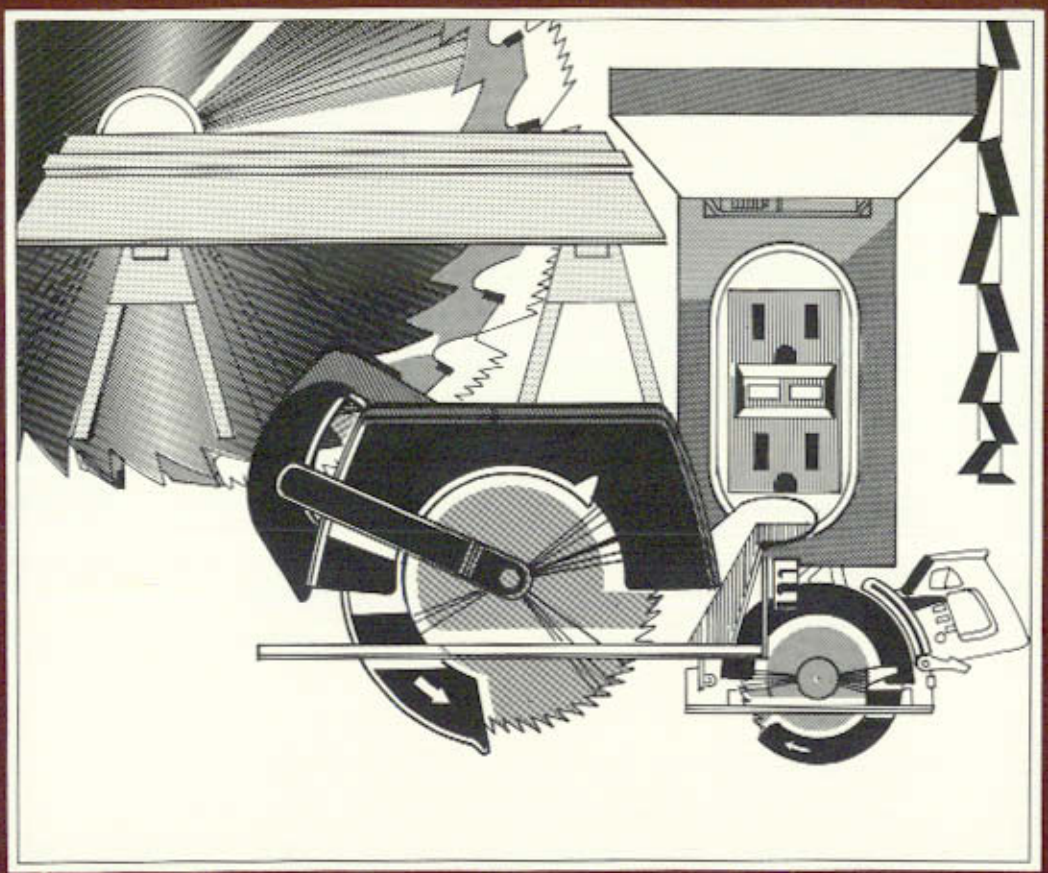
ELECTRIC CIRCULAR HANDSAWS



CONSTRUCTION SAFETY ASSOCIATION OF ONTARIO

ELECTRIC CIRCULAR HANDSAWS

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In the past, members of the public have used printed information that was outdated by subsequent improvements in knowledge and technology We therefore make the following statement for their protection in future

The information presented here was, to the best of our knowledge, current at time of printing and is intended for general application This publication is not a definitive guide to government regulations or to practices and procedures wholly applicable under every circumstance The appropriate regulations and statutes should be consulted Although the Construction Safety Association of Ontario cannot guarantee the accuracy of, nor assume liability for, the information presented here, we are pleased to answer individual requests for counselling and advice

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Contents

Introduction

Electric circular handsaws have become indispensable in the construction industry They save time and labour operate with precision and handle easily But like all electric tools they can be dangerous when not used properly

This manual provides guidelines for the proper maintenance and safe operation of electric circular handsaws Used extensively in training programs conducted by labour unions community colleges and construction management the manual has been revised in keeping with industry recommendations

In the time since this book was first published three companion volumes have been printed **Electric Drills Sabre Saws Planes and Routers** (M011), **Chain Saws in Construction** (M016) and **Table Saws** (M023) These manuals are intended to help labour and management save time effort and money by using portable electric tools safely and efficiently

The Electric Circular Handsaw

The two models most often used on construction sites are illustrated in Figures 1 and 2. The main difference between the two lies in the drive action. The worm drive saw in Figure 1 has gears arranged so that the blade runs parallel to the motor. The direct drive saw in Figure 2 has the blade at a right angle to the motor.

The first saw periodically requires special gear oil to keep the inner gears lubricated; this requirement is eliminated in the second, lighter model which has sealed bearings and gears.

For safe operation both saws must be inspected regularly for defects and operated and maintained in accordance with manufacturers' recommendations.

