

# Operate and Maintain Chainsaws

National code - AHCMOM213



## Welcome

Welcome to Treetec's course on how to operate and maintain chainsaws. The course is the national unit of competency titled *Operate and Maintain Chainsaws* (National code - AHCMOM213). Treetec provides training and assessment on behalf of 'The Management Edge (TME) a Registered Training Organisation (RTO #3927)

You will find that most of the training on the day is hands-on, practical, skill-development. However, there is a theory and assessment part to the training that you must complete.

## Passing the course

There are three parts to the assessment:

1. A written test that will be forwarded when you enrol (to be submitted to the instructor)
2. A second, closed book, test conducted on the training day
3. Assessment of practical skills throughout the training day

To pass the course and to receive your certificate of competency, you must know most or all of the information in this document. If you don't know the information before you attend the course, then you will find the course difficult and are at risk of not passing the assessment.

We have a duty of care to our students — so if a student can't use a saw properly and doesn't know the theory material, then we must fail them. If you fail the course, then there will be no certificate issued and you will need to return on another day. Please ensure that you:

- Take plenty of time (more than a couple of hours) to learn the information in this document.
- Complete the test (Assessment 1) provided. You should be able to answer the questions without going back through the notes. This completed test must be handed in to the instructor at the start of the training day.

If you find you can't answer some of the questions, then you need to spend more time learning the information before coming to the training day. Keep reviewing the material until it is clear.

If you have trouble reading, let us know now. There are alternative ways to research and complete tests.

There is more information on chainsaw use at our website: [www.treetec.net.au](http://www.treetec.net.au)

By understanding the information in this document, it will help make the training day informative, more practical, and more enjoyable.

*Regards, Mark*

*M. Cashmore  
Trainer and Assessor  
Treetec*

## The law, injury, and controlling risk

### What are the key requirements of the *Occupational Health and Safety Act*?

This law is an 'Act' of parliament that applies to all worksites. The law's key obligations include:

- All workers must be adequately trained, instructed and supervised in the work they perform; and
- All workers have a 'duty of care' — this means the law requires you to 'take care' of yourself and of others. Therefore:
  - doing dangerous things is illegal; and
  - ignoring the fact that other people are doing dangerous things is illegal; and
  - not using safety gear that is supplied is illegal (...and it's silly); and
  - not asking for safety gear when it hasn't been supplied is illegal.

### Legislation, Standards and Codes of Practice

Each company or organisation will have operating procedures and SWMS's for chainsaw use, additionally there are a number of overarching legal documents, including the OHS Act mentioned above, that relate to chainsaw operations. They include Acts, Regulations and Australian Standards (AS):

- Occupational Health and Safety Act
- Occupational Health and Safety Regulations
- Environment Protection Act
- Environment Protection Regulations
- AS. Chainsaws - Guide to safe working practices
- AS. Protective clothing for users of hand-held chainsaws

### Do you need a 'license' to use a chainsaw?

There is a license required for driving a forklift, car, crane or working in confined spaces but not for chainsaw use. The organisation you work within may decide all personnel using chainsaws must have a 'certificate of competency' this is not a license.

If you were using a chainsaw whilst pruning, climbing a tree or felling a tree, then you would also require adequate training in these specialist areas.

You should check with management of any work site to confirm relevant licensing and legislative requirements and minimum training and/or supervision requirements.

### What are the legal requirements around controlling risk?

For each new job or task, the law requires you — and everyone on the job site — to participate in the risk assessment process. That process requires you:

- to assess each new job for hazards;
- to eliminate or control those hazards down to an acceptable level of risk; and
- to document those assessment and control steps

## Work site hazards and risk management

All work sites will present some level of risk, this may be to the workers or to the public. So far as is practicable (doable) it is essential that the worksite is clearly defined and monitored and all workers ensure the safety of themselves, anyone else who may be impacted and the environment.

