-rpm drill, 1/2 or 3/4 inch in size.

Thread angle determines how fast the bit will feed through the material.

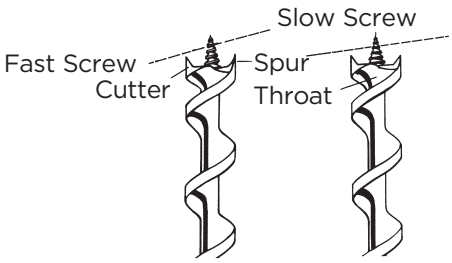


Figure 37-8: Self-Feeding Auger Bits

Never attempt to drill heavy timbers by yourself, especially when working on a scaffold or other work platform. If the self-feeding auger bit digs into a hidden knot or other obstruction, the sudden torque can twist or wrench your arm and throw you off balance.

Other Materials

The main hazard in drilling materials other than wood is leaning too heavily on the tool. This can not only overload and burn out the motor but also cause injury if you are thrown off balance by the drill suddenly twisting or stopping.

Always use a drill powerful enough for the job and a bit or attachment suited to the size of the drill and the nature of the work. As at other times, punching a layout hole or drilling a pilot hole can make the job safer and more efficient.

A drill press stand is ideal for drilling holes in metal accurately and safely. Small pieces can be clamped in a vise and bolted to the table. This prevents the workpiece from spinning when the drill penetrates the metal.

A drill press can also be used for cutting large holes in wood with a hole saw or spade bit. The stability of the press and the operator's control over cutting speed eliminate sudden torque.

Planes

Available in various types and sizes, electric planes are generally operated in similar ways. Adjustments between models may differ, however, depending on specific features.

Planes may be equipped with

- outfeed tables (back shoes) that are either fixed or movable
- infeed tables (front shoes) that move straight up and down or move up and down on an angle to keep the gap between the cutter head and table as small as possible
- cutter heads with two or more straight blades (also called knives or cutter blades)
- cutter heads with two curved blades.

Never operate an electric plane while wearing a scarf, open jacket, or other loose clothing. Always wear eye protection and practice good housekeeping.

Standard Plane (Figure 37-9)

- Hold with both hands to avoid contact with cutter blades.
- Always keep both hands on the plane until motor stops.
- Use the edge guide to direct the plane along the desired cut. Never try to guide the plane with your fingers. If the plane runs into an obstruction or starts to vibrate, your fingers can slide into the unprotected cutter head.

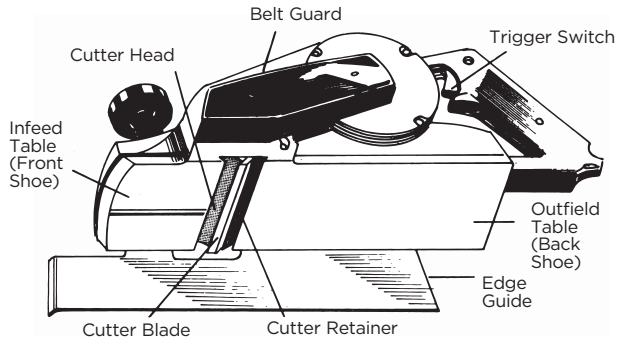


Figure 37-9: Standard Power Plane

Block Plane (Electric)

Designed for use on small surfaces, the block plane is necessarily operated with only one hand. Though convenient and useful, it is more dangerous than the larger, standard plane.

Operators tend to support the work with one hand while operating the block plane with the other. Any unexpected twist or movement can force the plane or the material to kick back and injure the operator. Keep your free hand well out of the way, in case the plane slips accidentally.

Maintaining Blades

- Avoid striking staples, nails, sand, or other foreign objects. The first step in operation is to make sure the work is free of obstructions.
- Keep blades in good condition and sharp. A sharp blade is safer to use than a dull blade that has to be held down and forced. A dull blade tends to float over the work and can bounce off, injuring the operator.
- Restore blades to original sharpness on a fine grit oilstone. Unless nicked or cracked, blades can be resharpened several times.

Changing Blades

Raising or replacing cutter blades takes time and patience. Blades must be the same weight and seated at the same height to prevent the cutter head from vibrating. Any deviation can cause the head to run off balance. Blades can fly out, inuring the operator or fellow workers.

