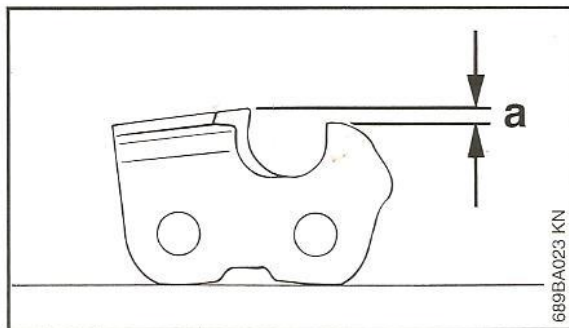




MANUAL ON CHAINSAW MAINTENANCE



April, 2010

Foreword

The chainsaw has developed into a very effective and versatile tool for felling trees, ripping logs and salvaging timber from defective trees. The chainsaw has emerged as one of the more indispensable tools in logging operations.

From a business perspective, the chainsaw represents an investment that is expected to foster the viability of the logging operations. If the technology is used improperly, and if due preventive maintenance is not carried out, production levels will fall and unnecessary expenditure is incurred to purchase spare parts; the chainsaw then becomes a liability. The larger the number of chainsaws utilized by an enterprise, the more critical the need for proper preventive maintenance. For the small logger, with just one or two chainsaws, the down time from mal functioning and maladjusted chainsaws are even more critical.

This manual attempts to point out simple steps to optimise the use of chainsaws and help loggers carry out timber harvesting operations more effectively.

This module complements FTCI's modules on Chainsaw Use and Maintenance, Cross Cutting Techniques, and Directional Felling Techniques. A major part of the content is based on Stihl Instructional Manuals.

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1.0 INTRODUCTION

Chainsaws are very robust devices built to cut timber. Over the years, manufacturers have been working to make the machines more effective and safer to use by researching and modifying key components. Like other constructors, manufacturers of chainsaws strive to produce a range of devices to match the needs of consumers.

For loggers and logging enterprises, the chainsaw represents an investment; and when the logger purchases a machine, his intention is that the machine will contribute to the profitability of the enterprise. Chainsaws however do not work by themselves, they have got to be *operated*, and therefore a trained operator and a trained assistant are also important in ensuring that the asset is productive and serve the needs of the enterprise. At the end of the day therefore, the chainsaw operator and his assistants have the responsibility of ensuring that the chainsaw remains an asset and that it serves the purposes-fell trees, cross-cut tree boles, and rip logs-for which it was bought.

The objective of this course is not to produce mechanics, but rather to encourage the chainsaw operator to carry out the tasks of tree felling, cutting and ripping timber as efficiently as possible. The Chainsaw Operator and his assistant must be vigilant, observant and disciplined enough to carry out routine maintenance while being alert to the vagaries of machine use. *'Vigilance'* and a *'Stitch in time saves Nine'* should be the watchwords of all chainsaw operators, their assistants and their supervisors.

All parts for any machine in use wear or become fatigued to the point where they cease to become effective. Normal machine vibration as well as friction from the act of cutting or ripping through wood fibres, put chainsaws under considerable tension, leading to wear of parts, misalignment and maladjustments of components, fracture of metallic components and loosening of bolts and screws.

The preventive maintenance procedures start with three items. Firstly the chainsaw operator must own and read the Chainsaw Manual. Even if the manual is kept in the office, there should be a copy in the field so that the operator can consult it as necessary. Secondly, the operator or his assistant must have hand the basic tool kit provided with the new machine. Thirdly, like any other machine user, the operator must get to know the machine well and to develop the habit of looking over and or listening to the machine; the operator must know when something does not *'look right'*, *'feel right'* or *'sound right'*; for example, oil leaks are usually an indicator that some component is malfunctioning.

However, for optimum performance, proper preventative maintenance must be carried out at regular intervals, daily and weekly. It is clear that in

Unit 2 deals with the Parts of a chainsaw & Glossary of selected terms, Unit 3 deals with common tools of the chainsaw operator; Unit 4 deals with fuel and lubricants, Unit 5 deals specifically with preventive maintenance for the chain; and units 6 and 7 deal with daily and weekly maintenance tasks respectively.

