Some of the things you need to consider before using a chainsaw include:

The operator

- Are you properly equipped and capable of doing the work?
- Do you have the necessary training and physical capabilities to do the work?
- Do you need assistance from other people, or special equipment?
- Are you tired, fatigued or under the influence of alcohol or medication?
- Do you have an adequate supply of drinking water?

The equipment

- Is your chainsaw sharp, properly maintained and suitable for the task at hand?
- Is it full of fuel and bar oil, so you don't need to stop the cutting sequence to refuel?
- Do you have other equipment such as an axe, wedges and hammer and first aid kit close at hand? Are they all in good condition?

The work environment

- What are the current and predicted weather conditions?
  Extreme temperatures, heavy rain, lightning or strong winds can make chainsaw operations very risky.
- What is the fire danger?
  Work should cease in the case of extreme fire danger. In summer months, keep fire fighting equipment handy.
- Are there any physical ground hazards that might hinder your movements?
  Look for rocks, undergrowth, stumps, holes, etc.
- Are there any unsafe trees nearby?
  Look for stags, hang-ups or burnt out trees. **Look up!** Are there any hanging dead or broken limbs overhead? (Known as 'widow makers' for obvious reasons.)
- Who else is in the area?
  Be aware of other public activity, traffic or machinery movements.
- What are your workmates doing?
  Is there sufficient separation distance between the saw operator and other personnel? Do not work alone, and maintain regular contact with other workers.
- Is there tree felling activity in the work area?
  Do not work within at least two tree lengths (minimum) of any tree felling activity.

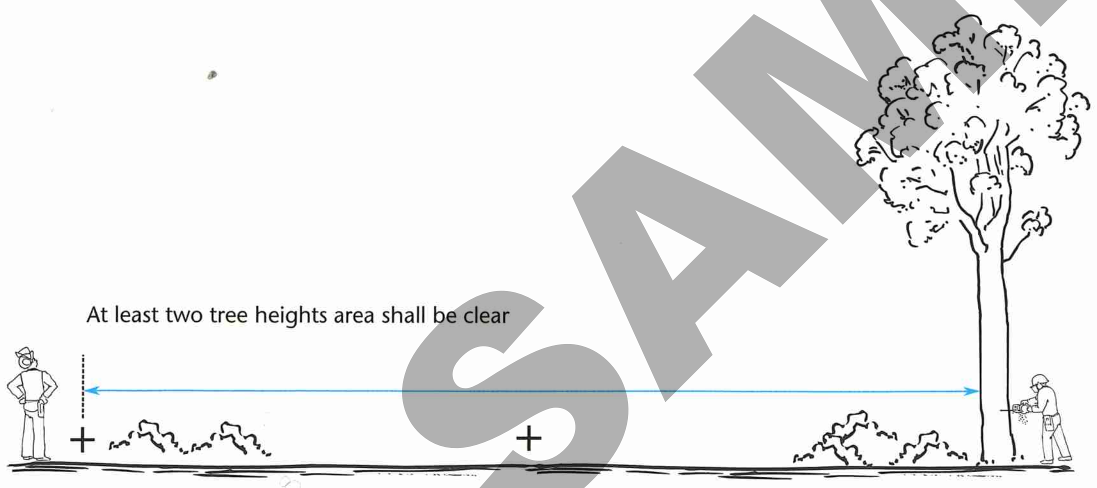


Figure 5: Area to be isolated during falling activity.

Personal protection equipment

The Australian Standard *AS 2727 Chainsaws – Guide for Safe Working Practices* lists the items of personal protection equipment (PPE) that a chainsaw operator must use. Remember that PPE is at the lower end of the scale of risk control, and will not guarantee your safety. Proper risk assessment and safe work practices must always be followed.

The items below are recommended when working in a forest environment. Refer to the list of technical standards at the back of this manual for more detailed specifications.

- Safety helmet (AS/NZS 1801)
  Must be replaced if cracked, damaged or past expiry date. Avoid damage caused by attaching stickers, storing in direct sunlight and contact with solvents. A legionnaire-style flap can be attached to protect the back of the neck.
- Eye protection (AS/NZS 1336 and 1337)
  Preferably non-scratch and non-fogging. Can be either clear or mesh visors or goggles. Safety glasses should also provide an acceptable level of protection.
- Steel-capped safety boots (AS/NZS 2210)
  Boots should also have non-slip tread and lace-up for better ankle support.
- Cut resistant trousers or chaps (AS/NZS 4453)
  The cut resistant layers cannot be repaired and the garment should be replaced if it has been cut. The effectiveness of the cut resistant layers may be reduced over time by the absorption of oil when used regularly.
- High-visibility vest/shirt (AS/NZS 4602)
  Long sleeves are preferable for sun protection. Some vests are also reinforced with cut resistant fabric for added protection.
- Safety gloves
  Should be snug fitting and of a hard wearing, protective fabric. Some gloves have gel cushioning to protect against vibration. Protective wrist bands and forearm guards are also available.
- Hearing protection (AS/NZS 1270)
  May be either ear plugs or ear muffs. Be aware that ear plugs and some cheap ear muffs may not provide sufficient protection when using larger saws. Check with your dealer for correct level of protection required for your chainsaw.