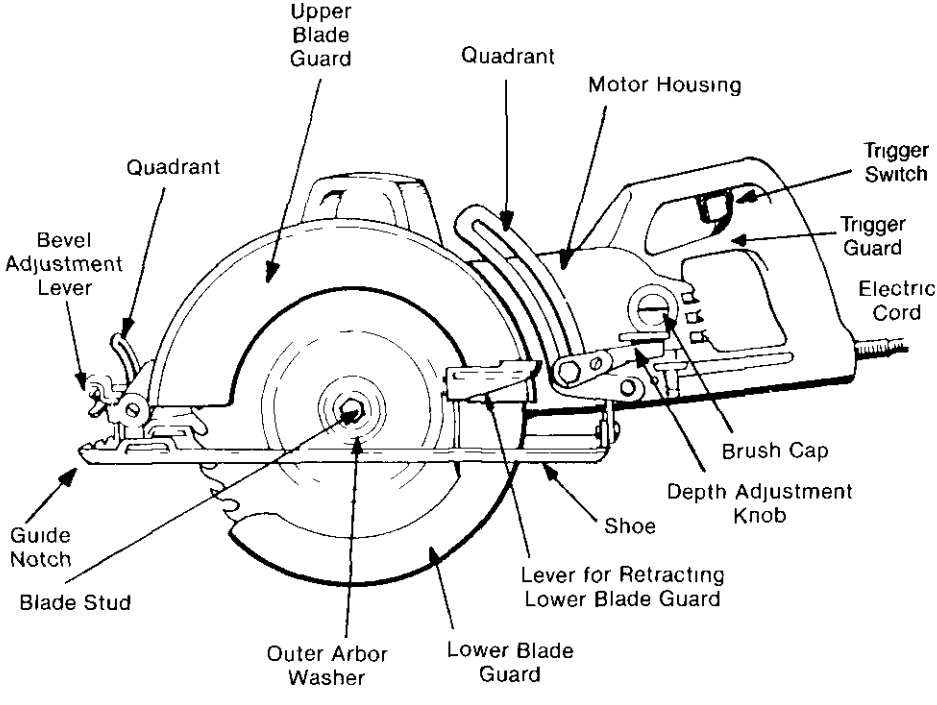


FIGURE 1

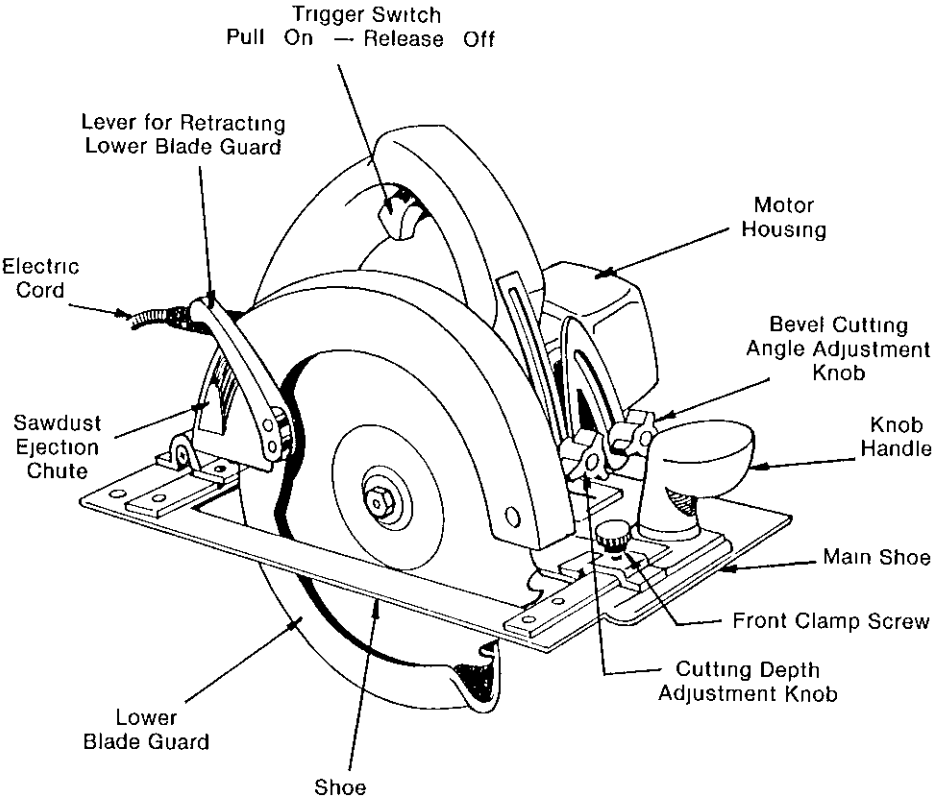

Trigger Switch
Pull On — Release Off
Lever for Retracting
Lower Blade Guard
Motor
Housing
Electric
Cord
Bevel Cutting
Angle Adjustment
Knob
Sawdust
Ejection
Chute
Knob
Handle
Main Shoe
Front Clamp Screw
Cutting Depth
Adjustment Knob
Lower
Blade Guard
Shoe

FIGURE 2

Safety Features

Recent changes in design have made circular saws safer to operate

Sawdust Ejection Chute
This feature prevents sawdust from collecting in front of the saw and obscuring the cutting line The operator can continue cutting without having to stop the saw and clear away sawdust

Clutch
Some worm drive saws are equipped with a clutch to prevent kickback Kickback occurs when a saw meets resistance and violently backs out of the work Governed by a friction washer on the outer arbor the clutch action allows the blade shaft to continue turning when the blade meets resistance Blade stud and washer can be adjusted to provide kickback protection for cutting different materials Check friction washers for wear

Brake
An electric brake on some circular saws stops the blade from coasting once the switch is released This greatly reduces the danger of accidental contact especially when an operator unaware of a sluggish or defective guard puts the saw down after completing a cut

Trigger Safety
On some light duty saws a latch prevents the operator from accidentally starting the motor The trigger on the inside of the handle cannot be pressed without first pressing a latch on the outside of the handle On heavy duty saws a bar under the trigger switch helps to prevent accidental starting

Double Insulation
Some electric handsaws are double insulated They do not have ground wires because the tools are encased in plastic that will not conduct electricity External metal parts are insulated from internal electrified parts Under normal conditions contact with the electrified components is almost impossible Never operate the saw if the case is cracked or broken or if the tool is damp or wet

Double insulated tools in Canada will bear the CSA (Canadian Standards Association) label or will have the CSA approval stamped in the plastic case In Ontario double insulated tools are accepted by Ministry of Labour inspectors

Precautions with Electrical Parts

Inspection
Saw cords extension cords and electrical fittings should be inspected daily for damage Check extension cords and outlets with a pocket circuit tester before using (Figure 3) Damaged equipment must be repaired or replaced before the saw is operated

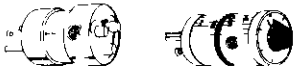


FIGURE 3

Grounding
Unless it is double insulated the electric saw must be grounded to protect the operator from electrical shock The saw must have an approved three wire cord with a three-pole receptacle that is properly grounded

NEVER CUT OFF OR BEND BACK the ground pin on a three prong plug to make it fit a two pole receptacle NEVER use a two prong cheater or adapter The three wire cord on grounded saws MUST NOT BE REPLACED with a two wire cord These practices are extremely dangerous and in most jurisdictions illegal

Power Source
The power source must be the same voltage and current (alternating or direct) called for on the nameplate of the saw Using higher voltage can cause serious injury to the operator as well as burn out to the tool Using lower voltage can also damage the saw motor

Before any electric tool is connected to a power source the switch on the tool must be OFF

Many contractors use portable generators to power electric tools Respect these generators as you would any Hydro supply

Electric Cords
Never carry an electric saw by the cord (Figure 4) or disconnect the plug by pulling or jerking on the cord Such practices can damage the cord and loosen or separate connections

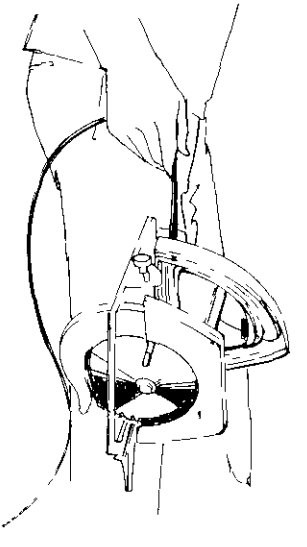


FIGURE 4

Keep cords out of water and oil If vehicles must pass over cords the cords should be put in a conduit or protected by planks (Figure 5)

Check cords frequently for such damage as kinks cuts and cracked or broken outerjackets

Cords should be fitted with dead front plugs These plugs are sealed and present less danger of shock or short circuit than open front plugs (Figure 7)

Make sure that the cord is clear of the saw when cutting Avoid setting the saw down on the cord after completing a cut

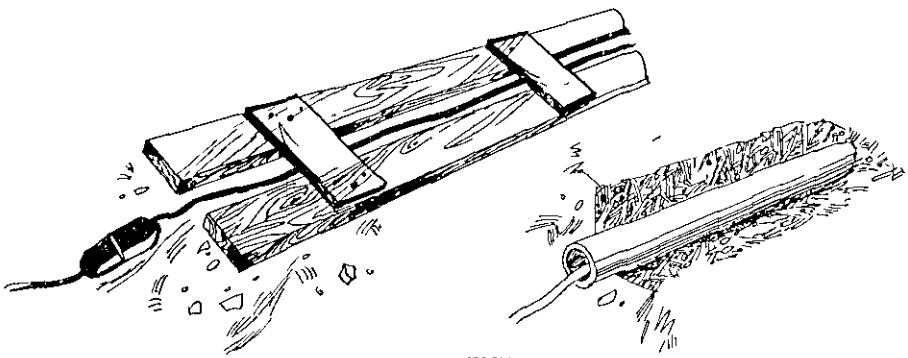


FIGURE 5

Any cord that feels more than comfortably warm to the touch should be checked by an electrician for overloading

Knotting extension cords to saw cords can cause short circuits and shocks Loop the cords (Figure 6) or use a twist lock plug

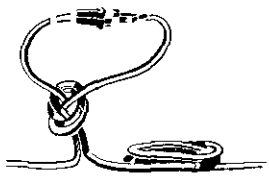


FIGURE 6

Extension cords should be of sufficient wire gauge for the voltage and amperage specified on the nameplate of the saw and for the length of run A general rule of thumb is to increase the gauge of an extension cord one wire size over its entire length for every 30 metres (100 feet) of cable used The practical limit to the overall length of extension cords is about 90 metres (300 feet) Even with larger gauge cables the line resistance in cords longer than 90 metres can cause a drop in voltage and overheating stalling or burn out of the saw motor See the Appendix for a table of extension cord gauges