Chainsaw operators are encouraged to bring along their Instruction Manuals when they go for training in *chainsaw maintenance*.

2. MAIN PARTS OF A TYPICAL CHAINSAW AND A GLOSSARY OF SELECTED TERMS

2.1 The components of a typical chainsaw

Chainsaws are rugged machines with a large number of

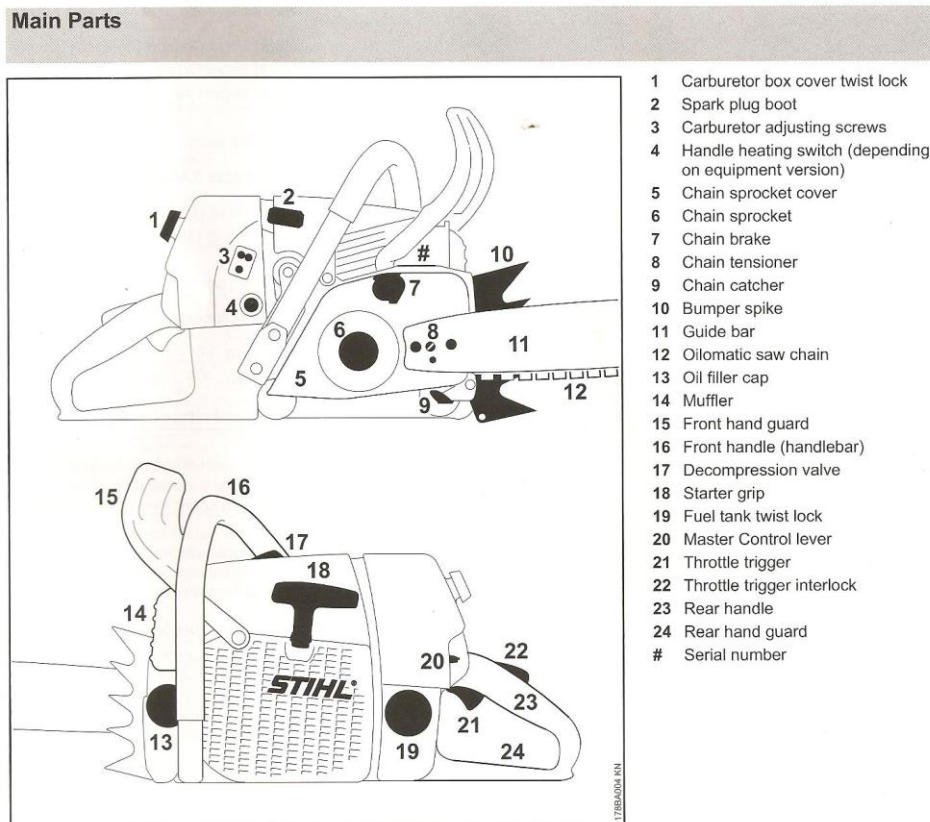


Figure 1: Main components of a chainsaw

2.2 Glossary of selected terms

- a) **Chain brake:** A device to stop the rotation of the chain (especially if inadvertently activated in a kickback situation by the operator's hand).
- b) **Chain sprocket cover:** covers the clutch and sprocket
- c) **Chain sprocket:** The toothed wheel that drives the saw chain
- d) **Chain tensioner:** permits precise adjustment of the chain tension
- e) **Muffler:** The *muffler* is a hearing protection device used on chainsaws to reduce engine noise.
- f) **Oilomatic Saw Chain:** A loop consisting of cutters (teeth) tie straps and drive links.
- g) **Throttle trigger interlock:** the locking mechanism prevents the throttle from activating until the interlock is depressed; the trigger must be depressed before the throttle trigger can be activated.
- h) **Throttle trigger:** Controls the speed of the engine.