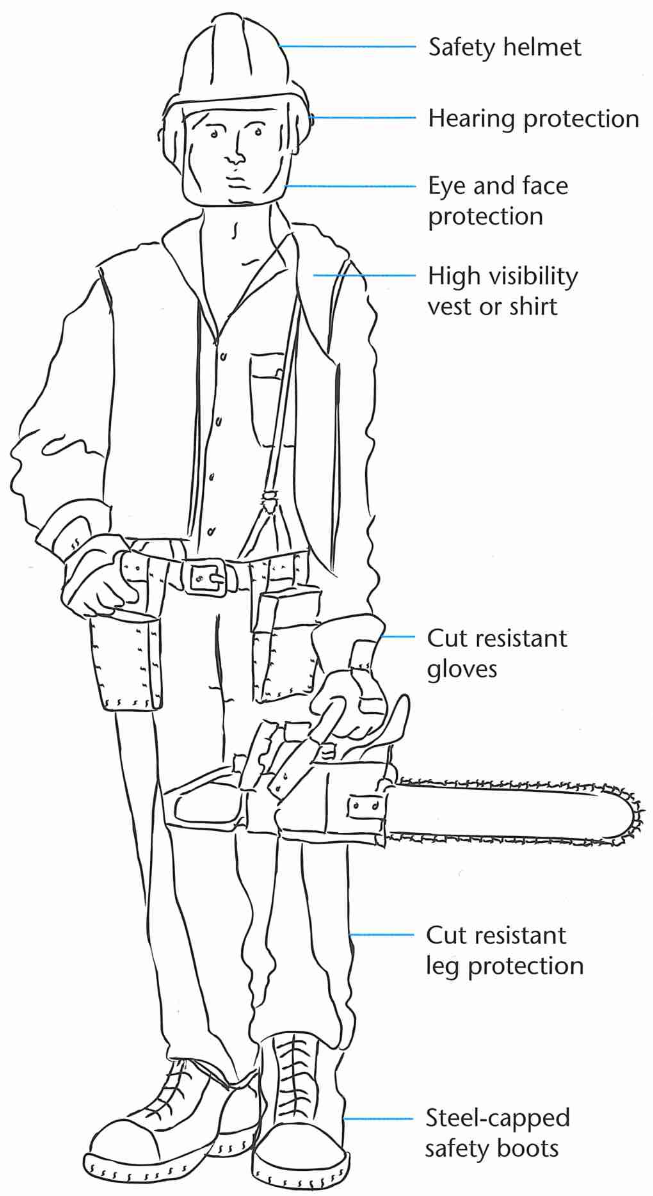


Figure 6: Personal protective clothing and equipment.

Warning signs

Workplace signage needs to be erected at all entry points to the work area. Workplace signage warning of falling trees must be prominently erected beside coupe access roads and tracks.

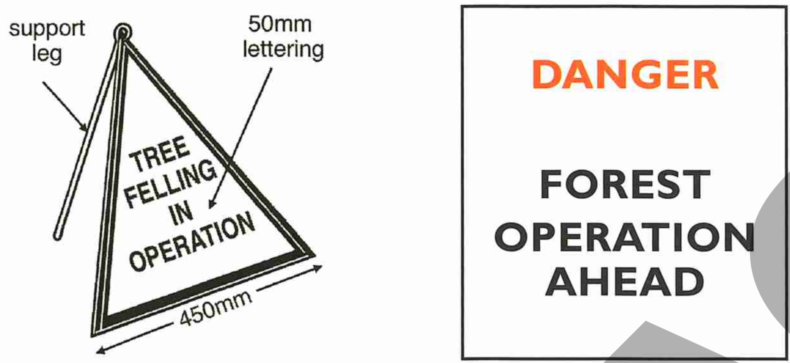


Figure 14: Workplace warning signage.

