

# Power Saws

## Section 5.1

Circular Saws

## Section 5.2

Table Saws

## Section 5.3

Miter & Radial-Arm Saws

## Section 5.4

Jigsaws & Reciprocating Saws

## Chapter Objectives

After completing this chapter, you will be able to:

- **Identify** circular, table, miter, radial-arm, and reciprocating saws as well as jigsaws.
- **Describe** the safety rules that apply to each type of power saw.
- **Explain** the causes of kickback on circular saws and table saws.
- **Construct** a rip cut with a circular saw, a table saw, and a jigsaw.
- **Demonstrate** how to maintain a circular saw and a table saw.



### **Discuss the Photo**

**Saws** Safety should always be the number one consideration when using any type of power saw. *Why is it important to understand the differences between types of power saws?*



### **Writing Activity: Research and Report**

Use the Internet to locate buying-guide articles about any saw listed in this chapter. Write a one-page report noting the saw features that are most highly recommended.

# Chapter 5 Reading Guide



## Before You Read Preview

The most common use of power saws on a job site is to cut solid wood or wood products. However, carpenters and other tradespeople also rely on power saws to cut many different kinds of materials. Choose a content vocabulary or academic vocabulary word that is new to you. When you find it in the text, write down the definition.

### Content Vocabulary

- crosscut
- kickback
- torque
- kerf
- miter cut
- bevel cut
- offcut
- rip cut
- feed rate
- compound miter saw
- internal cut

### Academic Vocabulary

You will find these words in your reading and on your tests. Use the academic vocabulary glossary to look up their definitions if necessary.

- diameter
- precise

### Graphic Organizer

As you read, use a chart like the one shown to organize information about content vocabulary words and their definitions, adding rows as needed.

Content Vocabulary	Definition
crosscut	a cut made across the grain of a piece of lumber and at a 90° angle to the edge

Go to [glencoe.com](http://glencoe.com) for this book's OLC for a downloadable version of this graphic organizer.

### Academic Standards



#### Mathematics

**Measurement:** Understand measurable attributes of objects and the units, systems, and processes of measurement (NCTM)

**Geometry:** Use visualization, spatial reasoning, and geometric modeling to solve problems (NCTM)



#### English Language Arts

Use different writing process elements to communicate effectively (NCTE 5)



#### Science

**Science and Technology:** Abilities of technological design (NSES)

#### Industry Standards

Power Tools for Finish Carpentry  
Stationary and Portable Power Tools

**NCTE** National Council of Teachers of English  
**NCTM** National Council of Teachers of Mathematics

**NSES** National Science Education Standards

# Circular Saws

## Understanding Circular Saws

*What are the two types of circular saws?*

In the past, most carpenters had to depend on handsaws to cut framing lumber. A power saw is faster and cuts a wider variety of materials. Like many other power tools, power saws are available in cordless, as well as corded, models.

### Circular Saws

A circular saw is one of the most important tools on a job site. It is especially useful for cutting panel products such as plywood and oriented-strand board (OSB), and for crosscutting framing lumber, as shown in **Figure 5-1**. A **crosscut** is a cut made across the grain of a piece of lumber, and at a 90° angle to the edge. It is sometimes called a square cut. With the proper blade, even materials such as plastic laminate, masonry, fiber-cement, and nonferrous metals can be cut. *Nonferrous metals* are metals that do not contain iron.

Circular saws vary considerably in size, shape, and power. They are generally classified according to the **diameter** of the blade. A 6½" saw, for example, has a blade with a diameter of 6½". Blades can range in size from 4½" to 12" or more. The smallest saws are used for trim work and for cutting panel products such as sheathing. The largest saws can cut through large beams in one pass. The most common circular saw is the 7¼" model. It is very maneuverable, yet powerful enough to cut a great variety of materials.

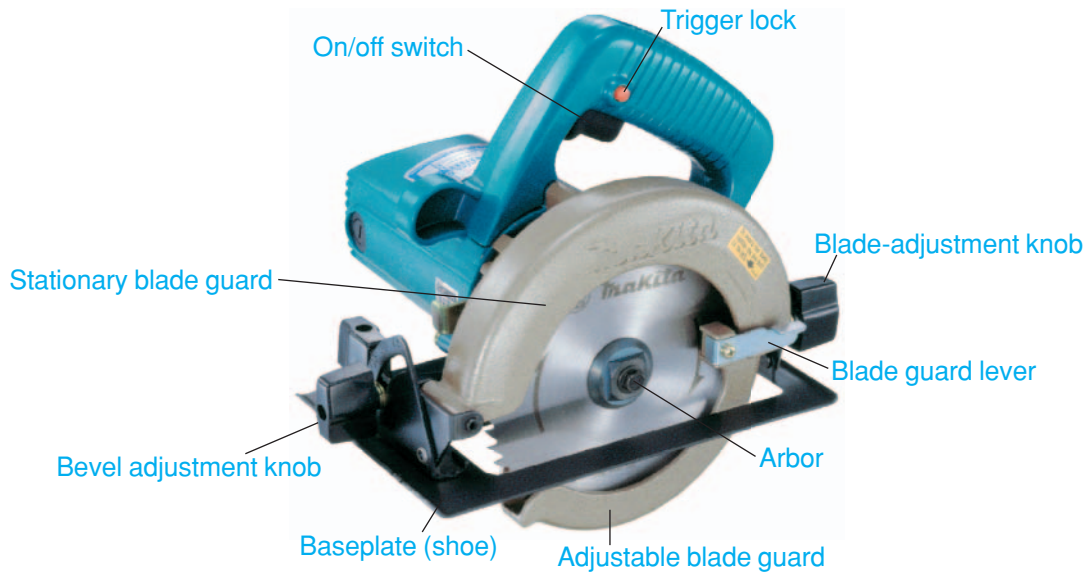
Cordless saws that operate on rechargeable batteries are becoming increasingly popular. They may not have the power of a corded saw, but they can operate anywhere.

This makes them particularly useful on a roof or for installing wood fencing far from the nearest electrical outlet.



**Figure 5-1 A 7¼" Circular Saw**

**Under Control** Always maintain control of the saw. Use both handles if necessary. *What safety equipment do you notice in this photo?*



**Figure 5-2 Parts of a Circular Saw**

**Circular Saws** This contractor's saw has an electric brake. The blade is mounted on the right side of the motor. Some saws have a left-mounted blade instead.

### Parts of a Circular Saw

The main parts of a circular saw include a motor, a handle, a *baseplate* or shoe, a fixed guard, an adjustable guard, a blade-guard lever, a blade, a blade-adjustment knob, and an on/off switch, as shown in **Figure 5-2**. Blades are described later in this section.

### Types of Circular Saws

The two basic types of circular saws are the contractor's saw and the worm-drive saw. The motor on a contractor's saw is perpendicular to the blade. The blade is usually mounted on the right side of the motor and is driven directly by the motor shaft, called an *arbor*. A contractor's saw is sometimes called a *sidewinder*. **Figure 5-2** shows a contractor's saw with a right-mounted blade.

Kickback is a particular hazard with circular saws. **Kickback** is a reaction that occurs when a spinning blade encounters something that slows or stops it while the saw is under full power. Consequently, the

saw is violently "kicked back" at the operator. You can read more about preventing kickback on page 134.

The motor on a worm-drive saw is parallel to the blade, as shown in **Figure 5-3**. The blade is on the motor's left side. Power from



**Figure 5-3 A Worm-Drive Saw**

**In Control** A worm-drive saw has two large handles. This feature improves operator control.

the motor is transferred to the blade through two gears mounted at right angles to each other. This arrangement generally results in slower blade speed but higher torque.

**Torque** is a twisting force that produces rotation. The other parts of a worm-drive saw are similar to those of a contractor's saw.

## Circular Saw Blades

Circular saw blades can cut a wide variety of materials. Blades that cut wood, plastic, and metal have teeth formed in the perimeter of the blade. Blades that cut masonry, ceramic tile, and other hard-to-cut

materials have a grinding edge that is coated with an abrasive. Blades for circular saws are designed to withstand rough job-site conditions, such as cutting through green lumber or hitting an occasional nail. They are intended for general-purpose crosscutting and ripping in soft woods and panel products, such as plywood.



**Describe** What are some characteristics of circular saw blades used for cutting wood, plastic, and metal?

**Standard Blades** The toothed saw blades used on circular saws are similar to those used on table saws, radial-arm saws, and miter saws. Thus, the following information about blades also applies to blades for those tools.

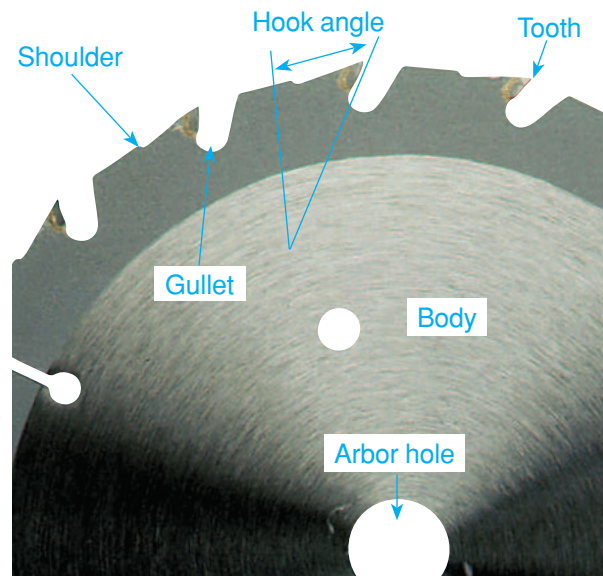
The circular blade for a saw can be altered by the manufacturer to cut different materials or to increase the effectiveness of the saw, as shown in **Figure 5-4**. The key parts of a circular blade are the arbor hole, body, teeth or grinding edge, gullet, and shoulder.

## JOB SAFETY

**GENERAL POWER SAW SAFETY** Specific safety tips for various types of power saws may be found in the sections dealing with those saws. The following safety tips apply when using any power saw. We strongly advise you to check the manufacturer's manual for any special safety instructions.

- Review the tool-related safety guidelines in Chapter 3, "Construction Safety & Health."
- Always wear safety glasses.
- Wear hearing protection, particularly when using miter saws.
- Avoid wearing loose clothing and jewelry because it could get caught in a blade.
- Make sure that the guard is installed and working properly.
- Never cut while off balance.
- If a loose piece of wood contacts a spinning blade, the wood can be violently ejected from the saw. For this reason, never stand in a direct line with the blade.
- When cutting certain materials, such as fiber-cement, it is important to collect the dust created so it is not inhaled. Most saws can be fitted to collect sawdust. Saws can also be connected to a vacuum hose. Wear a respirator that will protect your lungs.

Go to [glencoe.com](http://glencoe.com) for this book's OLC for more on job safety.



**Figure 5-4 Circular Saw Blade**  
**Parts of a Blade** The main parts of a circular blade. This blade has carbide-tipped teeth.

**Arbor hole** This is where the blade is mounted on the saw. The hole is round on most power saws used in residential construction, but some arbor holes have a diamond shape. Be sure to select a blade with the correct arbor hole for your saw. Never install a blade with an arbor hole that is too large.

**Body** This is the flat disk that serves as a base for the teeth. It is also sometimes called the plate. Thin, straight slots at the edge of the body prevent the blade from warping as it heats up. Wider, curved slots between the arbor hole and the teeth are called body vents. They reduce the noise of the blade and help to cool it. Body vents also reduce blade vibration, which makes for cleaner cuts.

**Teeth or grinding edge** Like tiny chisels, teeth slice through the material being cut. Some blades have a grinding edge instead. The edge is coated with an industrial abrasive such as carbide or diamond grit.