3. COMMON TOOLS FOR THE CHAINSAW OPERATOR

Chainsaw operators must be prepared for any eventuality. The following items are recommended:

- a) Brush (an old 2" paint brush will do)
- b) Cleaning rags
- c) Combi-Can
- d) Combination spanner
- e) Cylinder plug
- f) Depth gauge
- g) Devices for measuring oil, fuel
- h) Flat file
- i) Gasoline (for cleaning parts)
- j) Round file in file holder
- k) Soap
- l) Socket spanner
- m) Sledge hammer
- n) Spanner
- o) Spare bar
- p) Spare chain
- q) Spare spark plugs
- r) Water
- s) Wedges
- t) Fuel and lubricants

4. FUEL AND LUBRICANTS

4.1 Fuel

Chainsaws utilize two stroke, air-cooled engines and these require a mixture of gasoline and engine oil. Operators and/or their assistants should study the manuals which accompany the saw for specific instructions on fuel mixes. (For example, STIHL recommends the use of STIHL MotoMix Oil for its chainsaws).

The operator must take care that fuel to be used is not contaminated with water, dust or debris and re-fuelling must be taken seriously. The operator must clean the area around the fuel tank prior to re-fuelling and the fuel itself must be kept in sealed containers.

4.2 Oil

Oil helps lubricate the moving parts of the engine. Oil should be added to the container with the fuel prior to putting the fuel mix into the tank of the chainsaw. Unsuitable fuel and oil may cause severe damage to the engine and render the chainsaw inoperable.

4.3 Fuel-Oil mix ratio

For STIHL chainsaws, a fuel mix ratio of 50 parts of fuel to 1 part of Stihl fuel oil is recommended: Table 1 illustrates the relative volume of Stihl Oil per volume of gasoline and also for other brand name oils where a ratio of 25 parts gasoline to one part of oil is recommended:

Chainsaw operators (and their assistants) must ensure they carry devices for accurately measuring fuel and oil.

4.4 Storage of fuel mixes

Operators are discouraged from storing fuel-oil mixes as these mixes may degrade with time and potentially can become contaminated.

4.5 Chain lubricant

The service life of the chain and guide bar depends on the quality of the lubricant. Here again the chainsaw operator is urged to read their Instruction Manuals. A typical test for a well lubricated chain is to check that the chainsaw throws a bit of oil (see Figure 2).

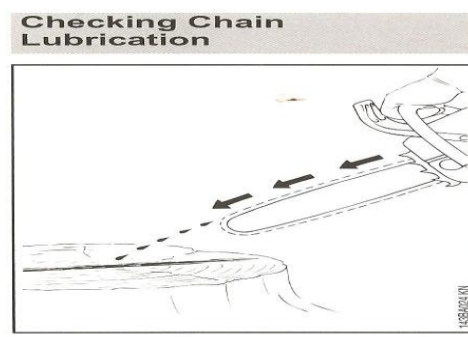


Figure 2: Illustration of Oil drip from Chain

Table 1: Example of Mix ratio for Fuel & Engine Oil

Gasoline		Stihl engine Oil		Gasoline		Ordinary engine Oil(metric)	
Liters	Liters	(ml)	Liters	Liters	(ml)	Liters	(ml)
5	0.1	100	5	0.2	200	5	200
10	0.2	200	10	0.4	400	10	400
15	0.3	300	15	0.6	600	15	600
16	0.32	320	16	0.64	640	16	640
17	0.34	340	17	0.68	680	17	680
18	0.36	360	18	0.72	720	18	720
19	0.38	380	19	0.76	760	19	760
20	0.4	400	20	0.8	800	20	800
21	0.42	420	21	0.84	840	21	840
22	0.44	440	22	0.88	880	22	880
23	0.46	460	23	0.92	920	23	920
24	0.48	480	24	0.96	960	24	960
25	0.5	500	25	1	1000	25	1000
26	0.52	520	26	1.04	1040	26	1040
27	0.54	540	27	1.08	1080	27	1080
28	0.56	560	28	1.12	1120	28	1120
29	0.58	580	29	1.16	1160	29	1160
30	0.6	600	30	1.2	1200	30	1200
40	0.8	800	40	1.6	1600	40	1600
50	1	1000	50	2	2000	50	2000

5. PREVENTIVE MAINTENANCE OF THE CHAIN

5.1 Introduction

The saw chain, driven by a sprocket, that rotates when engine speeds accelerate beyond the idle status, runs along a groove in the guide bar. Whilst doing so, its cutters bite into timber cutting or ripping the fibres of the timber. A well primed, well prepared saw carries out this task easily, even with the toughest of our hardwoods.