Chainsaw maintenance kit

The most basic chainsaw maintenance kit is that carried on the operator's tool belt. A comprehensive kit contains the following small tools:

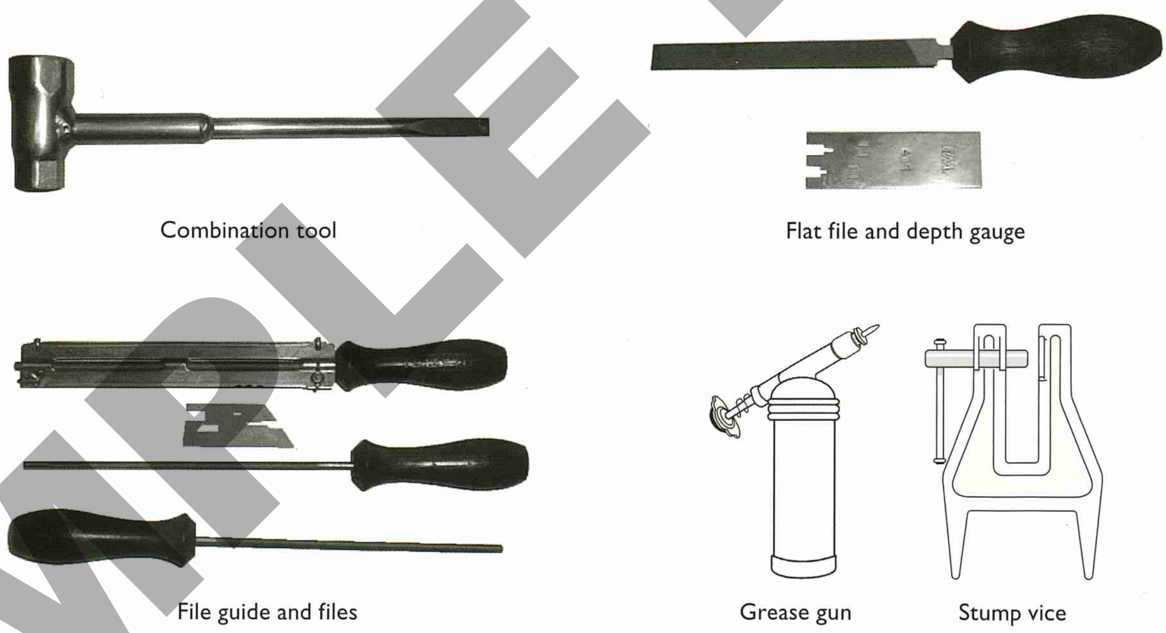


Figure 15: Some components of a basic maintenance kit.

Additional items include wrenches, a flat head screwdriver, wooden scraper, brushes, air filter treatments and cleaning rags. It is essential that all tools and equipment are well maintained in sound condition.

4. Chainsaw maintenance

Regular maintenance of the chainsaw, in accordance with the manufacturer's advice, is essential for safe, reliable and trouble-free operation. Chainsaw breakdowns are costly both in repair expenses and lost production. A professional attitude to maintenance means paying attention to:

- the recommended frequency of servicing
- careful inspection of all components
- cleanliness of the saw and related equipment
- reporting of problems and faults promptly
- arranging for specialist repairs when required.

Do not operate the saw if any components become defective, particularly any safety devices.

Powerhead and guide bar maintenance

REFER MANUFACTURERS Recommendations

Daily service (or frequent service as required)

The maintenance schedules are based on a regular daily engine operating time of 6 to 8 hours. However, when working in particularly dirty or dusty conditions, or when cutting dry timber, the service intervals may need to be shortened. The tasks below should be carried out daily according to manufacturer's specifications:

Cleaning

- Thoroughly clean saw body, air intake vents and cooling fins.
- Use plastic or wooden scrapers, not metal screwdrivers which can damage paintwork, leading to corrosion.

Air filter

- Before removing filter, apply the choke to close off the carburettor throat to prevent the entry of foreign matter. Remove and check the filter for damage and penetration of foreign material. Clean as per manufacturer's recommendations. Replace filter if damaged.
- A spare filter is useful to have as a replacement as required.

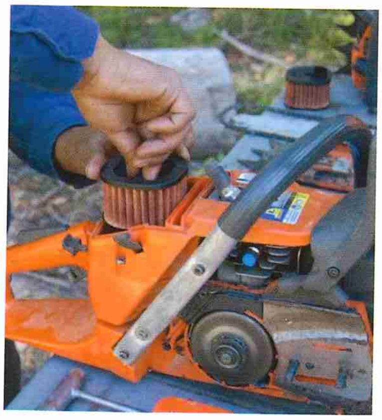


Figure 16: Checking the air filter.

The cutting attachment

The cutting attachment on a chainsaw does the real work when the saw is operating. Therefore it is essential that all three components – drive sprocket, guide bar and saw chain – are properly maintained for the saw to be used efficiently and safely. The drive sprocket, guide bar and chain work as a closely related trio. If any of these parts are not in top working order, problems will result in the other two. For example, a loose chain will cause rapid wear behind the nose of the bar and will increase wear on the guide bar.

Drive sprockets

The clutch transmits power through the clutch drum to the drive sprocket. The sprocket draws the chain around the guide bar and through the wood. The drive sprocket is a gear, and gear terminology is used to name its parts. There are two types of drive sprockets: spur (fixed) and rim (floating).