Place cords so that they will not trip the operator or other personnel on the jobsite

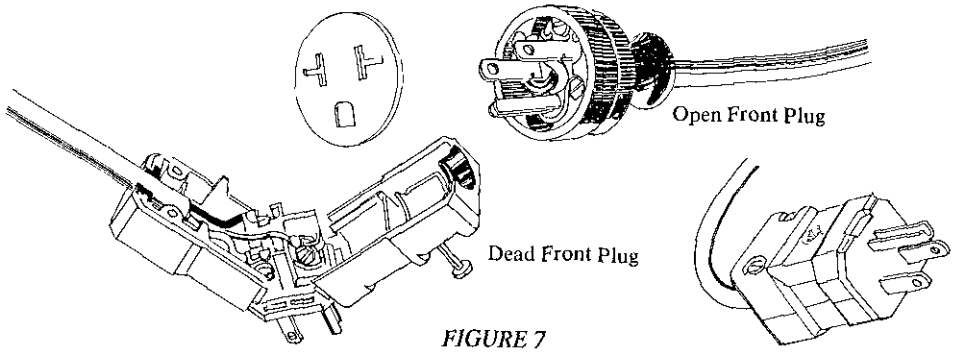


FIGURE 7

Switches

Contact points in the sealed switch operating the saw may wear out with use Never tamper with a broken switch Have it repaired by a qualified repair shop Never bypass the switch and operate the saw by connecting and disconnecting the cord If the saw jams it is practically impossible to turn it off by this method before the tool and material are damaged or the operator is injured

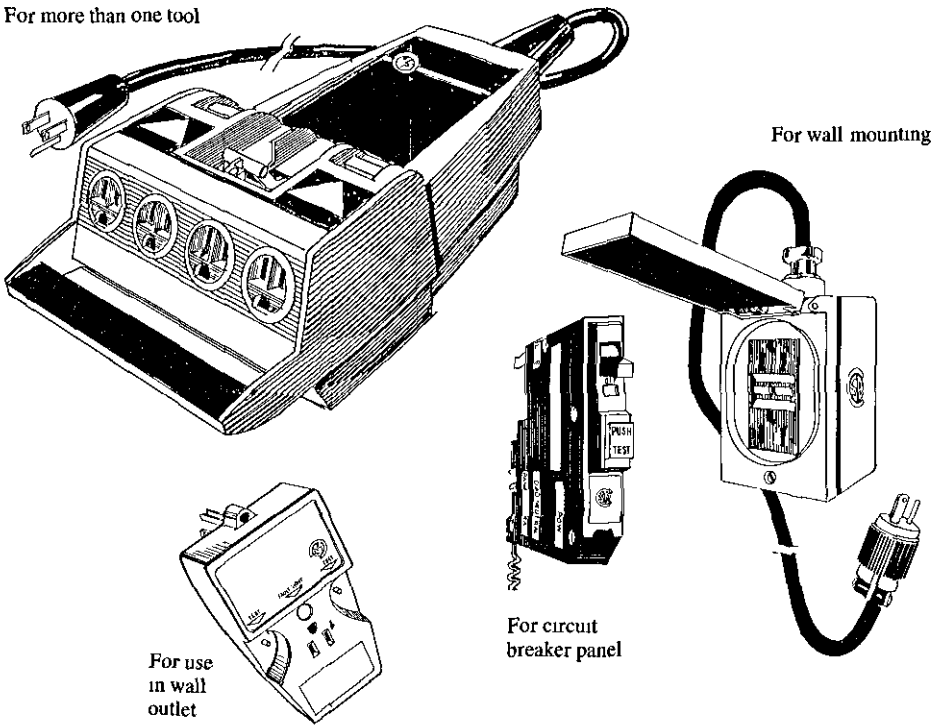
Shocks Sparks and Moisture

No matter how minor shocks from electric saws should always be reported to the supervisor The tool must not be used until it has been checked for ground fault Minor tingles or slight shocks can be a warning of fatal shocks later if the tool is not checked

Remember that a shock of only 20 to 40 milliamperes can be lethal That is only 20 to 40 **thousandths** of the one ampere required to keep a 100 watt lightbulb burning

The motors in electric saws are not normally spark proof Never use any electric tools in areas where there may be exposure to flammable gases liquids or explosives

A ground fault circuit interrupter (GFCI) must be used with any portable electric tool operated outdoors or in damp locations (Figure 8) In fact a GFCI is advisable for use with electric tools under all conditions This fast acting device detects any current leaking to ground from the tool and quickly cuts off electricity before damage or injury can occur GFCI s are activated by current leakage of 5 milliamperes – well below the 20 to 40 milliamperes that can be *fatal*



GROUND FAULT CIRCUIT INTERRUPTERS

FIGURE 8

Precautions with Mechanical Parts

Blades

Blades should be sharpened or changed frequently to prolong saw life increase production and reduce operator fatigue The sides of the teeth on a dull or abused blade will turn blue from overheating Such blades should be discarded or reconditioned

Before changing or adjusting blades disconnect the saw from the power source

Take care to choose the right blade for the job Blades are available in a variety of styles and tooth sizes Combination blades (rip and crosscut) are the most widely used

Ensure that arbor diameter and blade diameter are proper for the saw

Because all job lumber is not new make sure that the material is clean and free of nails This precaution not only prolongs blade life but may also save the operator from serious injury

Take special care to ensure that blades are installed in the proper rotational direction (Figure 9) Remember that electric circular handsaws cut with an upward motion The teeth visible between the upper and lower guard should be pointing toward the front of the saw Most models have a directional arrow on both blade and guard to serve as a guide

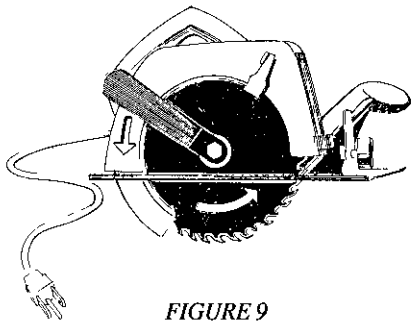


FIGURE 9

Blade Guards

Never operate an electric saw with the lower guard tied or wedged open The saw may kick back and cut the operator or another worker may pick up the saw not knowing that the guard is pinned back and consequently injure himself Accidents have also occurred when operators forget that the blade is exposed and put the saw on the floor The blade still in motion forces the saw to move cutting anything in its path (Figure 10)

Make sure that the lower guard returns to its proper position after completing a cut Never operate a saw with a defective retracting lever (Figure 11) On most saws the lower guard is spring-loaded and correct tension in the spring will automatically close the guard however a spring weakened by use and wear can allow the guard to remain open after cutting This creates a potential for injury if the operator inadvertently rests a still turning blade against his leg after finishing a cut (Figure 12) Always maintain complete control of the saw until the blade stops turning

Case History

A carpenter cutting studs for a partition had wedged open the telescoping guard on his electric saw Another worker started to use the saw without realizing that the guard was wedged in the open position After finishing a cut he put the saw down on the plywood subfloor The blade was still in motion and forced the saw across his foot severing one toe and badly injuring the others

Before operating an unfamiliar saw always make sure that the blade guard is working properly Never tamper with blade guards

