# CHAPTER FOUR

# MAINTENANCE PROCEDURES

## OPERATOR'S RESPONSIBILITY

4.01 Regular maintenance of the chain saw is essential to ensure a relatively trouble-free life It is the operator's responsibility to carry out a routine service on the saw after use. Organsations should consider writing a maintenance check list for their saws. An example check list is at Annex A.

### 4 02 ATTITUDE

The right attitude towards servicing the chain saw is important and includes the following;

a. **Frequency** - Servicing on time

b. **Conscientious Approach** - Willingness to look closely into all aspects of servicing.

c. **Cleanliness** - Keeping utensils used for handling of fuel and oil clean Keep the saw free from accumulation of saw dust dirt etc particularly around the clutch sprocket area and the engine's cooling fins.

### 4.03 REACTION TO DEFECTS

Rectify any deficiencies defects, etc promptly. Don't operate the saw if any of its components, particularly safety components, become defective, eg. chain (dull or loose), chain brake, anti-vibration mounts etc.

## SERVICING

### 4.04 ROUTINE SERVICE

The following routine service may need to be carried out daily, before or after each use, depending on the situation and organisational policies Refer to manufacturer's handbook for particular information relevant to the chain saw.

a **Air Filter**:

(1) Remove and clean.

(2) Wash in chain saw petrol/oil mix

b. **Chain/Guide Bar:**

(1) Remove chain & inspect bar

(2) Clean out groove. remove any burrs.

(3) Sprocket tip·

(a) Clean out debris.

(b) Ensure sprocket rotates.

(c) Grease sprocket (where applicable)

(4) Reverse guide bar to even out wear (does not apply to shark nose bars) .

(5) Install chain and sharpen. It may be necessary to sharpen the chain several times during the day.

(6) Tension chain correctly.

c. **Chain Brake (excluding internal types):**

(1) Thoroughly clean, particularly around brake band.

(2) Ensure correct operation.

d. **Clean** - Thoroughly clean saw, paying particular attention to cooling fins.

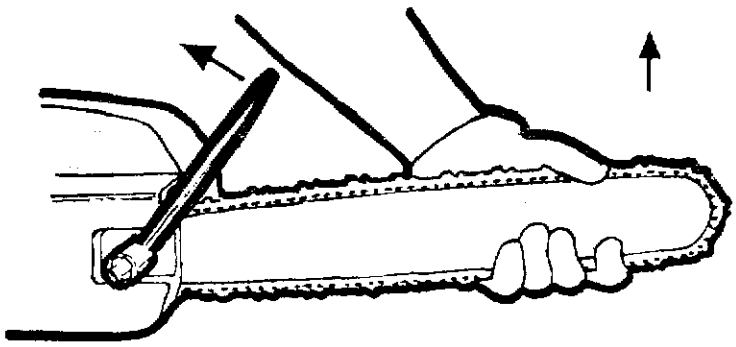
e. **Loose Screws/Nuts** - Check screws/nuts for tightness if found to be continually loosening, apply 'Loctite' or similar.

f. **Petrol/Oil Ratio** - Refer to manufacturer's handbook.

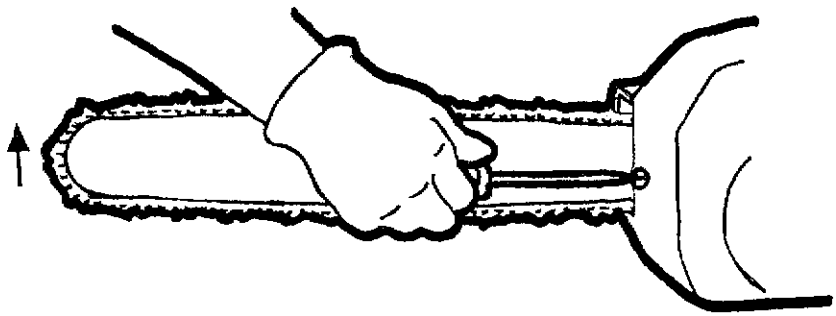
## 4.05 CHAIN TENSION

Correct chain tension is the bottom of the chain's tie straps are just touching the underside of the guide bar. When tensioned the chain must be able to pulled around the bar freely by hand.

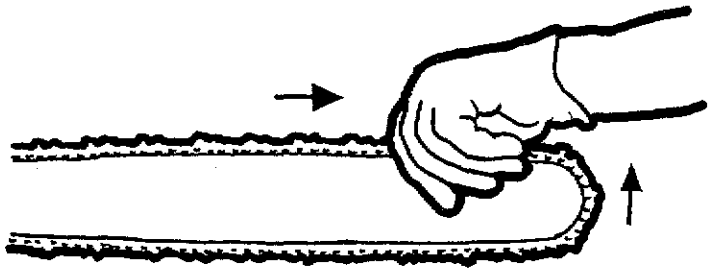
4.06 Sprocket tip bars allow the chain to be run slightly tighter. See Figure 4:1



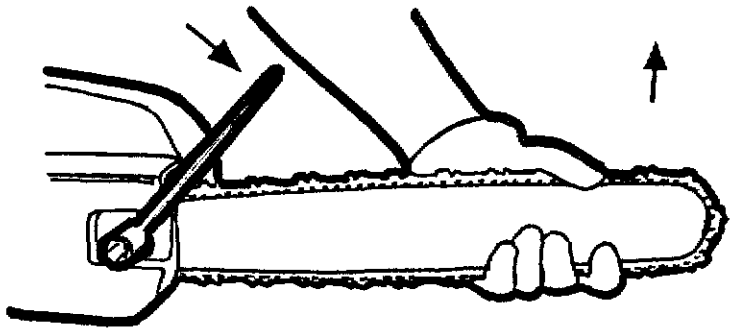
1. Loosen bar nuts.



2. Tighten tension screw. Tighten until chain just touches bottom bar rails. Chain on sprocket nose bars must be tighter.



3. Pull chain around bar to be sure it fits sprocket and bar.



4. Hold bar tip up. Tighten nuts.

Note: chain brake not shown for clarity.

Figure 4:1
Chain Tension

## 4.07 DETAILED SERVICE

A detailed service should be carried out as required, depending on use, as follows:

a. **Air Filter:**
   (1) Remove and check for damage.
   (2) Clean or replace as necessary.

b. **Spark Plug:**
   (1) Remove and clean.
   (2) Adjust gap.

c. **Fuel System:**
   (1) Remove filter and clean.
   (2) Wash out fuel tank to remove accumulated saw dust etc with petrol oil mix.
   (3) Clean breather.

d. **Oil System:**
   (1) Check operation.
   (2) Clean as necessary.

e. **Cooling Fins:**
   (1) Remove fin housing.
   (2) Clean fin and cylinder fins.

f **Rubber Mountings:**

(1) Check for looseness & deterioration.

(2) Adjust or replace.

g. **Sprocket/Clutch:**

(1) Remove, clean debris from clutch & sprocket.

(2) Check sprocket for wear. Replace if necessary (must also renew chain).

(3) Grease bearing.

h. **Spark Arrester:**

(1) When engine performance begins to deteriorate, remove and clean spark arrester.

(2) The spark arrester must be securely fitted at all times.

i **Tune Engine:**

(see paras 4.08, 4.09 and 4.10)

## ENGINE TUNING

### 4.08 PRELIMINARY CHECK

Satisfactory engine tuning can only be achieved if all parts of the chain saw are functioning properly, ie:

a. **Air Flow** - Check clean air filter.

b. **Fuel Flow** - Check clean tank and fuel filter.

c. **Fuel Mixture** - Check correct petrol oil mixture ratio.

d. **Electrical Current** - Check clean spark plug and gap.

### 4.09 ENGINE TUNING PROCEDURE

The following is one method for field tuning a saw.

a. **Step 1** - Screw both low and high speed mixture jets in until they are lightly seated. (Be careful not to over tighten mixture screws).

b. **Step 2** - Turn both speed jets out - one full turn (this is basic setting - refer to manufacturer's handbook).

c **Step 3** - Start saw and allow to warm up.

d **Step 4** - Low speed jet - adjust first.
Achieve the smoothest idle possible.
Enrich mixture (turn out) if there is hesitation when snap accelerating (idle to full throttle), only turning 1/10 turn at a time.
Lean mixture (turn in), if saw runs roughly at idle, smokes, etc.

e. **Step 5** - Re-adjust throttle stop screw so engine is idling smoothly without the chain running.

f. **Step 6** - High Speed Jet
Enrich - turn out 1 4 turn
Full throttle (no load) - engine should '4 stroke'.
Test cut in log at maximum revs - engine should '2 stroke'.
Adjust high speed jet - lean (turn in) 1·10 turn at a time until best power is achieved High speed jet must not be leaned more than 7 8 turn

g. **Step 7** - After low and high speed jets are correctly adjusted, it may be necessary to re-adjust throttle stop screw to adjust idle.

## 4.10 CDI ELECTRONIC IGNITION SYSTEMS

**CAUTION:** A CDI ignition system will be damaged if the engine is pulled over without the high tension (HT) grounded to the engine.

To ensure that no damage is sustained by CDI systems, the following procedure is recommended when checking for 'spark':

a. Before removing the spark plug HT lead·
   (1) place stop switch in the STOP position; and
   (2) pull engine over at least one revolution.

   This process discharges the capacitor in the ignition system ensuring that no residual voltage is stored in the ignition circuit. It is now safe to remove the spark plug HT lead

b. To check for spark.
   (1) remove spark plug from engine, connect HT lead and ground plug to engine frame;
   (2) place stop switch in the '**run**' position, and
   (3) pull engine over briskly.

**Note:** Before removing the plug from the grounding point, repeat procedure 'a ' as ignition system is charged once more.

**CAUTION:** Do not check the spark by holding the HT lead away from the engine frame. The gap between the HT lead and frame will be too large resulting in a high build-up of voltage which may cause damage

c. Checking engine compression etc - Before turning over the engine with the HT lead disconnected
   (1) place stop switch in the RUN position: and
   (2) ground HT lead to the frame of the saw

**Note:** Ensure the HT lead is grounded to the frame of the engine and not the handles, as anti-vibration mounts do not allow electric current to pass through

## GUIDE BAR MAINTENANCE

4.11 The following points should be observed when maintaining the guide bar:

a. The groove should be kept clean and the clearance to the bottom of the chain drive links maintained at the manufacturer's recommended setting.

b. Remove any burred or feathered edges with a flat file.

c. Check the oil holes regularly to ensure they are clear.

d. Turn the bar regularly to ensure even wear.

e. Ensure the chain entry point is properly funnelled.

f. Ensure the rails are even and run at right angles to the body of the bar.

g. Sprocket tip bars which require greasing should be greased with every fuel tank refill.

h. Clean and file away from the sprocket end to avoid dirt and filings entering the sprocket bearing.

## CHAIN SHARPENING

### 4.12 WHEN TO SHARPEN

Chain should be sharpened when:

a. the chain saw requires undue force to make it cut;

b. saw dust consists of fine powder rather than chips; or

c. chain saw starts to dish or run off in the cut (ie not cut straight).

### 4.13 HOW TO SHARPEN

Always use the correct diameter file for the particular chain. File diameter is governed by chain pitch.

| Chain Pitch | File Diameter |
|---|---|
| 0.325 | 3.16" to 5.32" (4.5 mm) |
| 3.8" | 7.32" to 3.16" (5.5 mm or 4.8 mm) |
| 0.404 | 7.32" (5.5 mm) |

4.14 Generally the larger diameter file is used until the cutter is half worn, then a smaller diameter file is used.

When filing, points to remember are:

a. file using a full length stroke;

b. the art of sharpening is to 'hone' rather than the removal of a lot of metal;

c. don't attempt to sharpen an oily chain, rather, cut some dry wood to clear oil from the chain before sharpening;

d. file a little often, rather than a lot, occasionally;

# CHAIN SAW POWER HEAD TROOBLESHOOTING CHART

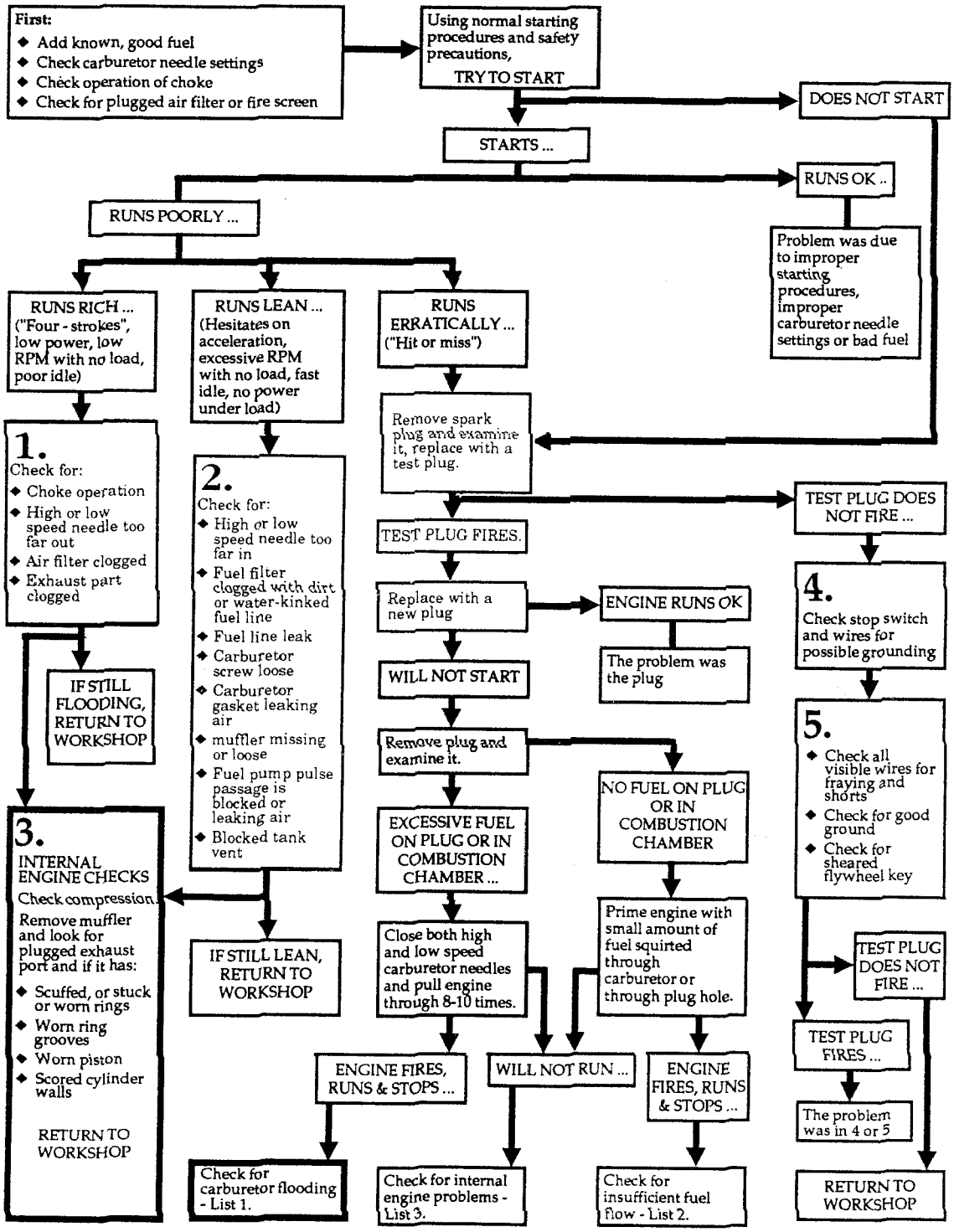
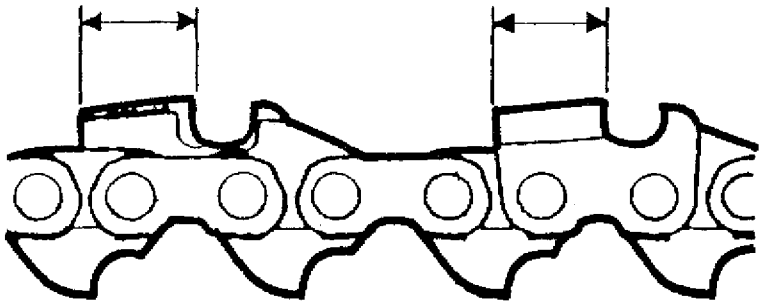