The performance of the chainsaw, including fuel consumption, is strongly linked to the condition of the chain in terms of **uniformity** in sharpness and depth-gauge among links.

The cutting attachments of the chainsaw comprise a chain guide bar and the chain itself, comprising a drive link, tie straps, rivets, cutters (teeth) (see Figures 3, 4).

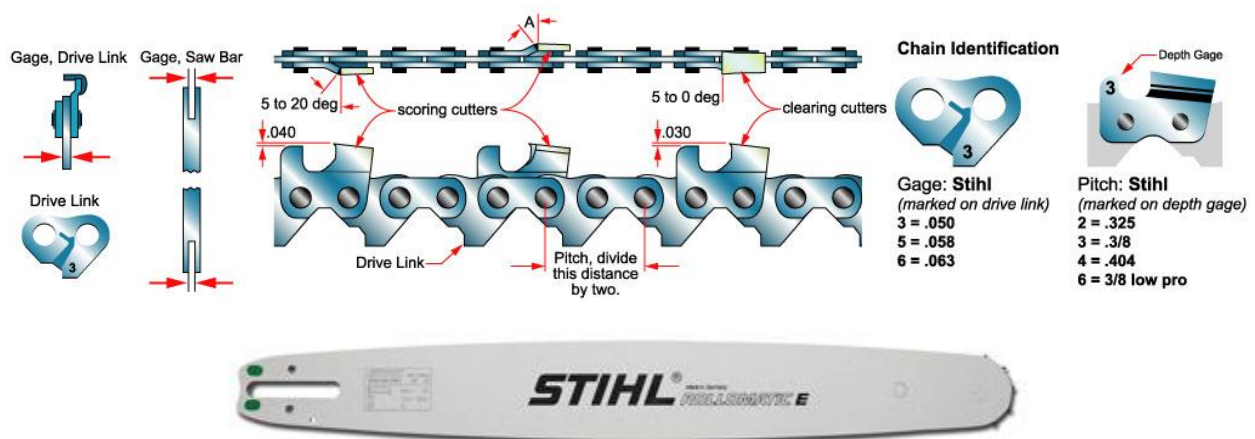


Figure 3: Specimens of saw chain components

Key considerations relate to:

- The pitch: the distance between two rivets
- The gauge: the relative thickness of the drive link and the groove of the guide bar so that the chain is kept upright
- The tie straps: the side rails of the chain that serve to hold the chain together and keep it in one plane as it travels around the guide bar
- The rivets: these hold the chain together while allowing single directional movement
- The cutters: the teeth that carry out the main functions of the saw

One can therefore appreciate that with so many moving parts, the lubrication of the chain is of critical importance. Apart the lubrication of the chain, the most critical maintenance tasks are the **sharpening of the teeth** and the maintenance of the **depth gauge**.

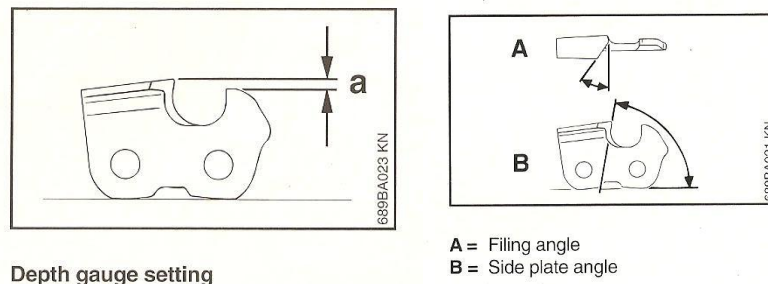


Figure 4: Profile of the Cutters (Teeth)

5.2 Sharpening of the Teeth

The teeth are formed of steel as an extension of the tie strap; this extension extends upwards in an outward curve, then continuing slightly outwards before being folded over flat; the flat surface folds inwards, back over the side plate and other sections of the saw chain, covering to almost the point where opposite saw chain tooth would begin its own fold back towards the centre. Each surface is called a plate, hence we have 'side plate' and 'top plate'; where they join they form a corner and the forward point of this corner is called the working corner as this point does the work when cutting wood fibres.