**Gullet** This pocket in front of each tooth helps remove sawdust during the cut.

**Shoulder** The raised portion behind each tooth supports the tooth. A large shoulder is needed on blades that might encounter a nail. Some shoulders are raised to limit the amount of material each tooth can remove. A raised shoulder helps prevent kickback.

The cutting surface of saw blade teeth may be steel or carbide. Blades with steel teeth are inexpensive and can be sharpened on site by the user. However, most carpenters and builders now use carbide-tipped blades. Each tooth is a chunk of tungsten carbide that has been permanently fastened to a shoulder. Tungsten carbide is a metal alloy that maintains a sharp edge much longer than steel. These blades cut a wide variety of materials, but they must be taken to a professional for sharpening.

Differences in the angle, shape, size, and number of teeth greatly affect a blade's cutting ability, as shown in **Figure 5-5**. The number of teeth also affects a blade's cost. More teeth usually means a more expensive blade. Choosing the right blade for a particular use can be difficult. It requires a compromise between cost and various performance features. In general, however:

- More teeth make a smoother but slower cut.
- Fewer teeth make a faster but rougher cut.
- Blades with less than 40 teeth are suitable for ripping.
- Blades with more than 40 teeth are good for making smooth crosscuts.

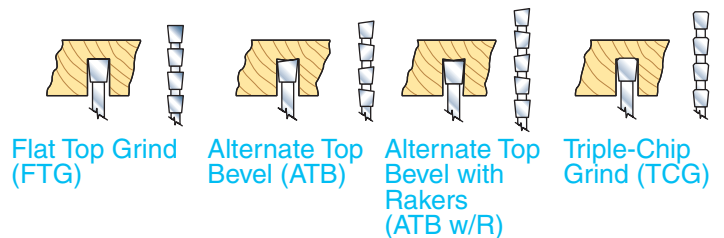
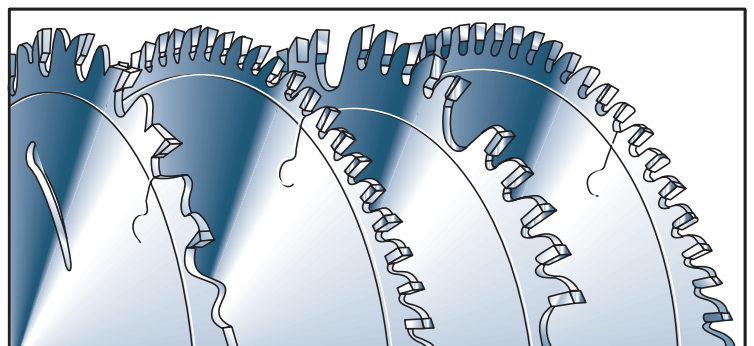
**Figure 5-5 Carbide Tooth Patterns**

**Flat Top Grind (FTG).** These blades are particularly suited to making rip cuts. Each tooth, sometimes called a raker, removes a uniform chip of wood. FTG blades are intended for heavy-duty cutting.

**Alternate Top Bevel (ATB).** Pointed tooth surfaces sever wood fibers, which makes this pattern especially suitable for crosscutting.

**Alternate Top Bevel with Rakers (ATB w/R).** This arrangement combines two patterns. FTG teeth rake the bottom of the kerf while ATB teeth sever the fibers. One set of teeth cuts while the other set cleans up.

**Triple-Chip Grind (TCG).** This blade alternates raker teeth with others that have beveled edges. This arrangement excels at cutting hard materials.



- Teeth with a steep forward angle cut fast but leave a rough edge.
- Teeth with a shallow forward angle make slower, smoother cuts.

**Thin-Kerf Blades** The amount of power required to cut through a material depends partly on the thickness of the blade and the kerf. The **kerf** is the width of the cut. A thin-kerf blade has thinner teeth and a thinner body. It requires less power during cutting than a standard-kerf blade, and is particularly suitable for cordless circular saws. Thin-kerf blades are also often found on portable table saws.

**Grinding-Edge Blades** Grinding-edge blades can be classified by whether they cut wet or dry. They can also be classified by the type of abrasive that does the grinding: diamond, aluminum oxide, or silicon carbide.

## **JOB SAFETY**

**POWER TOOL MAINTENANCE** Safety depends on proper tool maintenance. The following are general rules for maintaining all power tools:

- Disconnect a tool from its power source before performing any maintenance. If the tool is cordless, remove the battery.
- Check the power cord for cuts and abrasions. Repair any damage before using the tool. If the damage cannot be repaired, replace the entire cordset.
- Replace a power tool's plug if any of the prongs are damaged.
- Brush off or blow off accumulated sawdust and other debris.
- Replace or sharpen worn blades or bits.
- Use only identical replacement parts when servicing a power tool.
- Consult the owner's manual before applying cleaning agents. Some solvents may damage plastic or rubber parts.

 Go to [glencoe.com](http://glencoe.com) for this book's OLC for more on job safety.

## **Builder's Tip**

**KNOW YOUR SAW** The owner's manual is a booklet packaged with a power tool. It contains specific instructions on how to use the tool safely and how to maintain it. Keep this manual for reference. If you no longer have the printed manual, you can usually download a copy from the saw manufacturer's Web site.

Wet-cutting blades must be sprayed with water during use. Water cools the blade and prevents it from clogging. Wet-cutting blades are also used to reduce the amount of dust caused by cutting materials such as concrete block and stone.

Dry-cutting blades are used without water, and they create a large amount of fine dust. When using them, wear a dust mask or respirator, depending on the material being cut. An inexpensive type of dry-cutting blade has a resinlike body of silicon carbide reinforced with fiberglass and crusted with abrasive. It is used to cut masonry materials such as concrete, brick, and cement block. It can also be used to cut *nonferrous metals*.

### **Care of Saw Blades**

Any saw blade can be damaged by careless handling. Blades with carbide-tipped teeth are especially vulnerable to damage because carbide is a hard but brittle material. Teeth can be chipped if they come into contact with another metal, such as a nail embedded in the wood. Chipping might also occur as a blade is being changed.

Whenever you store a blade, be sure to protect its teeth. Do not stack blades in a way that allows their teeth to touch. Also, be careful when handling a blade. Sharp teeth can easily cut fingers. The teeth of any blade will eventually dull. A dull blade cuts poorly and is likely to warp. Dulling occurs most quickly when cutting abrasive materials, such as cement board or particleboard.

Carbide-tipped blades are also dulled by heat and corrosion. Always inspect a blade before using it to see if the teeth are sharp. Look closely at the teeth at different points along the blade. If they have chipped corners or rounded edges, the blade should be sharpened. A high-quality blade can be sharpened many times, but lesser-quality blades are often considered disposable.

Frequently inspect abrasive blades that have a resinlike body. Never use an abrasive blade that is cracked or damaged. It can shatter in use, spraying pieces away from the saw at high speed. Damaged or worn abrasive blades of this type should be discarded.

### Circular Saw Maintenance

A saw in good working order is safer and will cut more accurately than a damaged saw. Blade guards are particularly prone to damage.

- Inspect blade guards frequently to ensure that they are working correctly. Never use a saw with a damaged or missing blade guard.
- Check that the baseplate is straight. Check along the bottom of the plate at the beginning of each day and if the saw has been dropped. If a baseplate cannot be bent back into alignment, replace it.
- Make sure the baseplate is perpendicular to the blade. Lower the blade as far as it will go, then rotate the blade guard out of the way and place a square against the blade and the baseplate.
- Check the alignment of the plate to ensure that it is perpendicular to the blade and make adjustments as needed.
- Worm-drive saws require a special lubricant to protect the internal gears. Drain the old lubricant periodically and replace it with

## JOB SAFETY

**CIRCULAR SAW SAFETY** The following are general circular saw safety rules. Always check the manufacturer's manual for any special safety instructions.

- Make sure the teeth of the blade are sharp.
- Make sure that the stock you are going to cut is free of nails.
- When working outside or near moisture, make sure that the power source is protected with a GFCI (ground-fault circuit interrupter).
- If you cannot hold a piece of stock safely, clamp it to a sturdy work surface.
- Never make an adjustment on a saw while it is running.
- Be careful when making adjustments when a saw is plugged in but not running. Some adjustments are safe when the saw is plugged in, such as changing blade height or angle.
- Do not stand directly in line with the saw blade. If the blade binds, it may kick the saw back out of the cut. If this happens, turn off the switch immediately.
- Always keep the guard in place and the blade adjusted for the correct depth of cut.
- Use the correct blade for the work to be done.
- Make sure the power cord is clear of the blade.
- Unplug the saw before changing a blade. Make sure the teeth are pointed in the direction of blade rotation and the arbor nut is properly tightened.
- Always allow the saw to reach full speed before starting a cut.
- Always keep your hands clear of the cutting line.
- When finished with a cut, release the switch. Wait until the blade comes to a stop before setting the saw down.
- Always properly support the material being cut so it does not pinch the blade.
- Make sure the blade is the correct diameter and that the arbor hole is the right size and shape for the saw.



Go to [glencoe.com](https://www.glencoe.com) for this book's OLC for more on job safety.



new lubricant as recommended by the manufacturer.

- Inspect the power cord. A saw's power cord can be damaged by the blade or by other abuse. If the damage extends through the cord's outer casing, the cord should be replaced.



**Recall** List key parts of a circular blade.

## Using a Circular Saw

### *How do you prevent kickback?*

If used improperly, a circular saw is much more likely to injure a worker than a handsaw. Its whirling blade can cause a serious injury before the user can react. For this reason, it is very important that you learn the proper use of this saw. Pay close attention to all the safety recommendations noted here.

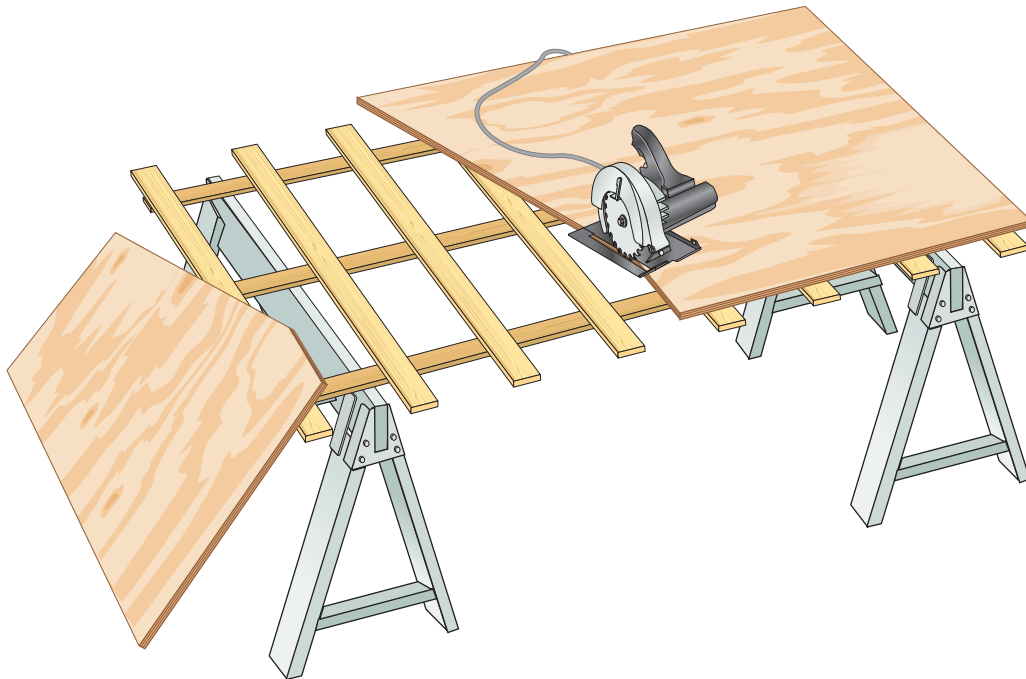
## Preventing Circular Saw Kickback

Though kickback can occur when using any type of saw with a circular blade, it is particularly dangerous with a circular saw. After kickback occurs, the saw operator can lose control of the saw when the blade starts spinning again. This can lead to serious injury or death. The following situations can result in kickback:

- The saw may be twisted to the side during the cut or pulled backwards. This causes the blade to bind.
- The material on one or both sides of the cut may bend inward, pinching the saw blade.
- The saw may encounter a large knot, which suddenly slows the blade.