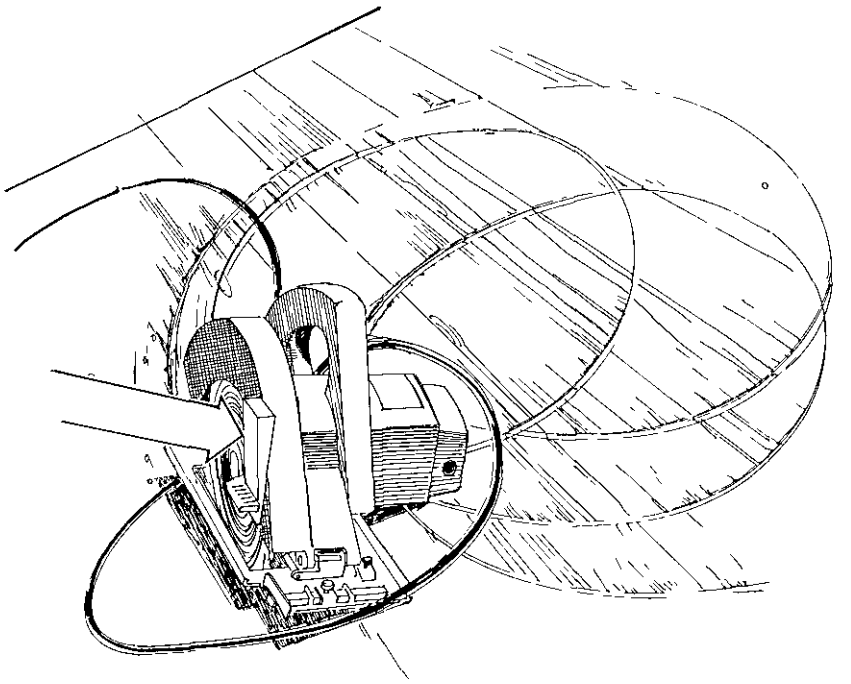


FIGURE 10

Case History

A carpenter was using a saw with a broken retracting lever to cut the bird s mouth (notch) on rafters Because the retracting lever was broken the carpenter had to reach under the saw to open the guard After several cuts the guard had moved up without his noticing it When he reached under the saw the rotating blade cut into the palm of his hand severing critical nerves and tendons

This injury could have been prevented by repairing the defective lever When the lower guard does not open freely use the retracting lever to draw it back Never reach under a running saw

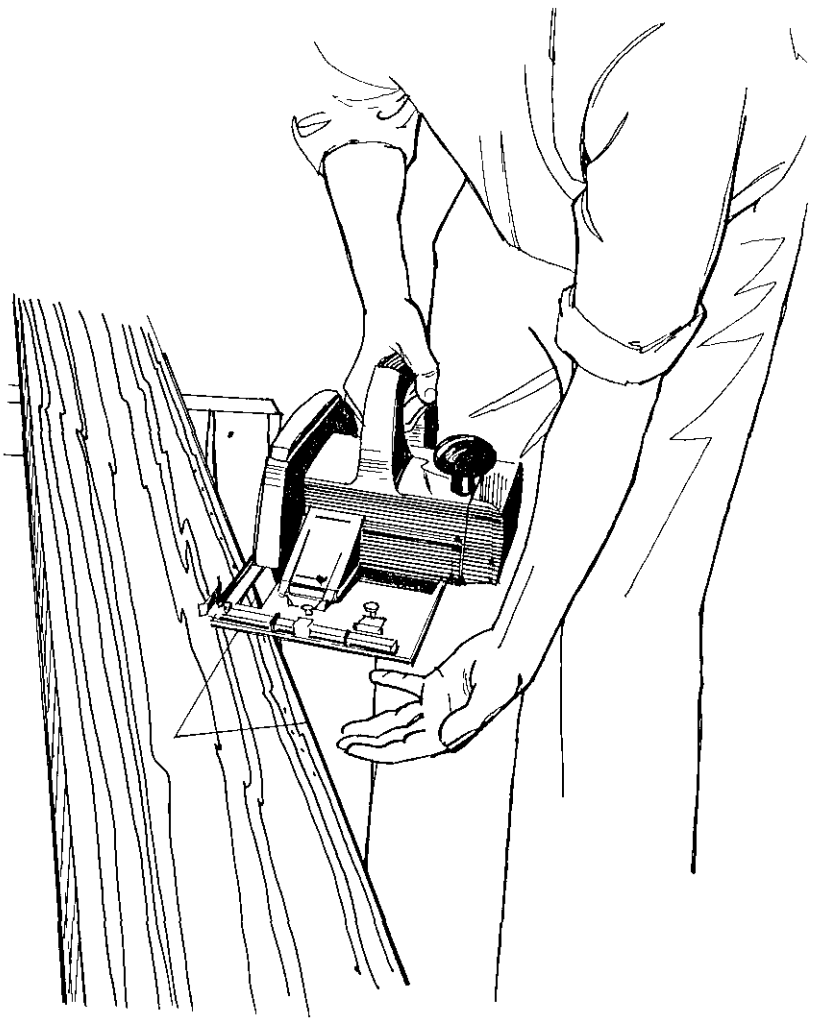


FIGURE 11

Case History

A worker was installing braces in an attic between prefabricated trusses while standing on bottom chords Even though he knew that the spring closing the guard on his saw was weak he used the saw anyway He was cutting pieces of lumber in a bending position After completing a cut he rested the saw on his knee without realizing that the blade guard had failed to close The exposed blade cut his leg

This injury could have been prevented by replacing the defective spring on the guard It would have also been safer and easier for the worker to use an ordinary handsaw in the first place

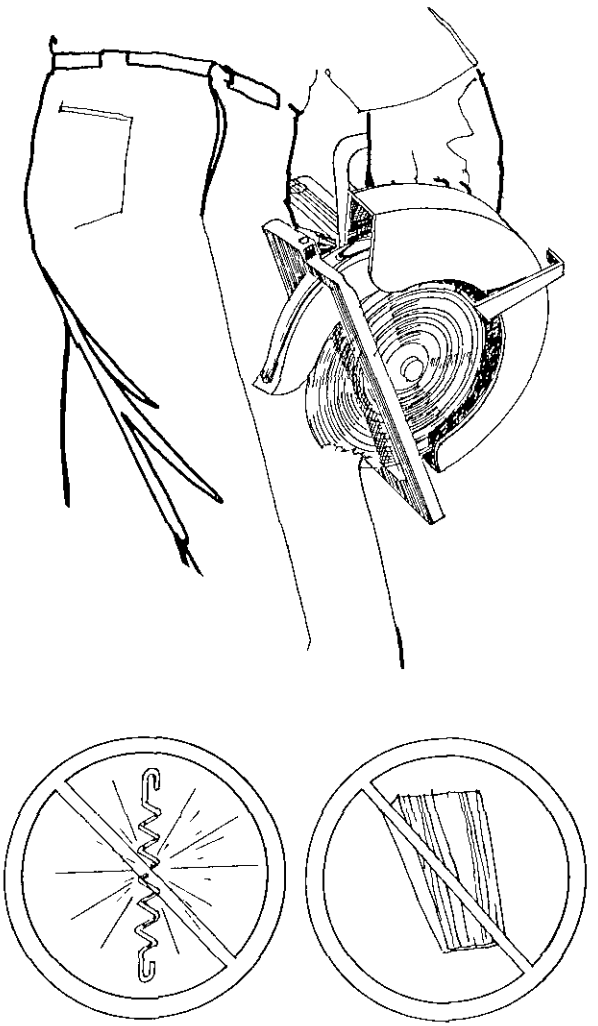


FIGURE 12

Electric saws are not always used in the upright position For instance they can be used upside down on ceilings sideways on siding or joists and vertically on stud walls (Figure 13) In any of these positions sawdust especially damp sawdust, can collect in the guard housing and make the lower guard stay open after cutting

Wherever possible avoid using the saw upside down When the saw must be used that way periodically remove it from the cut turn it right side up and clean out the sawdust either by shaking the saw or by running the motor freely Often it is faster less tiring and safer to use an ordinary handsaw in overhead or tight spots