Figure 4:2

e. cutters should be filed from inside to outside;

f. do not use any tilt on square or semi-square profile cutters if the cutter bar rails are slightly spread (the chain wil tilt);

g. keep cutters equal in length and angles, as failure to do so will cause uneven cutting (running off) chain chatter and excessive vibration



**Keep all cutters same length**

Figure 4:3

h. when using a file guide, ensure that the guide rests both on the top plate and depth gauge; and

## File guide

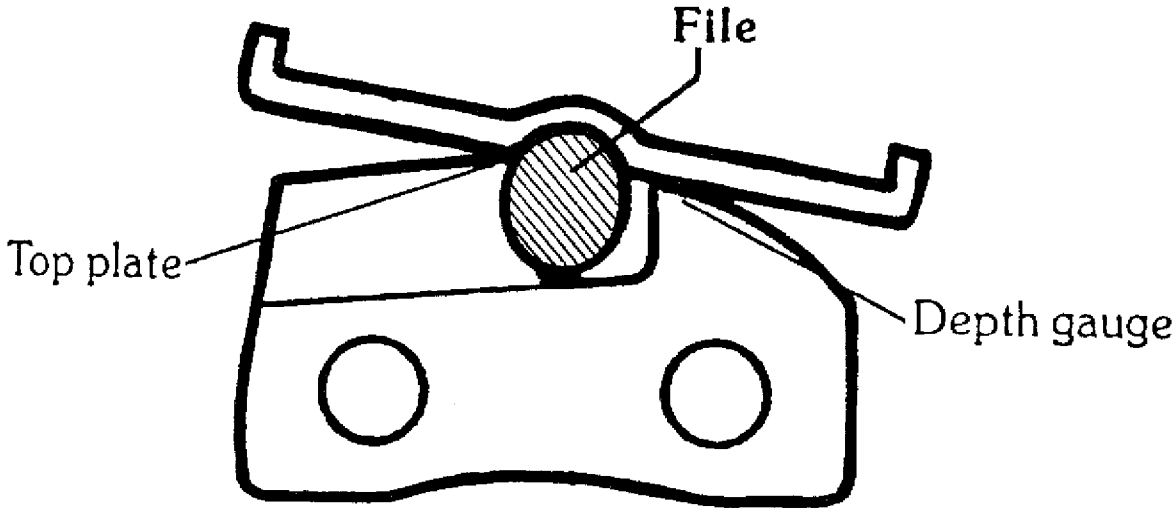



Figure 4:4

i. sharpen with saw firmly positioned.

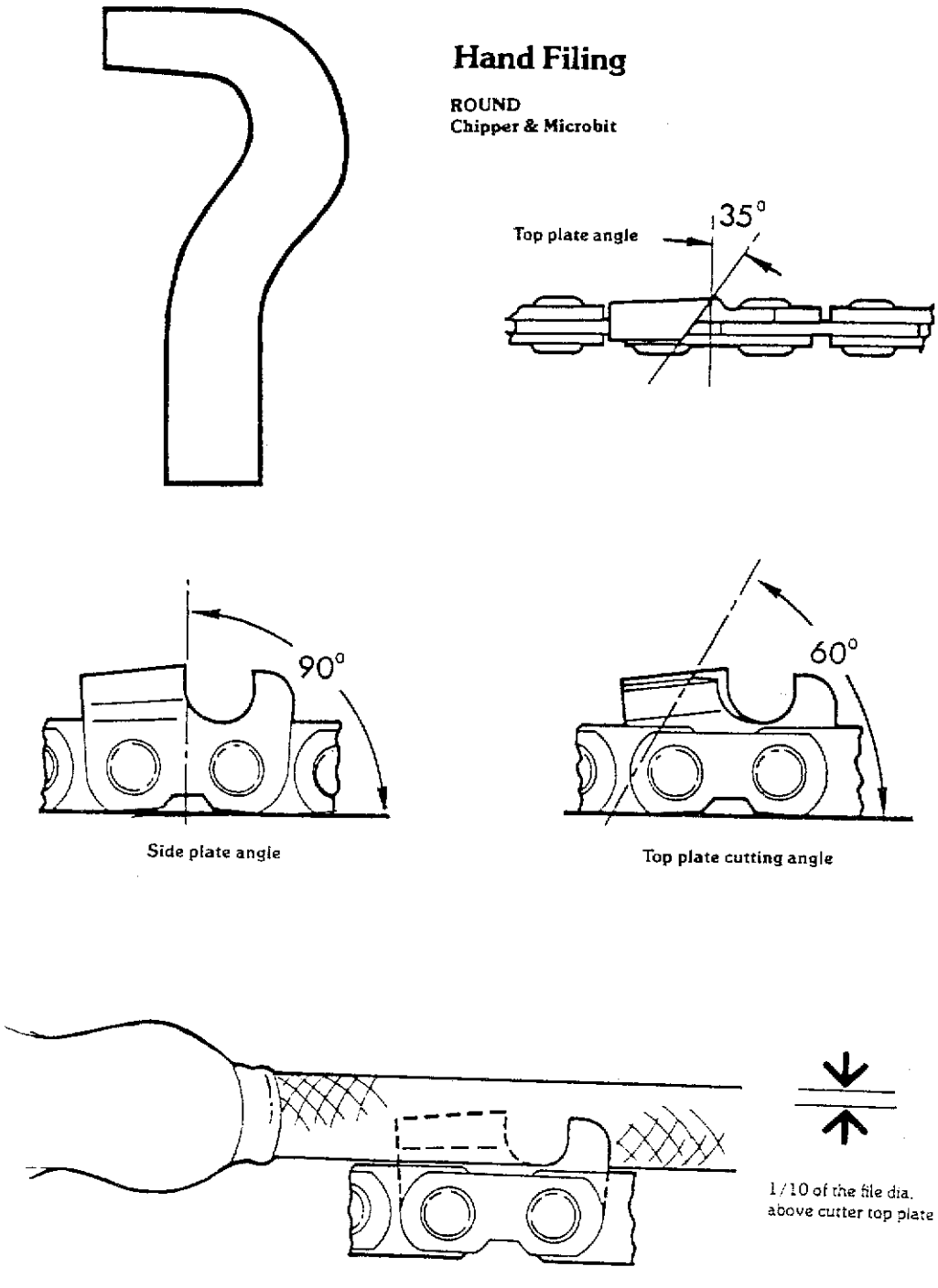
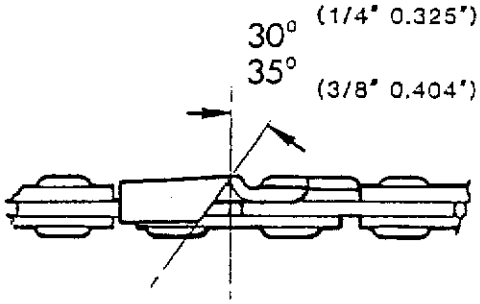


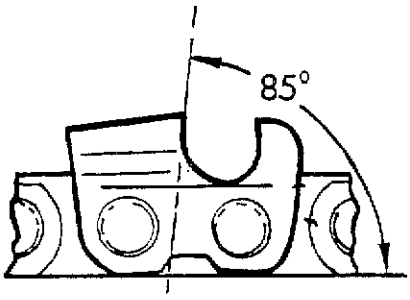

Figure 4:5

## Hand Filing

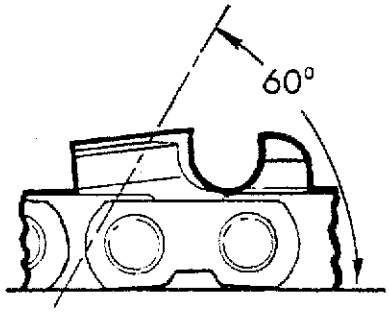
**SEMI SQUARE**
**Mirco Chisel**



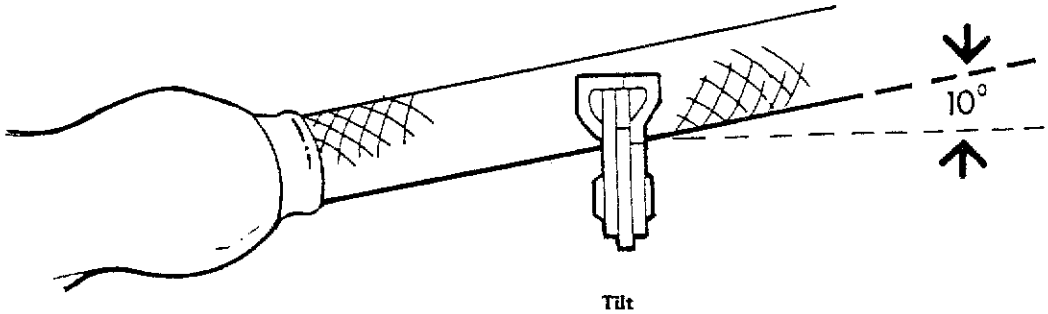

Top plate angle




Side plate angle




Top plate cutting angle

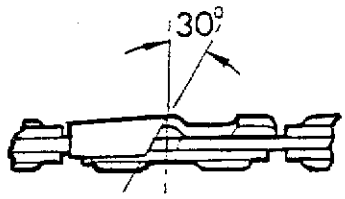



Tilt

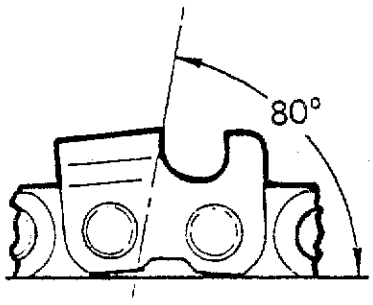
Figure 4:6

## Hand Filing

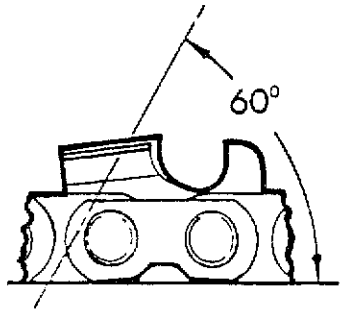
**SQUARE**
**Chisel**



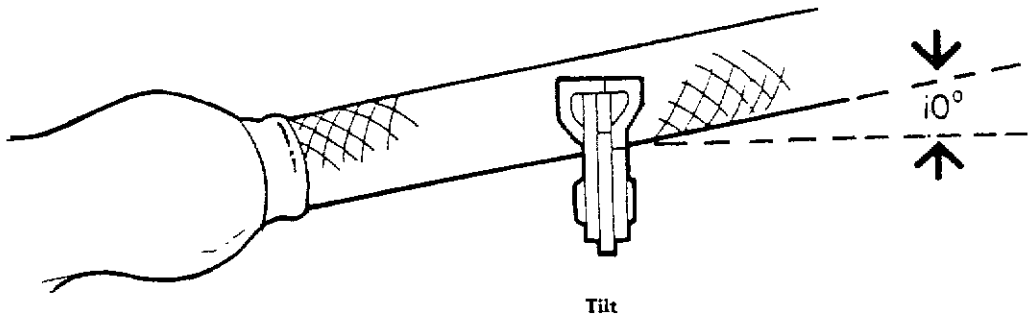

Top plate angle




Side plate angle




Top plate cutting angle

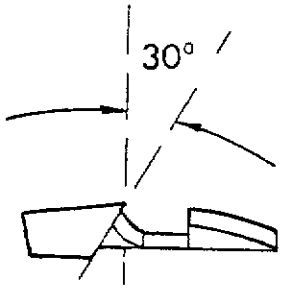



Tilt

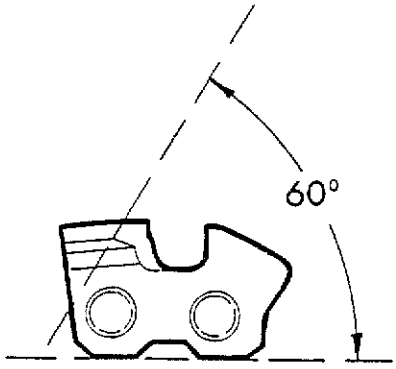
Figure 4:7

## Hand Filing

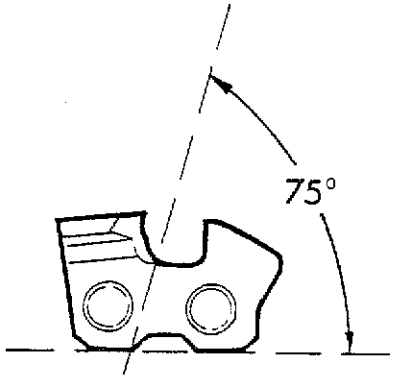
**SQUARE**
**Chisel**
**(Low Profile)**



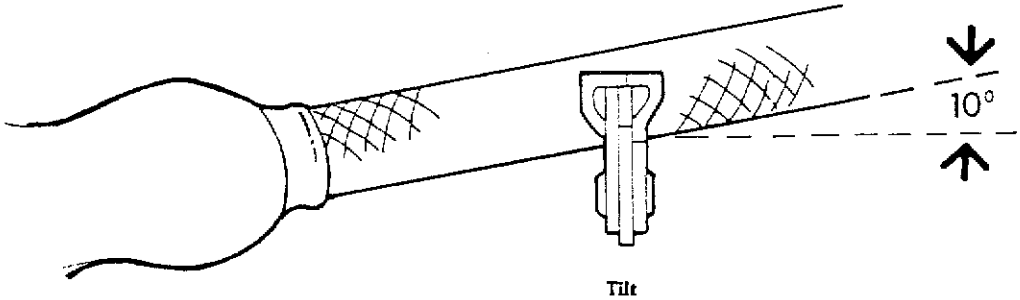

Top plate angle




Top plate cutting angle




Side plate angle




Tilt

Figure 4:8

## 4.15 COMMON FILING ANGLES

With square and semi-square profile chains, the top plate is filed at $35^0$ but because of the $5^0$ to $10^0$ tilt, a $30^0$ angle should be obtained.

| | Round | Semi-Square | Square |
|---|---|---|---|
| Top Plate Filing Angle | $35^0$ | $35^0$ gives $30^0$ | $35^0$ gives $30^0$ |
| Side Plate Angle | $90^0$ | $85^0$ | $80^0$ |
| Tilt | Nil | $5^0$ to $10^0$ | $5^0$ To $10^0$ |

## 4.16 DEPTH GAUGE SETTING

Depth gauge setting is critical to the performance of the chain:

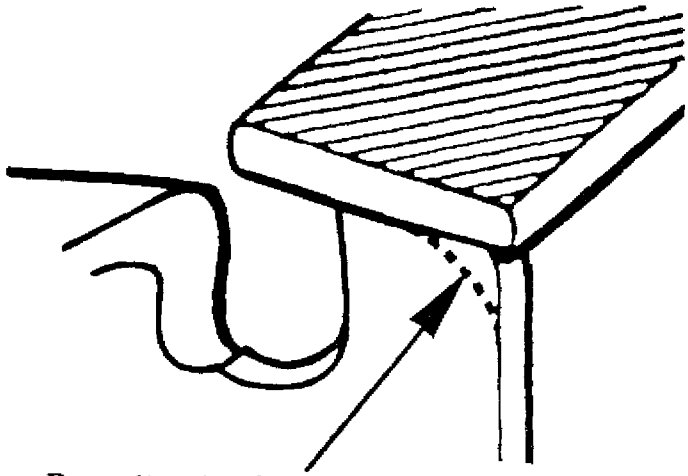
a. Depth gauge too low - Chain grabs, binds easily, chatters and leads to rapid cutter bar wear.

b Depth gauge too high - Chain looses self-feeding characteristics and extra pressure is required to make the chain cut Leads to rapid wear on all components.

c Uneven depth gauge setting - Gives excessive vibration and chain chatter.