The top surface of the tooth is plated with very hard industrial chrome plating; the chrome is very thin and so when the edge is exposed it is very sharp; because the chrome is very thin, it is supported by a shoulder of steel, so that it stays in a position to penetrate wood. The steel supporting the chrome edge wears during cutting, causing the thin chrome plating to fold over, to the extent that it does not cut; in other words, the saw becomes blunt. To restore the chain to its optimum cutting mode, the leading edge has been restored to its original profile.

The teeth may be restored to full cutting mode through filing (or grinding). When filing, the correct file size should be selected and the file pushed through teeth at such a depth that 1/5th of the file protrudes above the top of the tooth.

The file should travel in a straight line and move at the correct angle to the guide bar and a number of considerations should be borne in mind:

- a) The angle to the guide bar will vary with the application of the saw, but must be exactly the same (reversed) as that used on the opposing side of the chain teeth; if this is done correctly the top plate angle will be the same for each side of the saw chain teeth. Incidentally, whenever an operator experiences problems with cutting, this similarity of angle should be the first point for problem solving.
- b) The sharpening action of the file in relation to the side plate of the chainsaw teeth creates a small angle of forward sloping tooth just below the leading corner where the side plate joins the top plate; this angle must be the same on each side of the saw.
- c) Each plate that for the tooth slope gently towards the back of the tooth; this slope is required to give clearance to the forward cutting edge and is called the relief angle; as the tooth is filed back the angle becomes smaller or the slope lower. If the tooth is lower, it will be held out of the wood by other higher teeth, on the opposing side of the chain and so not cut as quickly, which may lead the saw

chain to run off in the cut. All teeth should therefore be filed back to same 'height'; tooth height could be verified by measuring each tooth.

In order to control the filing procedures, the use of a File Holder (see Figure 5) is recommended. The file holder more less guarantees that cutting angles are equal and the right tooth height are achieved across all teeth. File holders are specific to the size of file, which in turn is specific to the size of chain.

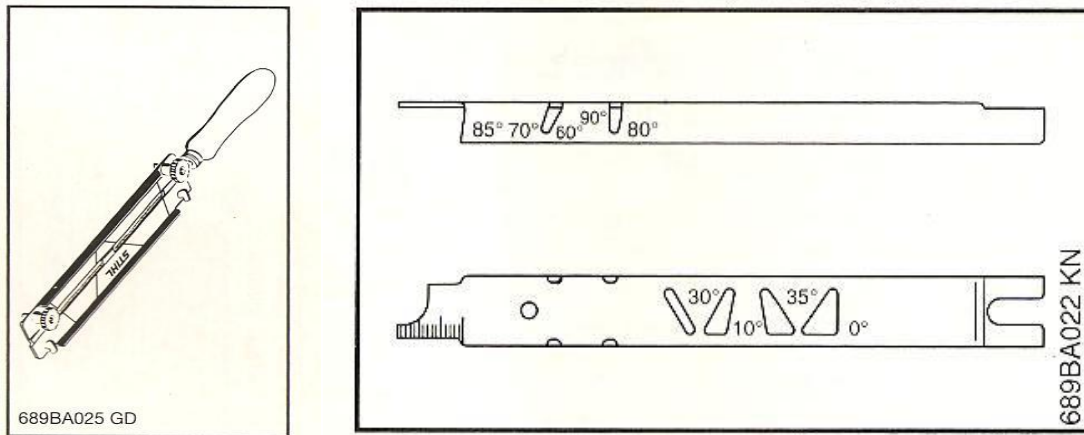


Figure 5: Diagrams of a File Holder (left) and a Filing Gauge Tool (right)

Key considerations in the use of a file holder are:

- a) The file should be held horizontally (at a right angle to the side of guide bar) and the filing should be done according to the angles marked on the file holder. The file holder should be placed on the top plate and depth gauge.
- b) Filing strokes should be done from the inside to outside of the tooth
- c) File only on the forward stroke, lift the file off the cutter on the backstroke
- d) Avoid touching the tie straps and drive links with the file
- e) Rotate the file at regular intervals while filing to avoid one-sided wear
- f) Use a piece of hardwood to remove burrs from cutting edge
- g) Check angles with the filing gauge
- h) Ensure that all teeth are of the same 'height'.