To avoid injury from kickback, follow these precautions:

- Cut in a straight line.
- Support the wood in a way that prevents the cut pieces from pinching the blade.



**Figure 5-6 Supporting Plywood**

**Strong Support** The wood grid of this panel-cutting table supports plywood, OSB, and other panel products as it is being cut. The blade should extend no more than  $\frac{1}{8}$ " below the wood being cut.

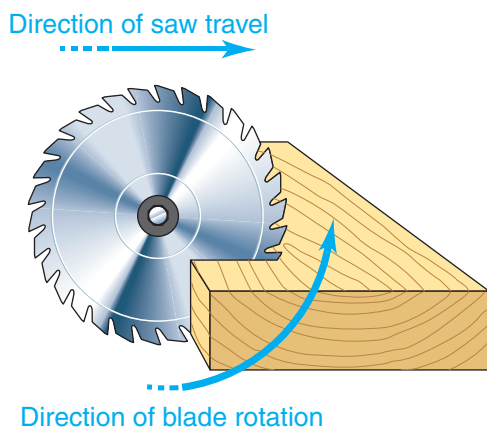
- Grip the saw firmly.
- Always use a sharp blade. Dull blades are more likely to bind or stall.
- If cutting through a knot is unavoidable, push the saw through at a slower rate.
- Never stand in a direct line with the blade.

## Basic Cutting Techniques

Carpenters who cut a lot of plywood can work more safely and quickly by using a panel-cutting table, as shown in **Figure 5-6**. This table is supported by sawhorses and provides a flat surface for cutting plywood and other large panels. Most importantly, it prevents the material being cut from pinching the saw blade. A pinched blade is a major cause of saw kickback. A panel-cutting table can be made on the job site.

**Crosscuts and Rip Cuts** The most common cut made with a circular saw is the crosscut. When using a circular saw to make a crosscut, place the work over sawhorses or support it securely in some other way. Make sure that the area beneath the cutting line is clear.

Because the blade of a circular saw cuts as its teeth enter from the bottom of the material, it will leave a smoother cut at the bottom than at the top, as shown in **Figure 5-7**. This is why plywood used for cabinetry

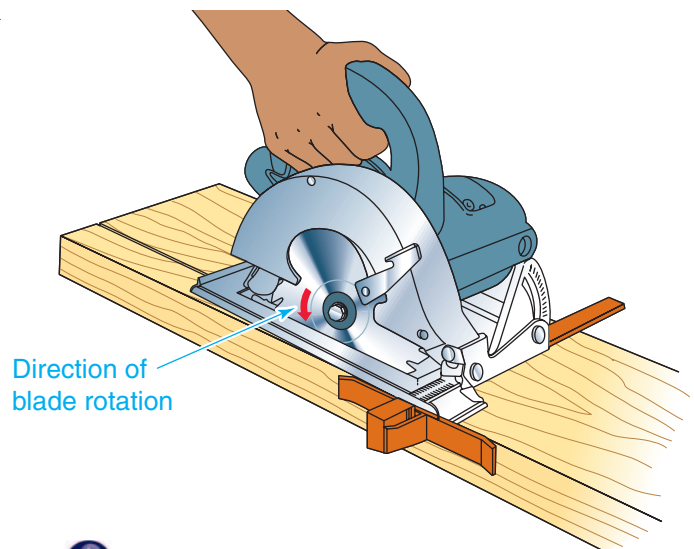


**Figure 5-7 How a Circular Saw Blade Cuts**  
**Cutting Action** The cutting action of a circular saw blade. The blade cuts from the bottom up.

or siding should be cut with the good side facing down. It is not important to do this when cutting sheathing.

To use a saw, loosen the blade adjustment lever to adjust the depth of cut. Only about  $\frac{1}{8}$ " of the blade should show below the stock. Be sure to tighten the blade adjustment lever before making any cuts. Rest the front of the baseplate flat on the work, but do not let the blade touch the wood yet. Pull the trigger switch and allow the blade to reach full speed. Guide the saw across the board firmly but without force.

You can make a long rip cut in much the same way. A rip cut is made along the direction of the grain. If the cut does not need to be perfectly straight, you can follow a layout line freehand. For the straightest cuts, however, guide the saw with a rip guide such as the one shown in **Figure 5-8**. The rip guide is a metal guide that slips into slots in the saw's baseplate. A circular saw can also be guided by sliding it along a stiff straightedge that has been clamped to the *workpiece*. When ripping a long board, stop the saw before you overreach, then pull it back in the kerf slightly. Stand in a new position, then start the saw again to continue the cut.



**Figure 5-8 Using a Rip Guide**  
**Ripping Straight** A rip guide can be used to ensure a straight cut.

## Miter Cuts

A **miter cut** is similar to a crosscut, except that it is made across the grain of a board at an angle other than 90°. Miter cuts can be made freehand, or they can be guided by a saw protractor such as the one in **Figure 5-9**. A saw protractor is a metal guide with two arms that can be adjusted to various angles. It is marked in degrees. To use it, hold the protractor firmly against the workpiece with one hand. Use your other hand to guide the saw's baseplate along the projecting arm. A triangular framing square can be used in a similar way to guide a saw for crosscuts.



### Reading Check

**Explain** Which hand tool may be used to help ensure a perfectly straight crosscut?



**Figure 5-9 Making a Miter Cut**

**Crosscutting Straight** Use a saw protractor as a guide if perfectly straight cuts are necessary. It can be adjusted to any angle to make miter cuts.

## Bevel Cuts

A **bevel cut** is a type of miter cut that is made at an angle through the thickness of a board, as shown in **Figure 5-10**. When making a bevel cut, the saw cannot cut as deeply as it can when making a crosscut. Most saws can be adjusted to make bevel cuts at angles between 45° and 90°.

To make a bevel cut, loosen the wing nut or adjusting lever and tilt the saw to the desired angle. Then retighten the wing nut or lever. Adjust the saw for the correct depth of cut. Retract the blade guard until the blade engages the wood, then allow it to slide back into position. Otherwise the guard may interfere with the cut. Make the bevel cut freehand or guide it with a saw protractor. Sometimes the blade guard will prevent a bevel cut from starting easily. In that case, using the saw blade lever, raise the guard slightly as you start the cut. Then release the lever.

A compound-bevel cut (which is also called a compound-miter cut) can be made when a bevel cut is combined with a miter cut. It can be created by tilting the blade *and* using a saw protractor to guide the saw.



**Figure 5-10 Cutting a Bevel**

**Beveled End** When making a bevel cut, it is important to keep good control of the saw by using both hands.

**After You Read: Self-Check**

1. When using a circular saw, what should you do with a 2×4 that cannot be held safely?
2. What special maintenance does a worm-drive saw require?
3. When making a crosscut with a circular saw, how much of the saw blade should show below the stock?
4. Describe how a bevel cut is made.

**Academic Integration: English Language Arts**

5. **Create an Outline** You have been hired by a major saw manufacturer to create a circular saw owner's manual. Use Section 5.1 to create an outline of the information you would include in the owner's manual. The outline should be no more than one page long.



Go to [glencoe.com](http://glencoe.com) for this book's OLC to check your answers.

# Table Saws

## Understanding Table Saws

### *What purpose does a fence serve?*

A table saw is one of the most versatile tools on a job site. The primary use of a table saw is to rip stock to width, though it can also be used to crosscut stock. It can rip cut with greater precision than a circular saw, which is why it is often used for ripping framing lumber and wood panel products. With the proper blade, a table saw can also be used to cut materials such as rigid sheet plastic. Though very similar to the type of table saw found in woodworking shops, table saws for building construction tend to be lighter and more portable.

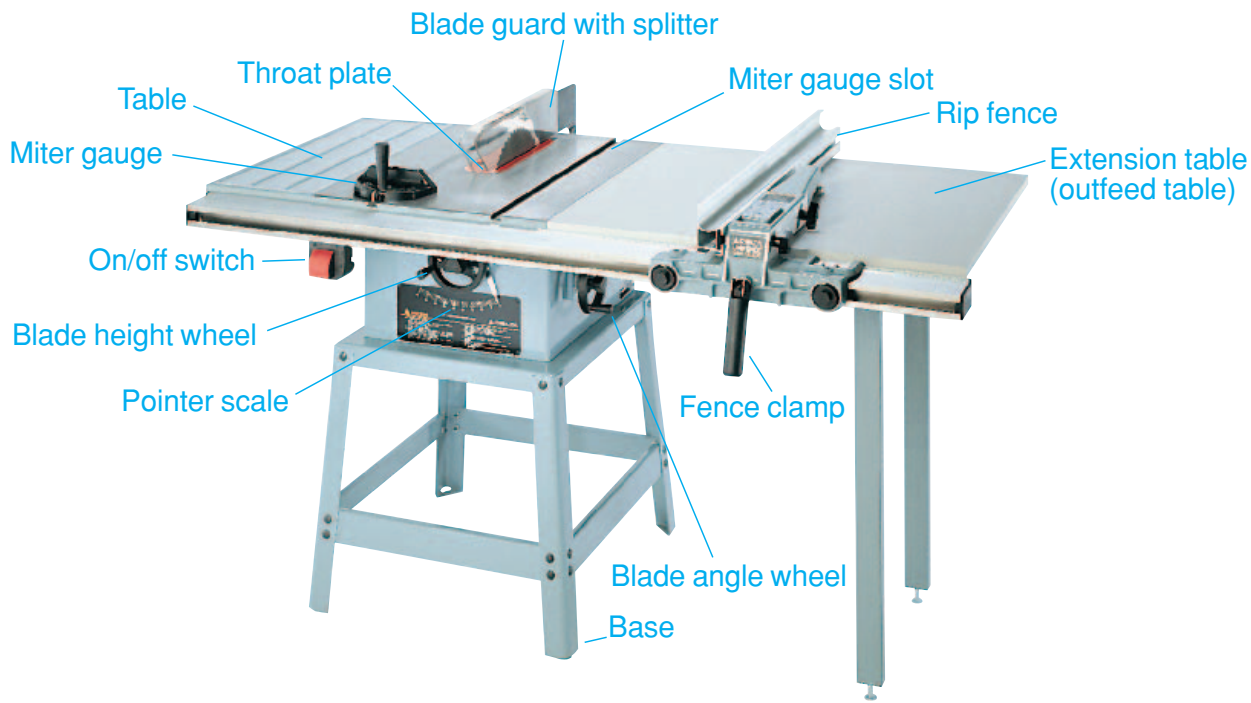
### **Parts of a Table Saw**

The main parts of a table saw are the table, the motor, the base, and the on/off switch, as shown in **Figure 5-11**. For safety purposes,

the on/off switch should be large and easy to reach. A miter gauge or a rip fence guides wood through the blade, and a guard prevents accidental contact. A splitter directly behind the blade prevents the stock from pinching the blade as it is being cut.

An opening in the center of the table allows the blade to be raised above the table surface. The opening is partially covered by a throat plate (the red area around the blade in **Figure 5-11**). This plate is an important safety feature that prevents small pieces of wood from being wedged against the blade.