**4.17** Check the depth gauges every third or fourth sharpen. In order to maintain maximum performance throughout the entire life of the chain, the depth gauges must be lowered progressively as the cutter's length is reduced

**4.18** The leading edge of depth gauges must always be rounded This prevents cutters from burrowing into the wood when boring, thus reducing 'kickback' potential

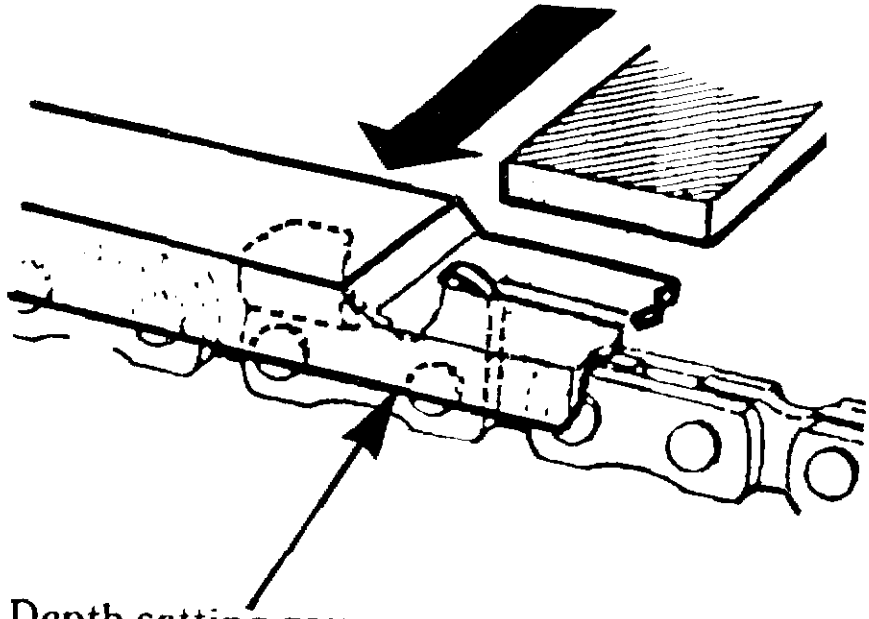


Rounding leading edge of depth gauge.

Figure 4 9

4.19 **Depth gauge setting varies depending on chain type, saw power and** wood to be cut. See Figure 4:10

| | |
|---|---|
| 0.025" | = pine--small saw (minimum) |
| 0.045" | = hardwood--large saw |
| 0.030" to .035" | = general cutting |



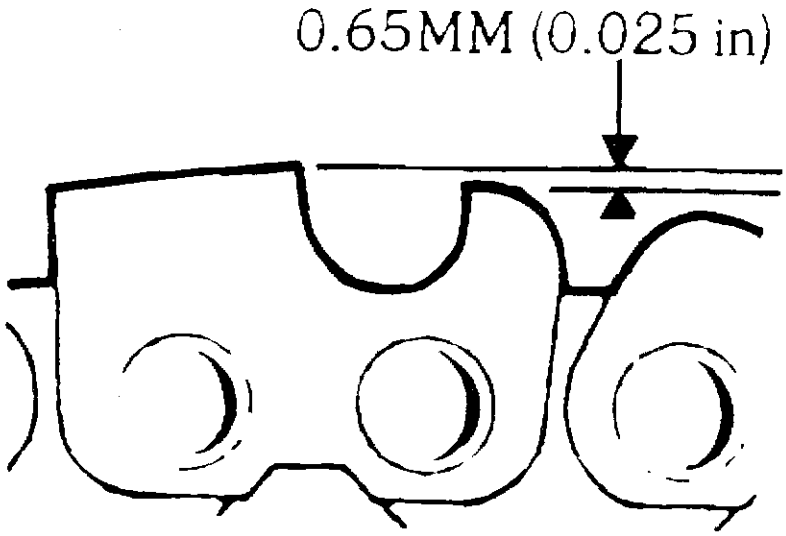




Figure 4-10

## BREAKING-IN A NEW CHAIN

**4.20** It is important to take care to progressively break-in a new chain to ensure it will be capable of maintaining a tension throughout its life. The main concern in 'breaking-in' is lubrication.

**4.21** **PROCEDURE**

a. Step 1 - Tension new chain normally.

b. Step 2 - Pump or pour oil onto chain.

c. Step 3 - Run chain at 1 4 throttle for 2 to 3 minutes (no load) maintaining a liberal supply of oil on chain.

d. Step 4 - Stop saw and allow to cool--re-tension if necessary.

e. Step 5 - Cut for 2 to 3 minutes at 1/2 throttle in green timber.

f. Step 6 - Stop saw and allow to cool--re-tension if necessary.

g. Step 7 - The chain is now ready for use.

**Note:** Never re-tension a very hot chain and leave it. Contraction could bend the crankshaft.

## CLEANING CHAIN GULLETS

**4.22** After a few sharpenings chain gullets will become misshaped. When this happens poor chip clearance will result and the chain may cut roughly. The new lower profile cutters tend to keep correct gullet shape longer than previous chains but still need periodic maintenance.

**4.23** Usually a ridge will develop at the bottom of the side plate. A round file should be held level and at a $20^0$ angle to cutter to reshape the gullet. The filing stroke is made in opposite direction from the sharpening stroke. Be careful not to remove more material than necessary or chain life will be shortened.

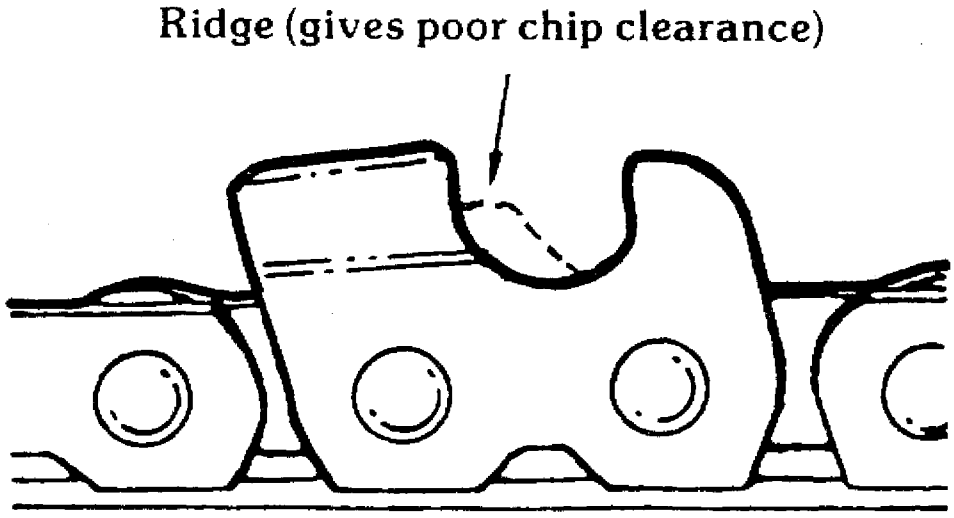



Figure 4:11

ANNEX A TO
CHAPTER FOUR

## MAINTENANCE CHECKLIST

| ITEM | MAINTENANCE | FREQUENCY | | | | |
|---|---|---|---|---|---|---|
| | | HOURLY | DAILY | WEEKLY | MONTHLY | OTHER |
| Screw nuts, bolts | Inspect and tighten | | xxx | | | |
| Chain brake | Inspect and check | | xxx | | | |
| Air filter | Clean | | xxx | | | OR more often in dusty conditions |
| Side plate cover | Remove and clean | | xxx | | | OR if removed during day for bar maintenance |
| Bar | Clean and turn | | xxx | | | OR clean if removed during day |
| Spark plug | Inspect and clean | | | xxx | | |
| Muffler screen | Remove and clean | | xxx | | | |
| Sprocket | Inspect | | xxx | | | |
| Sprocket bearing | Grease | | | xxx | | |
| Cylinder fins | Clean | | xxx | | | |
| Starter rope | Inspect | | xxx | | | |
| Fuel filter | Clean | | | xxx | | |
| Chain tension | Check and adjust | xxx | | | | |
| Chain | Sharpen | | Twice daily | | | OR more often in abrasive condition |
| Chain oil flow | Check | | xxx | | | |
| Exhaust port | Clean - use wooden scraper | | | | xxx | |
| Fuel tank | Clean - flush out with petrol | | | | xxx | |
| Oil tank | Clean - flush out with kerosene | | | | xxx | |
| Muffler screen | Remove and clean | | xxx | | | |
| Muffler box | Remove and clean | | | xxx | | |

# CHAPTER FIVE

# CROSS CUTTING

## INTRODUCTION

5.01 Cross cutting usually refers to operations that involve cutting across the grain of the timber. It generally refers to timber that is not free standing ie fallen trees.

5.02 It is important to use good cross cutting techniques in order to.

a. minimise the chance of injury;

b. minimise damage to power head and cutting attachment; and

c minimise jamming of the saw.

## BASIC PRINCIPLES

5.03 Good cross cutting depends on the following basic principles·

a Always assess the bind relationship in the log and choose the sequence of cuts to suit.

b. Stand to one side of the cut

c. If there is a chance of either half of the log springing, keep an escape route open.

d Stand on the opposite side to which a log will spring or roll when making the final cut (stand on the uphill side of a log if it is likely to roll).

e. Minimise up-cutting (it's hard work), boring in and down-cutting may be easier.

f. Watch the kerf to see whether it is opening or closing. This may cause you to alter the sequence of cuts.

g. If there is a risk of the log pinching or jamming the cutter bar, 'saw' back and forth during the cut. This makes it easier to feel when the log is beginning to pinch the bar.

h. 'Sawing' the chain saw back and forth is also effective when cutting badly split timber as it widens the kerf of the cut.

i Use the saw as a lever and the dogs as the pivot point to minimise work effort. Similarly use the leg muscles when cutting upwards.

j. Insert a wedge in the cut if there is a high risk of the log dropping or twisting This will prevent jamming

## TYPES OF BINDS

5.04 In cross cutting, always cut the wood in compression first, be it on the top, bottom or on either side. If wood in compression is cut last then the saw may jam See Figures 5 1, 5 2 and 5 3

**Top Bind — Both Ends Supported**

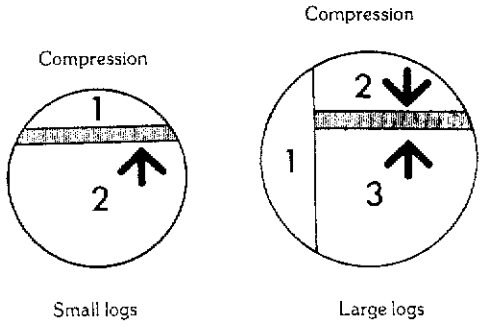
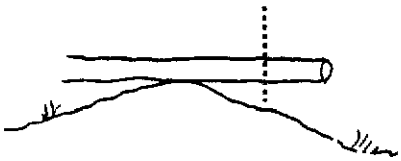



Figure 5:1

**Bottom Bind — One End Supported**



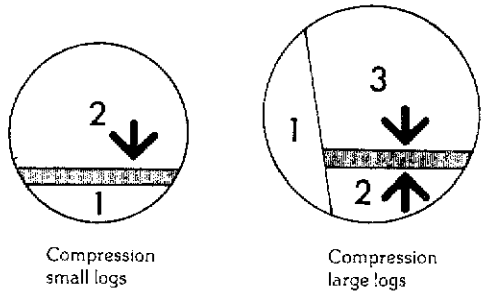
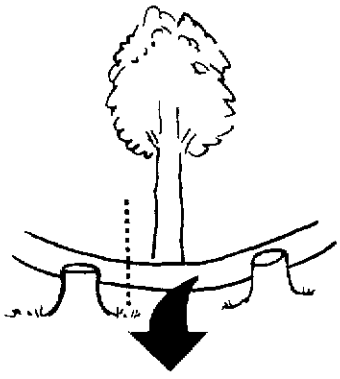



Figure 5:2



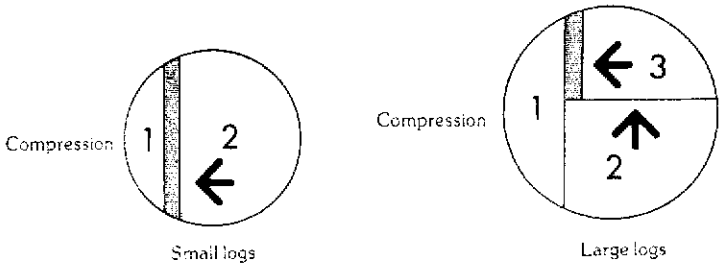



Figure 5:3

## 5.05 LOG TRAP

Before beginning the cuts through a log check for any possible lateral movement. If one end of the log is unable to move and the other end can drop away when cut, an angled cut is used. Ensure that the angle cut is sloped to the correct side so that the release cut will not cause the citter bar to be trapped when one end drops away.

