STIHL®

A guide to the care and maintenance
of saw chain and guide bars

# Sharp Advice For Chain Saw Owners




STIHL®

0000-000-3409.M_.G10.BP. Printed in USA © 2010 STIHL Incorporated

www.stihlusa.com

# Important Information

Any chain saw, no matter what make, is only as good as its saw chain. Never ignore chain maintenance – if you do, poor cutting is just one result. An improperly cared for chain will eventually ruin the bar, the sprocket and other engine parts. Poorly maintained chain is also a potential safety hazard, since it can contribute to a reaction known as "kickback" (see page 22 for definition and hints on how to reduce the risk of kickback).

Keeping a chain in good repair will save both money and cutting time.

**This brochure is designed to cover only chain, bar and sprocket maintenance. For general chain saw care, always refer to the Instruction Manual and your servicing chain saw dealer. Please visit stihlusa.com to download Chain Saw Instruction and Safety Manuals, and to view or order a DVD of the Chain Saw Safety, Operation & Maintenance video.**

The following trademarks used in this booklet are among those owned by ANDREAS STIHL AG & Co. KG, Waiblingen. November 3, 2009

**Some of STIHL's Registered Trademarks**

1. STIHL®
2. STIHL
3. 
4. The color combinations ® (U.S. Registrations #2,821,860; 3,010,057; 3,010,058; 3,400,477; and 3,400,476)
5. OILOMATIC®
6. STIHL DUROMATIC®
7. STIHL Quickstop®
8. STIHL ROLLOMATIC®

**Some of STIHL's Common Law Trademarks**

9. BioPlus™
10. Ematic™
11. Micro™
12. STIHL Compact™
13. STIHL PICCO™
14. STIHL RAPID™

This listing of trademarks is subject to change. Any unauthorized use of these trademarks without the express written consent of ANDREAS STIHL AG & Co. KG, Wailblingen is strictly prohibited.

# Contents

Quick Summary of Maintenance Instructions ..... 2
Important Information (ANSI / CSA) ..... 4
11 Chain Care Rules ..... 4
It's Time To Sharpen When ..... 5
Chip Removal ..... 5
STIHL OILOMATIC® Saw Chain ..... 6
Lubrication ..... 8
Saw Chain Care ..... 11
Tensioning Saw Chain ..... 11
Breaking In Saw Chain ..... 12
Sharpening Saw Chain ..... 13
Guide Bar Care ..... 16
Drive Sprocket Care ..... 17
Troubleshooting Chain Wear ..... 18
Special Cold Weather Care ..... 22
Kickback Warning ..... 22
File Recommendations ..... 23
Notes ..... 24
Date of Chain, Sprocket and Bar Replacement ..... 25

# Quick Summary of Maintenance Instructions




When assembling the bar and chain, it is necessary to observe important but partially different procedures for each powerhead. Therefore, the instructions outlined in the Instruction Manual for the specific unit must be followed.

In order to increase the service life of the saw chain, sprocket and guide bar, two new chains should always be used in rotation with a new sprocket. Service life of the saw chain and guide bar depends on the quality of the lubricant. It is therefore essential to use a specially formulated chain lubricant.

A chain should be tensioned correctly and run without load at partial throttle for about 3 minutes to break it in. Ample lubrication is essential during this period. If the saw is equipped with an adjustable bar and chain oiler, the maximum flow should be set for the first hour of operation.

Correct chain tension and lubrication are critical for both the cutting results and the service life of the cutting attachments. Chain lubrication must be checked before starting work. Chain tension should be visually checked with the engine switched off both before and during cutting and corrected as necessary.

Correct sharpening requires not only sharpening of the cutters, but also correct depth gauge settings. Filed back cutters lead to lower depth gauge settings. if not adjusted, low depth gauge settings (caused by filing only cutters and not depth gauges) may lead to lower cutting efficiency. Higher feeding force would be required which can cause operator fatique and further wear on chain, guidebar, sprocket and anti-vibration system.

The guide bar should be turned over every time the chain is sharpened or changed. The guide bar groove and the oil inlet hole must be cleaned at regular intervals.

The operator should never cut with a dull chain. The chain should always be sharpened as necessary according to instructions supplied in the Instruction Manual or the instructions supplied with the chain. Only STIHL sharpening aids should be used and the detailed sharpening instructions in the Instruction Manual or the instructions supplied with the sharpener must be followed.

The operator should always observe the safety precautions and warnings given in the Instruction Manual when operating the saw or sharpening the saw chain.

