AGRICULTURAL

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Basic Chain Saw Safety and Use

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Chain saws have become an everyday tool for a wide variety of individuals. Once the tool of the professional logger, today more than 25 makes of saws are available in a wide variety of sizes and configurations. Homeowners use them to cut firewood and to do general tree trimming around their homes. Farmers find them useful for such jobs as clearing land, trimming trees and cutting firewood. Contractors use them for cutting large timbers, crossties and landscaping ties as well as land clearing.

However, in the hands of a careless, inexperienced or tired operator, the chain saw can be very hazardous. In 1991 the U.S. Consumer Product Safety Commission estimated that more than 44,000 people required hospital treatment for chain saw-related injuries. Most accidents were caused when the operator came in contact with a moving chain. Injuries from a chain saw are usually serious because of the jagged cut the chain leaves.

Shopping for a saw

The first, and possibly most important, step to safely operating a chain saw is to select a saw that fits your needs, is quiet, balanced and equipped with safety features (see the list below). It is important to remember that these safety features do not take the place of proper training, safe operating practices and common sense.

The U.S. Consumer Product Safety Commission (in accordance with American National Standards Institute Standard B175.1) classifies gasoline-powered chain saws into two groups based on engine displacement: those under 3.8 cubic inches (62.3 cubic centimeters) are intended primarily for consumer or homeowner use and may be called nonprofessional saws, while those saws with larger displacement are considered professional saws. There are different requirements for the two groups of saws. Similar classification and requirements have been established for electrically powered saws.

Kickback

One of the major differences between professional and consumer saws that consumer saws must be equipped with low-kickback chain (or safety chain) when they are purchased. These chains are required on all saws that have an engine smaller than 3.8 cubic inches. They are also available for larger saws and are

Modern Chain Saw Safety Features

Front hand guard — A bar in front of the top handle designed to stop a slipping hand from coming in contact with the chain.

Chain brake (gasoline only) — Designed to stop a moving chain in a fraction of a second if kickback occurs, reducing the chances of severe injury. May also function as a front hand guard.

Throttle trigger lockout — Prevents the accidental opening of the throttle. The throttle trigger is locked in the idling position when the lockout is not engaged by the proper hand grip on the handle.

Stop switch — Should be located so that it can be activated easily by your right thumb without losing your grip on the rear handle of the saw.

Rear hand guard — The lower part of the rear handle on the chain saw is designed to protect the hand from a broken or jumping chain.

Chain catcher — Found on the bottom of the saw engine as far forward as possible. It is designed to catch a broken or jumping chain.

Vibration damping — Rubber bushings between the handle and saw body or on the engine mountings help reduce the operator's exposure to vibration.

Muffler — Designed to decrease the noise level and direct hot exhaust gases away from the operator. This may be combined with the spark arrester.

Spark arrester — Keeps sparks from being ejected by the exhaust. The sparks occur when carbon deposits in the cylinder break lose and are ignited by the exhaust gases. Spark arresters are required in many areas.