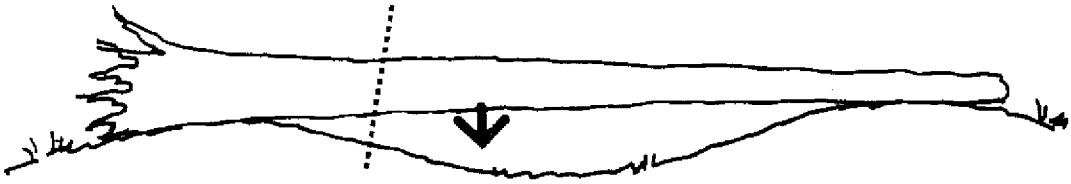


Figure 5:4

**Sequence of Cuts**

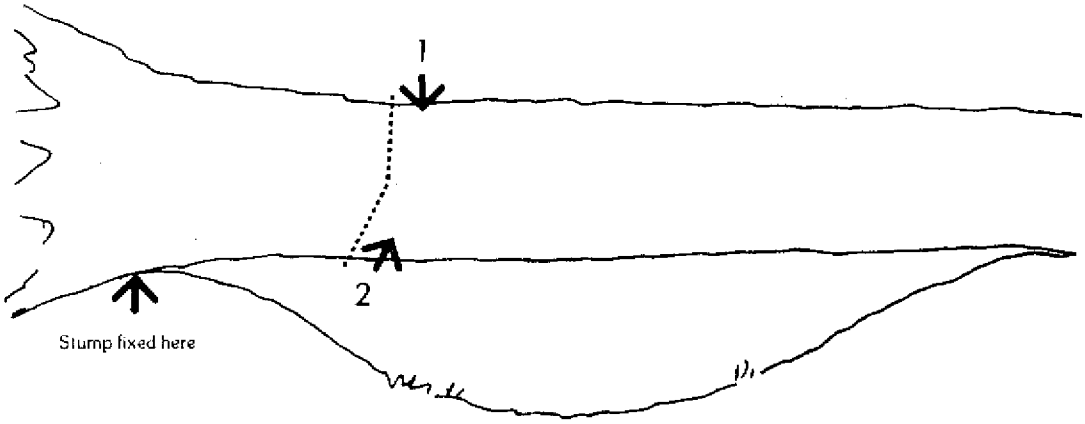



Figure 5:5

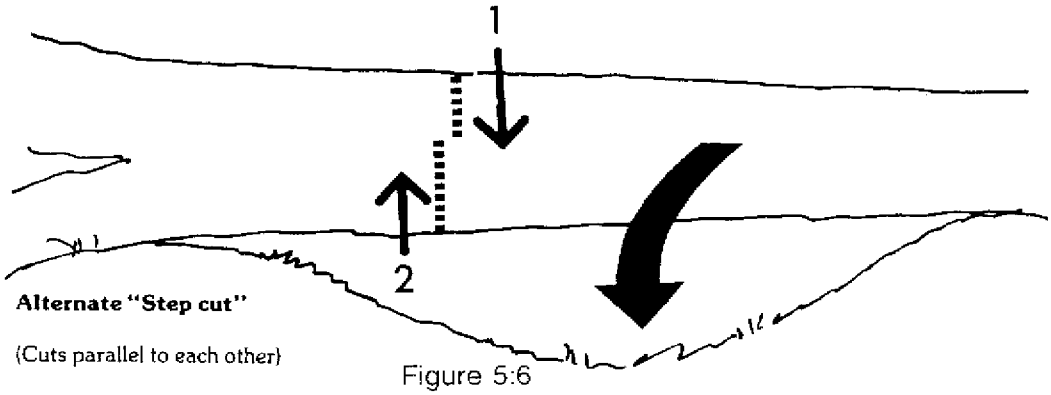



Figure 5:6

**Removing trees that have fallen across the road**

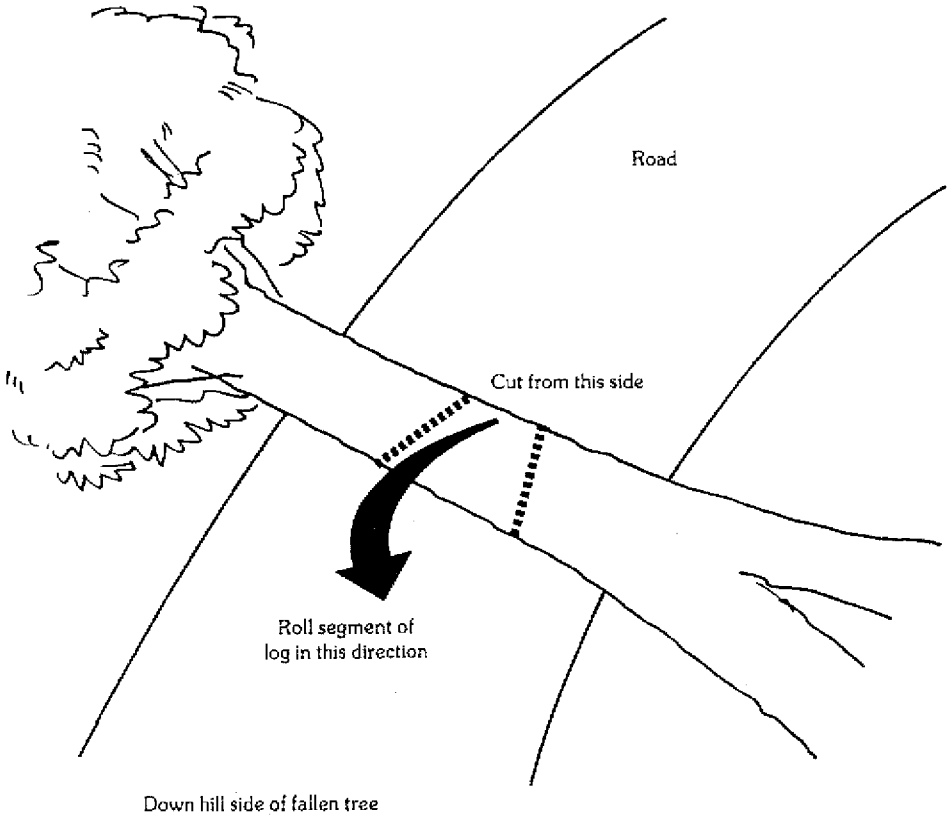



Figure 5:7
Wind Blow

## Wind Blow

**Tree with partially buried or obstructed stump**

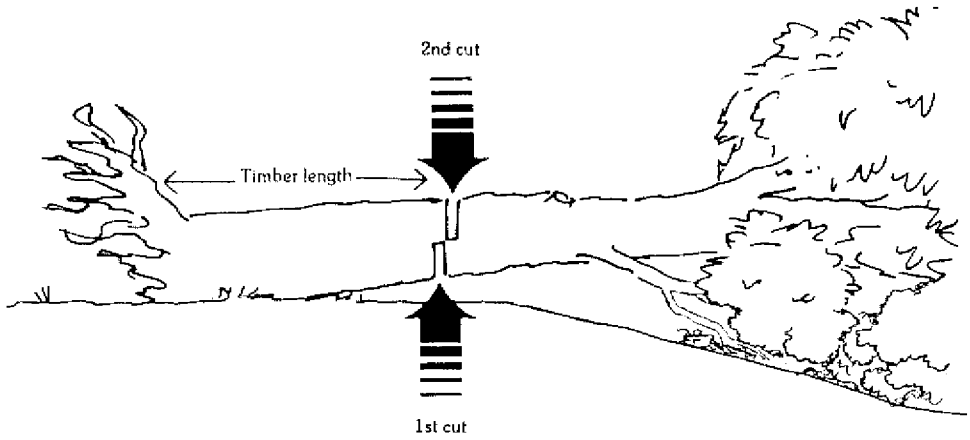



Figure 5:8

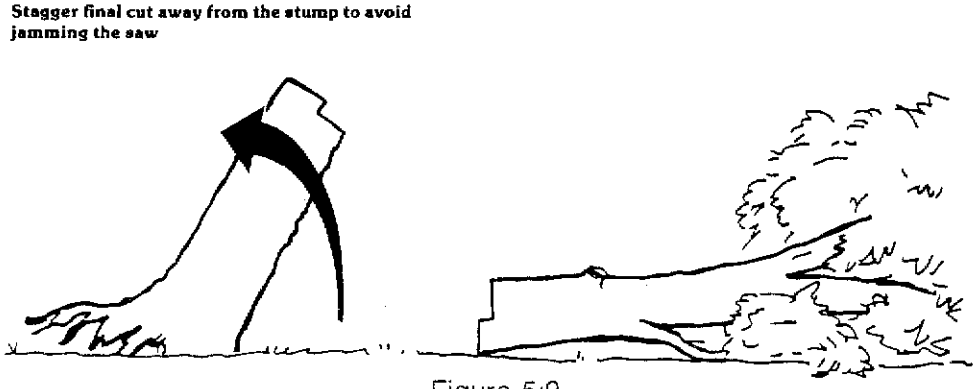



Figure 5:9

## LIMBING

5.06 Limbing is a potentially dangerous operation. Always be aware of where the nose of the cutter bar is at all times to reduce the risk of kickback. There is a real danger of the operator being injured by branches swinging back or dropping down, or the tree shifting during the limbing process.

5.07 **BASIC RULES**

a. Stand in a safe working position and watch out for obstacles.

b. Where possible never limb on the side of the tree you are standing on.

Figure 5:10

c. Concentrate on what your are doing.

d. Always be aware, where the nose of the cutter bar is

e. At times it may be necessary to work the saw horizontally. Adjust your grip on the chain saw's handles to suit the position of the saw.

f. When ever possible, let the tree support the weight of the chain saw. Pivot the saw, using the saw's dogs (spikes) as a fulcrum.

## 5.08 CUTTING BRANCHES FROM A STANDING TREE

A chain saw should not be used above chest height as control. balance and vision are impaired. Don't attempt to cut with the saw overhead or the cutter bar in a vertical position. If the saw should kickback, you may not have enough control to prevent possible injury

**Note:** If it is necessary to cut something which is above chest height a firm platform such as scaffolding or a cherry picker should be used. A chain saw should not be operated from a ladder. In some circumstances it may be necessary for operators to use roping systems to enable them to operate above ground level This must not be attempted unless your organisation approves of such procedures and all personnel are properly trained These procedures are beyond the scope of this manual.

## 5.09 LIMBING LARGE HARDWOODS (EG EUCALYPTS).

This operation requires close attention in order to avoid.

a. kickback;

b. the guide bar becoming pinched;

c. the operator being injured by:

(1) branches swinging back or dropping; or

(2) the tree shifting

**5.10** The following rules should be observed·

a. First cut and remove branches hindering your work. Cut branches in two or more sections when this facilitates clearing work at (a). (b) and (c) in sequence for each limb as shown in Figure 5:11. (See Figure 5:11). Keep your working space clear of cut branches.

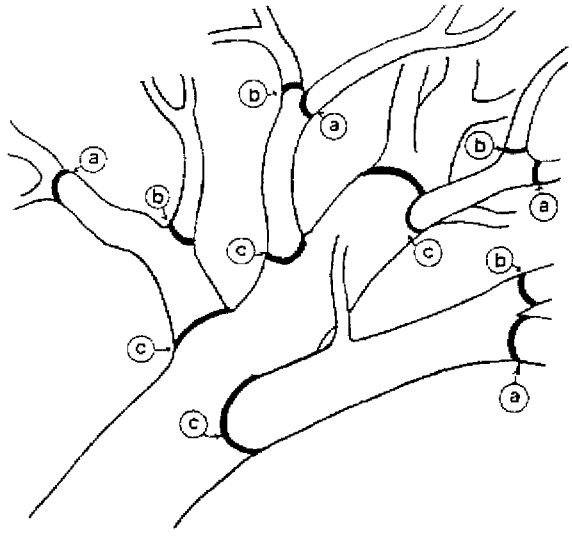



Figure 5·11

b. It is very important to observe the tensions in the wood particularly on large branches Refer to the section on 'Types of Binds' for the correct cutting techniques.

# CHAPTER SIX

# PRINCIPLES OF TREE FELLING

## INTRODUCTION

### 6 01 COMPETENCY

A 'competent' tree feller always controls the situation, rather than letting it control him/her by working outside the limits of his/her own abilities.

### 6.02 IMPORTANCE OF DIRECTIONAL FELLING

The aim is to fell the tree as near as possible to the intended 'place of fall', safely, without personal injury damage to property and equipment.

## FELLING CONSIDERATIONS

6.03 Consider the sequence of felling trees to guard against creating:

a. 'hang-ups';

b hangers or 'widow makers'; and

c. extra work through placing heads of trees or limbs at the base of another tree to be felled.

### 6.04 HUNG-UP TREES

Trees that have lodged together following felling must be immediately and completely felled or otherwise made safe for persons who may pass underneath.

### 6.05 HANGERS OR WIDOW MAKERS

Take extra care when felling a tree with a hanger in it. The first stage of a tree's fall may dislodge the hanger, continue watching during escape

### 6.06 WEIGHT DISTRIBUTION OF CROWN

Determine which side of the crown has the most weight. Branching or heavy growth on one side will tend to drag the tree in that direction.

### 6.07 INTER-GROWTH WITH ADJOINING TREES

Trees may be difficult to fell if there is inter-growth with adjacent trees, or vines interwoven with adjacent trees. When felling trees that may brush against other trees, consider the possibility of:

a. falling limbs: and

b making widow makers:

**Never work underneath a lodged or hung-up tree**

## 6.08 OPEN SPACES

Always fell into open space (even small trees in the felling line can be thrown back towards you) Create your own open space by working on a felling face whenever possible. Avoid felling into other trees, stumps, rocks or logs if possible.

## 6.09 WIND

Wind may be strong enough to overcome the trees natural lean. You may have to wait for a lull in the wind before felling. Remember that wind velocity is always less at ground level than crown level. Wind on the tree head exerts leverage on the tree that may have a considerable effect at ground level.

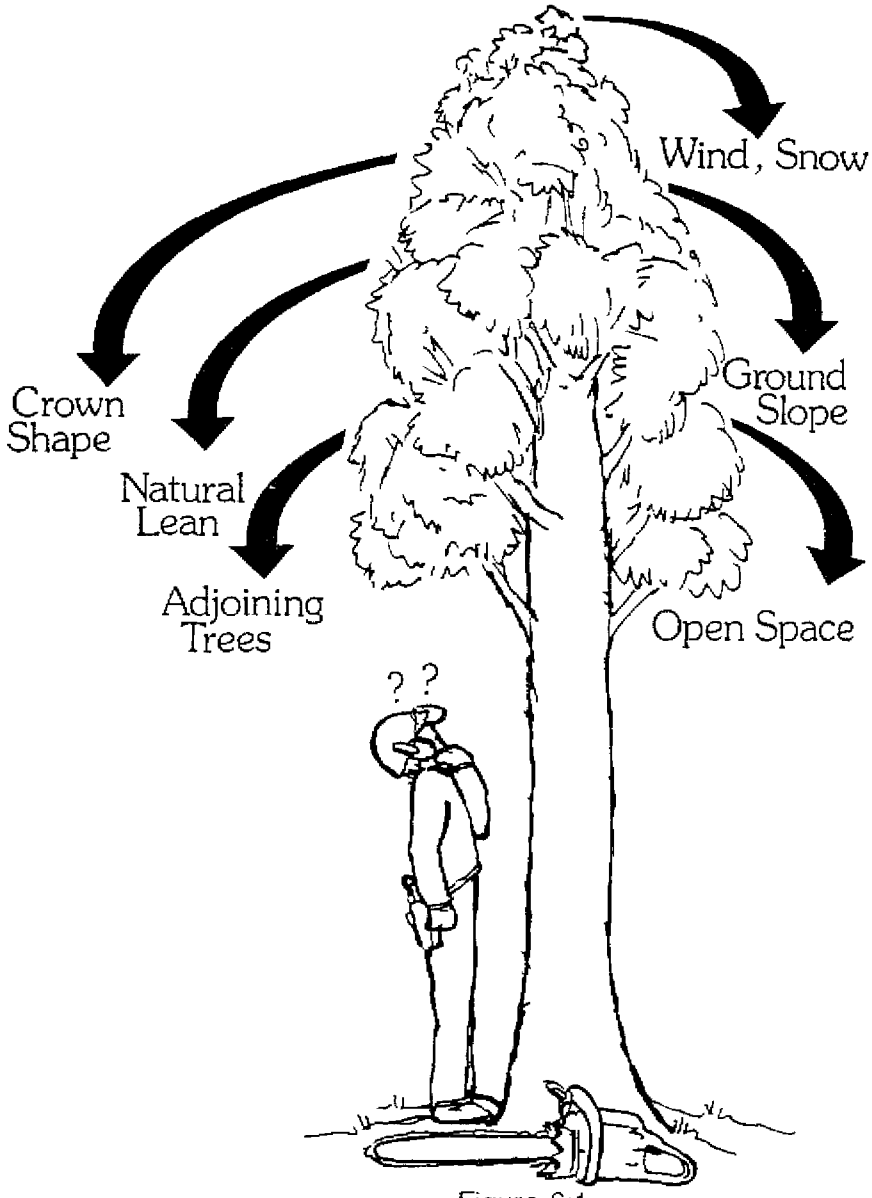



Figure 6:1
Felling Considerations

## PREPARATION AT EACH TREE

### 6.10 CHECK FOR DEFECTS

a. 'Sound' the tree with an axe, checking for hollow sections.

b. Look for external scars, deadwood in crown, burnt sections, ants, etc.

c. It may be necessary to adjust felling direction.

d. Some species of trees are prone to defects in the heart, eg pipes, etc

e. Internal defects can be detected by the condition of the sawdust.

### 6.11 CLEAN AROUND THE BASE OF THE TREE

a. Prepare a clean work area around the tree.

b Remove small bushes to enable a good footing and to prevent 'kickback' through the cutter bar striking hidden obstacles.

c. Clean dead wood etc along tree felling line as it may be flung up backwards, upon impact.