The occurrence called "kickback" can cause serious or fatal injuries. Always read your Instruction Manual carefully before using your saw. In the U.S.A., STIHL has developed a color code system using green and yellow to help you select a powerhead, bar and chain combination that complies with the kickback requirements of ANSI Standard B 175.1. Ask your STIHL dealer about safe operating procedures and the advantages of the STIHL Quickstop® chain brake, STIHL reduced kickback bars, and STIHL low kickback saw chains.

In Canada, STIHL saw chain meets kickback requirements of CSA Standard Z62.3 M1990 when tested on a representative sample of chain saws.

**Chain Care Rules**

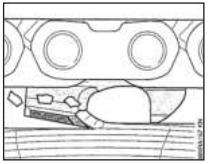
1. Avoid hitting dirt, rocks or any other abrasive material while cutting.
2. Check the chain tension often. Never allow the chain to sag. (See page 11).
3. Never force a dull chain to cut; it increases the risk of injury and will damage the bar and chain.
4. Never install a new chain without inspecting the sprocket and replacing a worn sprocket.
5. Always sharpen chain cutters to correct angles. (See pages 13-15).
6. Measure the depth gauges with every sharpening; lower and re-profile as necessary. (See page 15).
7. Check the entire chain often for visible wear or damage. (See pages 18-21 for common wear problems).
8. Check the depth of the bar groove for proper drive link clearance, examine the bar rails for even wear, and clean the bar groove.
9. Always wear gloves when handling saw chain.
10. Keep a protective scabbard on the bar when the saw is not in use.
11. Make sure that your chain is always properly lubricated. (See page 10). Use a quality brand of bar and chain lubricant.

**It's Time To Sharpen when …**

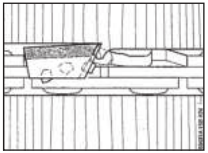
- You are getting fine sawdust instead of wood chips.
- The saw does not cut in a straight line.
- The cutters are not properly sharpened.
- The chain chatters and jumps - the depth gauge needs adjustment.

**Chip Removal**

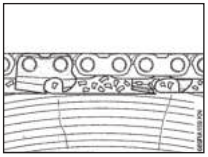
The following description of the chip removing process refers to the action of a single random cutter. The guide bar is parallel to the bottom of the kerf. The feed force is transmitted via the guide bar and toe and heel of the cutter edge into the bottom of the kerf.



As a result of the top plate clearance angle and the acute angle of the cutting edge, the cutter plunges into the wood as the chain moves forward. When the depth gauge touches the bottom of the cut, the cutting edge levels out and continues running parallel to the bottom of the cut. It is at this point that chip removal takes place. The depth gauge setting determines the thickness of the chip removed.



The side plate cutting edge separates the chip from the wall of the cut. As the saw chain has alternate right and left hand cutters, chip separation is performaed at each side of the cut with every second cutter.



The chip removed in this way passes through the chip channel, under the top plate, and into the chip space between the cutters where it remains until the cutters emerge from the kerf. The chip is then ejected.

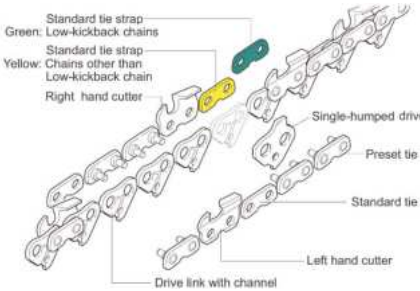
**Design of STIHL Saw Chain**

STIHL saw chains are always assembled in the same basic pattern. The illustration shows the component parts of a "STIHL RAPID™" chain.

The important characteristics which define a chain are the chain pitch, the drive link gauge, drive link count and chain length. The pitch is the distance in inches between the centers of any three rivets divided by two. The result is the pitch in inches (Example: 3/8"). The pitch size in inches is stamped on each depth gauge.

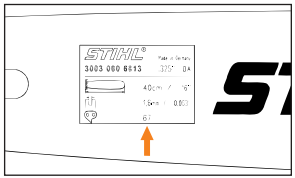
The drive link gauge must match the width of the guide bar groove so that the chain fits the bar exactly. This measurement is quoted in inches or millimeters, There are chains with drive link gauges of .043" (1.1 mm), .050" (1.3 mm), .058" (1.5 mm), .063" (1.6 mm) and .080" (2.0 mm)(for harvester chain only). The last digit of the measurement in millimeters is stamped on every drive link.

The chain length is quoted in terms of the numbers of drive links. The complete marketing numbers of STIHL saw chains give all the details regarding the chain pitch, drive link gauge and the number of drive links.