All new work sites require a documented risk assessment to be completed, this is often called a 'Pre-Start Job Safety Analysis' (JSA), this can be done on paper or using a digital system such as the ProofSafe App ([www.proofsafe.com.au](http://www.proofsafe.com.au)).

The Pre-Start JSA should consider all significant hazards unique to that site on that day, however it should not cover unnecessary, low risk items or get bogged down in small details that are covered previously as part of regular risk assessments or training.

**Reporting** – Some sites or organisations will require reports be prepared that relate to chainsaw work, ensure the applicable data is collected and reports prepared.

## Hazards associated with chainsaw use

There exist many hazards when operating and maintaining a chainsaw, all hazards must be adequately controlled to ensure the safety of everyone. The hazards vary depending on the activity, below are some examples of hazards:

- Transporting saws and fuel – fuel spills, saw damage, exposure to fumes
- Starting a saw – elbow and back injuries, kickback, cut injuries to yourself and others
- Operating a saw – cut injuries, kickback, manual handling injuries, hearing damage, eye/stick injuries
- Maintaining a saw – cuts to hands, fuel spills, eye injuries, chemical exposure.

For each hazard there must be adequate safety measures (controls) used, for example:

- When transporting equipment ensure fuel is in appropriate containers, everything is secure and separated from people
- When starting a saw you need to be clear of all other people and obstacles, use the decompression button, have a good stance, chain break must be on and PPE must be worn
- When operating a chainsaw you must be able to communicate with other team members, this might include hand signals, radio or whistle
- When doing maintenance wear gloves and glasses and use the appropriate tools

Inspecting timber before starting is very important, make sure there are no nails or rocks embedded. Also look for defects, splits and tension or compression forces. Once you identify the issues you can remove the nail or stabilise the log or cut in a different spot or go to the uphill side.

Whilst at work you must protect the environment, consider protection of endangered flora or fauna, chemicals spills such as fuel or oil, risk to protected trees, implications of leaving rubbish or debris at the site. Consider for example all the bar-oil spitting off the bar, particularly when working near water.

## Safety gear

### What are the requirements for safety gear?

One way to reduce risk is the use of appropriate safety wear — known as “Personal Protective Equipment” or “PPE”. You need to use your PPE gear at all times while operating a chainsaw. PPE for chainsaw use includes:

- helmet fitted with hearing protection, ideally also with a face shield
- safety glasses
- steel-toed, high-ankle boots;
- chainsaw pants or chainsaw chaps.

Also, gloves are recommended at all times and are essential when you are working with the chain. Loose fitting gloves are dangerous and awkward, snug fitting gloves enable the user to operate the various chainsaw controls and are less likely to get caught or snagged.

### Safety features on a chainsaw

There are more than 10 basic safety features on a modern chainsaw starting with the chain break and the anti-vibration system, ending with felling sight lines and safety labels. You will need to be able to identify and explain the purpose of at least 8.

We recommend you spend some time looking at a chainsaw and/or a chainsaw manual to become familiar with not only the safety features but also the other various components of a chainsaw.

If you are not sure what a component is then please ask the instructor on the training day.

### Equipment and plant management

On any worksite and/or within every business there needs to be a system to ensure plant or equipment such as chainsaws are not used when faulty or broken. Some workplaces will have a ‘tag-out’ system, others will make repairs in the field.

Of most importance is that any faults are identified and repaired before anyone is put at risk. Usually the inspection and maintenance system will follow these steps:

1. Operators are trained to inspect and use equipment
2. Equipment is inspected before use
3. Faulty equipment is tagged with details of the issue – all staff understand through training that the tag signifies an issue and potential risk
4. The equipment is fixed (tag removed)
5. Repairs and maintenance may or may not be documented depending on the circumstances

Each organisation needs to have an agreed, documented system to manage equipment inspection and maintenance.