### 6.12 PREPARE AN ESCAPE ROUTE

a. 90% of felling accidents occur within 4 metres of the stump.

b Chose a line of retreat 45 degrees diagonally backwards, away from the direction of fall.

c. If the butt kicks up as the tree falls, it will generally go straight backwards or to one side.

d If the tree splits up it will stab backwards from the line of fall.

e. If the tree snaps in the falling line it will generally come back straight over the stump.

f. When felling up-hill, trees may slide backwards, straight over the stump

g. When the tree begins to fall you will hear fibres in the holding wood begin to snap.

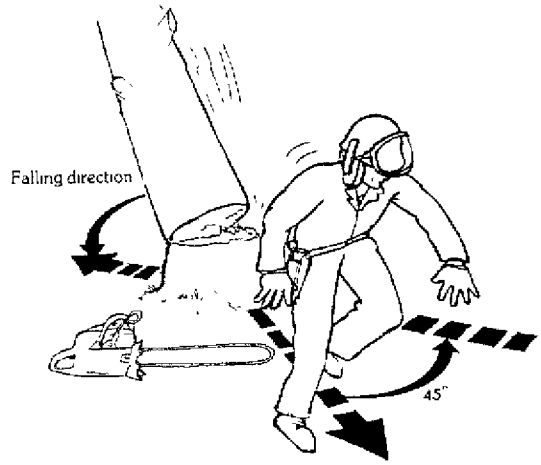



Figure 6:2
Escape Route

h. You should then, immediately.

(1) withdraw saw, switch off and place it on the ground away from risk of damage;

(2) follow intended escape route; (see Figure 6·2); and

(3) continuously look back at the tree's fall, watching for flying/falling limbs.

## ELEMENTS OF SIMPLE TREE FELLING

### 6.13 THE SCARF

The function of a scarf is to direct the tree in the desired direction of fall. Always point the scarf to the desired direction of fall. It controls the tree during its fall and allows a smooth steady fall of the tree. It also serves as a means of breaking the holding wood.

### 6.14 TYPES OF SCARF

The following types of scarf are the most common used in felling operations:

a. Standard scarf (45 degrees for pine, 30 degrees for hardwood).

b. Humbolt or reverse scarf.

c. V-scarf.

d. Box scarf

e. 90 degree scarf.

### 6.15 STANDARD SCARF

This is the most commonly used. It consists of horizontal and angled open cuts. Both cuts need to be at the same depth into the tree. The scarf wood should be able to be removed cleanly.

**Both cuts are to finish at the same depth in the tree.**

Figure 6.3

## 6.16 HUMBOLT SCARF

This is frequently used in saw log operations. It allows greater utilisation of the saw log as no butt trimming is necessary. It is sometimes difficult to cut very low to the ground. It can be an advantage when felling uphill as it provides an extra 'step' to prevent the tree sliding back over the stump

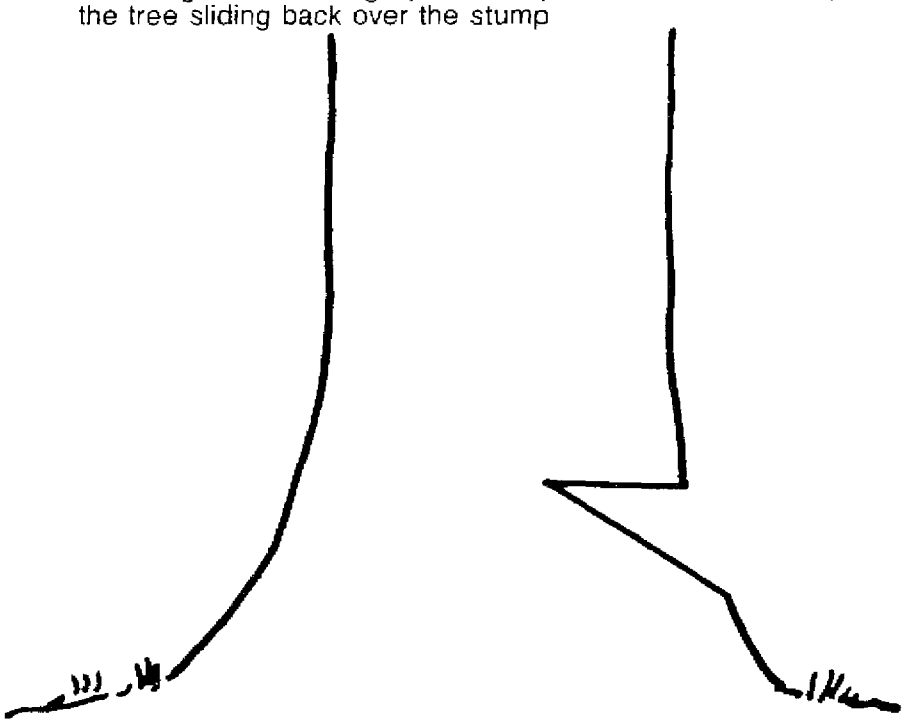


Figure 6.4

## 6.17 VEE SCARF

This is fairly difficult scarf as two sloping cuts have to meet. The advantage is that this scarf gives a very wide opening and allows the tree to fall under control through a greater angle. It can be used to advantage when felling trees with trunk diameters larger than twice the chainsaw's cutter bar length.

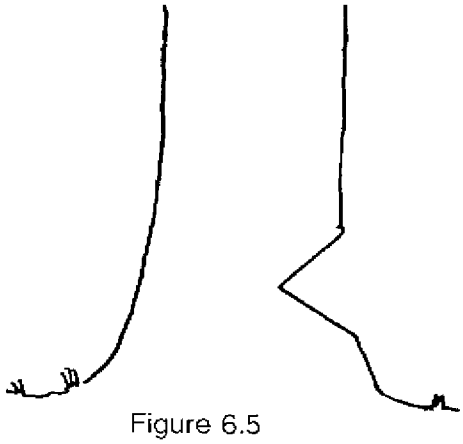


Figure 6.5

## 6.18 BOX SCARF

This was developed because old cross-cut saws and early chain saws didn't cut satisfactorily at an angle to the grain. It can be used when felling a tree with a diameter more than three times the length of the cutter guide bar.

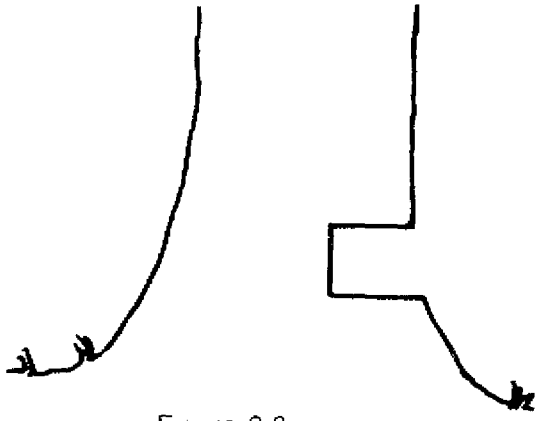


Figure 6·6

## 6.19 90 DEGREE SCARF

It can be used in trees with a very pronounced butt swell. Both cuts are relatively easy to match. It needs to be cut to such a depth that the scarf width is 2 3 of the tree's diameter. Usually the depth of the 90 degree scarf is less than the depth of a standard scarf.

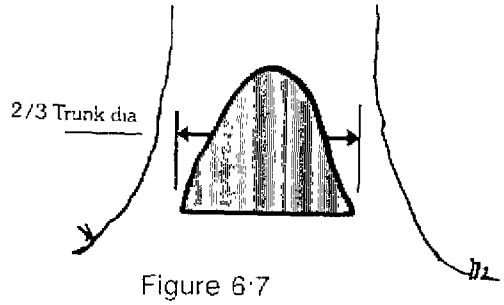



Figure 6·7

## 6.20 CHARACTERISTICS OF A GOOD SCARF

a. **Direction** - The line of the scarf must be at right angles to the proposed direction of fall. The scarf is always in the direction of desired fall, regardless if you intend to 'swing' the tree away from its natural lean

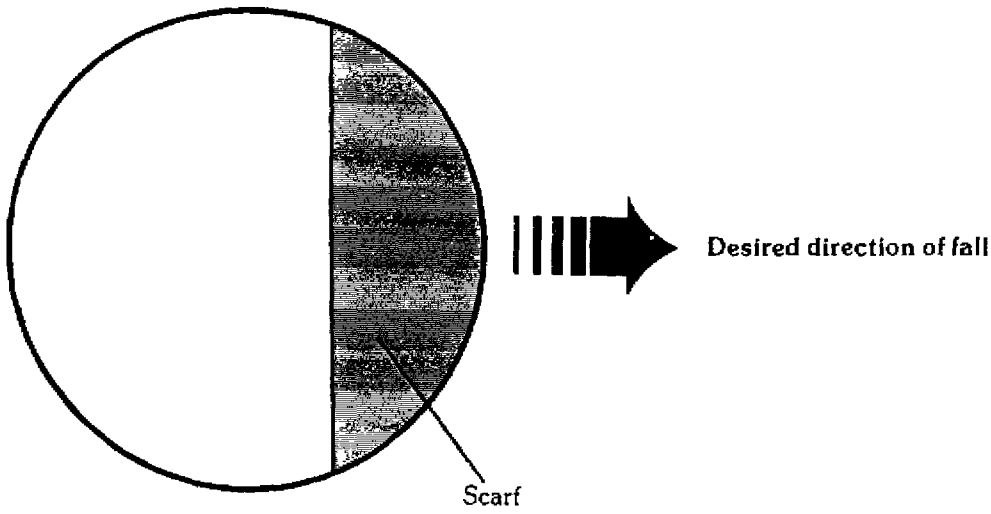



Figure 6:8

b. **Depth** - The depth of a scarf should be 1/4 to 1/3 diameter of the tree. It can be made deeper if the tree is prone to splitting. The desired depth may not always be possible as the tree may start to sit forward

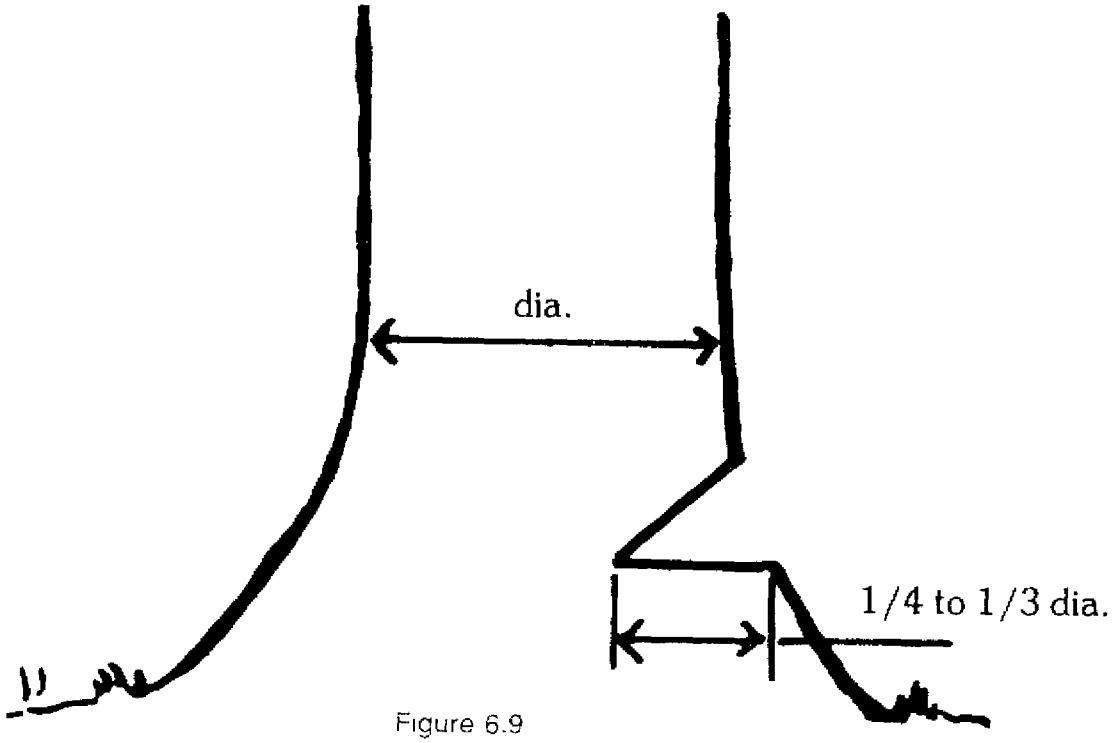



Figure 6.9

c **Size of Opening** - The slope of the top (or bottom) cut should be 30 to 45 degrees. This creates an opening to control the tree's fall through as large an angle as possible.

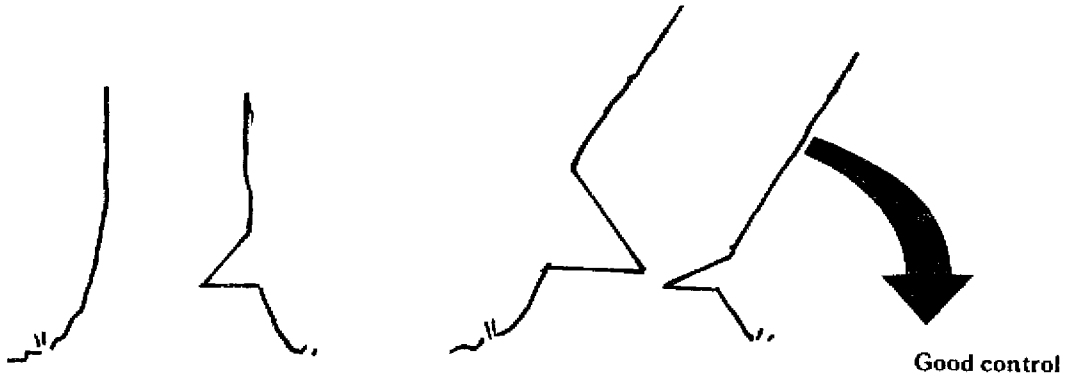



Figure 6.10

If the opening is too narrow, then the scarf closes soon after the tree begins to fall thus breaking the holding wood too early.

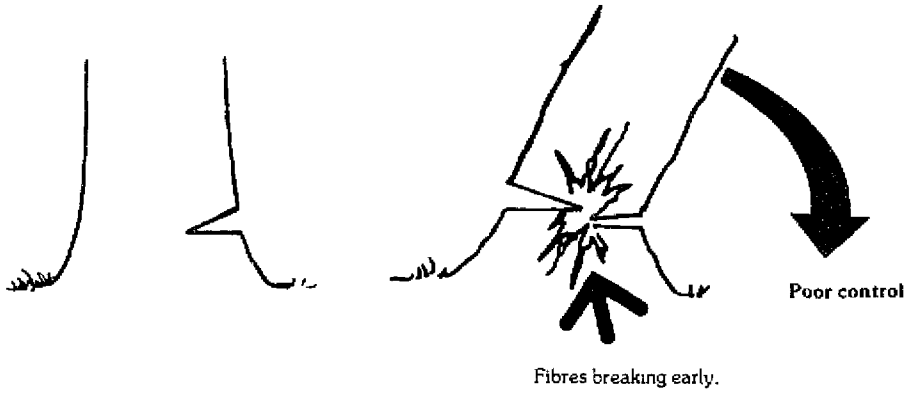



Figure 6:11

d. **Cuts Should Meet Exactly** - Don't over-cut on the top or bottom cuts and ensure the holding wood is not cut This allows the tree to fall through the full angle of the scarf, rather than sit on the over-cut and prematurely break the holding wood

e. **Line of Scarf is Horizontal** - If the line of the scarf is not horizontal, then the holding wood on the higher corner will break first thus pulling the tree off its line of fall

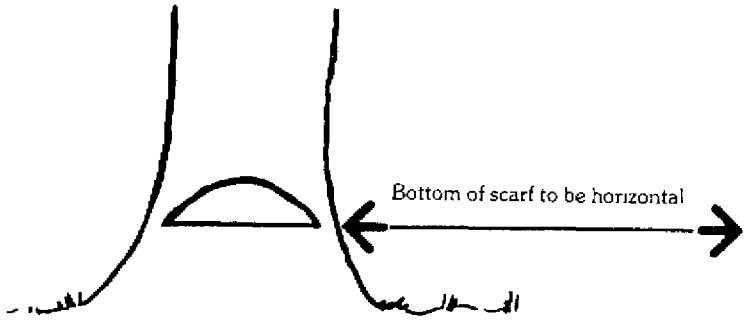



Figure 6·12

## 6.21 BACK CUT (FELLING CUT)

The characteristics of a good back cut are as follows:

a It should be at least 36 mm above the level of the horizontal cut in the scarf.

b. As a general rule, the height of the cut above the scarf horizontal cut is approximately 50 mm for each 500 mm of the tree s diameter up to a maximum of 100mm for trees 1m diameter or greater.

c It provides a step which prevents the tree slipping backwards over the stump especially when felling up hill.

d. Trees are harder to fall with high back cut as this creates more holding wood to be broken. It is particularly dangerous when wedging a slightly backwards leaning tree.

e. The line of the back cut should be horizontal

f. A sloping back cut will give uneven thickness in the holding wood.

g. It is important that sufficient thickness of holding wood be left to guide the tree through its intended fall

h The features of the back cut are common to all types of scarfs.