For illustrative purposes this diagram contains both green and yellow tie-strap compnents

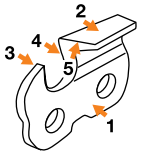
Green: Low-Kickback chains, Yellow Chains other than Low-Kickback chains



**Chain length** depends on the length of the bar and is measured by drive links. Each STIHL bar has the number of required drive links stamped into the tail of the bar.



**Tie straps** connect the cutters and the drive links together with rivets. A tie strap with rivets already mounted is called a preset tie strap.




***1 = basic tooth body***
***2 = top plate***
***3 = depth gauge***
***4 = side plate cutting edge***
***5 = top plate cutting edge***

**Cutters:** Each cutter has the cutting edge itself and the ramp in front of the cutting edge, called the ***depth gauge,*** which leads the cutter into the wood and determines how large a "bite" the cutter will take. If the depth gauge is too high, the chain will cut very slowly; if the depth gauge is too low, the cutter will grab too much wood and jam, perhaps causing kickback. On saw chains, cutters are positioned so that each right-hand cutter alternates with a left-hand cutter.

# Lubrication

**In General:**

Saw chain revolves around the bar at approximately 50 feet per second, depending on engine type, size and bar length. That means extreme friction wherever any two parts rub: rivets against drive links, tie straps against drive links, drive links against cutters, and the entire chain against the guide bar. Without proper lubrication between the friction faces, the parts will rapidly deteriorate and eventually wear themselves out.

All STIHL chain saws have automatic chain oiling systems. Some chain saws have adjustable automatic chain oiling systems. With either the oil is pumped into the bar groove, where it is "scooped" up by the passing drive link.

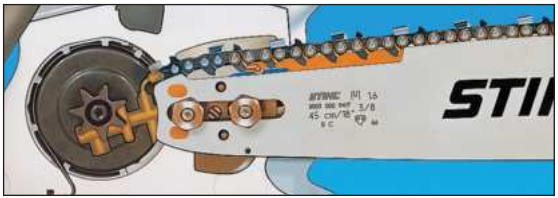
**STIHL OILOMATIC® Saw Chain**

STIHL is the only chain saw manufacturer worldwide that designs and manufactures its own saw chains. You can be assured the same quality engineering and innovative technology that have made our chain saws famous goes into every component of long-life STIHL OILOMATIC® saw chain.

STIHL produces saw chains for all types of wood cutting and for most makes of chain saws. Every saw chain manufactured by STIHL incorporates the exclusive patented OILOMATIC® lubricating feature.

**The Ematic™ Bar Lubrication System**

When used with STIHL OILOMATIC® saw chain, it will provide optimal lubrication, longer wear and less oil consumption than conventional methods. Two ramps, strategically placed in the guide bar rail, help contain the flow of oil and direct all lubrication to where it is needed. The Ematic™ system can reduce bar oil consumption up to 50%.



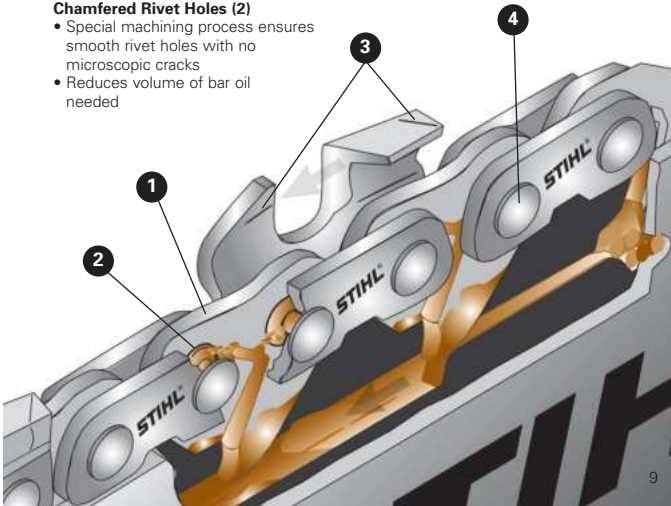
**Prestretched Chain**
- Prestretched before leaving the factory
- Helps eliminate excessive chain stretching during break-in period
- Reduces maintenance time and component wear

**OILOMATIC® Drive Links (1)**
- OILOMATIC® channel funnels oil directly to rivets reducing friction and wear
- Reduces volume of bar oil needed

**Chamfered Rivet Holes (2)**
- Special machining process ensures smooth rivet holes with no microscopic cracks
- Reduces volume of bar oil needed

**Chromed Cutters**
- Sharpened before assembly
- Stay sharp longer with less filing
- Filing angle indicator mark on depth gauge
- Wear indicators on cutters (3)