## The parts of a chainsaw — and making sure they fit

### What are the parts of the chain?

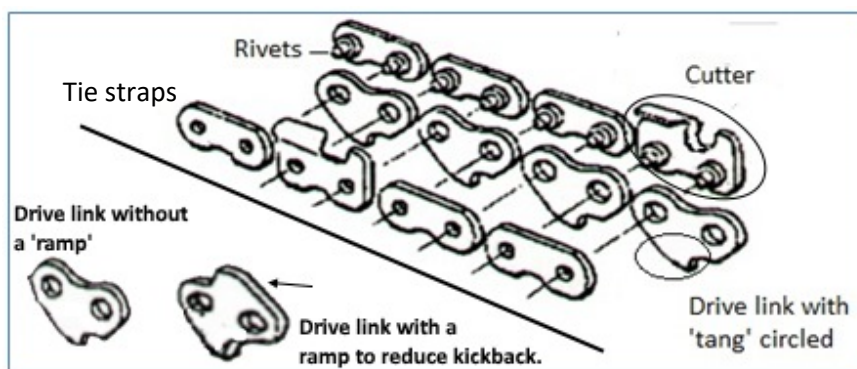
To use and maintain a chainsaw safely and efficiently, you need to understand a little about:

- the chain and its components; and
- the different types, profiles, angles and sizes of chain.

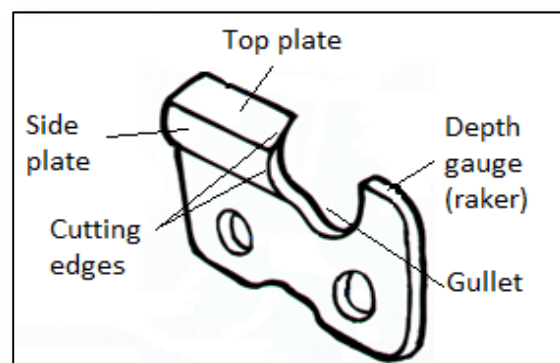
A chainsaw is a precision instrument. If the chain does not match the bar and drive sprocket or is not suited to the relevant wood then:

- the saw cuts inefficiently — you are wasting time and effort; and
- risk of injury increases.

#### Chain - parts

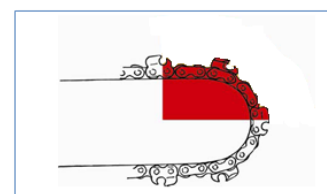


#### Cutting tooth (cutter) - parts



#### Note above the ramped drive link specially designed to reduce the risk of kickback

A chainsaw chain travels at about 90km per hour around the guide bar, on each 'cutting tooth' (cutter) there are two chisels; the 'top plate' chisel and the 'side plate' chisel and just in front of them a depth gauge, the depth gauge ensures the cutter only slices off about .65mm of wood as it passes over the log. Now, as these teeth go around the tip of the cutter bar (the Top quadrant) the teeth move down and around suddenly exposing the full height of the depth gauge (on the following cutter) to catch the wood. Usually the cutter in front protects the next following cutter but as the leading cutter drops over the edge of the bar tip the next depth gauge is exposed completely and instead of the tooth slicing 0.65mm of timber the depth gauge may contact as much as 5mm of timber, if this happens the chain can suddenly stop moving forwards and down at 90kph and the guide bar will start moving up and backwards at 90kph....towards you. By putting a ramp or slope in front of the depth gauge it reduces the chance of kickback occurring as the ramp helps to guide the wood up and over the depth gauge.

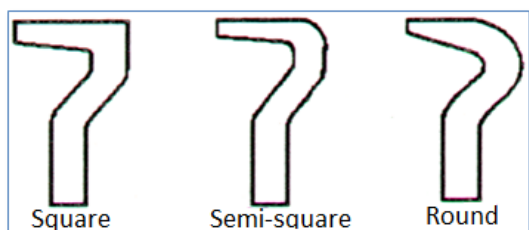


Kickback zone

There are two other 'reactive forces', these are 'push back' or 'pull in' and these can occur when the chain is suddenly pinched while the bar is still free to move. These events are less likely however they can very quickly push or pull the saw toward or away from the operator.