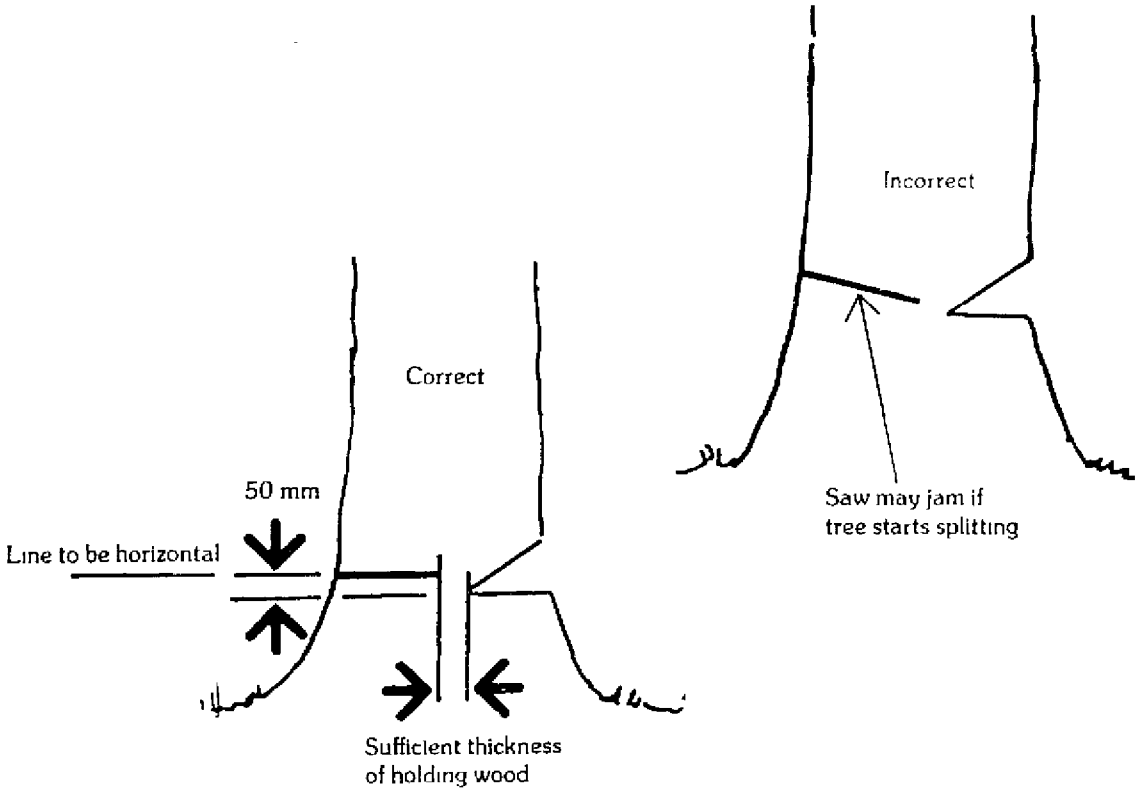



Figure 6:13

## 6.22 HOLDING WOOD (HINGE WOOD)

This acts as a hinge controlling the tree's fall. See Figure 6:14 It should be approximately 10% of a solid tree's diameter. It needs to be thicker if the tree is defective. See Figure 6:15. In simple falling it should be an even thickness across the stump. See Figure 6:15

6.23 When felling trees against their natural lean, ensure that sufficient holding wood is left on the narrow end of the taper. See Figure 6:16

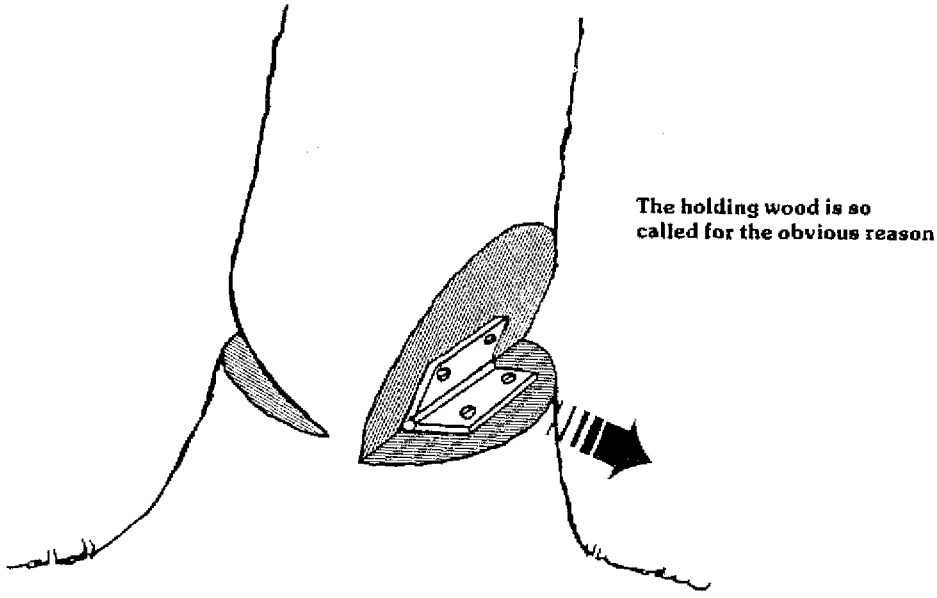



Figure 6:14

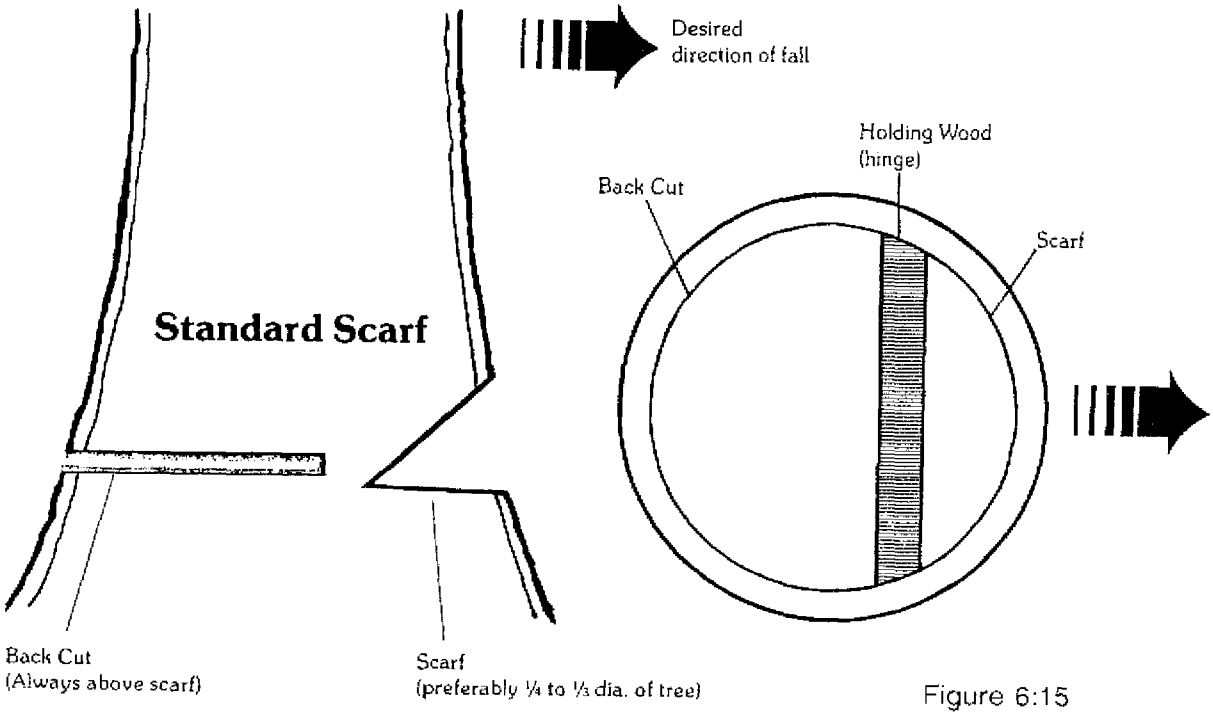
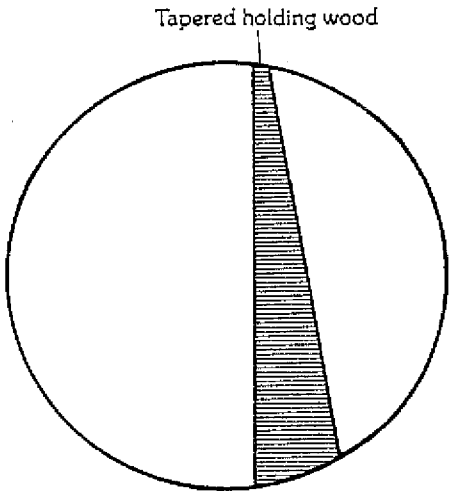
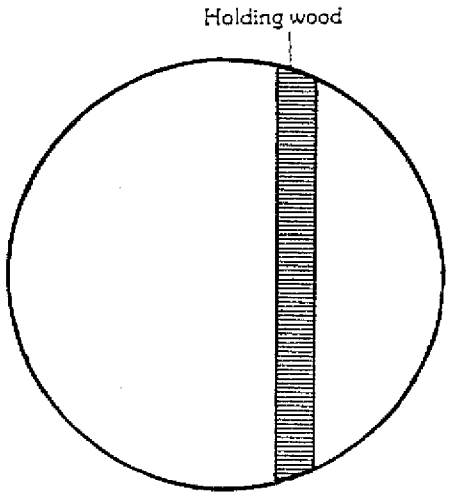


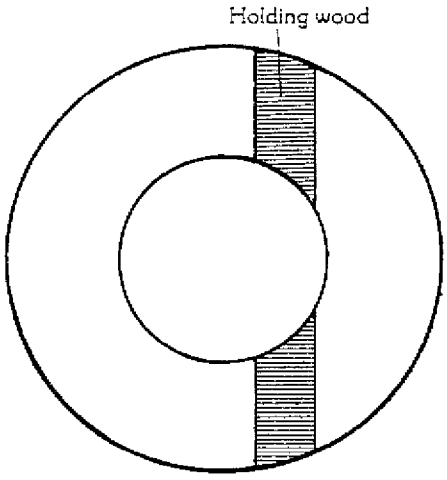

Figure 6:15



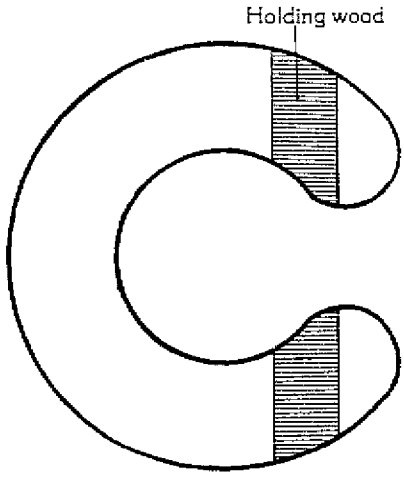

Pulling tree away from its natural lean.




Solid




Defect piped




Defect burnt section

Figure 6:16

# AIDE MEMOIRE

## PREPARATION FOR FELLING

Before felling each tree consider these points:

1. Lean of the tree.
2. Weight distribution.
3. Inter-growth with adjoining trees.
4. Hang-ups.
5. Climbing vines.
6. Open space.

## PRECAUTIONS

1. Clean around base of the tree.
2. Prepare an escape route.
3. Check for defects, window makers etc.
4. Ensure area is clear of personnel.

# CHAPTER SEVEN

# PROBLEM TREE FELLING

## INTRODUCTION

**7.01** Problem tree felling techniques include felling trees with:

a. side lean;

b. forward lean;

c. diameter over twice the cutter bar length;

d. double leaders; and

e. defects - pipes etc and snags.

## TREE WITH SIDE LEAN

**7.02** When a tree has to be felled at an angle to its natural lean, there are three main techniques that can be used. These are:

a. uneven holding wood;

b. uneven holding wood plus wedges; or

c. the Dutchman

**7.03** UNEVEN HOLDING WOOD

a. Place a scarf in the desired direction of fall.

b. Start cutting the backcut on the side of the natural lean.

c. Continue the backcut towards the opposite side of natural lean leaving thicker holding wood on that side. The thicker holding wood will break last, thus swinging the tree towards the desired direction of fall.

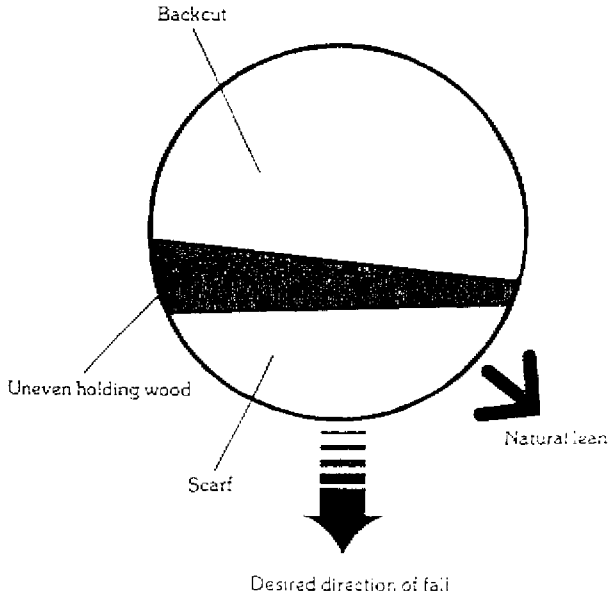



Figure 7:1

## 7.04 UNEVEN HOLDING WOOD PLUS WEDGES

The technique of uneven holding wood can be assisted by using a wedge in the back cut on the side of the lean. The wedge is inserted in the back cut as soon as possible and driven in gradually as the back cut proceeds.