The miter gauge is used during crosscut operations and can be adjusted for various angles. It slides forward and back in one of two grooves in the top of the saw table. Both grooves are parallel to the saw blade. When not in use, the miter gauge should be removed from the table.



**Figure 5-11 Parts of a Table Saw**

**Open Base** The main parts of an open-base saw, or contractor's table saw. This saw is fitted with an extension table to increase cutting capacity.

The rip fence is used for all ripping operations. It is adjusted by sliding it left or right across the table. When it is ready for use, it is locked in place. If not being used, the fence should be moved well away from the blade and locked, or removed entirely. Also available are table extensions that can be fastened to the sides of the saw table. These are especially convenient when cutting a large panel, such as a sheet of plywood. The blade guard should be kept in place whenever possible. If a cut cannot be made with the

standard guard in place, some other safety method should be used instead.

### Types of Table Saws

A table saw is generally classified according to the diameter of the largest blade it will accept. The most common table saw on a job site is the 10" saw. Table saws for the job site have the same features as models found in woodworking shops, but are easier to transport. Most table saws have a fixed, horizontal table and a blade that can be raised, lowered, and angled. This type is called a tilting-arbor saw. In contrast, a few saws feature a table that tilts; the blade can only be raised or lowered. This type has limitations on a job site and is rarely used.

Two types of tilting-arbor table saws are commonly used in building construction. Contractor table saws, sometimes called open-base saws or builder's saws, rest on a metal framework. This makes the saw light enough for two people to carry and move from site to site. Portable table saws, also called *benchtap saws*, are even lighter,

**JOB SAFETY**

**UNEXPECTED MOVEMENT** When using the fence to rip stock, always remove the miter gauge and store it elsewhere. This will prevent it from interfering with the cut or vibrating loose.

Go to [glencoe.com](http://glencoe.com) for this book's OLC for more on job safety.

and can be carried by one person. These are easy to move around the job site, but are not generally used for heavy duty cutting. Many include folding stands with built-in wheels that make the saws even easier to transport.

## Table Saw Blades

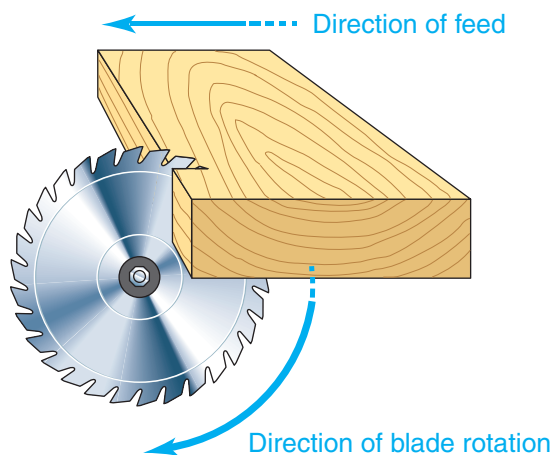
A table saw uses a circular blade that has the same basic features as a circular saw blade (see “Circular Saw Blades” on page 130). The main difference is that table saw blades are usually at least 10" in diameter. Also, the teeth may be shaped to provide a higher quality cut. Blades often feature a combination of ripping and crosscut teeth that make it suitable for a variety of cutting jobs. Several styles of teeth are available, and each has a particular application.

The blade of a table saw cuts as its teeth enter the top of the material, as shown in **Figure 5-12**. This means it will leave a smoother cut at the top than at the bottom. Material should be cut with the good side facing up.

## Table Saw Maintenance

A table saw requires less maintenance than some other saws. Refer to the manufacturer’s instructions for specific recommendations. The following are general guidelines only.

- Keep the table clean and smooth.  
Remove patches of rust with metal



**Figure 5-12 How a Table Saw Blade Cuts Good Side Up** A table saw blade cuts from the top surface down.

polish. Scrape off paint drips and glue to prevent them from interfering with the movement of stock. After cleaning, some builders coat the top with paste wax. This makes it easier to slide stock over the surface. After cleaning, the table to may be coated with a paste wax as a lubricant so that the material cut may be fed smoothly towards the blade.

- Unplug the saw, then gently brush or blow accumulated sawdust from the blade-raising-and-tilting mechanism beneath the table. Lubricate the mechanism as recommended by the manufacturer.
- Some saws are driven by a V-belt that links the motor to the arbor. Replace the belt if it becomes worn or damaged.



**Explain** What is the advantage of a benchtop saw?

## Using a Table Saw

### Why is a push stick important?

Many of the same safety precautions that you would take with a circular saw also apply to table saws. However, because a table saw blade cuts in a different fashion, you must also know some safety rules that are specific to this tool.

### Adjusting the Saw

To operate a table saw safely, you must carefully adjust the blade, the rip fence, and the miter gauge. Never make adjustments while the saw is running.

**Setting the Blade Height** To raise the blade, hold the workpiece near the side of the blade and carefully turn the blade-height wheel until the top saw tooth is at the correct height. For most cutting, the top of the blade should extend no more than  $\frac{1}{8}$ " above the stock. When making some types of cuts, such as grooves, the blade must be set for the exact depth of cut.

**Tilting the Blade** A blade-angle wheel on the side of the machine tilts the blade. A pointer or scale on the front of the saw indicates the degree of tilt. Turn the wheel until the blade is tilted to the desired degree. Lock the wheel to maintain the angle.

**Adjusting the Rip Fence** The rip fence is usually placed to the right of the blade. For accurate and safe cutting, set the rip fence exactly parallel to the blade. To check it, align it with one of the miter gauge slots in the table. Then lock the fence. Check alignment again. If the edge of the fence is not parallel to the slot, unlock the fence and readjust it.

To adjust the fence to a specific distance, first move it to the approximate location. Holding a rule or tape measure at a right angle to the fence, carefully measure the distance from the fence to the nearest edge of one tooth, as shown in **Figure 5-13**. Then lock the fence. Make a small test cut on the workpiece. Measure it to double-check the setup before making the complete cut.

**Adjusting the Miter Gauge** The miter gauge, which is used for crosscutting operations, can be used in either groove on the table. There is a pointer and scale on the miter gauge for setting it to any angle to the right or left. Most gauges have automatic stop positions at 30°, 45°, 60°, and 90°.

Before relying on the accuracy of a miter gauge, square it to the blade. Unplug the saw and use a framing square to see if the gauge and the blade form a 90° angle. If they do not, adjust the gauge.

## Builder's Tip

**BLADE INSTALLATION** The arbor nut that holds a table saw blade in place always loosens when turned in the direction in which the blade's teeth are pointing. This is the direction of blade rotation.

## Preventing Table Saw Kickback

Kickback from a table saw can be as dangerous as it is from a circular saw. However, on a table saw, the workpiece is kicked back, not the saw itself. A piece of wood ejected from the saw can become a deadly missile.

Kickback can occur:

- When the workpiece is twisted to the side during the cut. This causes the blade to bind.
- When the stock on one or both sides of the cut bends, pinching the saw blade.
- When the rip fence is not parallel to the blade. This causes the blade to bind.



**Figure 5-13 Adjusting the Fence**

**Measure Carefully** Measure from the fence to the blade tooth, then double-check the distance after locking the fence.

- When wood is being crosscut with a miter gauge and a rip fence. A waste piece, called an **offcut**, can become wedged between the blade and the rip fence. This can produce kickback.

Follow these guidelines to avoid kickback:

- Be sure that one edge of the workpiece is always held firmly against the rip fence. Always keep a firm grip on the stock, and hold it flat against the table. Use a push stick when necessary.

## Builder's Tip

**CHECK THE SCALE** The blade-tilt pointer or scale may get out of adjustment over time. This will result in inaccurate cuts. Periodically check to make sure the pointer is on zero when the blade is perpendicular to the table. If the cut must be absolutely accurate, make a cut on scrap stock and check the angle with a try square.




## JOB SAFETY

**GENERAL TABLE SAW SAFETY** The following are general table saw safety rules. Always check the manufacturer's manual for any special safety instructions.

- Remove rings, watches, and other items that might catch in the saw. Wear garments with short or tight sleeves. Keep long hair tied back.
- Wear proper eye protection.
- Always keep the area around the table saw clean and uncluttered.
- Never stand directly behind the blade.
- Never cut freehand.
- Do not cut warped or bowed material on the table saw.
- Make sure the stock is free of nails.
- When ripping stock that cannot be fed safely by hand, always push the stock past the blade with a push stick.
- Make all rip fence adjustments after the saw has been turned off and the blade is no longer spinning. Be certain the rip fence is clamped securely while cutting.
- Use the proper saw blade for the operation being performed. Always cut with a sharp blade.
- Unplug the saw before changing blades.
- Always adjust the saw blade so that it protrudes just enough above the stock to cut completely through.

- Never reach over a spinning saw blade. Instead, reach around the side of the machine.
- Keep your fingers away from the saw blade at all times.
- Always keep the guard and splitter in place. If the cut you are making does not permit use of the guard, use a featherboard or a special guard. A featherboard is a piece of stock with a series of long saw cuts on one end. It is used to hold narrow stock against the rip fence when making a rip cut with a table saw.
- When crosscutting with the miter gauge, never use the fence as a stop unless a clearance block is used. A clearance block prevents the wood from becoming trapped between the fence and the blade.
- When ripping, place the jointed or straightest edge of the stock against the fence.
- Keep the saw table clean. Remove all scraps with a brush or push stick, never with your fingers.
- Always hold the stock firmly against the miter gauge when crosscutting and against the rip fence when ripping. A helper should not pull the stock. The helper only supports the stock.

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- Always support the wood in a way that prevents the cut pieces from pinching the blade. This might require a table or roller stands placed under the stock where it leaves the table.
- Always work with a sharp blade. Dull blades are more likely to bind or stall.
- When using the miter gauge to crosscut stock, make sure any offcuts cannot become trapped between the blade and the rip fence. To do this, remove the fence or push it well clear of the cutting area.



**Explain** Why do sharp blades help prevent saw kickback?

## Basic Cutting Techniques

The most common cuts made on a table saw are rip cuts and cross cuts. Of the two, rip cuts are by far the most common. A **rip cut** is a cut made in the direction of the wood grain. It is usually parallel to the edge of a board or panel.

## Ripping

It is essential to make sure the rip fence is properly adjusted when ripping stock. Whenever possible, place the widest part of the stock between the blade and the fence. The **feed rate** is the speed at which stock is pushed through the saw blade. For ripping thick stock or hardwoods, the feed rate should be slowed. The person on the infeed side controls the feed rate and the person on the outfeed side helps by supporting the material.

**Wide Stock** Stock with a width of 6" or more is considered wide. To rip wide stock:

1. Adjust the rip fence to the appropriate width and lock it.
2. Turn on the saw. Place the end of the stock flat against the table, as shown in Figure 5-14.
3. Push the wood against the fence with your left hand, and push it forward with the right. If the board is long, use one or more roller stands to support it as it leaves the table. Set up stands before you begin the cut.



**Figure 5-14 Making a Rip Cut**

**Slow and Steady** Rest the leading edge of the panel on the front of the saw table. A roller stand can support long stock as it exits a table saw. The guard should be in place for all tool operations.

4. Feed the stock into the blade at a slow, steady speed. Hold your right hand close to the fence as you work. Be careful not to overload the saw.
5. To avoid kickback, push the stock completely past the blade to complete the cut.

**Narrow Stock** Narrow stock is generally considered anything with a width less than 6". Keep in mind that the narrower the stock, the more difficult it will be to rip safely. Always try to position the stock so that the widest portion is between the blade and the fence. To rip narrow stock:

1. Observe the same general practices as in starting the cut on wide stock.
2. As the uncut end of the board reaches the front of the table, use a push stick instead of your hand to guide the board between the blade and the fence, as shown in **Figure 5-15**.
3. Use a *featherboard* if necessary. Again, a featherboard is a safety device that can be attached to the saw. It helps to hold stock firmly against the saw fence.