5.3 Maintenance of the Depth Gauge

The depth gauge is the small protrusion that 'stands up' in front of each tooth (see Figure 5) with the function of setting the depth of cut that the tooth is able to make in wood.

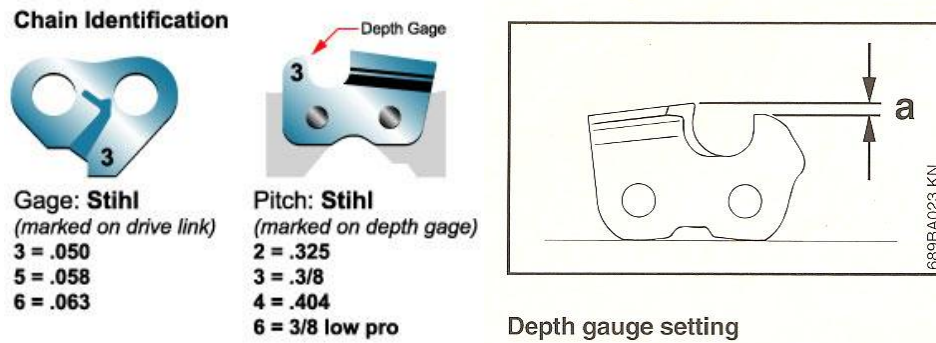


Figure 6: Illustration of the Depth Gauge

The depth can be measured down from the usual top line of the saw chain and should be from 0.30" to 0.035" for larger capacity saws and 0.025" to 0.030" for small capacity saws.

Due to the *relief angle* of the teeth, as the chainsaw is filed back, the top of each tooth gets lower in relation to the top of the depth gauge. This must be corrected by filing the top of the front of this depth gauge down to the correct height; if the height is not corrected, the guide digs into wood, contributing to possible kick-back. The tools normally used to correct the height are a filing gauge (See Figure 7) and a flat file.

The depth gauge setting is reduced when the chain is sharpened; the filing gauge is used to check the setting every time the chain is sharpened; the filing gauge, matching the pitch of the chain is placed on it and if the depth gauges projects from the filing gauge, the depth gauge has to be lowered (see Figure 7).

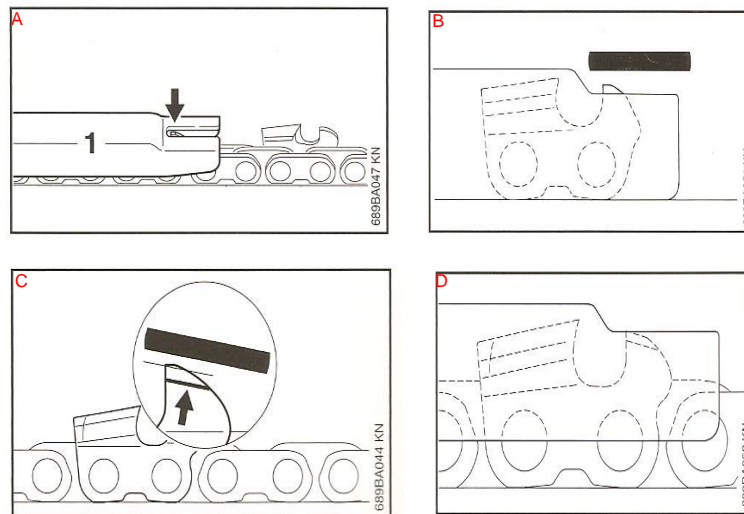


Figure 7: Use of a Filing Gauge

6. GENERAL MAINTENANCE

6.1 Maintenance during work

Three basic maintenance tasks occur during normal working operations:

- a) Tensioning of the chain: the chain tends to run slack from the impacts with the fibres of the timber and
- b) Refuelling/re-oiling: Both the fuel mixture tank and the oil tank needs replenishment during field operations
- c) Sharpening of the tooth and adjustment of the depth gauge: Wear from continually slicing through timber would wear the saw, causing it to become progressively less sharp and even blunt. A vigilant operator can normally sense when the chain requires sharpening; common symptoms are 'pulling of the saw' as it cuts through timber, and erratic machine tones.