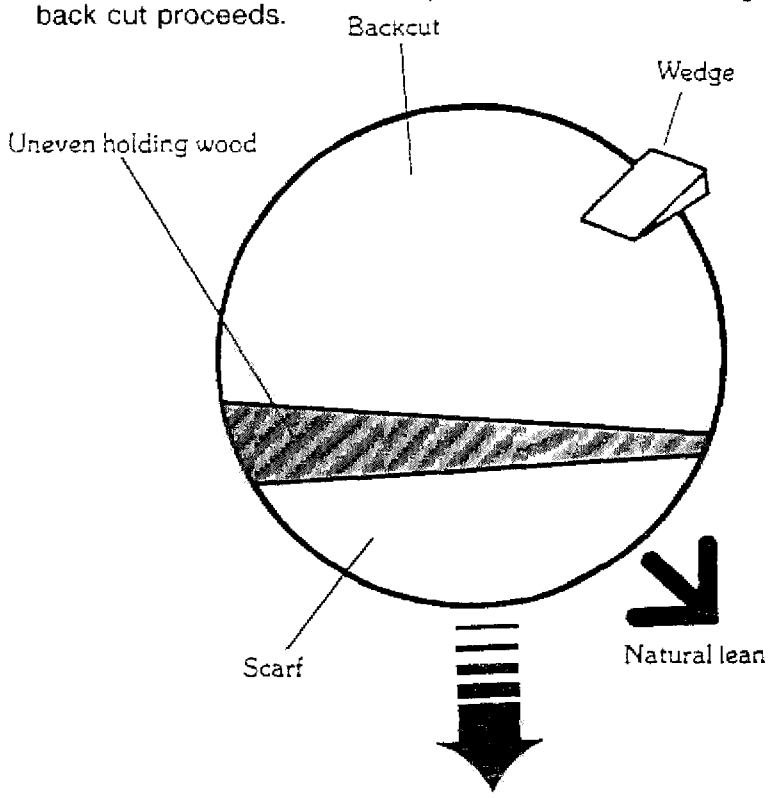



Figure 7:2

## 7.05 THE DUTCHMAN

This technique should only be attempted by experienced fellers.

a. **Method 1**

(1) Cut a standard scarf

(2) Continue the horizontal cut of the scarf to undercut the holding wood on the side of the natural lean.

(3) Cut a standard back cut for the uneven holding wood. (Thicker wood on opposite side to the natural lean.) See Figure 7:3

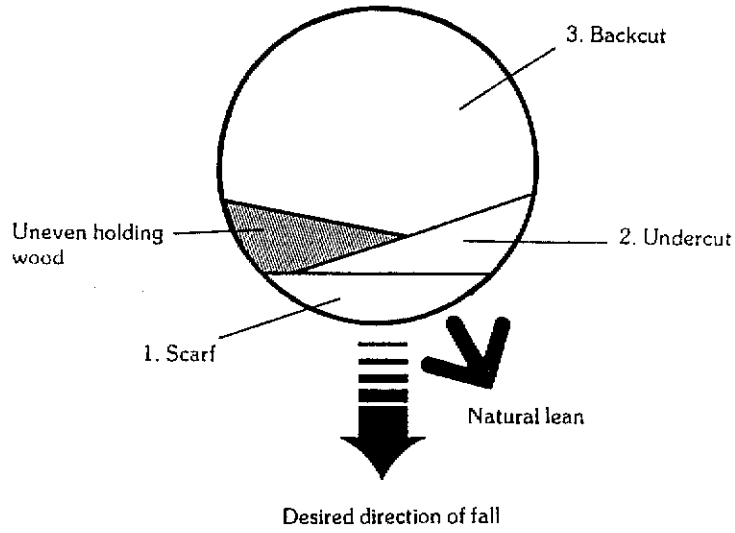



Figure 7:3
Dutchman - Method 1

b. **Method 2**

(1) Cut a standard scarf.

(2) Cut off a section of the scarf's wedge and replace it back in scarf on the side of natural lean.

(3) Cut a standard backcut for uneven holding wood.

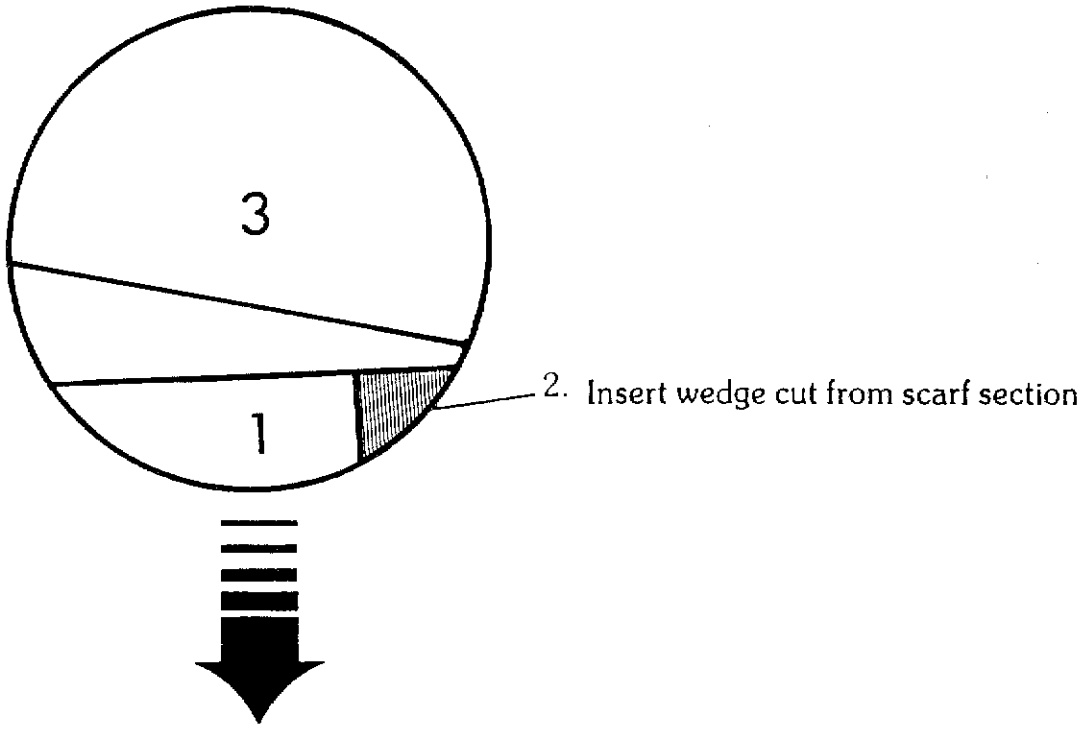



Figure 7:4
Dutchman - Method 2

7.06 Both 'Dutchman' methods work by letting the tree settle into the lean side then swinging it around towards the desired directions of fall.

7.07 Never finish the backcut under the leaning side of the tree. Apart from personal safety, this also minimises the chance of the cutter bar being jammed if the tree sits towards the lean side.

## TREE WITH FORWARD LEAN

7.08 In the case of heavily leaning trees, there is a danger of the back splitting up ('slabbing' or 'barber chairing') if the wrong cutting technique is used. This is potentially a very dangerous situation.

7.09 Two methods can be used. All rely on the operator cutting as much as possible of the potential 'splitting wood' in an intermediate cut before the final release backcut is made.

a. Cut a standard scarf as large as possible without jamming the saw.

b. Bore in behind where the holding wood is to remain. Cut forwards to the holding wood, then backwards to leave a holding strap (anchor) say 150 mm thick.

c Then cut a release back cut (holding strap). See Figure 7:5

7.10 The second technique is similar to technique No. 1, instead of boring directly behind the holding wood, the saw is pivoted with the saw's dogs at points (i) and (ii) and nosed to make cuts 'b' and 'c'. Holding strap 'd' is cut by the release backcut.

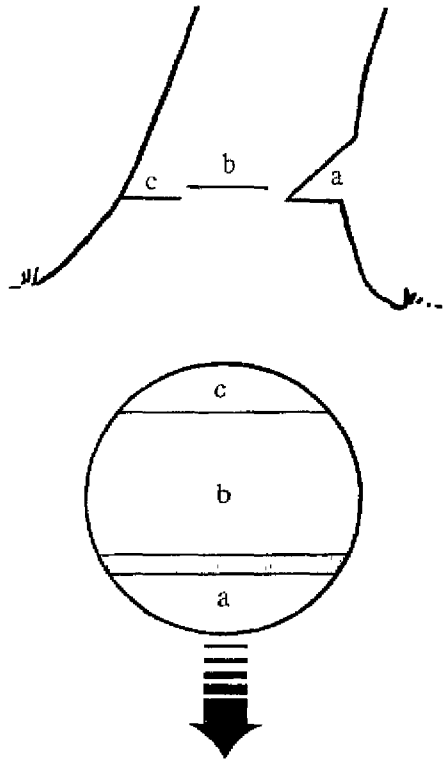



Figure 7.5

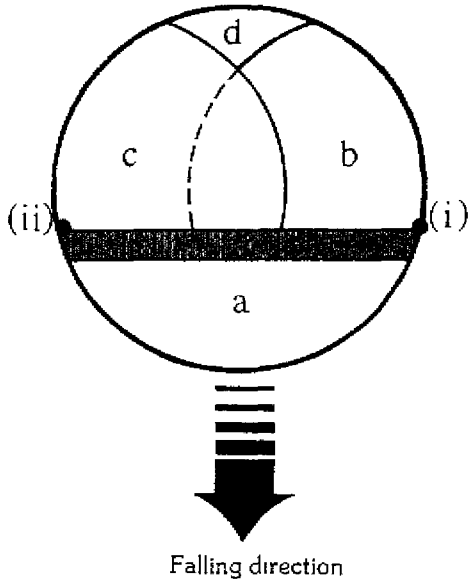



Figure 7:6

## 7.11 TREE DIAMETER EXCEEDS TWICE CUTTER BAR LENGTH

a. Cut a vee or standard scarf as large as possible.

b. Make a boring cut into the centre of the scarf slightly higher than the height of the intended back cut. Make this sufficiently wide so that the cutter bar can reach into the cut from either side when putting in the back cut.

c. At the back cut, standing on one side and swing around to the opposite side.

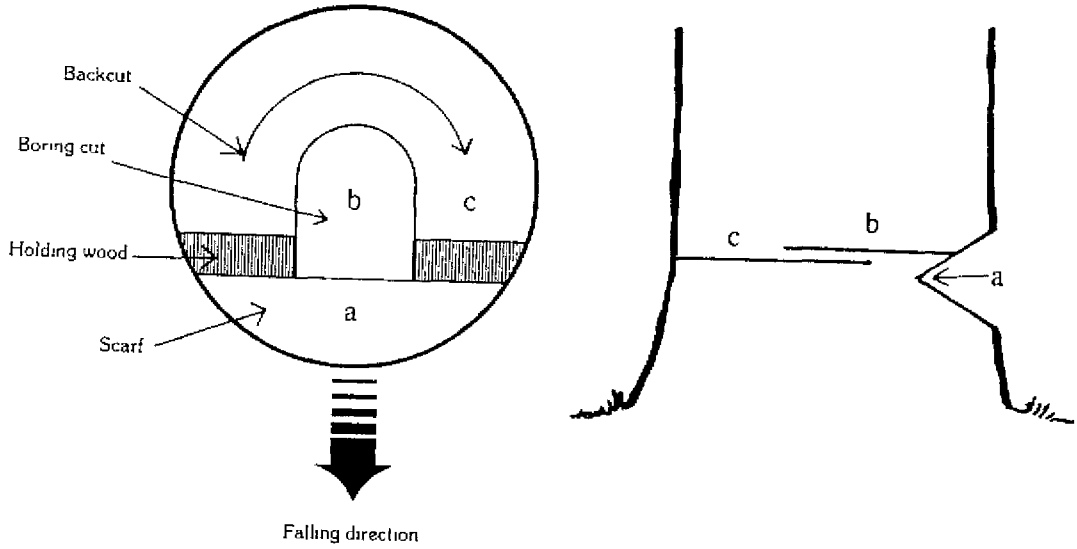



Figure 7.7

**Note:** Cuts (c) and (b) should be on the same level. As this is fairly difficult to achieve it is suggested that the boring cut (b) be put in slightly higher than the intended back cut (c). Ensure that cut (c) is higher than the scarf intersection point (a) by the required ratio. (See back cut).

## DOUBLE LEADERS

7.12 Double leaders are often difficult to fell. It depends mainly upon where the fork begins. Frequently, even though the fork is fairly high, a weakness runs down some distance below the bottom of the fork.

7.13 If the fork is high enough, fell as a single tree, at right angles to the fork.

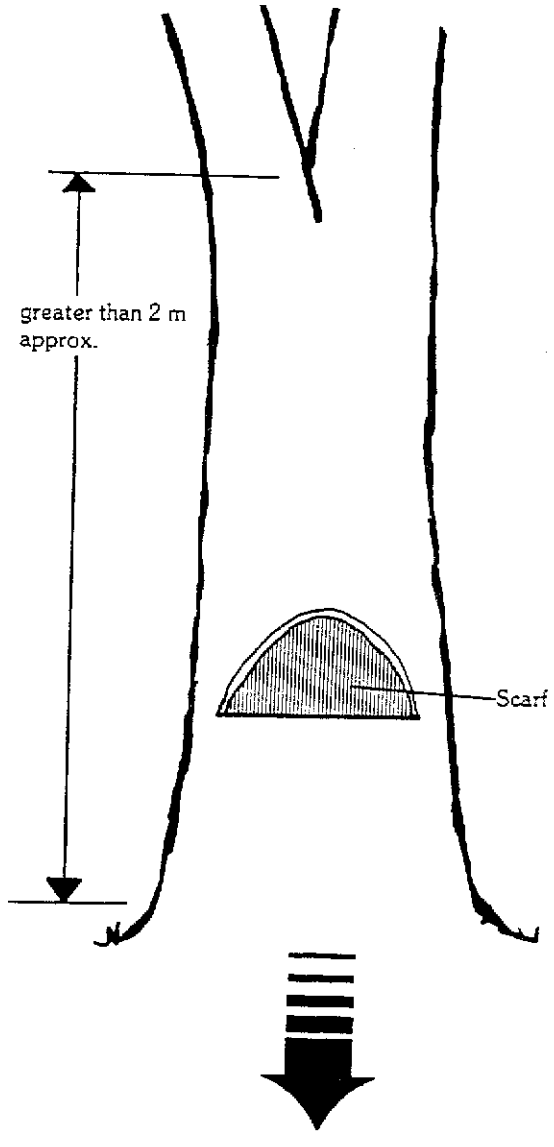



Figure 7:8

**7.14** If it is desired to fell both trees separately below the fork line rip the joint between the leaders to ensure they are separated. Then bore in, to begin the back cut.

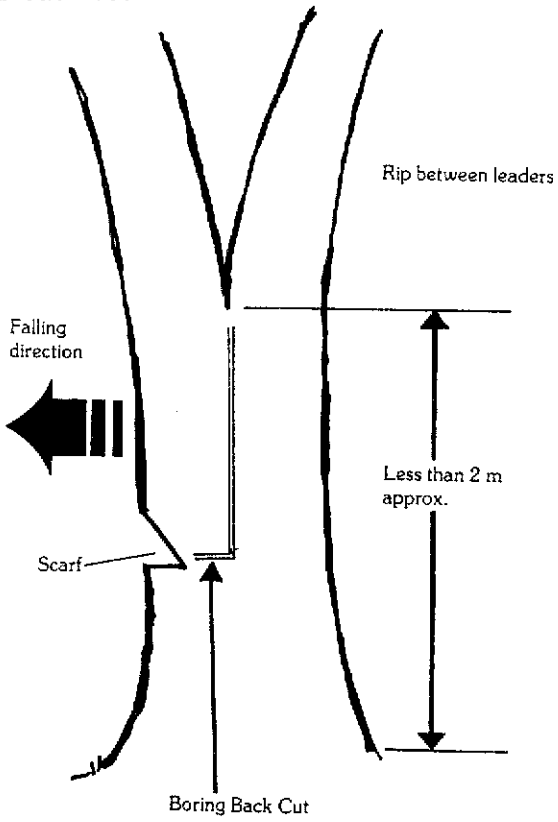



Figure 7:9

## DEFECTIVE TREES

**7.15** Make a larger than normal scarf. If there is enough solid wood put in a back cut in the normal manner but leave more holding wood on either side.