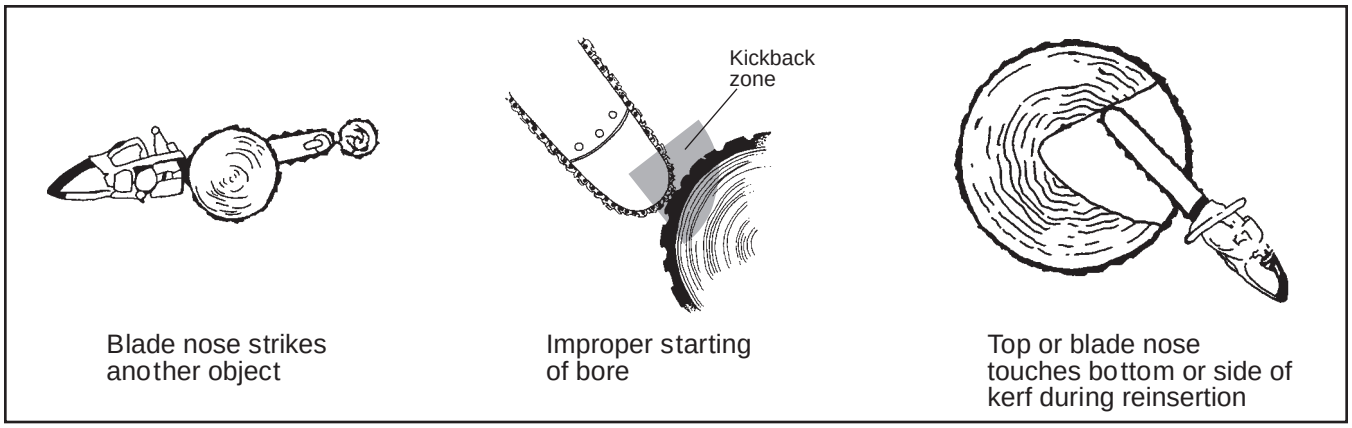

Figure 1. Avoid situations that can cause kickback.

highly recommended. Kickback occurs when the upper tip of the guide bar touches an object or when the wood closes in and pinches the saw chain in the cut (Figure 1). This contact may cause a lightning-fast reverse action of the guide bar back toward the operator. Results of kickback include severe upper body, neck, and facial lacerations or death. *Safety chain (and other features) minimize the dangers of kickback but do not eliminate the hazard***.**

Saw chain

The cutting chain is composed of drive links and cutters (Figure 2). The drive links ride in the groove on the saw bar and engage the sprocket on the motor. The cutters may be one of three styles: chipper, chisel or safety. Safety chain has features designed to reduce saw kickback such as a guard link (Figure 2). When purchasing replacement chain for an existing saw, note that all chain with a blue label meets the low kickback standard and can be used on any saw. Chain with a yellow label is recommended for professional use only. Some yellow-label chain can be used on certain saws less than 3.8 cubic inches. Remember, the larger, professional saws may not have additional safety features that might be desirable.

Guide bars

The guide bar on a saw is intended solely to provide a guide track for cutting chain. It is not intended to be used as a pry bar, lever or crow bar. Some guide bars are equipped with a sprocket nose that is designed to reduce friction as the chain passes around the nose of the saw. Since the tendency toward kickback increases as the radius of the guide bar nose increases, reducing the radius of the kickback zone can be accomplished using an asymmetric nose guide bars, or "banana bars," which are available from some manufacturers.

Next, you must decide whether a gasoline or electric chain saw is best for you. Consider the following points when selecting a saw.

Electric-powered saws

- Should be listed by Underwriters' Laboratories (UL).
- Require a nearby, convenient source of electricity.
- Need no fuel.
- Run quietly.
- Start easily and instantly.
- Are limited in guide bar length (usually under 14 inches).
- Can be used indoors.
- Have potential for shock hazard.
- Usually cost less.
- Vibrate less.
- Have no exhaust fumes.

Gasoline-powered saws:

- Can be used anywhere; not limited by electric cord.
- Use gasoline-oil mixture as fuel.
- Are relatively noisy and smokey.
- Require some effort to start.
- Are available in many engine and guide bar sizes.
- Are intended for outdoor use.
- Have potential for fire or burn hazard.

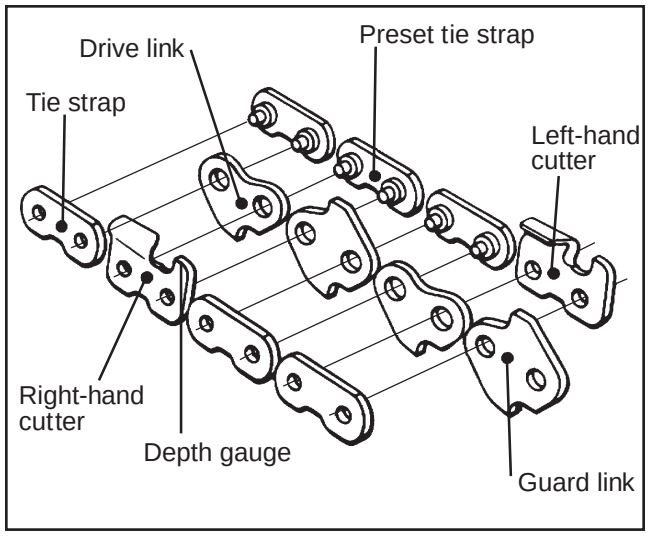

Figure 2. Parts of a cutting chain.

Table 1. Selecting a chain saw.