## Chain profiles

There are 3 basic profiles of chain, the images below show how the cutting teeth appear when viewed from behind.

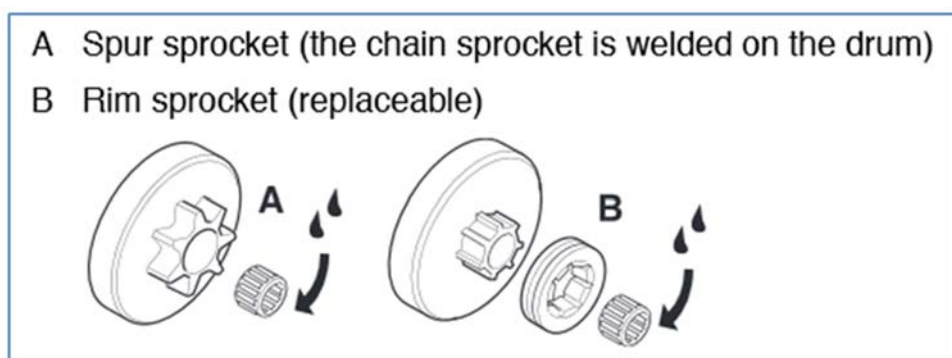


The difference between each chain profile is determined by how the top plate meets the side plate.

- 'Square profile' — the top and side plates meet at right angles and create the fastest cutting tooth. But this profile goes blunt more quickly;
- 'Round profile' is the most durable. But it's not used often, it is most suitable for conditions with dirt, mud, burnt wood, or other impurities.
- 'Semi-square' is a compromise between fast-cutting and durable.

## Drive sprocket

There are 2 types of drive sprocket:



### When do you replace the drive sprockets?

Replace worn drive sprockets every 2 or 3 chains.

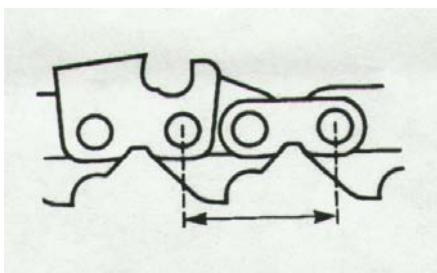
## How do you make sure the chain size, bar, and sprockets fit correctly?

There are a range of sizes and types of chain. Each type suits different tasks. We'll talk about this on the course.

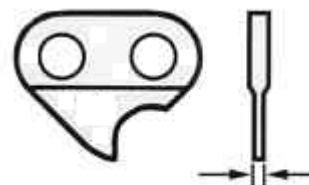
First, we need to understand the chains pitch and gauge:

**Pitch** – the distance between 3 rivets, divided by 2, in imperial measurements.  
(We need to divide by 2 because the rivets are spaced with 2 close together and 2 further apart. Dividing by 2 allows for that difference.)

Usual chain sizes - 1/4", .325", 3/8, .404"



**Gauge** – the bottom section of the drive link is called the 'tang' the thickness of the tang is the gauge, the gauge of the chain must precisely suit the cutter bar groove.



Most importantly, you need to make sure:

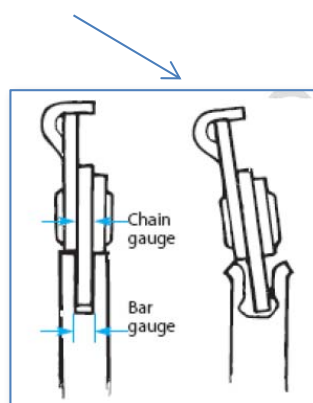
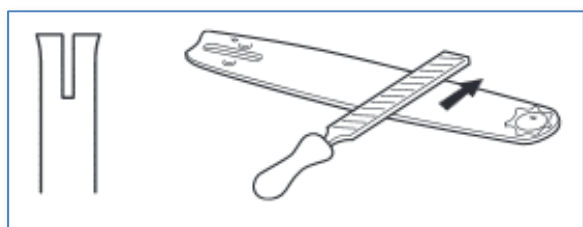
- the chain pitch matches the sprocket that drives the chain ('drive sprocket');
- the chain pitch matches the sprocket in the end of the chainsaw cutter bar; and
- the chain gauge matches the thickness of the groove in the cutter bar.