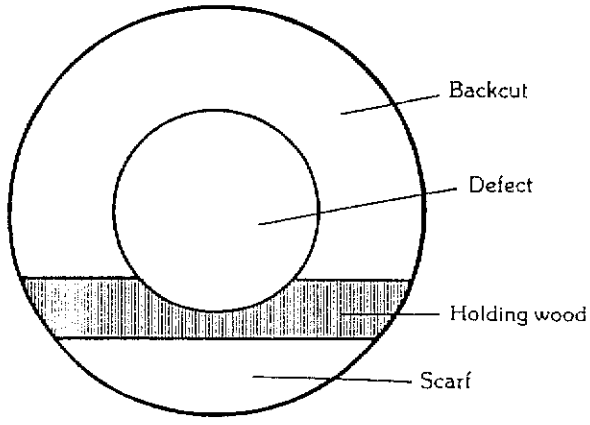
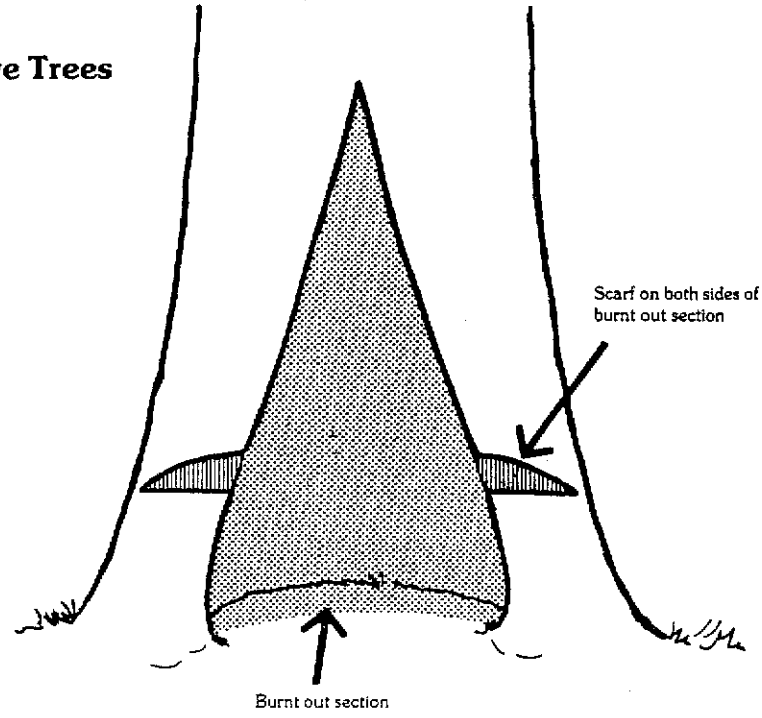



Figure 7:10

7.16 If in doubt, bore in from either side leaving a solid hinge and cut backwards leaving a strap of holding wood at the rear. (Same technique as for Forward Lean).

**Felling**
**Defective Trees**



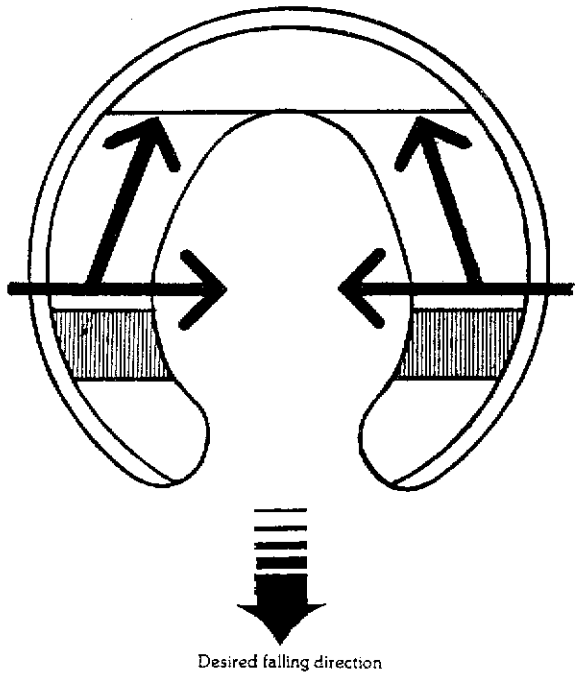
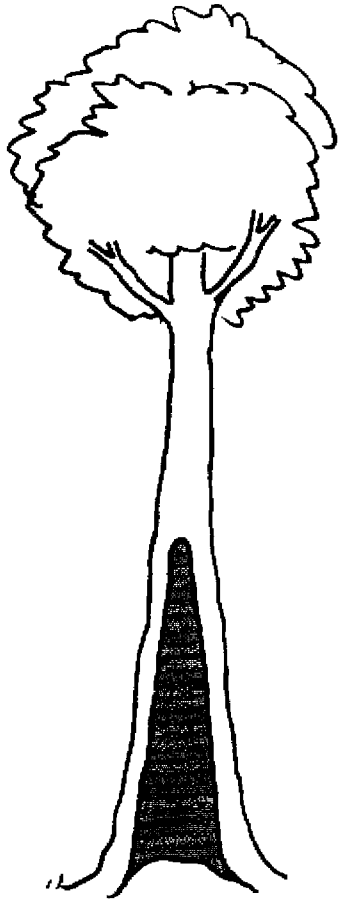




Figure 7:11

## STAGS

7.17 Don't over-cut the scarf. Place the back cut lower than normal, and take extra care when wedging.



Usually a dead or severly damaged tree that may cause a problem in a bushfire or high wind situation.

Figure 7:12
A Stag

### 7.18 BUTT TRIMMING TECHNIQUES

Butt trimming or pre-limbing trees may be necessary in order to remove branches that may get in the way during the felling operation. It is particularly important in softwood felling It can be very dangerous due to the high risk of kickback.

## WEDGES

### 7.19 APPLICATIONS

Wedges are most often used:

a. on slight backward leaning trees;

b. on side lean trees;

c. for cross cutting;

d. when heading;

e. to preventing the saw jamming; and

f. in removing a jammed saw.

**7.20 TYPES**

There are three main types of wedges:

a. **Steel** - These are durable but heavy. They will damage the chain if it contacts the wedge.

b. **Aluminium** - They are lighter than steel. Generally they won't damage the chain if it contacts the wedge. Less durable.

c. **Plastic** - They are light, easy on chain, more prone to damage and wear from hammer/axe blows and some types will 'pop' out if struck hard.

**7.21 TECHNIQUE**

Drive them into the back cut as soon as saw has cut deep enough for the wedge not to come in contact with the chain. Heavy or thick bark may have to be removed to allow the wedge to work on solid timber.

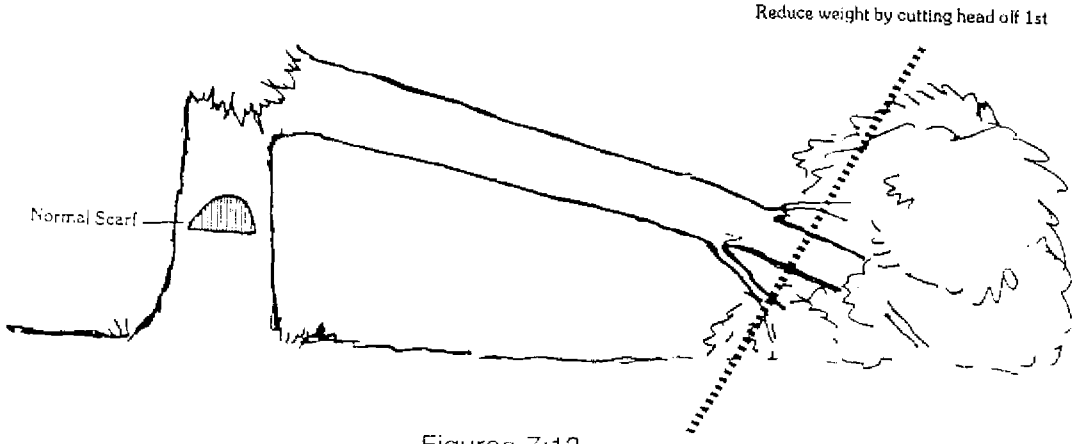
7.22 Wedges should be driven in with a sledge hammer rather than the back of an axe to eliminate the possibility of injury resulting from the axe rebounding etc.

7.23 Apart from the material chosen, wedge length and lift should be chosen to suit the application. (Tree species, tree size, etc.)

## WIND BLOW

7.24 Felling techniques for 'Wind Breaks' still attached to the stump.

**Note:** Felling this type of tree with a chain saw may be dangerous. The safest method is to push the tree over using a tractor.




Figures 7:13

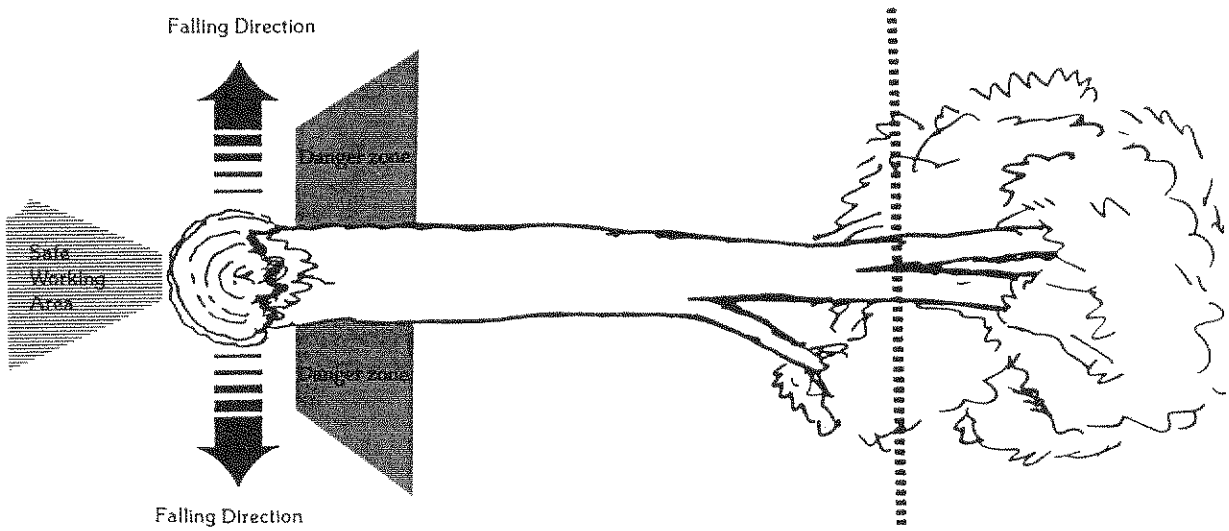

Falling Direction
Danger zone
Safe
Working
Area
Danger zone
Falling Direction

Figure 7:14

# CHAPTER EIGHT

# EMERGENCY TREE OPERATIONS

## INTRODUCTION

**8.01** During storms, trees may be blown over, or major branches may be broken from trees. In residential areas, falling branches or trees will commonly cause damage to buildings which may be severe.

**8.02 TREE DAMAGE PROBLEMS**

Crews responding to tree damage may be faced with:

a. damaged trees which threaten to fall or drop branches,

b. trees or branches which are leaning against buildings; or

c fallen trees or branches on or through building roofs.

**8.03 SKILLS REFERENCES**

Refer to the Australian Emergency Manuals - Disaster Rescue and Storm Damage operations for further information relating to emergency tree operations in urban areas.

## ASSESSMENT OF TREE OPERATIONS

**8.04 SAFETY ASPECT**

A careful assessment must be made of each situation before any action is commenced A decision to stabilise a damaged tree or remove a tree from a building **must be made in accordance with service policies and with safety as the primary concern.**

**8.05 CONSIDERATIONS**

The assessment must cover:

a. possible hazards;

b. the tree itself;

c. the structure involved, and

d. available resources.

**8.06 HAZARDS**

The following points must be considered in the assessment of hazards:

a. **Electricity** - The supply authority must be contacted where there is any concern.

b **Water and Gas supplies** - It may be necessary to shut off supply at main.

c. **Further Collapse** - All possibilities to be considered

d. **Wind** - Possible effect of further wind action

e. **Loose Material or Debris** - Possible effect on safety of operation.

f. **Associated Hazards** - Such as a garage complete with car. fuel supplies and so forth. or a store room for hazardous materials.

8.07 **THE TREE**

Considerations specifically relating to the tree include:

a. tension or compression forces within the tree;

b the results of a change of balance and any subsequent leverage effect at any time; and

c. the potential for movement if the tree is cut.

8 08 **THE STRUCTURE**

Considerations relating to the structure involved must include:

a. the security of the structure and the need for shoring;

b. the reaction of the structure of the tree is removed;

c. the prevention of further damage; and

d. the need for evacuation.

8.09 **RESOURCES**

Consideration must be given to:

a the availability of private contractors to tackle the job;

b. the need for cranes and elevated platform vehicles (cherry pickers): and

c. team competence and experience.

## GUIDELINES FOR TREE OPERATIONS

8.10 Guidelines for the management of tree operations will vary with respect to a given situation.

8.11 **THREATENING TREES BRANCHES**

In cases where a tree has been damaged or partially uprooted, or major limbs have been broken, the tree or limb may threaten to fall on a building

a. **Appropriate Action** - In such cases, a decision must be taken on the appropriate action. This decision is taken following the assessment, and emergency teams may.

(1) leave the task to a private contractor;

(2) secure the tree to prevent further collapse; or

(3) remove the tree or branch.

b. **Suitable Methods** - Considerations for securing a threatening tree or branch include:

(1) the use of guy ropes to stabilise the tree branch, with due regard to the safe working load of ropes. anchorages and other standard considerations; or

(2) use of jacks, hydraulic equipment and Acrow props to support a damaged tree.

c. **Removal Decision** - Removal of a threatening tree must only be undertaken where a clear working area is available and a safe course of action can be clearly set out. The tree may then be felled or winched clear of the building.

**8.12 TREES/BRANCHES LEANING AGAINST BUILDINGS**

a. These situations must be assessed in a similar manner to cases where a tree or branch is threatening a building.

b. The tree may be left for a contractor to handle, or measures may be employed to secure it so as to prevent further movement and damage. Where the decision is taken to remove the tree, the guidelines laid out in para 8.11b should be followed.

c. A decision to leave a leaning tree or secure it in place must be made with due regard to the force which the tree is exerting on the building, and the possibility of structural damage/collapse.

**8.13 TREES/BRANCHES ON OR THROUGH ROOFS**

a. As an initial measure, a fallen tree or major branch must be secured to prevent movement which may cause danger to personnel or further damage to the building.

b. Once secured, the tree can be worked on more safely, and personnel may cut and remove all or part of the material in a controlled and systematic manner.

c. Rescue personnel should be protected with a belayed rope or a fixed safety line in such operations.

d. The removal process must follow a series of logical steps such as:

(1) Safe access for rescuers to the work area.

(2) A sequence of cutting operations which causes least movement of the tree or damage to the roof.

(3) The provision of a safe working area for personnel.

(4) The use of cranes or roping systems to remove cut sections, and the possible use of elevated platform vehicles as work platforms for chain saw operators.

(5) Continual re-assessment of the situation.

(6) Minimal disposal of cut timber and clean-up of the area.

## SUMMARY

**8.14** Storm operations involving the felling of dangerous trees or the removal of trees from contact with buildings must only be undertaken following a careful assessment and appreciation of all factors.

**8.15** All tree operations must be conducted in accordance with service policies and procedures, and with local legislative arrangements.