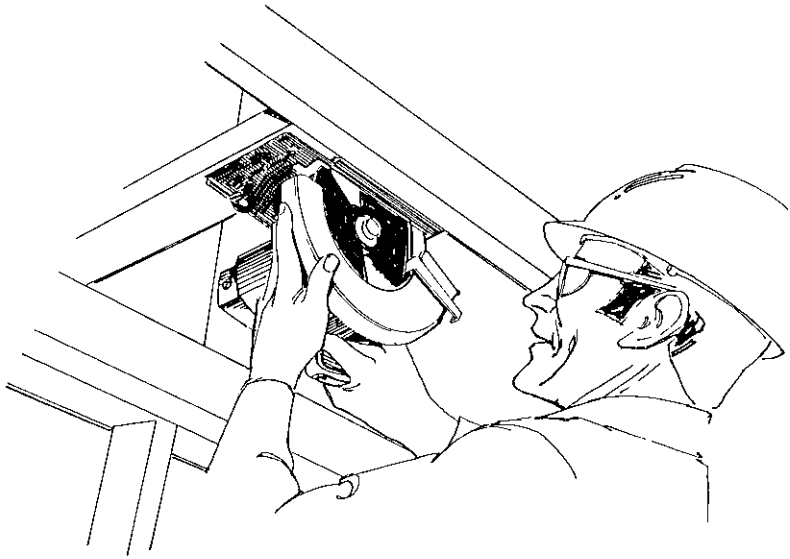


FIGURE 13

Choosing the Proper Blade

To prevent injuries to workers and damage to equipment saw operators must understand the different designs and uses of blades Blades unsuited for the job can be as hazardous as dull blades For instance a saw fitted with the wrong blade for the job can run hot so quickly that blade tension changes and creates a wobbly motion The saw may kick back dangerously before the operator can switch it off

Resharpened blades can be substantially reduced in diameter – for instance from nine to eight inches Make sure that blade diameter and arbor diameter are proper for the saw

Know how to choose the right blade for the job The types of blade commonly used in the construction industry are illustrated in Figure 14 and described below

Crosscut Blade
The bevelled sharp pointed teeth are designed to cut the crossgrain in wood Size and bevel of the teeth are important factors in cutting different woods Softwood requires bigger teeth to carry off the sawdust Hardwood requires fine teeth with many cutting edges Note the different angles and edges needed for cutting hardwood and softwood

Ripsaw Blade
The flat sharp teeth are designed to cut the long grain in wood They are neither bevelled nor needle pointed Needle pointed teeth would get clogged and the blade would become overheated Never use a ripsaw blade for crosscutting or for cutting plywood The material can jam and overheat the blade or splinter in long slivers that may seriously injure the operator

Combination Blade
This blade combines features of the crosscut and ripsaw blades It can be used for crosscutting and ripping or for cutting plywood Carpenters on construction sites prefer the combination blade for rough woodwork such as stud walls and formwork because they don t have to change blades The teeth are alternately bevelled and have a straight front The heel of each tooth is not lower than the heel of the tooth on either side of it

Standard Combination or Mitre Blade
This type is mainly used by trim carpenters It includes teeth for crosscutting raker teeth for ripping and deep gullets for carrying off sawdust The blade can be used for cutting both hardwood and softwood and for mitring

Carbide Tipped Blades
Some of the blades described above are also available with carbide tipped teeth The blades stay sharp longer but are more expensive to purchase and to sharpen than ordinary blades Take special care not to strike metal when using a carbide tipped blade The carbide tips can come loose and fly off ruining the blade and injuring the operator Inspect the blades regularly for cracked or missing tips

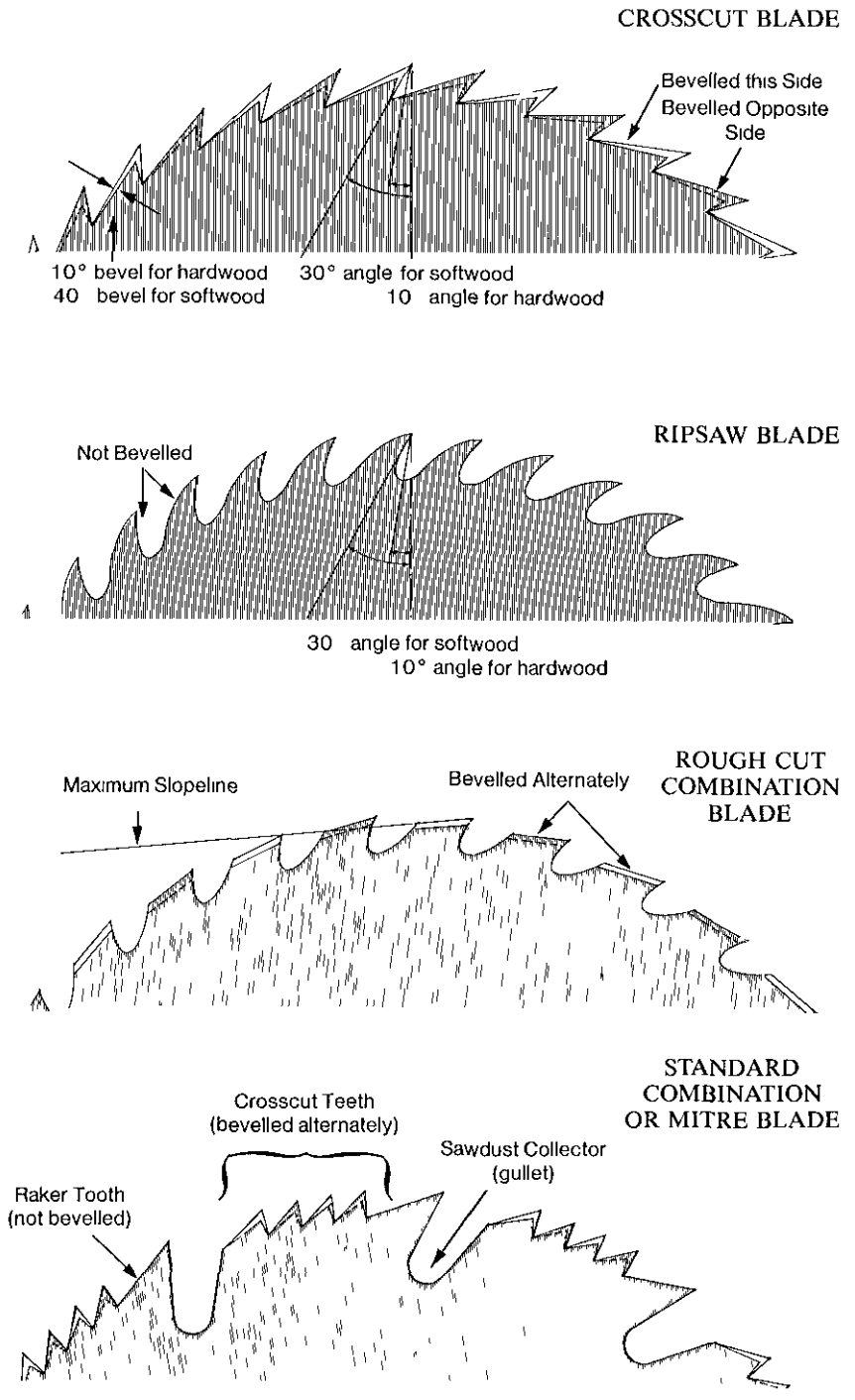

CROSSCUT BLADE
Bevelled this Side
Bevelled Opposite Side
10° bevel for hardwood
40 bevel for softwood
30° angle for softwood
10 angle for hardwood
RIPSAW BLADE
Not Bevelled
30 angle for softwood
10° angle for hardwood
ROUGH CUT COMBINATION BLADE
Maximum Slopeline
Bevelled Alternately
STANDARD COMBINATION OR MITRE BLADE
Crosscut Teeth
(bevelled alternately)
Sawdust Collector
(gullet)
Raker Tooth
(not bevelled)