**Bevels** On a table saw, a bevel cut is an angled cut made in the direction of the grain. To cut a bevel:

1. Tilt the blade to the correct angle for the bevel.
2. Place the fence on the table so the top of the blade is tilting away from the fence.




**Figure 5-15 Ripping Narrow Stock**  
**Use a Push Stick** Note that the push stick is used between the blade and the fence, not on the outside of the blade. The guard should be in place for all tool operations.

3. Adjust the fence for the correct width of cut.
4. Adjust the height of the blade to clear the top of the board slightly.



**EASY SAFETY: PUSH STICK** Never under any circumstances cut narrow stock without a push stick. It is good practice to hang the push stick conveniently at the side of the saw so that you are not tempted to make a cut without it.

Go to [glencoe.com](http://glencoe.com) for this book's OLC for more on job safety.



**KNOWING WHEN STOCK IS FLAT** Make sure that the material to be cut is flat against the saw table as cutting starts. Before cutting large pieces of stock, rock the wood forward and back on the front surface of the saw table. You will feel it "slap" the table when it is flat.

5. Hold the work firmly against the fence as the cut is made. **Figure 5-16** shows the blade entering the stock.

## Crosscutting

Use the miter gauge for most crosscutting operations. Always remove the rip fence or slide it well out of the way. In some cases the rip fence can be used during crosscutting operations. However, this is an advanced technique that must not be used without supervision by your instructor.

To crosscut:

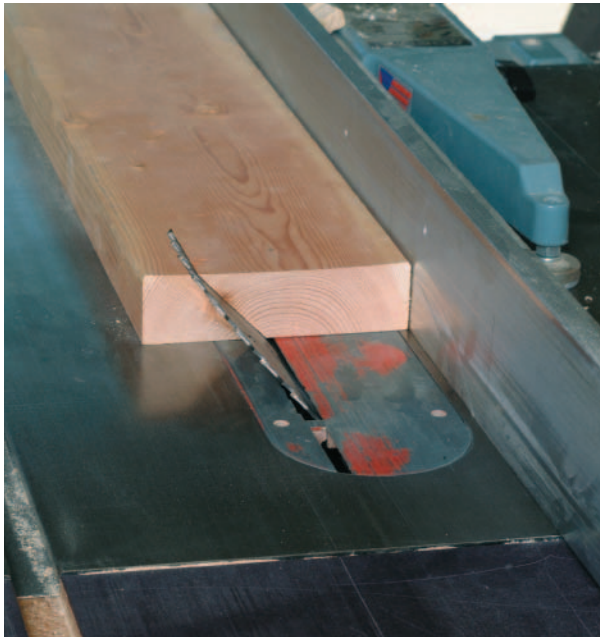
1. Hold the stock firmly against the gauge and advance it slowly into the blade, as shown in **Figure 5-17**.
2. When the cut is complete, slide the stock away from the blade and remove it. Never drag the cut edge back across the blade. Never put your fingers near the blade to remove the offcut.

## Cutting Panels

Because of their size, panels such as plywood and oriented-strand board present

cutting problems. The workpiece is often too large to fit conveniently on the saw table. The panel and any waste should be fully supported as they leave the top of the table saw. This can be done with a roller stand or an outfeed table. To cut panels:

1. Adjust the blade to the proper height. Adjust the fence for the width of cut.
2. Make sure the panel edge that will ride against the rip fence is flat and straight. If it is not, the cut will not be accurate. Place a different edge against the fence if necessary.
3. Turn on the saw, and rest the leading edge of the panel on the front of the saw table. The good side should be facing up, as shown in **Figure 5-14** on page 142.
4. Push the panel steadily forward, while at the same time applying pressure to keep its edge firmly against the rip fence. Do not allow the panel to move sideways or it will bind on the blade.
5. As you complete the cut, be sure to push the panel and the waste piece completely past the blade.



**Figure 5-16 Bevel Cutting**

**Angled Cut** The guard is not shown here. This allows the operation to be shown more clearly. The guard should be in place for all tool operations.



**Figure 5-17 Crosscutting Narrow Stock**

**Feed Direction** The arrow indicates the feed direction. Note how the guard slides over the stock as the blade cuts through the wood.

## Step-by-Step Application

**Installing a Table-Saw Blade** Sometimes a blade must be removed for sharpening. In other cases, it must be replaced by another blade when cutting a different material. Knowing how to change the blade safely is important.



**Step 1** Unplug the saw to prevent accidental startup.

**Step 2** Remove the throat plate. This usually snaps in and out of position.

**Step 3** Select a wrench to fit the arbor nut. On most saws, the arbor has a left-hand thread. The nut must be turned clockwise to loosen it. Hold a piece of scrap wood against the blade to keep the arbor from turning as you work, as shown in the figure.

**Step 4** Remove the nut and the collar. Hold them securely or they may drop into the sawdust below and be difficult to find. Take off the old blade, being careful not to bump its teeth against the table.

**Step 5** Slip the new blade onto the arbor. The teeth should point in the direction of blade rotation (toward the operator). Replace the collar and nut. Tighten the nut firmly, but not too tight. The nut will tighten further as the saw is used.

**Step 6** Replace the throat plate.

 Go to [glencoe.com](http://glencoe.com) for this book's OLC for additional step-by-step procedures, applications, and certification practice.


## Section 5.2 Assessment

### After You Read: Self-Check

1. When you are cutting wood with a table saw, should the good side be facing up or down?
2. Name the two devices that are used to guide stock when cutting with a table saw.
3. Explain two ways of supporting long stock for ripping on a table saw.
4. List the required steps in installing a table-saw blade.

### Academic Integration: English Language Arts

5. **Research** Research table saw blades for rip cutting and crosscutting. Describe the two types of blades. Write one paragraph about the differences in teeth as well as the type of cut produced by each.

 Go to [glencoe.com](http://glencoe.com) for this book's OLC to check your answers.

# Miter & Radial-Arm Saws

## Understanding Miter Saws

*How are the various miter saws similar?*

The miter saw, or chop saw, has become a very important tool on the job site. Frame carpenters may use it for making quick, repetitive crosscuts of framing lumber. Finish carpenters rely on it for accurate cuts on molding and trim, especially crown molding.

The miter saw makes a clean cut that is very accurate. It is portable, easy to set up, and maintains its accuracy, which is why it is often preferred over a radial-arm saw. However, it can be used only for crosscutting, not ripping. Some miter saws can make compound cuts in one pass. Fitted with a suitable blade, the miter saw can even cut metal pipe and light-gauge metal framing. Also, miter saws can easily be fitted with dust-collection equipment such as a dust bag.

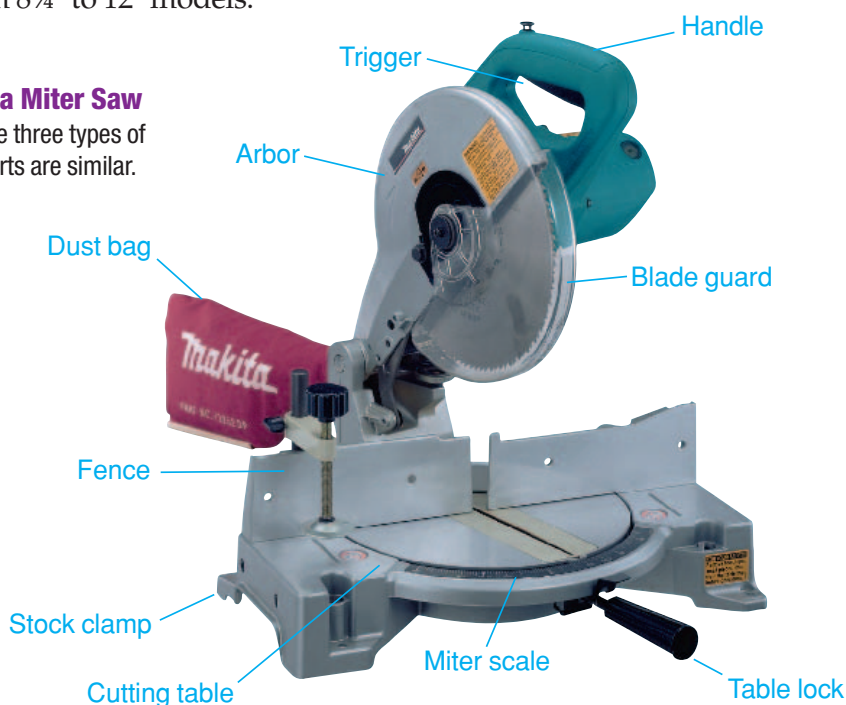
The size of a miter saw is determined by its blade diameter. Most miter saws used for residential work range from 8¼" to 12" models.

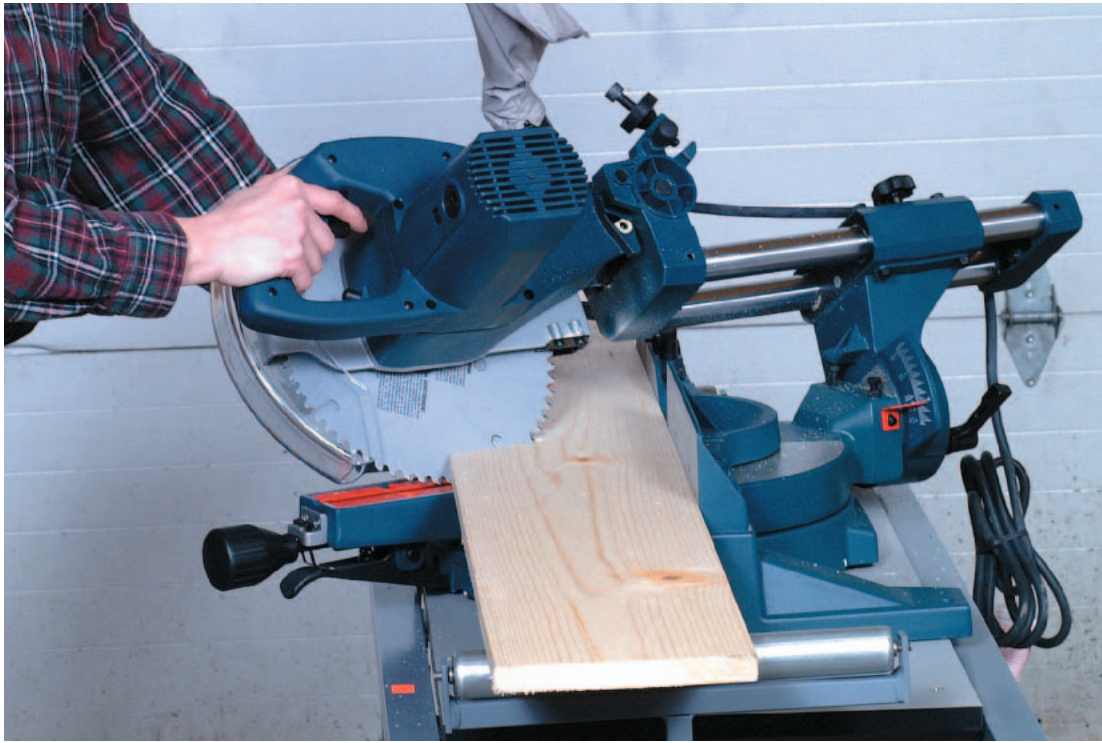
## Parts of a Miter Saw

A miter saw looks something like a circular saw mounted on a pivoting frame, as shown in **Figure 5-18**. The saw head may be mounted on a pivoting mechanism or on metal rails. The saw table has a miter scale. Most miter-saw scales contain positive (locked) stops at 90° and 45°. Positive stops allow the saw to be set quickly to commonly used angles. Some saw tables also contain positive stops at 15°, 22.5°, and 30°. On compound saws, the head may also contain positive stops.