Spur sprockets

Spur sprockets have wide tooth faces which engage the chain's drive link tangs. These wide faces help in the alignment of the chain to the guide bar groove. The spur sprocket supports the chain either on the tip of the teeth or by nesting the drive link tang between the sprocket teeth. Spur sprockets are permanently attached to the clutch drum. They have the advantages of good bark and chip removal but tend to cause more wear on the saw chain than rim sprockets. These sprockets are also more expensive to replace.

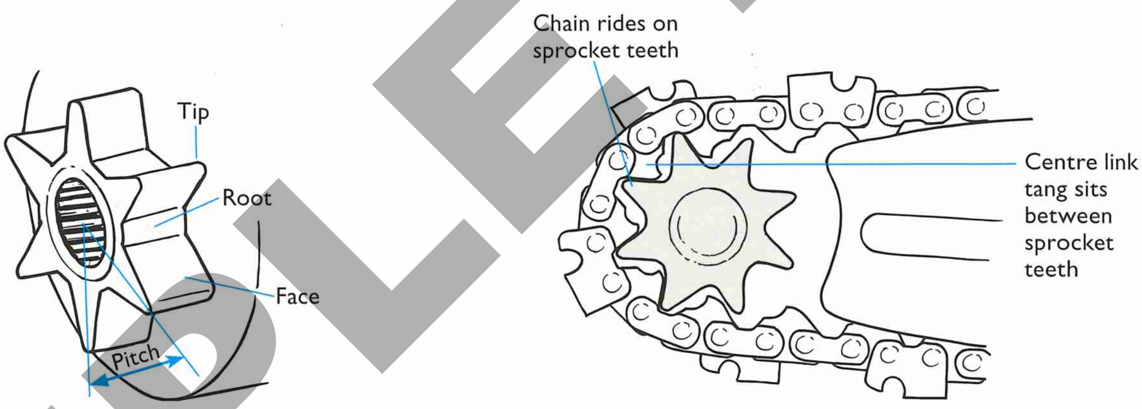


Figure 19: Spur (fixed) drive sprocket.

Rim sprockets

Rim type sprockets look like a wheel because they have the sprocket teeth mounted between two rims. The rims support the tie straps and cutters thus allowing the chain to run more smoothly with less wear. The drive link (tangs) of the chain is engaged by the faces of the sprocket teeth.

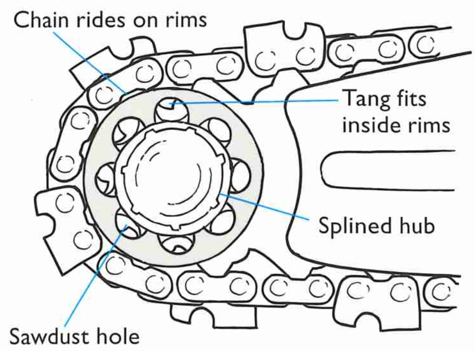
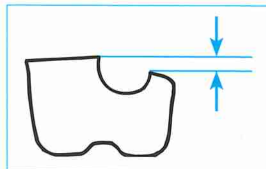
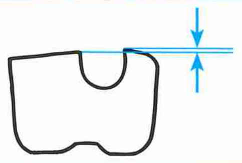


Figure 20: Rim (floating) drive sprocket.

Problems caused by incorrect depth gauge setting are listed in Table 6.

Table 6: Problems caused by incorrect depth gauge setting.

	Depth gauge too low	Increased chance of kickback. Chain grabs, causing excessive bar wear and stretching of the chain. Increases pressure on the drive sprocket and clutch.
	Depth gauge too high	Chain loses self feeding characteristics and extra pressure is required to get the chain to cut. Leads to rapid wear on all components.
	Uneven depth gauge setting	Gives excessive vibration and chain chatter.

Points to remember when filing depth gauge:

- If the depth gauge protrudes above the setting gauge, file it level with a flat file and depth gauge tool.
- As for cutters, work on one side first then the other, always filing from the inside out.
- Make sure all depth gauges are filed to the same height.
- Finally, slightly file each leading edge to round the corner back to its original shape. This will reduce the tendency for kickback.

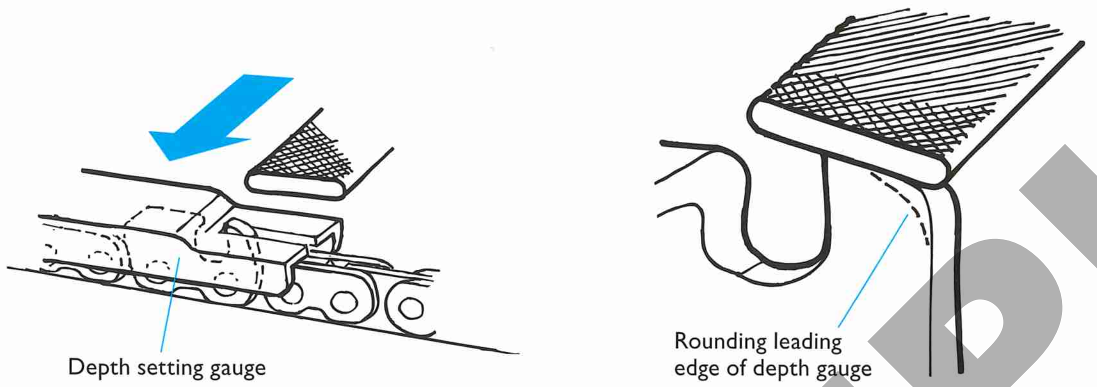


Figure 44: Depth gauge filing.