Type of saw	Guide bar length	Use
Mini or lightweight saws	8 to 14 inches	Light and occasional use for limbing, cutting small logs and felling small trees.
Midweight saws	14 to 20 inches	Frequent log cutting and felling of small to medium diameter trees.
Heavyweight saws	over 20 inches	Professional use — not recommended for consumers.

Next, consider the length of the guide bar. Match the bar size to the type of job you expect to do most often. Use Table 1 as a guide for selecting the right bar size for your needs. As a general rule, do not attempt to cut material that is larger than the guide bar of the saw.

If the guide bar is substantially longer than the material you are cutting, accidental contact between the guide bar tip and a branch, the ground, or another piece of wood could result in a serious kickback injury. If the guide bar is too short, you will have to bury the tip of the guide bar in the cut. Although most manufacturers indicate that a saw can cut a log twice as thick as the length of the guide bar, loosing sight of the tip of the guide bar can also result in serious kickback injuries.

You and the saw

Before operating the saw, read and study the operator's manual. Even if you are an experienced operator, it is good practice to review the manual occasionally. If you buy a used saw, ask the previous owner for the manual or obtain a copy from the saw manufacturer. Make sure that all safety features on the saw are functional.

Proper clothing and personal protective equipment is as important in reducing the risk of injury as knowing the specifications and operating parameters of the saw. Professional saw operators use this equipment regularly. Use the following list as a guide.

- **Clothing** should be well-fitted and free of dangling or ragged edges that could become entangled in either the saw or brush (see Figure 3).
- The specialized protective clothing that is available is intended for occasional saw operators as well as professionals. This includes **protective chaps or leggings that** cover the area from the groin to about 2 inches above the ankles. Many of these chaps wrap around the leg and protect the calf area as well. These chaps are made from synthetic fabrics that are designed to prevent the running saw chain from coming in contact with your legs. Remember, with some of the newer saws, the chain can be running at speeds of 4,000 to 5,000 feet per minute (45 to 55 miles per hour). Pants made from the same materials are also available.
- A properly fitted **hard hat** protects your head from serious head injury from falling limbs or other debris. Once these hats become cracked or discolored, they should be replaced.
- A pair of **safety goggles** or **safety eye glasses** with side shields to prevent injury from flying wood chips, sawdust, or twigs.
- A good pair of **ear muffs or ear plugs** to protect your ears from the 90+ decibel noise level of modern saws. The muffs or plugs will have a decibel noise reduction rating assigned to them, the higher the rating the better. Complete sets of hard hats, muffs, and eye shields are available from many suppliers.
- **Gloves** or **mittens** should be worn to protect your hands from abrasions, splinters and cuts. Special woodcutter's gloves have slip-resistant palms and use the same fabric on the backs of the gloves that is used in the chaps and leggings described above.
- A pair of **safety boots or shoes** with high tops will protect your ankles in case of accidental contact with the moving saw chain. Steel toes will help protect your feet from injury from falling limbs or logs as well as from accidental contact with the moving chain. Some shoes use the same fabric that is used in the protective chaps or

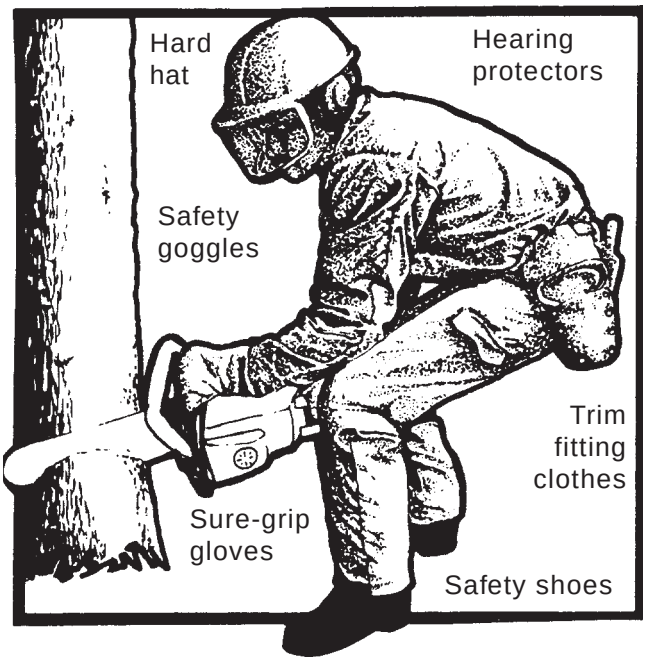

Figure 3. Proper clothing and equipment can reduce injury.

gloves. Your safety shoes or boots should have a nonskid sole.