## Maintaining and replacing the bar and drive sprockets

### How do you maintain the bar?

You should:

- regularly remove burrs on the edge of the bar with a flat file and ensure the edge of the bar is flat and not worn into a 'V' shape – this is 'dressing' the bar;
- clean the bar regularly ensuring the groove is free of debris and the oil hole is clear and the sprocket is greased. Don't spin the sprocket in the tip of the bar at high speed with air, or strip out the grease if cleaning with a solvent;
- ensure the bar and chain are matched and that the chain does not sit at an angle as in the right hand image below.



### When does the bar need replacing?

You need to replace the bar if any of the following is the case:

- the groove in the bar is worn;
- the sprocket in the tip is damaged; or
- the bar is bent.

## Sharpening the chain

### How does a blunt chain increase risk?

Never use a chainsaw with a dull chain. Here's why. If you continue to work with a blunt chain, then you need to push down on the saw with more pressure to enable it to cut. This increases heat, damages the bar, stretches the chain and tires you.

The fact is the chance of an injury increases if:

- you are tired
- you lose control of the saw when you are pushing too hard because the saw is not working properly.



## When do you sharpen the chain?

You should sharpen (hone) the chain regularly, don't wait until it's blunt. Ideally a chain would be sharpened after each tank of fuel, or immediately if the chain hits something such as dirt, and becomes blunt. Sharpening should occur very regularly, potentially 5 or 6 times a day.

## How do you sharpen the chain?

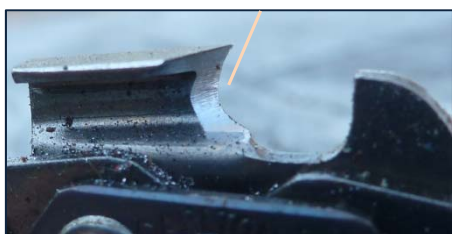
To sharpen the chain, you need to be able to work out the pitch of the chain so that you can select the correct sized round file. Round file sizes vary from 4.0mm to 5.5mm.

If a round file that is too large is used, then the top cutting edge is flattened.

If the file is too small, then the cutting edge becomes fine and quickly chips away.

The correct file size depends on the pitch and the brand of chain.

Correct angle and file depth



File too small or too low, cutting edge too thin



File too large, cutting edge flattend.

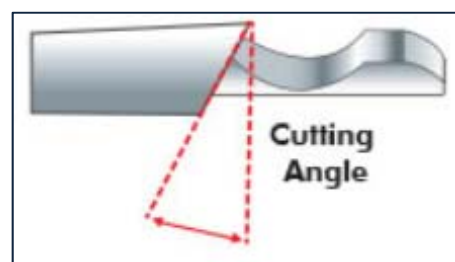


The angle of the cutting edge is also affected by how deep the round file sits when sharpening. If the file sits up high, then the cutting edge will be flattened off.

When sharpening, the angles are very important. You need to sharpen in line with the specifications of the chain.

Generally, the angle of the **cutting edge** of the top plate is:

- 30° for cross-cutting chains — that is, cutting across the grain; and
- 10° for ripping chains — that is, cutting into the end grain.



For some chains you need to keep the file at 90° to the bar when sharpening, for others there will be a 10° difference. This will depend on the specific chain.



There are a number of sharpening devices to choose from, all with pro's and con's. We use a hand file with guide when working in the field. Mounted electric sharpeners are good.