Replacing cutter blades involves two steps: removing and installing.

Removing Blades

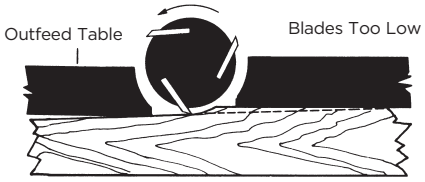
1) Disconnect the plane from the power source.
2) Turn the plane upside down and secure it in a fixed position.
3) Hold the cylinder head stationary by tapping a softwood wedge between the cutter head and the bearing (some tools are equipped with a locking device for this).
4) Loosen all the screws and lift out one blade and throat piece.
5) Turn the cutter head and repeat this procedure with other blades.
6) If necessary, clean parts thoroughly with recommended solvent.

Installing Blades

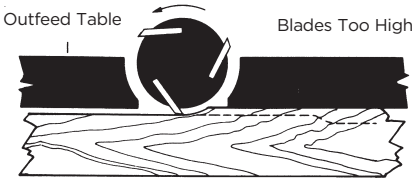
1) Replace one throat piece and blade.
2) Tighten the two end screws lightly.
3) Take a hardwood straight edge and use the outfeed table (back shoe) as a gauge. Raise or lower the blade until both ends are level with the outfeed table at the blade's highest point of revolution.
4) Tighten up the remaining screws.
5) Set the rest of the blades in the same way.
6) Turn the cylinder head and make sure that all blades are the same height.
7) Tighten up all the screws.
8) Double-check the height of all blades. Tightening can sometimes shift the set.
9) Double-check all the screws.
10) Turn the tool right side up and plug it in.
11) Hold the tool in both hands with the cutter blades facing away from you and switch it on.

Operation

- Always disconnect the plane from the power source before adjusting or changing blades or the cutter head.
- Make sure that blades at their highest point of revolution are exactly flush with the outfeed table for safe, efficient operation (Figure 37-10).



When cutter blades are installed lower than the level of the outfeed table, the plane hobbles over the material and the cut is uneven.



When cutter blades are installed higher than the level of the outfeed table, the plane gouges the material.

Figure 37-10: Blades of Plane Must Be Flush with Surface

- Support the work securely for safety and accuracy.
- When planing doors and large pieces of plywood, use a jack (Figure 37-11) to secure material and keep edges clear of dirt and grit.
- When using an electric block plane, clamp or fasten the workpiece whenever possible. Keep your free hand well away from plane and material.
- When using the standard power plane, adjust the edge guide to provide desired guidance.
- Adjust the depth of cut to suit the type and width of wood to be planed.
- To start a cut, rest the infeed table (front shoe) firmly on the material with cutter head slightly behind the edge of the material. After finishing a cut, hold both hands on the plane until motor stops.

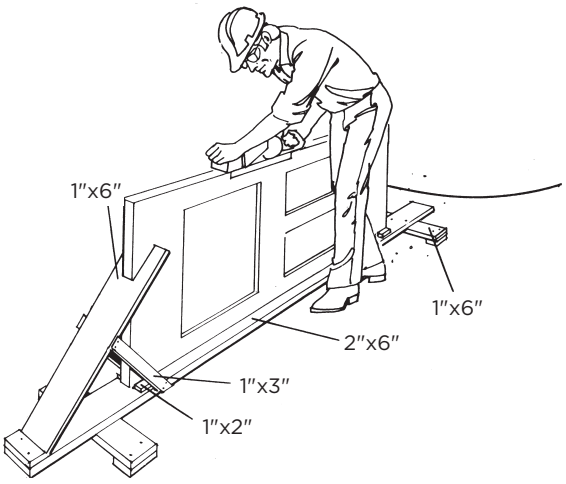


Figure 37-11: Use Door Jack to Secure Material

Routers

With special guides and bits, the portable electric router can be used to cut dadoes, grooves, mortises, dovetail joints, moldings, and internal or external curves. Carpenters find routers especially useful for mortising stair stringers and recessing hinges and lockplates on doors.

The router motor operates at very high speed (up to 25,000 rpm) and turns in a clockwise direction. Components are shown in Figure 37-12.