Prepare the saw

A saw in good condition is safer and easier to operate than one that has been poorly maintained. Preventive maintenance will allow you to cut more wood quickly and safely. Maintenance includes sharp teeth, correct chain tension, proper lubrication, a properly tuned engine, and functioning safety equipment. Check your operator's manual for specific information.

A properly sharpened chain

If you notice that the saw is cutting crooked, or the cut shows fine sawdust instead of chips, or you find yourself pressing down hard to keep cutting, or smell burnt wood, your saw needs sharpening. Remember, the chain is designed to cut wood! Contact with dirt, rocks, or metal will quickly dull and nick the cutting teeth on the chain.

Follow the instructions outlined in your owner's manual when sharpening the chain. If you do your own sharpening, use the proper tools. Wear gloves or place a rag over the chain to protect your hands from the sharpened cutters. Chain manufacturers recommend that the depth gauge (Figure 2) be lowered every third filing. The difference in height between the top plate of the cutter and the top of the depth gauge determines how well the saw cuts.

Correct chain tension

To ensure good cutting action and a long chain life, check chain tension. If the chain is too loose, it will come off; if too tight, the chain will bind and overheat.

All chains stretch with use. Most of the stretch occurs during the first half hour of operation. Follow the manufacturer's recommendation on chain tension. Soak a new chain in SAE 30 oil overnight before installing. Check the guide bar and sprocket before placing a new chain on the saw. A worn sprocket can ruin a chain quickly. Most manufacturers recommend that a cold chain be tightened to where the chain tie straps hang away from the bar about 1/32 inch at the center of the bar. A warm chain should be adjusted to a 1/8-inch gap. Chains should be somewhat tighter on a guide bar fitted with a sprocket nose tip.

Proper lubrication

Lubrication will prolong a chain's useful life. In the summer, either SAE 30 or bar and chain oil can be used; in the winter, use SAE 10 oil or bar and chain oil. Do not use crankcase or other reclaimed oil. Chain and saw manufacturers have found that waste oils can corrode the oil pump and have reduced lubricating properties.

Saws that are fitted with automatic oilers are designed to match the capacity of the fuel tank with that of the oil tank so that when you run out of fuel, you haven't quite run out of oil. Saws that have manual oilers need to be checked more frequently.

If the bar-oiling mechanism is not operating properly, serious damage to the chain and bar can occur in a short time. If the chain smokes while operating, there is not enough lubrication. When the saw is started, make sure that the oil pump is functioning and that oil is lubricating the bar by holding the saw tip above a light-colored surface and accelerating the engine. Oil should spatter on the surface if the oiler is operating properly. If not, shut the saw off, remove the guide bar and check the chain oil discharge slot. Sometimes it becomes clogged with sawdust and must be cleaned out.

The guide bar can become damaged as a result of poor lubrication, improper chain tension, or prolonged cutting with a dull saw. Your owner's guide should be consulted for proper maintenance of the guide bar. Don't forget to check the drive sprocket as well. It can also become worn or damaged by improperly fitted chains.

Functioning safety equipment

Many new chain saws are equipped with a "chain brake" that is designed to stop the chain almost instantaneously. It is either manually activated or triggered by the inertial forces of the kickback itself. Refer to your owner's manual for the proper way to check the chain brake on your saw. Maintenance on this feature is critical and repairs should be done by properly trained service technicians.

If you can diagnose chain saw problems, you can save on repair bills and keep your saw working. See the **Chain Saw Troubleshooting Guide** below for explanations of symptoms and possible mechanical problems and corrections.

Tool kit

Every owner should have good tool kit to help ensure continued operation of the saw. The kit should contain the following:

- Wrenches to fit all the nuts and lugs on the saw.
- Screwdrivers.
- Round file and file guide for touching up the chain.
- Flat file and depth gauge tool to file the depth gauge.
- Spare spark plug.
- Owner's manual (wrapped in a plastic bag).
- Cleaning rags.