However, if you use one, then be patient and only take a small amount of metal at a time, if you push hard you will 'blue' (overheat) the teeth. They then become brittle and damaged.

## How do you protect the chain from quickly becoming blunt?

To preserve the chain and slow down the dulling process:

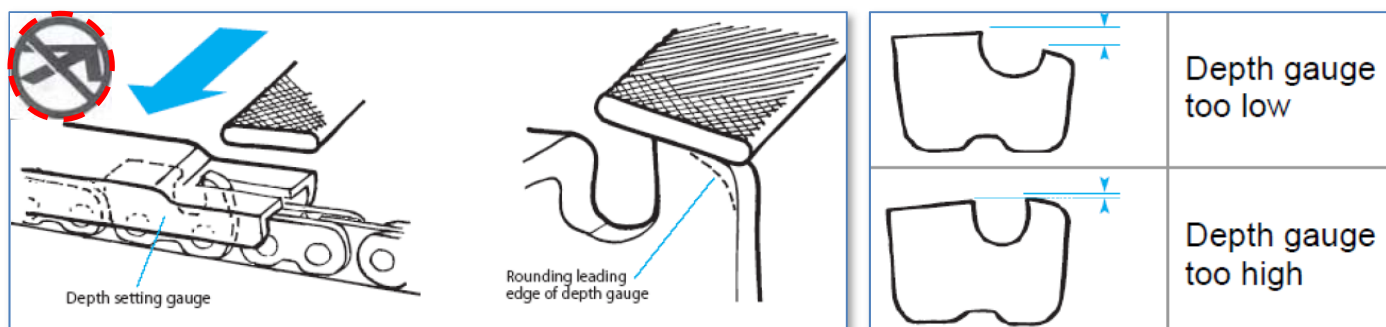
- don't cut through a log into the soil below — instead roll the log over;
- always check timber for nails, metal or stones (etc) — remove them before cutting; and
- ensure the bar is oiling (lubricating) properly and sharpen regularly.

Keep the height of the depth gauges correct and equal to each other. If the depth gauges are too high, then you get fine sawdust and slow cutting. If depth gauges are too low, then the chain grabs easily, stretches and increases loadings — see the next heading about the correct depth gauge settings.

## What is the correct height of the depth gauge?

The correct height of the depth gauge depends on the size (pitch) of the chain. Most chains have the depth gauge set at 0.65mm below the height of the top plate.

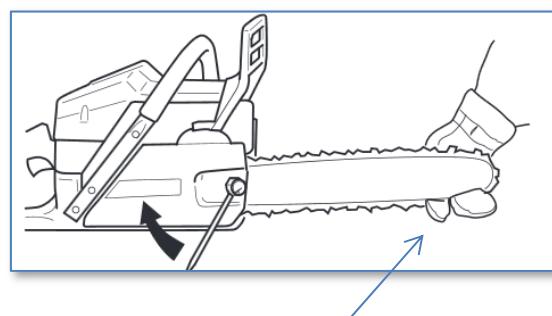
Larger “.404” pitch chains are set at 0.8mm. Most others are set at 0.65mm.



## How do you get the correct chain tension?

To check and set the correct chain tension:

- pull the chain from below and let go — it should snap back into the groove
- slide the chain around the bar — it should move easily;
- if necessary, **loosen the bar nuts**, then adjust with a screwdriver to get the correct tension; always holding the bar tip up;
- hold the tip up when tightening the bar nuts. Be careful, if you over-tighten the bar nuts you may rip the studs out of the saw. If you go too loose, then the nuts can vibrate off and be lost.



Some larger cutter bars are ‘hard-nosed’ bars, they have no sprocket in the tip. For hard-nosed bars the chain should be slightly looser.

## Oil and fuel

### What bar and chain lubricating oils should you use?

For the bar, you need to use proper bar and chain lubricating oil. Other oils don't have the sticky additive that sticks the oil to the bar and protects both the chain and the bar all the way around. Every time you refuel you should also fill the bar oil.