Chain tension

Chain tensioning should be carried out when required. Correct chain tension is where the bottom of the chain's tie-straps is just touching the underside of the guide bar. The chain must be able to be pulled around the bar freely using both hands, and should snap back smartly when pulled by the tie straps.

Sprocket nose bars require the chain to be tensioned slightly tighter.

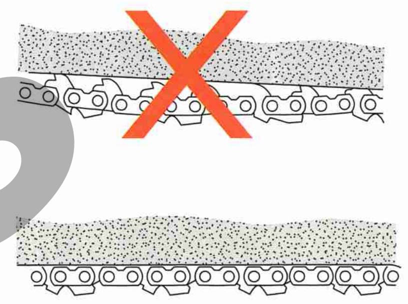
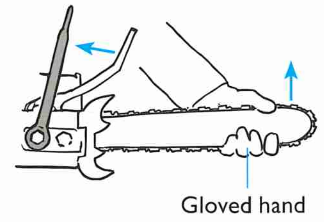


Figure 45: Loose chain (top) and correct tension (below).

Remember: a loose chain increases the potential of kickback, and may also snap or derail.

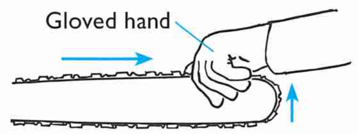
Tensioning a saw chain

1. Loosen bar nuts.
   Make sure you wear cut-resistant gloves.

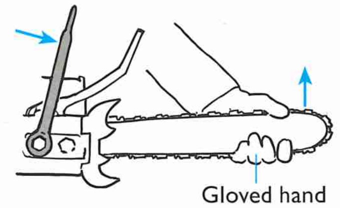


2. Tighten tension screw.
   Tighten until chain just touches bottom bar rails.
   For sprocket nose bars turn the adjuster one quarter turn more to achieve correct tension.

3. Pull chain around bar in direction of travel to be sure it fits drive sprocket and bar.



4. Hold bar tip up. Tighten nuts.



5. Check that chain moves freely and snaps back when pulled.

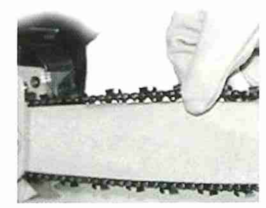


Figure 46: Steps in tensioning a saw chain.

Table 7: Cutting attachment troubleshooting chart.

Problem	Possible causes
Chain chatters	• High depth gauges • Badly worn sprocket teeth • Irregularly shaped cutters • Badly stretched chain (more than 6 mm per 30 cm of chain) • Incorrect matching of sprocket pitch and chain pitch
Chain dulls quickly or cannot be successfully sharpened	• Thin feathered top plate (file held too low or pressed down too hard) • Cutters rubbing against the wood (high depth gauges) • Abraded cutters (from hitting rocks, grit, dirt) • In this case the cutters will need to be filed back behind the abrasive mark, and all non-abraded cutters filed back equally. The depth gauges should be lowered accordingly.
Worn or cracked tie straps	• Cracked tie straps at rear rivet holes – caused by back-sloping cutters or blunt cutters • Crack at front rivet hole – caused by high depth gauges, pressure applied to make chain cut • Chain worn straight across the bottom with both rivet holes cracked – caused by tight chain or poor lubrication
Chain breakage	• Heat and excessive friction • Poor sharpening • Improper joining • Excessive wear
Chain pulls or dishes to one side	• Guide bar rails worn unevenly • Incorrectly set depth gauges • Filing angles – either top, or side plates, or right hand cutters – are different from those of the left hand side. Longer cutters on one side. • Abraded cutters, either left or right hand • Spread guide bar rails
Tight joints	• Loose chain • Round bar rails and/or worn satellite tip • Worn cutters, excessive pressure, chain chatter • Worn sprocket • Badly peened rivets of joining links

5. Chainsaw techniques

Pre-start checks

Before starting up your chainsaw, there are some essential checks you must do.