Miter saws have a split fence that allows the blade to pass through. Miter saws also have retractable blade guards. The guard automatically pivots to shield whatever portions of the blade are not being used in a cut. This safety feature should never be disabled. All miter saws are equipped with a dust bag, a vacuum port, or both.

**Figure 5-18** **Parts of a Miter Saw**  
**Basic Anatomy** There are three types of miter saws. Their basic parts are similar.





**Figure 5-19 A Sliding Compound-Miter Saw**

**Large Capacity** The blade of a sliding compound-miter saw can make a miter cut and a bevel cut at the same time, even across a wide board.

## Types of Miter Saws

The three basic types of miter saws include conventional miter saws, compound-miter saws, and sliding compound-miter saws. Conventional miter saws were the first to become available. A **compound miter saw** is a saw in which the head of the saw pivots up and down and from side to side. Conventional models are typically the simplest and lightest. They are suitable for crosscuts and miter cuts.

A compound-miter saw has the same range of motion as conventional models. In addition, the head of the saw can also be tilted at an angle to one side or the other to make a bevel cut. This allows the saw to make compound cuts in one pass. It is often used when cutting crown moldings, handrails, and other trims that require complex fitting.

A sliding compound-miter saw, shown in **Figure 5-19**, is similar to a compound-miter model, except that it can cut wider stock. The head of the saw slides back and forth on one or two metal rails, and also pivots up and down.

With all three types of miter saws, the direction of blade travel is away from the operator, as shown in **Figure 5-20** on page 148. In other words, the exposed teeth of the saw point toward the fence.

**Miter Saw Blades** The basic features of miter saw blades are the same as those for circular saw blades and table saw blades. However, these blades are sometimes referred to as crosscut blades or cutoff blades because they are used for trimming stock to length. A 40-tooth blade is a good general purpose miter saw blade because it provides a good-quality cut across the grain of a board. A blade with 60 teeth or more would be used for fine cuts on expensive molding.

**Maintenance** Check the positive stops for the table and the head (on compound models) regularly for accuracy. Adjust them as needed. The rails of a sliding-compound miter saw do not normally require attention other than brushing off excess sawdust. However, the sliding mechanism itself might

# JOB SAFETY

**MITER-SAW SAFETY** The following are general miter-saw safety rules. Check the manufacturer's manual for any special safety instructions.

- Remove rings, watches, and other items that might catch in the saw. Wear garments with short or tight sleeves. Tie back long hair.
- Wear proper eye protection.
- Use the correct cutting motion. The various types of miter saws have different requirements.
- Make sure that the stock is held firmly against the fence.
- Never disable the blade guard.
- Make any adjustments to the saw only after the blade has stopped moving.
- Unplug the saw before changing blades.
- Support the stock to be cut along its entire length. Never cut stock that is too short to hold safely.
- Most miter saws operate with a high-pitched whine. Wear hearing protection.
- Do not lift stock into the blade to complete a cut.

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require lubrication. Consult the owner's manual for specific recommendations.

Brush off the table periodically to remove sawdust and small bits of wood that can interfere with table movement. In addition, remove any sawdust or small pieces of wood that might prevent the blade guard from operating properly. Empty the dust bag frequently. A buildup of sawdust in the bag encourages the release of fine dust into the air. This can lead to respiratory problems for anyone in the area.

## Using a Miter Saw

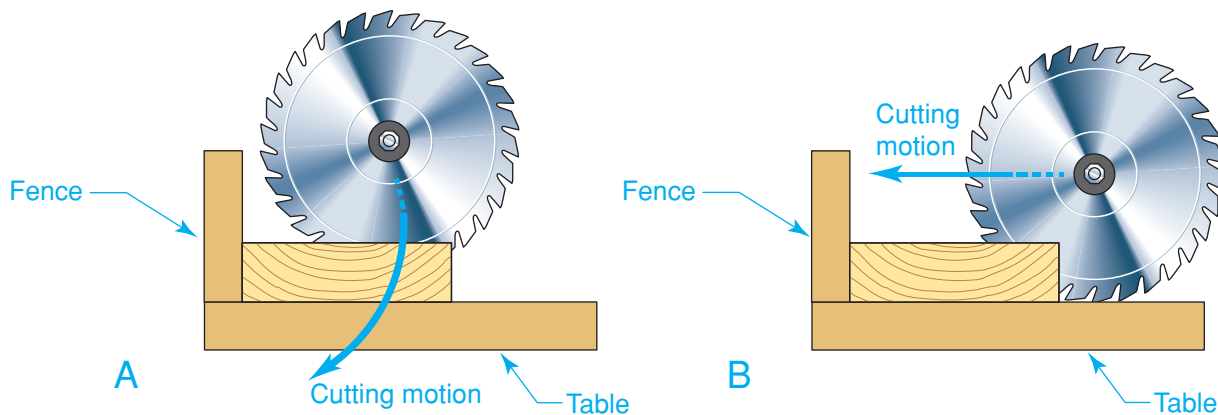
The various types of miter saws differ in operation. For safety, be sure you understand the differences.

**All Miter Saws** If the saw has a manually operated blade brake, push down on the brake button when the cut is complete. If the saw has an automatic blade brake, it will engage as soon as the trigger switch is released. The blade will stop quickly.

### Conventional Miter and Compound-Miter Saws

To turn the saw on, pull the trigger switch. Make the cut by pivoting the saw head down into the wood. As soon as the cut is completed, release the trigger when the blade stops, then return the saw to its starting position (See **Figure 5-20A**).

**Sliding Compound-Miter Saws** Slide the saw head outward, past the stock to be cut (see **Figure 5-20B**). Turn the saw on using the



**Figure 5-20 How Miter Saws Cut**

**Cutting Motions A.** The cutting motion of a conventional miter saw is downward and slightly toward the fence.

**B.** The cutting motion of a sliding compound-miter saw is directly toward the fence.

## Step-by-Step Application

**Installing a Miter-Saw Blade** Replace a blade whenever the teeth become dull. A sharp blade improves safety and the quality of a cut. To replace a blade:

**Step 1** Unplug the miter saw from its power source.

**Step 2** Remove the blade guard and, if necessary, the blade housing from the saw. On some saws, the guard may simply pivot out of the way.

**Step 3** Place a hex wrench in the depression in the end of the arbor to hold the arbor stationary. (Many saws have an arbor-lock button instead.)

**Step 4** Loosen the arbor nut with an open-end wrench by applying pressure on the wrench in the direction of blade rotation. Remove the nut and the collar.

**Step 5** Slide the old blade off the arbor.

**Step 6** Slide a new blade onto the arbor. Make certain the teeth at the bottom are pointing away from you and toward the fence.

**Step 7** With the recessed side against the blade, replace the collar. Replace and securely tighten the nut. Reinstall the blade housing and blade guard.

**Step 8** Plug in the saw and turn it on and off several times without making a cut. This will help you to determine if the blade is properly secured.

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trigger switch. To make the cut, pivot the saw head downward all the way and push it forward through the wood. When the blade is completely clear of the stock, release the trigger switch and lift the saw head.

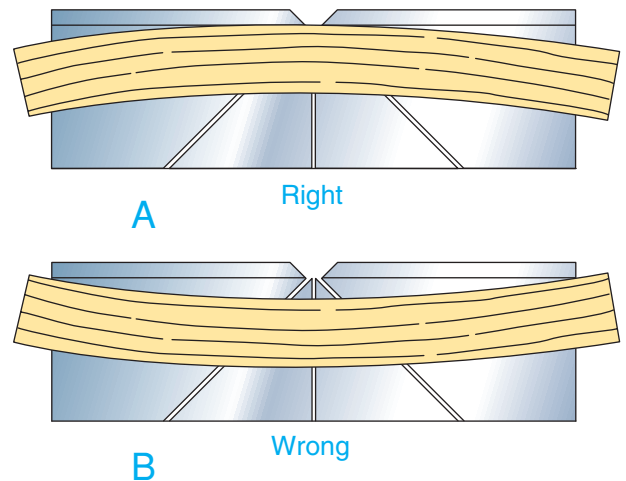
### Basic Cutting Techniques


Before making any cuts with a miter saw, make sure the tool is securely fastened to its stand. Also be sure that the stand rests on a solid surface and does not tip as the saw is used. The saw should be equipped with a blade brake. A blade brake allows the blade to be stopped quickly. This reduces the chances of hand injuries caused when the blade spins freely.

**Crosscutting** When cutting flat pieces, first check to see if the material is slightly *bowed*. If it is, make sure the material is positioned on the table as shown in **Figure 5-21**, example A. If the material is positioned as shown in **Figure 5-21**, example B, it will pinch the blade near the completion of the cut. This could result in kickback. The stock in these drawings is bowed to an extreme in order to make the drawing easier to understand. However, neither piece of wood could be safely cut on a miter saw if bowed this much.

Hold the stock flat against the table and tightly against the fence with one hand. Keep it well clear of the blade. Then make the cut by pulling the saw downward.

To make angle cuts, release the table lock. Move the indicator to the angle to be cut and engage the table lock. When making cuts at 45° or 90°, release the table lock and move the handle until the positive stop makes contact. Then engage the table lock.



 **Figure 5-21 Cutting Bowed Stock**  
**Bow Caution** A. If the material is slightly bowed, position it as shown. B. If positioned as shown, the stock may kick back. Bowing here is exaggerated.



# Radial-Arm Saws

## What is this type of saw used for?

The radial-arm saw, shown in **Figure 5-22**, can be used for ripping, *dadoing* (cutting a groove), and various combination cuts. However, it is best suited to crosscutting. For instance, a long board can be cut into shorter lengths easily because the board remains stationary on the table while the saw is pulled forward through the stock. Its primary advantage over miter saws is its ability to crosscut unusually wide or thick stock. However, this feature is seldom needed on residential job sites and the saw is awkward to transport, so this tool is much less common on residential job sites than it once was.

Like other saws with circular blades, the radial-arm saw is generally classified according to the largest diameter blade it will accept. Heavy-duty saws used in commercial construction might have a 14" blade.

The most common size used in residential construction is the 10" model.

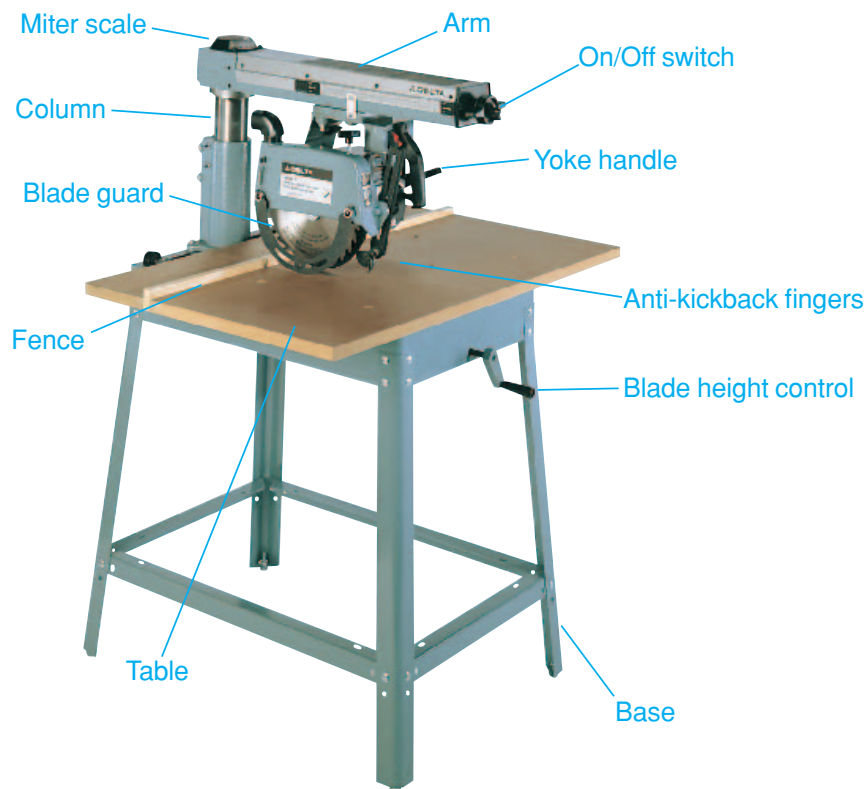
## Parts of a Radial-Arm Saw

A radial-arm saw is essentially a circular saw held by a yoke that allows it to slide forward and back on a track in the arm. The arm is attached to a vertical post that can raise or lower it. The saw takes its name from the fact that the arm moves in an arc from side to side (in other words, radially). Other parts of the radial-arm saw are shown in **Figure 5-22**.