FIGURE 14

Changing, Adjusting and Setting Blades

Changing

When changing blades take the following precautions

1 Disconnect the saw from the power source
2 Place the saw blade on a piece of scrap lumber and press down until the teeth dig into the wood (Figure 15) This prevents the blade from turning when the locking nut is loosened or tightened Some machines are provided with a mechanical locking device
3 Make sure that keys and adjusting wrenches are removed before operating the saw

Adjusting

Proper adjustment of cutting depth holds blade friction to a minimum removes sawdust from the cut efficiently and results in cool cutting

The blade should project the depth of one full tooth below the material to be cut (Figure 16) When using carbide-tipped blades or mitre blades let only one half of a tooth project below the material

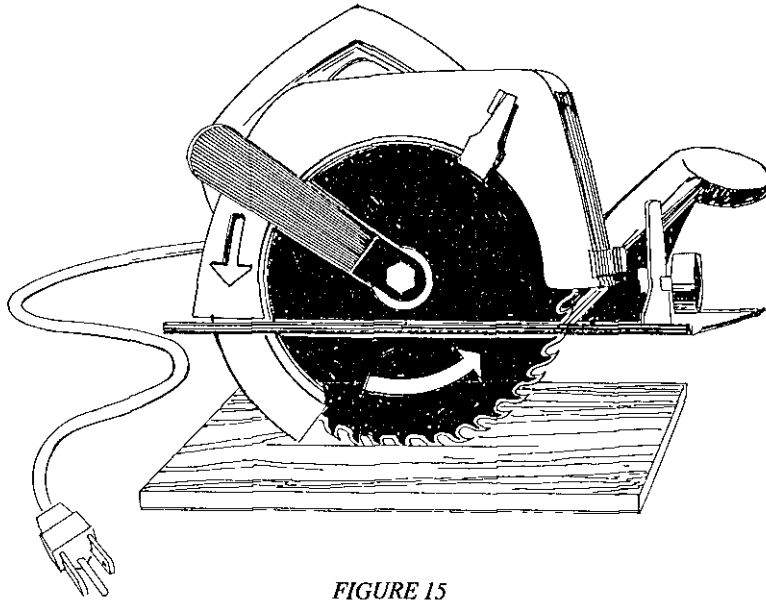


FIGURE 15

Setting

If the blade is to run freely in the kerf (saw cut) teeth must be set properly that is bent alternately (Figure 17) The setting of teeth differs from one type of blade to another Finer toothed blades require less set than rougher toothed blades Generally teeth should be alternately bent 1/2 times the thickness of the blade

Sharp blades with properly set teeth will reduce the chance of the wood binding They will also prevent the saw from overheating and kicking back

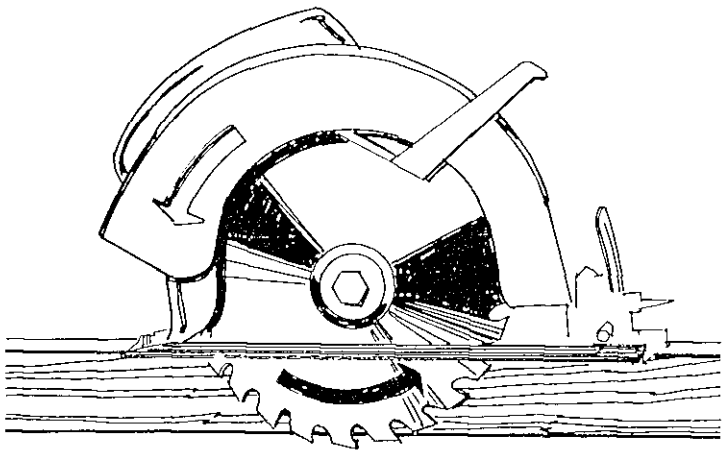


FIGURE 16

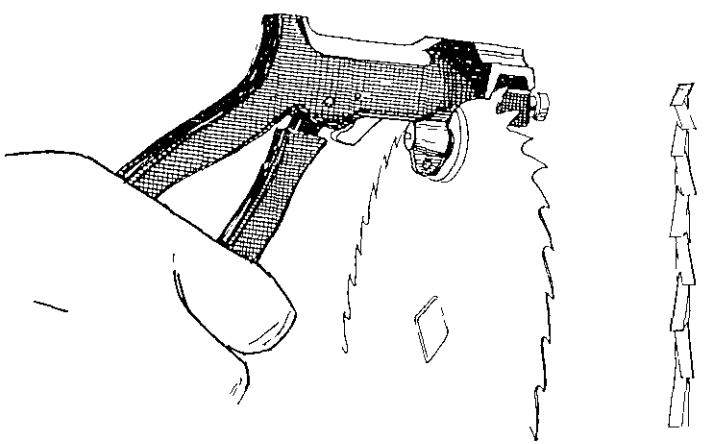


FIGURE 17

Cutting

Proper Supports for Cutting
Place the material to be cut on a rigid support such as a bench or two or more sawhorses (Figure 18) Make sure that the blade will clear the supporting surface The wide part of the saw shoe should rest on the supported side of the cut if possible

Plywood is one of the most difficult materials to cut with any type of saw The overall size of the sheet and the internal stresses released by cutting are the main causes of difficulty Large sheets should be supported in at least three places with one support next to the cut

Short pieces of material should not be held by hand Use some form of clamping to hold the material down when cutting it (Figure 19)

NEVER use your leg as a work bench Too many operators have ended up seriously injured by this careless act

Cutting
The material to be cut should be placed with its good side *down* if possible Because the blade cuts upward into the material any splintering will be on the side which is uppermost

Use just enough force to let the blade cut without labouring Hardness and toughness can vary in the same piece of material and a knotty or wet section can put a heavier load on the saw When this happens reduce pressure to keep the speed of the blade constant Forcing the saw beyond its capacity will result in rough and inaccurate cuts It will also overheat the motor and the saw blade

Take the saw to the material Never place the saw in a fixed upside-down position and feed material into it Use a table saw instead

If the cut gets off line don t force the saw back onto line Withdraw the blade and either start over on the same line or begin on a new line

If cutting right handed keep the cord on that side of your body Stand to one side of the cutting line NEVER REACH UNDER THE MATERIAL BEING CU T

Remember that electric circular handsaws weigh between 4 and 14 kg (9 and 30 lbs) depending on make size and type Avoid overextending your body and be ready to support the full weight of the saw at the completion of a cut Maintain a firm well balanced stance particularly when working on uneven footing

Binding
Plywood wet lumber and lumber with a twisted grain tend to tighten around a blade and may cause kickbacks Kickbacks occur when an electric handsaw stalls suddenly and jerks back toward the operator The momentarily exposed blade may cause severe injury

Case History

A carpenter was ripping a 1 2 m (4′) length of 19 mm × 140 mm (1″ × 6″) lumber to make stakes He rested one end of the board on the ground held the other end in his left hand and started to cut A passing worker tripped over the extension cord and pulled the saw into the carpenter s leg The blade cut open his thigh

This injury could have been prevented by using proper support for cutting and keeping the extension cord clear of passing traffic

Case History

A carpenter crosscutting a piece of 38 mm × 89 mm (2″ × 4″) lumber was holding the short end in his left hand He was trying by force to equalize the weight of the short end in his hand against the weight of the long end resting on the ground Ice on the lumber caused the saw to slide forward out of control The blade jammed and the saw kicked back sideways cutting off the carpenter s left thumb

Placing the long end of the lumber on a proper support such as a sawhorse could have prevented this injury Always keep your free hand on the long side of the lumber and clear of the saw