- Are you wearing the correct Personal Protective Equipment (PPE)?
- Warning signs displayed?
- Is the saw chain sharpened and correctly tensioned?
- Sufficient fuel and oil?
- Safety devices attached and operational? Chain brake working?
- All obstructions in the path of the chainsaw removed?
- Working environment as safe as practicable?
- Any other person or machinery in work zone?

Mixing and adding fuel

A spark or hot surface can easily ignite petrol or petrol vapours. Make sure you are in a clear area and follow safe procedures.

Safety precautions

- Always stop the motor and allow to cool before refuelling.
- Place the saw on clear ground or on a firm surface such as a stump away from any dry fuel material. If still in the forest, check for any overhead hazards.
- Don't smoke when handling fuel.
- Take care not to spill fuel on hot components, and wipe any spilt fuel from saw.
- Avoid fuel and oil contacting your skin. It is flammable and a carcinogen.

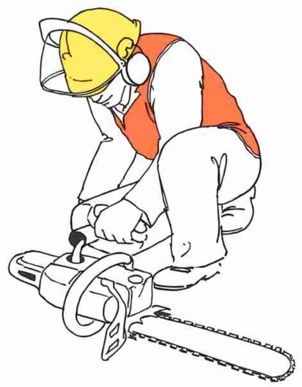


Figure 47: Refuelling.

Procedure

- Make sure you are using the correct fuel/oil 2-stroke mixture. Check your owner's manual and refer to the chart below.
- Fill fuel and bar oil at the same time. Fill the oil tank first to allow the saw to cool.
- Use chain/bar oil as recommended by manufacturer. (Bar oil is not suitable to mix with fuel).
- Store bar oil and fuel in suitable, clearly marked containers. Do not use glass.
- Take care not to contaminate fuel and oil with sawdust, dirt or water.

Figure 48: Do not start saw near fuel supply.

Calculating chainsaw fuel/oil ratio

When mixing fuel, always refer to manufacturer's recommendations.

When calculating amounts, note that 1 Litre = 1000 ml.

To calculate the amount of oil to be added to the fuel:

- Identify the container size (volume in ml)
- Calculate the total volume of fuel and oil (i.e. for 20:1 means 20 ml of fuel to 1 part of oil so the total volume is 21 ml)
- Divide the container capacity (ml) by the total volume of fuel and oil (i.e. 1000 ml/21 ml for 20:1)

The answer is the total oil required.

For example:

- For a container size of 4 Litres (or 4000 ml)
- Fuel/oil ratio required is 25:1 (i.e. 26 parts in total – 25 parts fuel and 1 part oil)
- 4000 divided by 26 is 154 ml

Therefore to get 25:1 fuel/oil mix in a 4 Litre container, you need to add 154 ml of oil to the container and then fill with fuel.

The table below sets out the calculations for various container sizes and fuel/oil ratios.

Table 8: Fuel/oil ratio calculator.

Fuel container size (Litres) / **Fuel/oil ratio**	**Fuel container size (ml)**	**20:1**	**25:1**	**30:1**	**40:1**	**50:1**	**60:1**
Total volume of fuel and oil combined		**21 ml**	**26 ml**	**31 ml**	**41 ml**	**51 ml**	**61 ml**
4	4000	190	154	129	98	78	66
5	5000	238	192	161	122	98	82
10	10 000	476	385	323	244	196	164
15	15 000	714	577	484	366	294	246
20	20 000	952	769	645	488	392	328
25	25 000	1190	962	806	610	490	410
30	30 000	1429	1154	968	732	588	492
40	40 000	1905	1538	1290	976	784	656
50	50 000	2381	1923	1613	1220	980	820
250	250 000	11 905	9615	8065	6098	4902	4098

For more information on understanding ratios, see the 'Scenario' and 'Activity' resources available at:

http://www.forestworks.com.au/services/learning-resources-and-tools/workplace-learning-tools/workplace-health-safety/

Safe operating techniques

The risk of accidents and injury is reduced if you follow safe work techniques.

Starting

- Don't start the saw at the place of refuelling – move at least 3 metres away.
- Make sure the area is safe, with no other people within a 2 metre radius.

Drop starting is not an acceptable safe method of starting a chainsaw.

Method 1: Starting saw on ground

This method is recommended for cold starting, and for heavy or hard-to-start saws.

1. Remove scabbard.
2. Depress decompression button.
3. Ensure ignition switch is on.
4. Apply chain brake.
5. Place saw on ground, guide bar pointing to left.
6. Clear away any obstacles, particularly near tip of guide bar.
7. Kneel on left knee and place the right foot through the rear handle. Left hand is on the front handle with the left arm straight and locked. Keep back straight.
8. Pull the starter cord with the right hand.

Figure 49: On ground method.

Method 2: Using 'leg lock' method

This method is recommended for most situations and starting warm saws.