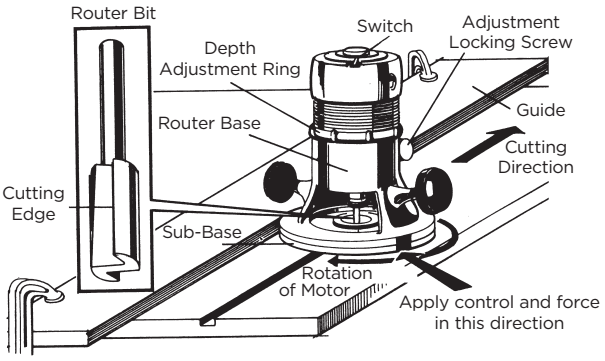


Figure 37-12: Router Parts and Operation

WARNING The speed and power of the router require that it be operated with both hands.

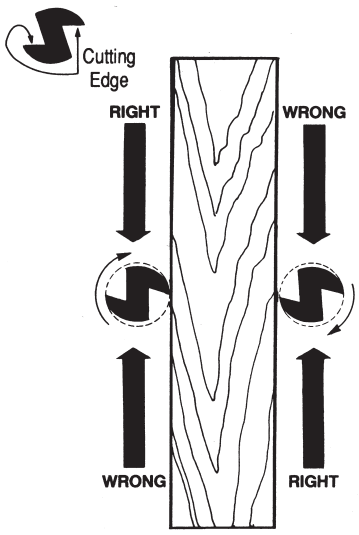
When starting a router with a trigger switch in the handle, make sure the blade is not in contact with the material being routed. Keep both hands on the tool to absorb the counterclockwise starting torque.

When starting a router with a toggle switch on top of the motor, hold the router firmly with one hand and switch on power with the other, then put both hands on the tool for control and accuracy.

Always wear eye protection. You will also likely need hearing protection.

Operation

- Always support and secure the work in a fixed position by mechanical means such as a vise or clamps. Never try to hold the work down with your hand or knee. Never rely on a second person to hold the material. Human grip is no match for the torque and kickback that a router can generate.
- Make sure that the bit is securely mounted in the chuck and the base is tight.
- Set the base on the work, template, or guide and make sure that the bit can rotate freely before switching on the motor.
- For work along edges such as bevels and moldings, make sure that the cutting edge of the router bit contacts the material to the ***left*** of the cutting direction (Figure 37-13). Otherwise the router will kick back or fly away from you.
- When routing outside edges, guide the router around the work in a counterclockwise direction (Figure 37-14). Splinters left at corners by routing ***across*** the grain will be removed by the next pass ***with*** the grain.
- Feed the router bit into the material at a firm but controllable speed. There is no rule on how fast to cut. When working with softwood, the router can sometimes be moved as fast as it can go. Cutting may be very slow, however, with hardwood, knotty or twisted wood, and larger bits.
- Listen to the motor. When the router is fed into the material too slowly, the motor makes a high-pitched whine. Push too hard and the motor makes a low growling noise. Forcing the tool can cause burnout or kickback. Cutting through knots may cause slowdown or kickback.
- When the type of wood or size of bit requires going slow, make two or more passes to prevent the router from burning out or kicking back.
- If you're not sure about depth of cut or how many passes to make, test the router on a piece of scrap similar to the work.
- When the cut is complete, switch off power and keep both hands on the router until the motor stops. When lifting the tool from the work, avoid contact with the bit.



For work along edges such as bevelling, the cutting edge of the bit must contact the material to the left of the cutting direction.

Figure 37-13: Routing Work Around Bevels and Moldings

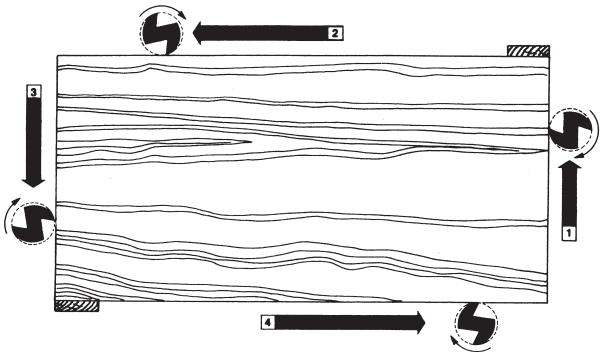


Figure 37-14: Routing Work Around Outside Edges