## Using a Radial-Arm Saw

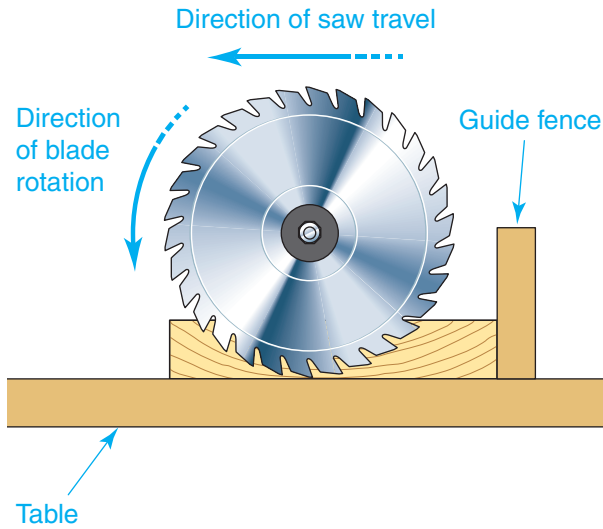
A radial-arm saw tends to feed itself into the work. This is due to the position of the blade and the feed direction, as shown in **Figure 5-23**. Though a radial-arm saw can make many types of cuts, its use should be limited to crosscutting.

To prevent the saw from lurching forward, hold it securely before turning it on and



**Figure 5-22** Parts of a Radial-Arm Saw

**Saw and Stand** A radial-arm saw is mounted on a post located at the back of the saw stand. Infeed and outfeed tables support long stock.

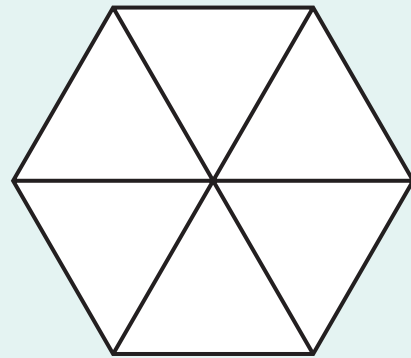


**Figure 5-23 How a Radial-Arm Saw Cuts**  
**Cutting Path** The teeth of the saw blade point away from the operator and cut from the top of the stock.

while cutting, as in **Figure 5-24**. Hold the stock to be cut tightly against the fence with one hand. With the other hand, grasp the motor yoke handle. For crosscutting and similar operations, pull the saw into the work. Return the saw to the rear of the table after each cut. Do not move the stock until the saw blade is behind the fence.

**Preparing to Cut Angles** You are building an octagon-shaped frame. You ask your teacher how to figure the angles at which your frame pieces will need to be mitered. The teacher draws the sketch below and challenges you to use it to figure out the angles. Write a few sentences explaining your reasoning and indicating the angle at which to cut the miters.

**Starting Hint** Figure out the interior angles of one of the triangles in the sketch. Notice that the triangles are congruent and isosceles.



**Figure 5-24 Hand Position**  
**Keep the Saw from Lurching** The proper hand position for crosscutting. Notice the position of the anti-kickback fingers. The guard should be in place for all tool operations.



## JOB SAFETY

**RADIAL-ARM SAW SAFETY** The following are general radial-arm saw safety rules. Check the manufacturer's manual for specific safety instructions.

- Remove rings, watches, and other items that might catch in the saw. Wear garments with short or tight sleeves. Tie back long hair.
- Wear proper eye protection.
- Always keep the safety guard and the anti-kickback device in position unless you are changing the blade.
- Before crosscutting, adjust the anti-kickback device (sometimes called

anti-kickback fingers) to clear the top of the work by about  $\frac{1}{8}$ ".

- Make sure the clamps and locking handles are tight.
- Never place your hand closer than 6" to the blade.
- Use a brush or stick to keep the table clear of all scraps and sawdust. Don't brush the table with your hand.
- When finished with a cut, return the saw head all the way back past the fence.



Go to [glencoe.com](http://glencoe.com) for this book's OLC for more on job safety.

## Section 5.3 Assessment



### After You Read: Self-Check

1. Explain the basic differences among the three types of miter saws.
2. What is a compound-miter cut, and what is it used for?
3. Why is a blade brake important?
4. What is the primary advantage of a radial-arm saw over a miter saw?



### Academic Integration: Mathematics

5. **Complementary Angles** A miter saw makes angled crosscuts across the grain of a board. To cut a board at  $90^\circ$ , the saw is set at  $0^\circ$ . What is the saw setting for a miter joint for a  $126^\circ$  wall?

#### Math Concept

To solve this problem, you will need to determine the complementary angle you would set your saw to make the cut. Complementary angles are two angles that equal  $90^\circ$  when added together. For example, if one angle is  $60^\circ$ , its complementary angle would be  $30^\circ$ . To cut a board at  $60^\circ$ , you would set your saw to  $30^\circ$ .

**Starting Hint** First divide the wall angle by 2, because you are measuring for a miter joint where two pieces of wood would meet at  $126^\circ$ . Next, determine your complementary angle and the appropriate miter saw setting.



Go to [glencoe.com](http://glencoe.com) for this book's OLC to check your answers.

# Jigsaws & Reciprocating Saws

## Jigsaws

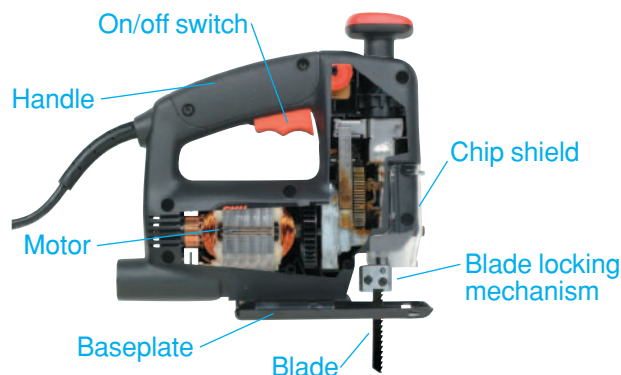
### *Which part of a jigsaw is adjustable?*

The jigsaw (sometimes called a saber saw or bayonet saw) is the best power saw for making curved or irregular cuts. Carpenters use a jigsaw to notch wood deck boards to fit around a post. Cabinet installers use it for fitting cabinets and for cutting sink holes in countertops. Siding installers use a jigsaw to cut siding to fit around arched windows.

Unlike the saws discussed in previous sections, the jigsaw has a straight blade. Teeth are formed into one edge, and, instead of spinning, the blade moves up and down. Fitted with a suitable blade, a jigsaw will cut metal, wood, plastic, and many other materials. It is often used instead of a hacksaw to cut angle iron and various kinds of metal or plastic pipe. The saws cannot be adjusted for depth of cut. Because the teeth of a jigsaw point upward, the good surface of a material should face down as it is cut.

### Parts of a Jigsaw

A typical jigsaw has a baseplate, a housing/handle, and a blade-locking mechanism, as shown in **Figure 5-25**. The baseplate on



**Figure 5-25 Parts of a Jigsaw**

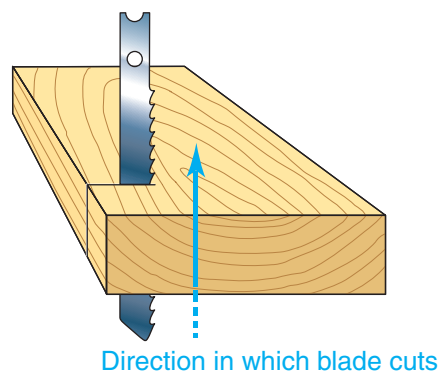
**Vertical Cutting** A jigsaw is a simple power tool. Few adjustments are required.

many models can be tilted to one side or the other. This allows the saw to make bevel cuts. Most jigsaws have a variable-speed control. This enables them to cut a wide variety of materials.

The blade of a jigsaw is often secured to the shaft by a clamp or mounting screw. In order to change the blade, older jigsaws require the use of a screwdriver or a hex key. Some jigsaws are fitted with a convenient blade-locking mechanism that does not require a special tool. The cutting motion of a jigsaw is shown in **Figure 5-26**.

### Types of Jigsaws

Two types of jigsaws are commonly used in residential construction. Top-handled models are the most common. The handle contains the trigger switch and is used to guide the tool. Some people prefer the second type: barrel-grip models. Instead of a handle, the user grasps the body of the saw to guide it. Because the hand is held low on the tool and directly behind the blade, some people find this model easier to control. Mechanically, however, the two types are the same.



**Figure 5-26 How a Jigsaw Cuts**

**Cutting Motion** The teeth of most jigsaw blades point upward, so the blade cuts only on the upstroke.

On some jigsaws, the blade moves straight up and down. On others, a setting on the tool allows the blade to move with a slight orbital motion as well. Jigsaws with an orbital setting cut much faster through wood. However, orbital motion is a disadvantage when cutting a material such as sheet metal. It causes the metal to vibrate and does not provide as smooth a cut.

## Using a Jigsaw

The blade and the specific cutting technique used with a jigsaw should be adapted to suit the material. The following techniques are commonly used when cutting wood. Safety tips are much the same as those for reciprocating saws (see the Job Safety feature on page 157).

**Straight and Irregular Cutting** Though jigsaws can make straight cuts with some accuracy, the tool excels at curved cuts. For either type of cutting, proceed as follows:

1. Mark a layout line on the wood. It must be dark enough to be seen beneath the fine layer of sawdust that will be created around the cutting line.
2. Hold the wood tightly against a work surface, or clamp it in place as in **Figure 5-27**. Make sure the area beneath the cutting line is unobstructed.



**Figure 5-27 Cutting a Curve**

**Clamping** When cutting small pieces of stock, clamps may have to be repositioned in order to complete a cut.  
*Which clamp had to be repositioned first?*

3. Rest the front edge of the baseplate on the wood. Start the saw and allow it to reach full speed.
4. Move the saw blade slowly into the wood. Do not force it. Use only enough pressure to keep the saw cutting at all times.
5. When the cut is complete, stop the saw. Let the blade come to a complete stop before lifting it away from the wood.

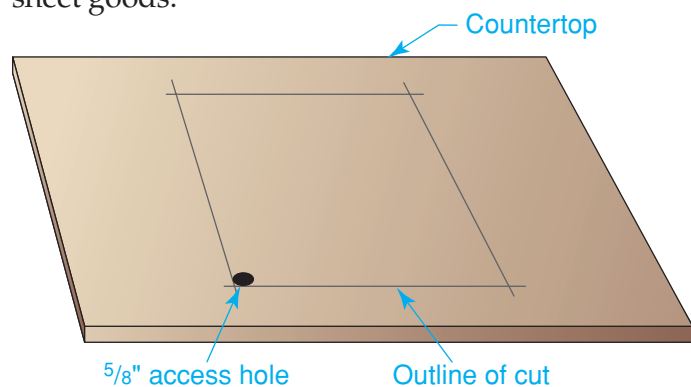
**Internal Cuts** Sometimes an internal cut must be made. An **internal cut** is the technique of cutting a large hole in a material without starting at the edge. This is often required prior to installing a sink in a countertop. A jigsaw is an easy way to make an internal cut. There are two ways to make internal cuts.