### How do you mix chainsaw fuel?

When mixing 2-stroke fuel, you need to use the 2 stroke oil recommended for your saw at the ratio specified: usually 50 to 1 for modern professional saws. Get it wrong and you may destroy the saw.

#### Amounts of fuel and oil for each ratio — in millilitres

Fuel Ratio	20:1	25:1	30:1	40:1	50:1	60:1
5 Litre	250	200	167	125	100ml	84
20 Litre	1000	800	667	500	400ml	334
205 Litre (44 gallon)	10250	8200	6834	5125	4100ml	3417

### Which 2 stroke oil should you use?

There are a number of oil types available. They have various properties. There are mineral based oils, synthetic oils and para-synthetic (blend). The oil needs to lubricate the engine while running and also coat and protect the engine while not in use. The quality of oil varies significantly – we strongly recommend that you use the oil recommended by the manufacturer of your chainsaw, and at the specified ratio. Without 2 stroke oil in the fuel the engine will overheat, expand and seize.

Petrol will change when stored over time and 'go off' this means you need to mix new fuel when starting a saw for the first time after a long break.

### What other equipment should you have when using a chainsaw?

When using a saw, you should have access to:

- an axe, wedges, a hammer and a 'cant hook' for rolling logs;
- basic maintenance tools — files (flat & round), sharpening guide, vice, spanner;
- chainsaw grease gun for bearings (bar nose), cleaning equipment
- fuel, and oil; and
- fire-fighting gear; and
- a first aid kit.

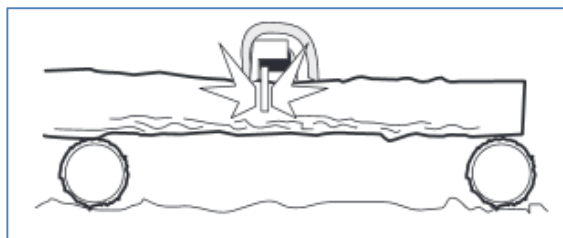
Avoid working alone with a chainsaw, if you must work alone ensure you have a means of communicating in case of an emergency.

## Using the saw

### How do you avoid jamming the saw in the wood?

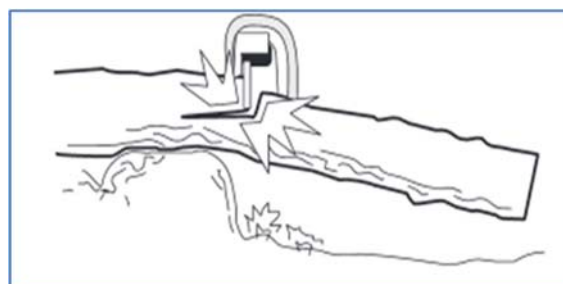
To avoid jamming the saw and splitting the timber, you need to understand about compression wood and tension wood. Here are the key thoughts:

**Compression wood** — the part of the log that will close and pinch the bar. In the image to the right, the compression wood is the top of the log. The gap created by cutting (known as the 'kerf') starts to close as the weight of the wood drops the log between its 2 supports. To prevent the log from pinching — and maybe jamming — the saw:



- first cut through some (10%) of the top of the log; and
- then, well before the saw jams, pull it out and cut the rest of the log from underneath.

**Tension wood** — the part of the log that is under tension and will open up. In this image, it's the top of the log. The kerf starts to open wider as the wood drops away (only supported at one end). However, to prevent tearing of the bark and outer layer of wood on the bottom of the log, you need to first do a small (about 10%) cut up from the bottom into the compression wood.