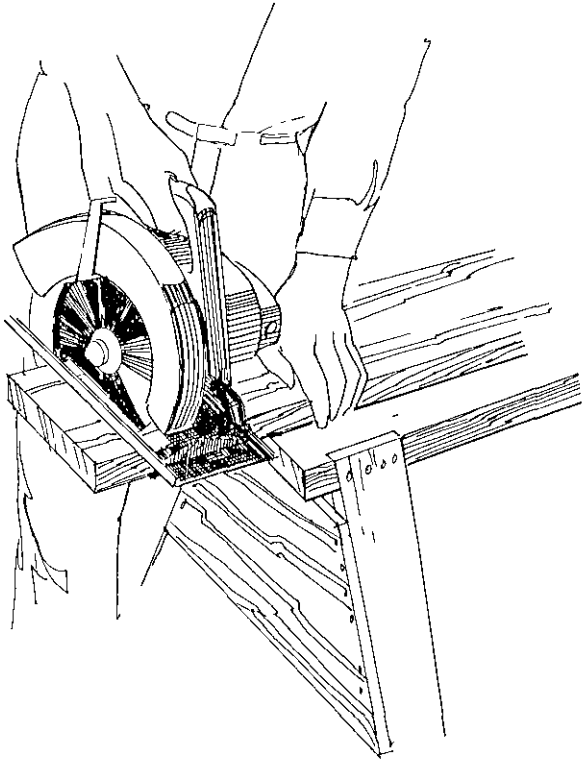


FIGURE 18

Case History

A carpenter working on top of a form asked his young helper on the ground floor to cut 25 mm (1″) off a 15 cm (6″) piece of 38 mm × 89 mm (2″ × 4″) lumber The helper tried to make the cut with an electric circular saw He lost his grip on the short piece of wood The saw jammed and kicked back severing part of his thumb

Short pieces of lumber should always be clamped down to ensure safe accurate cutting Keep your hands at least 15 cm (6″) away from the sawblade Inexperienced workers should always be taught to operate a circular saw safely

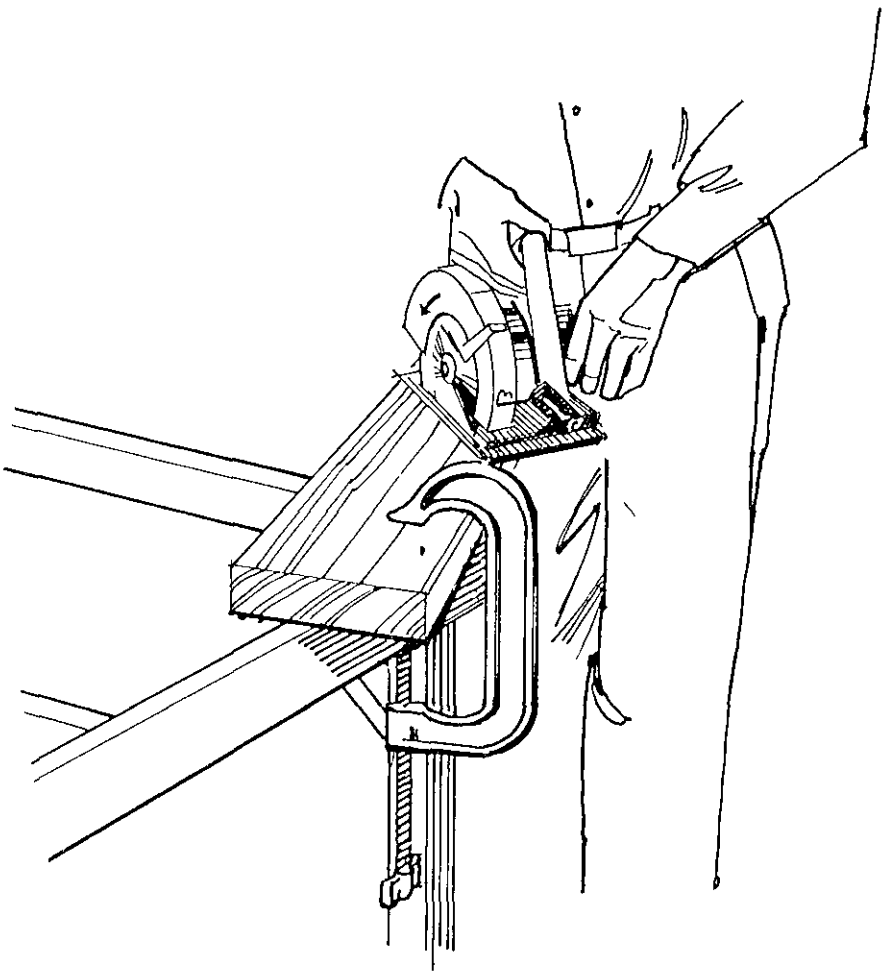


FIGURE 19

At the first sign of pinching or binding take the following precautions

1 Stop cutting and switch off the saw
2 When the blade stops rotating remove it from the cut
3 Place a small wooden wedge in the end of the cut to widen it and release the pressure (Figure 20)
4 Resume cutting

Pocket Cutting (Figure 21)

Disconnect the saw from the power source and adjust the blade for the desired depth of cut then plug in the saw tilt it forward and rest the front of the shoe on the material to be cut Use the retracting lever to draw the lower guard back into the upright position Lower the saw until the front teeth are almost touching the line Release the guard and let it rest on the wood in this position it will open freely Switch on the saw

Particular attention should be paid to the next steps Lower the saw until the front teeth start cutting the wood Keep the saw tilted forward and push it down and forward with even pressure Otherwise the back teeth will bite into the wood and cause the saw to kick back dangerously Push the saw forward gradually lowering it until the shoe rests flat on the material

When the cut is complete let the blade stop rotating before withdrawing it from the cut

On each new pocket cut repeat the same procedures NEVER TIE 1HE LOWER GUARD IN THE OPEN POSITION

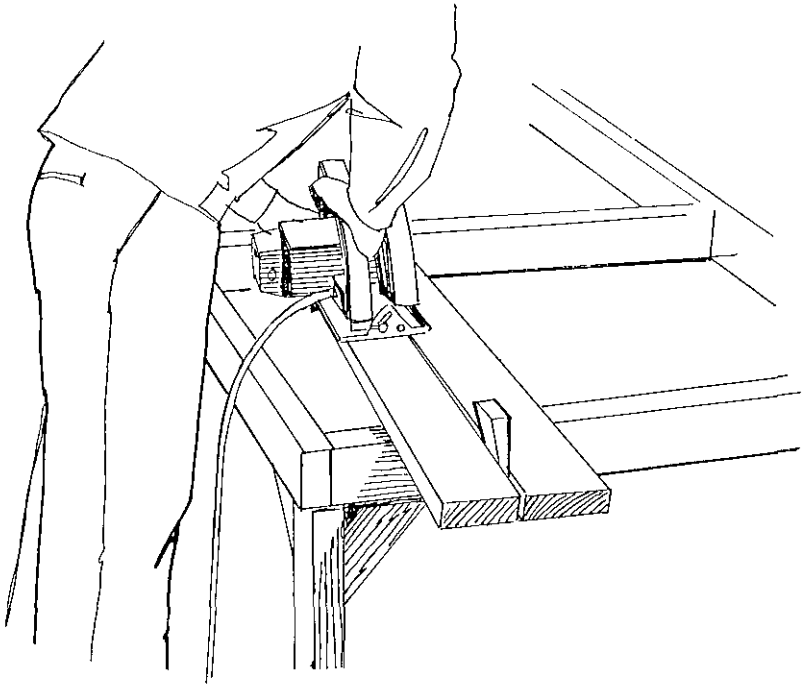
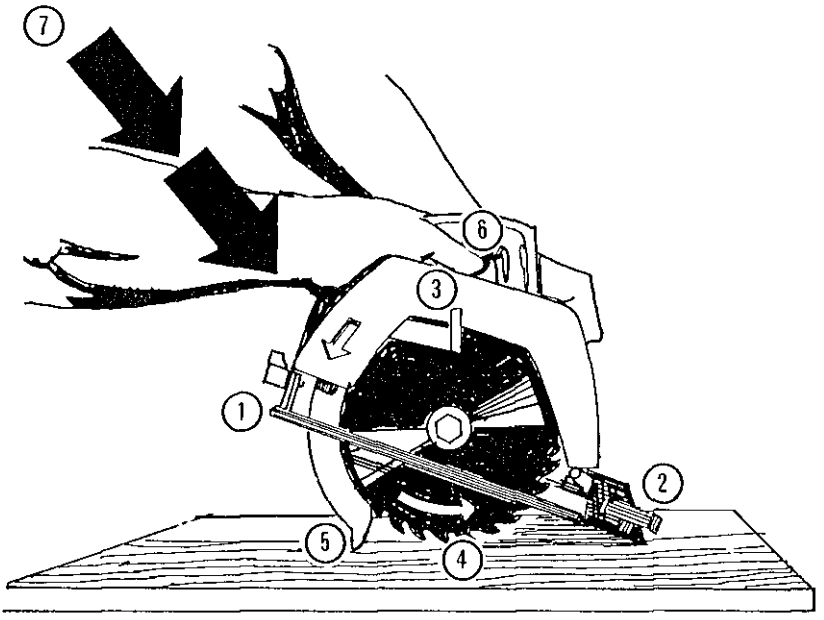