1. Remove scabbard.
2. Depress decompression button.
3. Ensure ignition switch is on.
4. For warm start, have chainsaw on idle.
5. Apply the chain brake.
6. Grip the front handle with left hand, keeping arm straight.
7. Place rear handle behind right leg with saw body supported on upper left leg.
8. Use right hand to pull starter cord.
9. Maintain straight back, look straight ahead.

Figure 50: Leg lock method.

Kickback reaction when contact with the tip or upper quadrant of the guide bar nose results in the chainsaw being thrust upwards and backwards in an uncontrolled arc. Kickback reaction generally takes only a fraction of a second to occur.

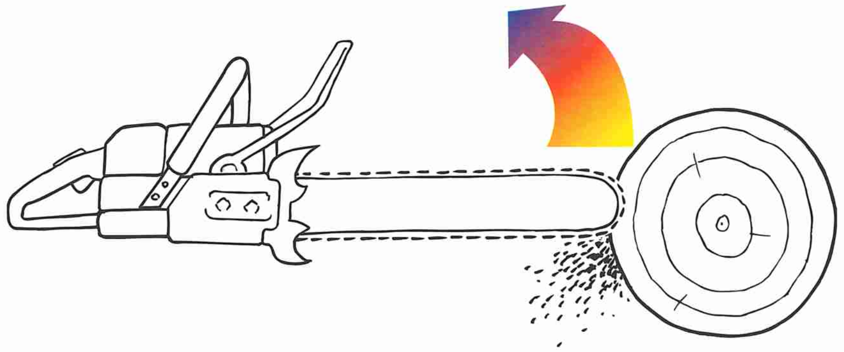


Figure 55: Chainsaw kickback reaction.

When cutting with the chainsaw guide bar in the vertical position, kickback reaction normally results in the chainsaw being violently flung back in the direction of the operator.

In the horizontal position, the reaction will result in the chainsaw 'kicking out' sideways which could be potentially dangerous for bystanders.

Kickback is one of the most common causes of chainsaw accidents. You can help reduce kickback by:

- maintaining a firm grip and balanced stance. The saw must not be in line with your face, but should be slightly to the right of the body.
- cutting at peak revs
- being aware of where the nose of the bar is at all times
- using correct cutting techniques
- making sure the chain is sharp and correctly tensioned
- ensuring correct depth gauge setting
- selecting a narrow profile sprocket tipped bar. This decreases the risk of kickback by reducing the size of danger area in the upper quadrant of the nose. There are also less cutters in the danger area at any one time.

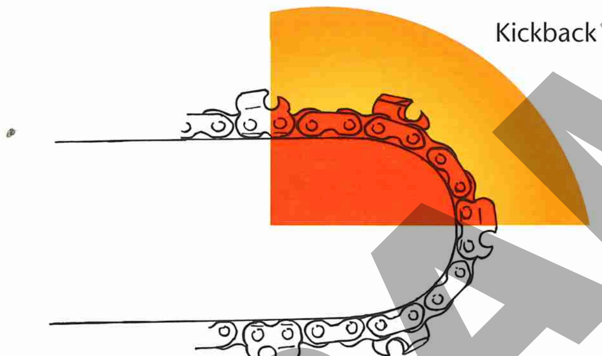


Figure 56: Kickback reaction zone.