### Method #1

1. Mark the outline of the cut on the workpiece.
2. Using a  $\frac{5}{8}$ " spade bit on an electric drill, drill through the material just inside the layout line, as shown in **Figure 5-28**. This will be the starting point for the saw.
3. Proceed as in steps 2 through 5 in "Straight and Irregular Cutting."

### Method #2

A plunge cut is an internal cut that is made without first drilling a hole. This is sometimes done for convenience, particularly with thin stock such as plywood and other sheet goods.



**Figure 5-28 Internal Cut**

**Access Hole** Once an access hole has been cut, slip the blade into it and start cutting to the inside of the layout lines.

1. Mark the outline of the cut on the workpiece.
2. Choose a convenient starting place inside the waste stock. Tip the saw forward with the baseplate resting on the surface of the material and the top of the blade clear of the work surface, as in **Figure 5-29**.
3. Turn on the saw. When the blade reaches full speed, slowly lower the back of the saw until the blade begins to cut through the material. It is important to hold the saw firmly.
4. Continue cutting, using light pressure on the saw blade. When the blade cuts completely through the material, straighten the saw and cut normally.

**Bevel Cuts** The baseplate of a jigsaw can be adjusted from 0° to 45° for bevel cutting. A bevel cut made with a jigsaw will not be as straight or as smooth as a bevel cut made



**Figure 5-29 Plunge Cutting**

**Tip Up** Tip the saw up on the front of the baseplate, then turn it on and gradually lower the blade into the wood.

## Builder's Tip

**CHIP ELIMINATOR** When cutting plastic laminate, draw cutting lines on masking tape. The tape will prevent the blade from chipping the countertop surface.

with a table saw or circular saw. However, a jigsaw can make a bevel cut that follows a curved layout line. After adjusting the baseplate to the bevel angle, follow the instructions for straight cutting.



**Recall** Which jigsaw motion setting is best for cutting quickly through wood?

## Reciprocating Saws

*What is the risk of using a very long blade?*

A reciprocating saw has a straight blade with teeth along one edge. It has many of the characteristics of a jigsaw. It cuts with either a straight or an orbital motion. It can be used to make straight or curved cuts and often has variable-speed capability. Fitted with the appropriate blade, a reciprocating saw will cut metal, wood, plastic, and many other materials, as shown in **Figure 5-30** on page 156. A reciprocating saw is most commonly used in remodeling and demolition work where a smooth finished cut is not required. When more **precise** control is needed, a jigsaw is often used instead.

### Using a Reciprocating Saw

When operating a reciprocating saw, be sure to follow all safety rules. Be sure to wear proper eye protection to protect against dust, debris, and shards from snapped blades. Here are some general safety rules for this tool. These rules are slightly different from the rules for a jigsaw.



**Figure 5-30 A Reciprocating Saw**  
**Hand Position** The saw should be controlled with two hands. Hold the shoe (the baseplate) firmly against the material being cut.

A reciprocating saw is a powerful tool. It is designed to be held with two hands, as shown in Figure 5-30 above. One hand should be on the handle, where it controls the speed of the tool and provides leverage for cutting. The other hand should be placed near the nose of the tool, just behind the blade. The operator should hold the saw's baseplate or shoe firmly against the material being cut. Otherwise, the saw may vibrate excessively.

Because the saw can accept blades as long as 12" long, it is important to check the area behind and to either side of the cutting line before starting the saw. This will reduce the chance of cutting something accidentally. Many electrical wires and water pipes have been severed by a reciprocating saw that was used carelessly. Before cutting into walls during remodeling work, use a keyhole saw to cut a small access panel. This will enable

you to look into the wall cavity and locate hidden pipes, wires, or other obstructions. Avoid using a blade that is longer than necessary.

## Straight Blades

*Why do some blades have very small teeth?*

Straight blades with teeth on one edge are used in both jigsaws and reciprocating saws, as shown in Figure 5-31. The type and size of the blade should be matched to the saw as well as to the material being cut. They are made from a flat piece of steel that has teeth or abrasive grit on one edge.

### Choosing a Straight Blade

The main features of blades for jigsaws and reciprocating saws are essentially the same. However, reciprocating saw blades tend to be longer and wider than jigsaw blades.

**Shank** This is the end of the blade that is inserted into the saw. A shank made for one brand of saw may not fit another.

**Body** The body carries the teeth. It is made of various metals or combinations of metals that offer different cutting characteristics.

**Gullet** This is a pocket at the base of each tooth that helps to remove sawdust from the cut.



**Figure 5-31 Straight Blades**  
**Various Sizes** The wide blades are for reciprocating saws. The narrow blades are for jigsaws.

**Teeth** Teeth are made of steel that is sometimes hardened for greater durability. Teeth point upward, toward the saw. This helps to hold the workpiece against the saw's baseplate.

A blade body made of high-speed steel (HSS) is best for cutting ferrous metals such as steel and iron up to  $\frac{3}{8}$ " thick and nonferrous metals (brass, copper, and aluminum) up to  $\frac{1}{4}$ " thick. Blade bodies made with carbon steel will cut wood, plastics, and plastic laminates. Bimetal blades are versatile and durable, which makes them very popular in construction. They have flexible spring-steel bodies and hardened tool-steel teeth and are less likely to snap if they hit a nail. Bimetal blades can cut ferrous and nonferrous metals. However, they are also good for cutting wood and plastic. That makes them an especially good choice for reciprocating saw blades used in demolition work.

Blades are often classified by the number of teeth per inch (TPI). Wood-cutting blades usually range between 6 TPI and 12 TPI. Metal-cutting blades range between 12 TPI and 36 TPI. In general, jigsaw and reciprocating saw blades with fewer teeth cut fastest. Those blades with more teeth cut smoothest.



## JOB SAFETY

**JIGSAWS AND RECIPROCATING SAWS** Jigsaws and reciprocating saws operate in similar fashion. The following safety rules apply generally to both tools. Check the manufacturer's manual for any specific safety instructions.

- Select the correct blade for the work and properly secure it in the saw.
- Be certain the material to be cut is properly clamped.
- Before starting a cut, look under the workpiece to make sure there are no wires or other obstructions near the line of cut.
- Keep the cutting pressure constant, but if you meet resistance, do not force the cut.
- Hold the baseplate firmly against the workpiece when cutting.
- When finished, turn off the power switch and allow the saw to come to a stop before pulling the blade from the cut and putting the saw down.

 Go to [glencoe.com](http://glencoe.com) for this book's OLC for more on job safety.

## Section 5.4 Assessment



### After You Read: Self-Check

1. By what other names is the jigsaw sometimes known?
2. How much pressure should you use when cutting with the jigsaw?
3. What other power tool is required before using a jigsaw to make an internal cut?
4. You have finished using a reciprocating saw. What should you do before pulling the blade from the cut and setting the saw down?



### Academic Integration: English Language Arts

5. **Give Examples** Write a paragraph describing the two ways to make an internal cut using a jigsaw. Give at least two examples of situations requiring an internal cut.



Go to [glencoe.com](http://glencoe.com) for this book's OLC to check your answers.



# Review and Assessment

## Section

## 5.1

## Chapter Summary

Circular saws are used for crosscutting. The two basic types of circular saws are the contractor's saw and the worm-drive saw. Kickback can occur when a spinning blade hits something that stops it while under full power.

## Section

## 5.2

Table saws are used primarily for rip cuts. Tilting-arbor saws are commonly used on construction sites. The feed rate is the speed at which the stock is pushed through the saw blade.

## Section

## 5.3

Radial-arm saws can be used for crosscutting, ripping, dadoing, and combination cuts. Miter saws are used for quick crosscuts and accurate cuts on molding and trim. The three basic types include conventional miter saws, compound-miter saws, and sliding compound-miter saws.

## Section

## 5.4

Jigsaws are used for making curved, irregular, and internal cuts. Reciprocating saws are similar to jigsaws.

## Review Content Vocabulary and Academic Vocabulary

- Use each of these content vocabulary and academic vocabulary words in a sentence or diagram.

### Content Vocabulary

- crosscut (p. 128)
- kickback (p. 129)
- torque (p. 130)
- kerf (p. 132)
- miter cut (p. 136)
- bevel cut (p. 136)
- offcut (p. 141)
- rip cut (p. 142)
- feed rate (p. 142)
- compound miter saw (p. 147)
- internal cut (p. 154)

### Academic Vocabulary

- diameter (p. 128)
- precise (p. 155)

## Speak Like a Pro

### Technical Terms

- Work with a classmate to define the following terms used in the chapter: *nonferrous metals* (p. 128), *baseplate* (p. 129), *arbor* (p. 129), *sidewinder* (p. 129), *workpiece* (p. 135), *benchtop saws* (p. 138), *featherboard* (p. 143), *bowed* (p. 149), *dadoing* (p. 150).

## Review Key Concepts

- Describe the saws listed in this chapter.
- Summarize the safety rules for each type of power saw.
- Describe how kickback occurs on circular saws and table saws.
- Describe how to construct a rip cut with two types of saws.
- List two guidelines for maintaining power saws.

## Critical Thinking

- Analyze** Why is a thin-kerf blade best suited for cordless circular saws?
- Describe** Why are panels such as plywood and oriented-strand board difficult to cut? What can be done to ease this difficulty?

## Academic and Workplace Applications

### 21st Century Skills

- Organizing Resources** Tools that you might use to help you make common saw cuts include a framing square, a carpenter's pencil, a permanent marker, sawhorses, an extension cord, and clamps. Describe which of these tools you would use to make a crosscut with a circular saw. List your process in a step-by-step format. Your format can be visual, written, or a combination of both.

### STEM Engineering

- Blade Manufacturing** The life of a saw blade depends mostly on what is being cut, and how often it is used. Other factors, however, affect how long a saw blade will last. The rubbing of one object against another, which is known as friction, can cause heat buildup. Heat buildup can damage a blade. Research and find one way in which blade manufacturers have designed blades to resist heat buildup and avoid damage. List your discoveries in a two-paragraph report.

### 21st Century Skills

- Media Literacy Skills** Consult a wide variety of media sources to locate as many product advertisements as you can for the various types of power saws. Use the Internet, local newspapers, or magazines to find your advertisements. Examine the ads you

have found. Who is the intended audience for these ads? What features and benefits of the saw are brought to the attention of potential buyers? Construct a one-page chart or spreadsheet that compares pricing, features, benefits, and additional observations for at least three power saws.

### Standardized TEST Practice



### Multiple Choice

**Directions** Choose the phrase that best answers the question.

- Which phrase accurately describes an arbor hole?
  - the raised portion behind each tooth that supports it
  - the flat disk that serves as a base for the teeth
  - the place where the blade is mounted on the saw
  - the pocket in front of each tooth that helps remove sawdust during the cut
- What is the primary use of the table saw?
  - to make crosscuts
  - to rip stock to width
  - to make miter cuts
  - to make bevel cuts
- Which of the following is *not* one of the three types of miter saws?
  - conventional miter saw
  - compound miter saw
  - sliding miter saw
  - circular miter saw

### TEST-TAKING TIP

*When answering a multiple-choice question, do not linger on any one question. Mark your best guess and move on, returning later if you have enough time.*

\*These questions will help you practice for national certification assessment.