6.2 Daily maintenance

Every chainsaw operator should carry out a number of basic tasks at the end of every day, as follows. The first task is to undertake the macro-cleaning of the entire chainsaw-removing sawdust and grime from the external parts of the saw. Macro cleaning could be done easily with an old 2-3" paintbrush. Once the macro-cleaning is complete, attention should now turn to specific components:

- a) Cleaning of the air-filter
- b) Removing and cleaning the chain
- c) Filing off the sharp edges of the guide bar
- d) Cleaning the oil canals
- e) Re-attaching and tensioning of the chain
- f) Adjusting the dept gauge
- g) Filing the chain
- h) Tightening bolts and nuts

The average time required for normal daily maintenance is twenty-five minutes.

6.3 Weekly maintenance tasks

Weekly maintenance tasks are more leisurely, requiring the operator to address a number of additional components. Weekly maintenance requires attention to the following:

- a) A thorough cleaning of the engine block, areas around the sprocket and cylinder head
- b) Checking the condition of the fuel filter and replacing same if required
- c) Checking the functionality of the Starter Rope
- d) Removing oil and grime from the chain sprockets, checking the sprocket for wear
- e) Checking and calibrating the spark plug.

7. DOS AND DONTs

At the end of the day, all chainsaw operators and their assistants need to adopt proper and responsible habits. The following recommendations are made specifically to assist chainsaw operators to optimise the use of the machine while paying attention to occupational safety and health.

Recommended actions:

- a. Use appropriate safety gear when operating or servicing the chainsaw
- b. Chainsaw operators must eat proper meals, and ideally should be in good physical shape
- c. Always start work by carrying out an inspection of the saw in relation to:
 - i. The chain brake
 - ii. The tension of the chain
 - iii. The tightness of bolts and screws
 - iv. The handles of the saw
- d. Set up and observe a maintenance schedule (see Annex I)
- e. Always carry a first aid kit
- f. Always carry a copy of the chainsaw manual

Do not:

- a) Mess around or modify the controls or safety devices in any way
- b) Operate the chainsaw if taking medication that may impair your ability to carry out tree felling, cross-cutting or ripping information
- c) Do not work if it's raining or drizzling or if there are very strong winds
- d) Do not play games or fool around with the chainsaw.

Annex 1

Recommended Checklist/Schedule for a Preventive Maintenance Programme												
#	Component	Task	Pre-work	End of day	After each refuelling stop	Weekly	Daily	Monthly	Annually	If Problem	If damaged	If required
1	Complete machine	Visual inspection,	X		X							
		Clean		X								
2	Throttle trigger, trigger interlock, choke lever, stop switch, Master control lever (depending on version)	Check operation	X		X							
		Check operation	X		X							
3	Chain Brake	Have checked by Dealer										X
		Check						X				
4	Filter in fuel tank	Clean, replace filter element						X		X		
		Replace							X		X	X
		Clean						X				
6	Chain oil tank	Clean					X					
7	Chain Lubrification	Check	X									
8	Saw chain	Inspect, check sharpness	X		X							
		Check chain tension	X		X							
		Sharpen										X
9	Guide Bar	Check (wear, damage)	X									X
		Clean and turn-over										X
		Deburr					X					
		Replace									X	X
10	Chain Sprocket	Check				X						
11	Air filter	Clean								X		X
		Replace									X	
12	Anti-vibration elements	Check	X							X		
		Have replaced by dealer									X	
13	Cooling inlets	Clean		X								
14	Cylinder fins	Clean		X				X				
15	Carburetor	Check idle adjustment-chain must not rotate	X		X							
		Adjusting idle speed										X
16	Spark Plug	Readjust electrode gap								X		
		Replace after 100 hours of operation										
17	Accessible nuts and screws	Re tighten										X
18	Spark arresting screen in muffler	Check								X		
		Replace if necessary									X	
19	Chain catcher	Check	X									
		Replace									X	
20	Safety labels	Replace									X	