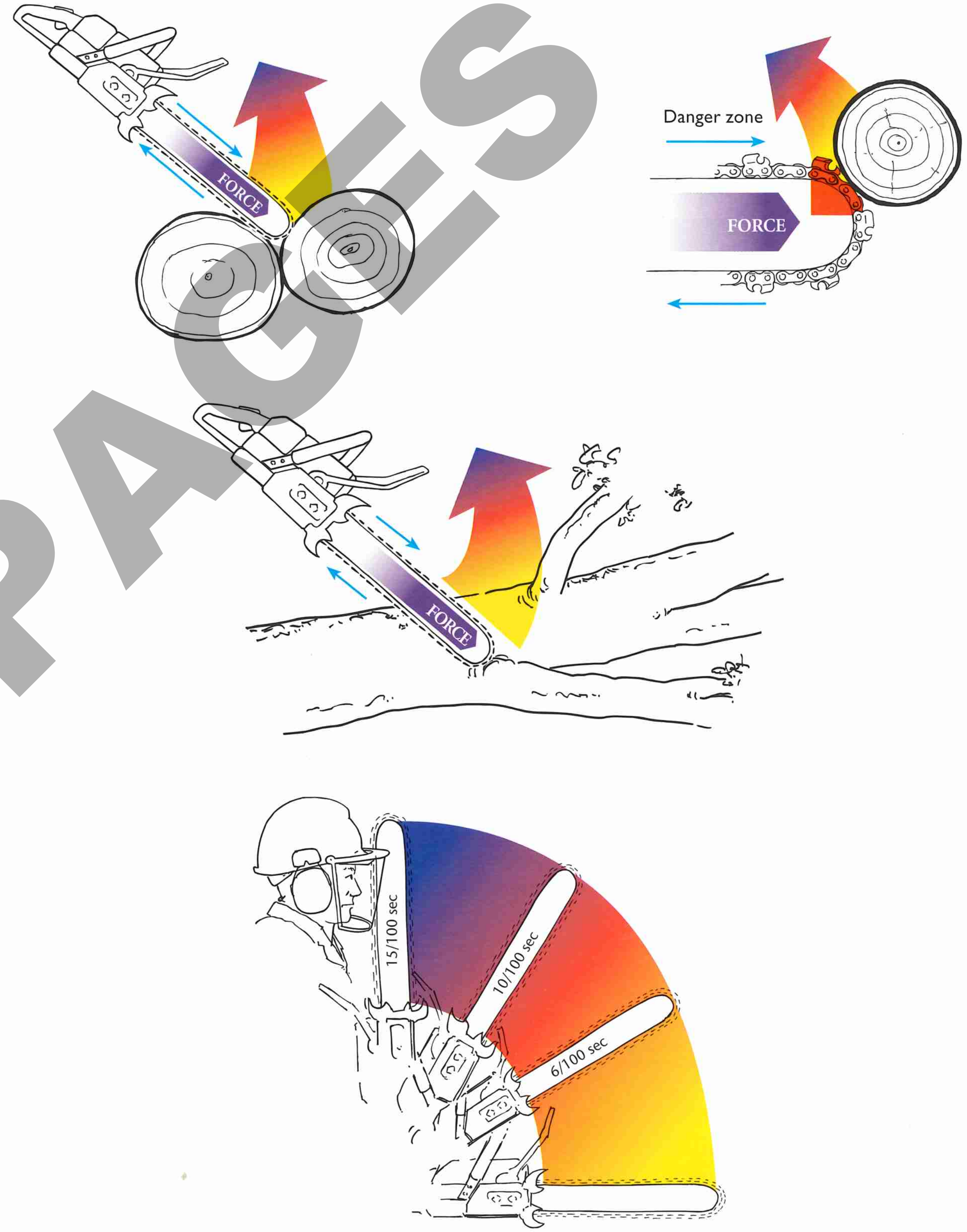


Figure 57: Common kickback situations.

The kickback reaction happens so quickly that you will not be able to react in time to avoid serious injury, even if the chain brake works.

Cutting technique

- ✓ Generally only the upper and lower edges of the guide bar and the lower quadrant of the guide bar nose should be used when cutting. Contact with the tip and the upper quadrant of the guide bar nose should largely be avoided. This will lessen the resultant 'kickback' reaction.
- ✓ The chainsaw will cut best when not placed under undue force, with the powerhead generally operating at peak revolutions.
- ✓ Control of the chainsaw must be maintained by having a firm two-handed grip, keeping the powerhead close to the body, keeping a secure footing and a balanced stance on a stable surface.
- ✓ A chainsaw should only be operated from below shoulder height, never above.
- ✓ Apply the chain brake before moving branch material, and stop and place the saw on the ground if you need to clear lots of material.
- ✓ When work is completed, the chain brake should be applied and the chain bar scabbard fitted for transport.

Figure 58: Keep a balanced stance and firm grip.

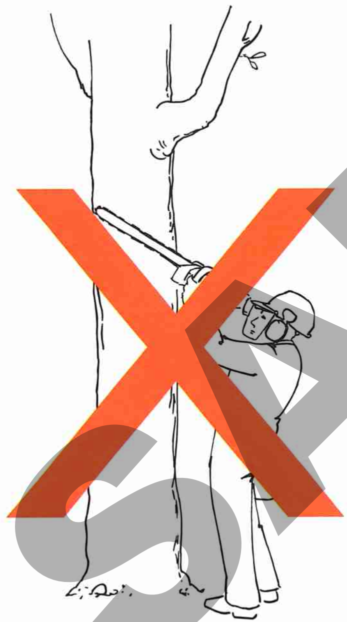


Figure 59: Do not cut with saw above shoulder height.

Vertical cuts

Vertical cuts should wherever possible be made with the rear handle being supported by the upper right leg, and the powerhead stabilised against the forward left leg.

In the vertical cutting position, your eyes should be focused to the left hand side of the cutter bar. Maintain a firm grip and balanced stance, so that should 'kickback' reaction occur, the chainsaw will only be forced backwards and up past the right hand side of the body.

Figure 60: Vertical cutting technique.

Horizontal cuts

Horizontal cuts will require that the left leg in this case be rearward, clear of the guide bar. Control here is aided by the right arm or back of the right hand being supported on the right knee. Adjust your grip on the handles to suit the position of the saw.

Figure 61: Horizontal cutting technique.

Muscles of the legs should be used in preference to those of the back. So far as possible the back should be kept straight, bending at the knees when cutting close to the ground.