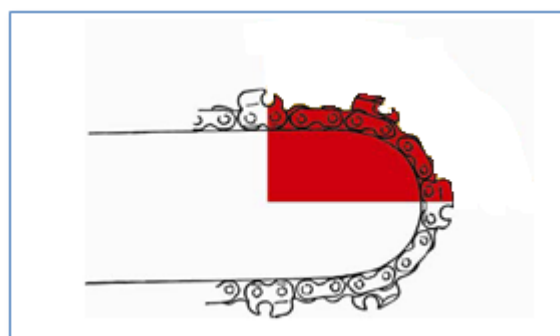
**2 cut method** — For all larger timber cut 10% – 15% of the compression wood first. Then cut the tension wood all the way through. Watch the kerf (gap), if it's closing up: stop and think about it.

This 2 method cut is important for larger timber. For sticks and small branches it often doesn't matter.

### What is kickback and how do you prevent it?

Kickback is a reactive force that happens when:

- the depth gauge at the front of the cutting tooth catches on something and stops the chain going forward; and
- the cutter bar then reacts by kicking up and backwards.



To prevent kickback, don't touch anything with the upper quadrant of the cutter bar — see red zone in graphic.

To reduce risk of injury from kickback, keep your head out of the firing line and wear a helmet fitted with a mesh face shield.

## **What are some common causes of injury?**

With chainsaws, the most common causes of injury are:

- using the wrong size saw, using a blunt saw, or using a saw above shoulder height;
- not wearing the right gear;
- not standing properly; and
- kickback — that is, when the saw suddenly kicks back and upward.
- Logs & timber moving during cutting (rolling onto the operator, smashing into an observer etc)

## **Prior to starting a saw, what should you check?**

All components of a saw should be fitted and working properly, of particular note you should check all the safety features such as the chain break, check the chain is tensioned correctly and bar nuts are tight. The fuel and oil should both be full, the chain must be sharp.

## **What is ‘running on’ in relation to a chainsaw?**

A chainsaw that is ‘running on’ poses a risk to the operator and will damage the chainsaw. Running on is related to the centrifugal clutch, the operation of the clutch is central to both safety and maintenance and you will need to do some independent research on this topic before the training day.

In summary; if for any reason the clutch plates are in contact with the clutch drum then the chain will keep spinning even when the saw is only idling. What should happen when the saw is idling is that the clutch springs pull the plates away from the drum and the chain disengages and stops moving even though the engine is still running.

## **What causes a chain to ‘dish’ or ‘spoon’ when cutting?**

There are 2 main causes of dishing or spooning, dishing puts uneven pressure on the bar rails and groove and quickly damages both the cutter bar and the chain.

Usually dishing is due to a damaged bar and/or chain so that the chain is not sitting properly on the bar, it may also be due to uneven sharpening of the chain.

## **What causes a chain to ‘chatter’ when cutting?**

If the chain is “chattering” when cutting, then the chain is not cutting smoothly. This is usually due to the depth gauges being of uneven height. It is very important that the chain is maintained and sharpened regularly and accurately, depth gauges all the same height, cutters all the same angle and length and everything well matched and maintained to the bar.

## How to use a saw safely

Here are the key tips to using a saw safely. We'll talk about them more on the course.

1. Two hands at all times — including when an arborist is working in a tree.
2. You should never be up a ladder with a chainsaw unless you are also using a rope and harness and have appropriate training.
3. Use the chainsaw with the left hand forward (on top) and right hand on the back handle.
4. Both thumbs need to be wrapped around the handles.
5. Operate the chain-break with the front (left) hand — when putting the brake on and releasing it.
6. Put the chain break on whenever you are not cutting — including when starting the saw.
7. Face your body (and feet) directly forward and don't lean over the line of kickback.
8. Left foot forward when the bar is vertical, this is most of the time. Right foot forward when the bar is horizontal – for example cutting off a stump.
9. Keep your head out of the kickback zone, you should usually be able to read the logo on the left side of the bar
10. Learn the safety features of your chainsaw.
11. When walking around, carry the saw with the bar facing behind you.
12. Keep fuel away from running or hot saws.