FIGURE 20



POCKET CUTTING

1 Tilt saw forward
2 Rest front of shoe on wood
3 Retract lower guard
4 Lower saw until front teeth almost touch wood
5 Release guard to rest on wood
6 Switch on the saw
7 Keep saw tilted forward and push it down and forward with even pressure gradually lowering it until shoe rests flat on wood

FIGURE 21

Sawing Large Panels

Large panels should be supported in at least three places with one support next to the cut

To maintain accuracy on long cuts nail or clamp a straight edge to the support side to act as a fence (Figure 22) Hold the shoe of the saw firmly against the fence Make sure that all parts of the saw clear the fence before proceeding

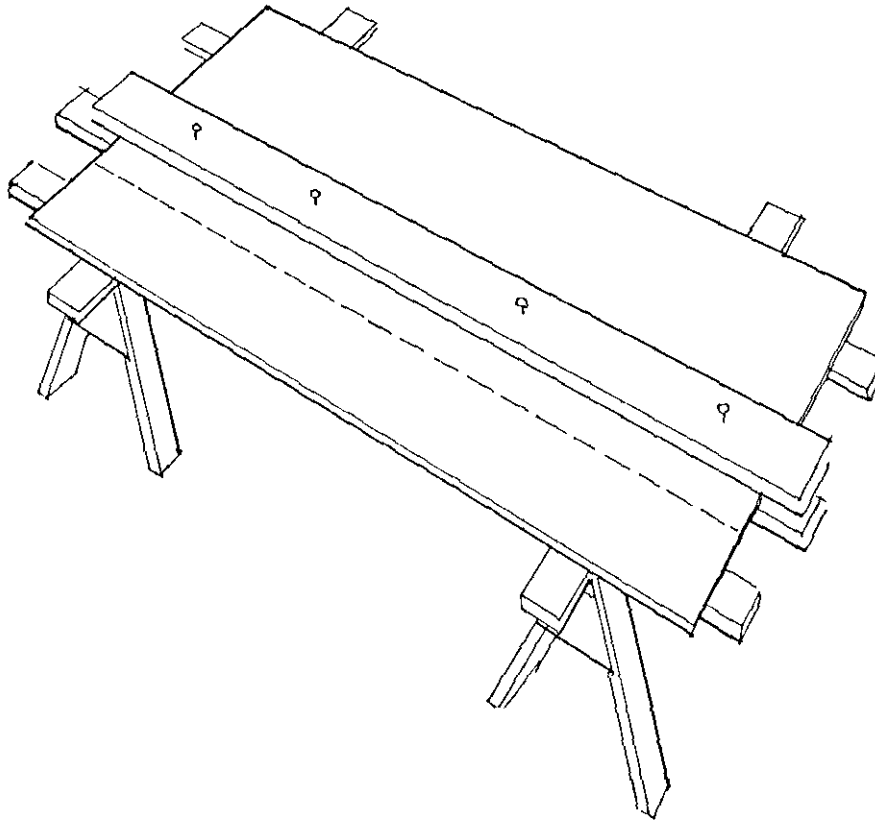


FIGURE 22

Protective Clothing and Equipment

Clothing
Clothing especially sleeve and pant cuffs should be snug-fitting to prevent entanglement and tripping

When operating electric tools do not wear finger rings or wristwatches Neck chains are also hazardous and must be worn under clothing so that they don t hang out

Head Protection
At all times on the job construction workers must wear a Canadian Standards Association (CSA) certified Class B hard hat

Foot Protection
At all times on the job construction workers must wear CSA certified Grade 1 footwear or CSA certified footwear with heavy duty toe and sole protection

Workers purchasing new work boots should obtain CSA certified Grade 1 footwear Such boots bear a green triangular patch stamped with the registered trademark of the Canadian Standards Association on the outside and a rectangular green label on the inside

Respiratory Protection
A dust mask usually provides adequate respiratory protection for cutting wood For cutting hazardous substances such as asbestos board however more sophisticated respiratory protective equipment is required and special precautions must be taken to protect both the operator and those working in the vicinity

Hearing Protection
Workers operating electric tools in confined spaces or for prolonged periods of time should wear appropriate hearing protection

Hearing protection is available in three general types
- disposable earplugs (made of pliable material one size fits all but can be used once only)
- permanent earplugs (must be fitted to provide a good seal but can be washed and reused)
- earmuffs (when properly fitted and worn these generally provide more protection than earplugs)

Eye Protection
Since sawdust is composed of millions of small slivers which can penetrate the eye proper eye protection is required for all saw operators The minimum eye protection recommended is spectacles with side shields The optimum eye protection recommended is eyecup goggles or cover goggles (for dust and splash) worn with face shields to provide eye and face protection

References
For further information refer to these publications from the Construction Safety Association of Ontario
- The Selection of Eye Protection for the Construction Industry (DS002)
- Hearing Protection for the Construction Industry (DS016)
- Respiratory Protection for the Construction Industry (DS017)

Appendix

Extension Cord Gauges for Electric Tools
(Based on 120 volt power supply)

Cord Length in Feet	Nameplate Amperes																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
25	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
50	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	12
75	14	14	14	14	14	14	14	14	14	14	14	14	12	12	12	12	12	12	12	12
100	14	4	14	14	14	14	14	14	14	12	12	12	12	12	12	10	10	10	10	10
125	14	14	14	14	14	14	14	12	12	12	12	12	10	10	10	10	10	10	10	8
150	14	14	14	14	14	14	12	12	12	12	10	10	10	10	10	10	8	8	8	8
175	14	14	14	14	14	12	12	12	10	10	10	10	10	10	8	8	8			
200	14	14	14	14	12	12	12	10	10	10	10	10	8	8	8					
225	14	14	14	14	12	12	10	10	10	10	8	8	8							
250	14	14	14	12	12	12	10	10	10	8	8	8								
275	14	14	14	12	12	10	10	10	8	8	8									
300	14	14	14	12	12	10	10	10	8	8										
325	14	14	12	12	10	10	10	8	8											
350	14	14	12	12	10	10	10	8												

American Wire Gauge (AWG) standard annealed copper wire solid temperature 25 C (77°F)

Shaded area indicates combinations of amperage and length for which no extension cord gauge can be safely recommended

For example operating a 10 amp saw 100 feet from the power source would require a 12 gauge extension cord At 200 feet a 10 gauge cord would be necessary Gauges apply over the entire length of the run When two or more cords are joined to reach a work area the gauge of EACH cord must be sufficient to handle the amperage over the entire run

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