Most chain saw manufacturers make and sell multipurpose tools that function as a screwdriver,

Chain Saw Troubleshooting Guide

Symptom	Problem	Correction
Difficult or poor cutting	Chain dull	Sharpen chain
	Improperly sharpened chain	Check chain
	Chain installed backward	Turn chain around
	Improper chain tension	Correct chain tension
	Bar and chain aren't being lubricated	Fill oil tank, adjust oiler
	Damaged guide bar	Inspect guide bar
	Exhaust ports dirty	Clean muffler and exhaust ports
	Fuel filter dirty	Clean filter
	Improperly adjusted carburetor	Adjust carburetor
Oiler not working	Out of oil	Fill oil tank
	Oil hole plugged	Clean oil supply hole
	Oil strainer dirty	Clean oil strainer
	Oiler adjusted incorrectly	Adjust oiler
	Plugged vent on oil tank cap	Clean vent
Engine won't start	Switch off	Turn switch on
	Improper starting procedure	Follow correct procedure
	Fuel tank empty	Fill fuel tank
	Engine flooded	Clean spark plug
	Carburetor adjustment incorrect	Adjust carburetor
	Spark plug fouled	Clean or replace plug
Engine dies or accelerates poorly	Fuel tank empty	Fill fuel tank
	Air cleaner dirty	Clean air cleaner
	Spark plug fouled	Clean or replace plug
	Carburetor adjustment incorrect	Adjust carburetor
	Plugged vent of fuel tank cap	Clean vent on fuel tank cap

spark plug wrench and bar lug nut wrench. One of these tools, as well as a round file and file guide, can easily be carried to the woods in the pouch of your chain saw chaps. The other items can be left in the tool kit in the vehicle until needed.

In addition to the tool kit, the following items are useful to have:

- First aid kit.
- Multipurpose fire extinguisher.
- Sledge hammer and wedges.
- Sharp axe.
- Extra bar and chain oil.
- Extra cans of two-cycle motor oil to be mixed with gasoline for the engine.

The fuel for the chain saw engine should be mixed in accordance with the manufacturer's recommendations. Best results will be obtained by using oil that is intended for two-cycle motor use. Reclaimed or waste crankcase oil should not be used in the fuel mix. The fuel should be carried in a UL listed or F.M. [Factory Mutual] approved safety can.

Basic operating procedures

Refueling the engine

When refueling the engine, use a funnel or a flexible nozzle to avoid spilling fuel on the engine. Never refuel a hot engine; always allow the engine to cool before refueling. This also allows the operator to rest a while as well. Make sure that the area around your refueling site is free from combustible materials. Clean sawdust and debris away from the fuel and oil caps before opening so that the debris does not fall into the fuel or the oil tank.

Under **NO** circumstances should you smoke during fueling or refueling. Gasoline is a flammable liquid; a pint of gasoline has the explosive power of a stick of dynamite.

Each time you refuel the saw, refill the oil tank as well, check the chain tension, and make sure that all the nuts and bolts are tight.

Starting the engine

Place the saw on level ground in a area free from rocks. Make sure that the bar and chain are up out of the dirt. Make sure the saw is turned on! With one foot placed in the hand guard at the rear of the saw, grip the top handle of the saw firmly with one hand and use the other hand to pull the starting rope. Some small saws may not have room in the rear hand guard for your boot, so make sure that the saw is held firmly on the ground. *Never drop start the saw.* If you do this, you can hold the saw with only one hand and have no control whatsoever over the swinging action that the bar will make.

Planning

Before starting the saw, make sure that you know what you are going to do. Do not walk around revving the motor while you figure out your next move. Prior planning prevents poor performance on the part of both the saw and the sawyer! If you are felling a tree, figure out where the tree is going to fall before you start. What obstacles are in the way? Are there heavy branches in the crown? Is the wind blowing? Are there dead branches in the crown that might fall on you when you start to cut? (These are called widowmakers for a good reason.)

If you are limbing some standing trees, do not cut above the level of your shoulders, you simply do not have good control over the saw in that situation.

Plan escape routes where you can go if something goes wrong? These should be to the rear or the sides of the tree.

For more information about these and other safety issues, see MU publication G 1958, *Felling, Bucking and Limbing Trees.* Your operator's manual will also give guidelines on safe and efficient operation.

Notes

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