**Hardened Rivets (4)**
- Enable rivets to withstand high loads

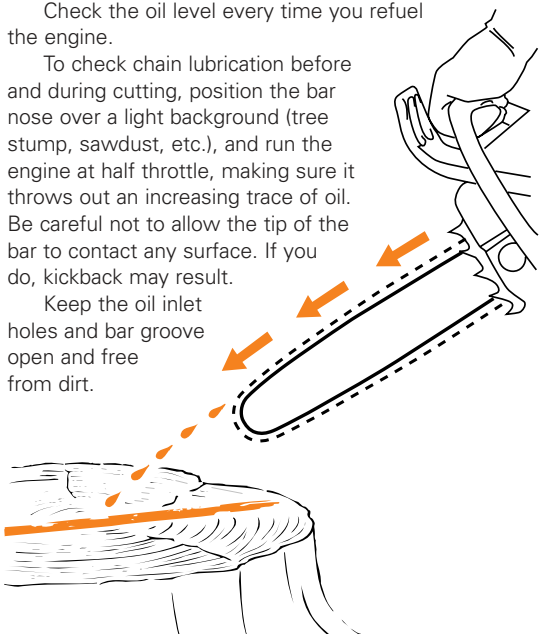


**Perform a lubrication checkup:**

Check the oil level every time you refuel the engine.

To check chain lubrication before and during cutting, position the bar nose over a light background (tree stump, sawdust, etc.), and run the engine at half throttle, making sure it throws out an increasing trace of oil. Be careful not to allow the tip of the bar to contact any surface. If you do, kickback may result.

Keep the oil inlet holes and bar groove open and free from dirt.



**Use STIHL Bar & Chain Oil:**

Do not use old engine oil or other oil not designed for bar and chain lubrication. STIHL bar and chain oil has special additives that help it adhere to the bar and chain, as well as keep tree pitch from gumming up moving parts. There are also formulations for working in cold conditions.

A STIHL biodegradeable bar and chain oil is also available from your local STIHL dealer.

**Tensioning Saw Chain**

*Never attempt to adjust the tension while the engine is running.*

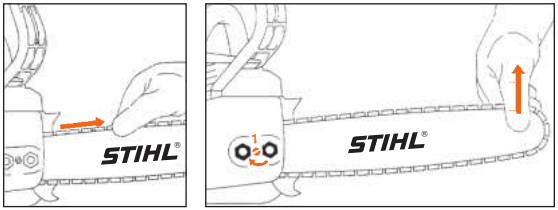
Saw chain should not be tight when you're done cutting, since the chain will "shrink" as it cools off. Loosen it slightly, so it doesn't tighten on the bar.

Wearing work gloves, loosen bar mounting nuts enough for the nose of the bar to slightly move up and down.

Hold up the nose of the bar. Tighten the chain adjusting screw (1) until the chain will move freely without binding when pulled by hand.

To make sure no kinks are in the chain, snap it by pulling it out from the bar and letting go. Then check the tension again. Lift the chain from the top middle of the bar. The drive links should remain in the bar groove.

Retighten bar mounting nuts while still holding up the bar nose, and then make a final tension check.

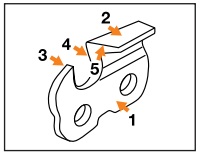


**Breaking In Saw Chain**

Even though STIHL OILOMATIC® saw chain is pre-stretched at the factory, new saw chain needs a first run just to "break in." The break-in smooths out tiny irregularities on the friction faces and allows the chain to properly "seat" the rivets. The tension should be readjusted just before the chain actually goes to work.

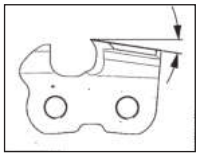
Run the saw at low speed for approximately three minutes. If your automatic oiler is adjustable, initially increase the flow for a short time.

**Geometry of the Cutter**



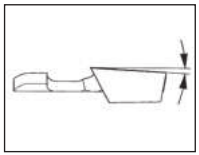

The cutter consists of:
1. Basic tooth body
2. Top plate
3. Depth gauge
4. Side plate cutting edge
5. Top plate cutting edge

**Clearance Angle of the Top Plate**



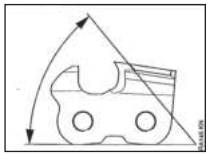
The top plate is inclined to the rear to form the clearance angle that is essential for the top plate cutting edge to feed into the wood.

**Clearance Angle of the Side Plate**



The top plate is tapered to the rear to form the clearance angle for the side plate cutting edge. This angle is necessary to separate the side of the chip from the wall of the cut.

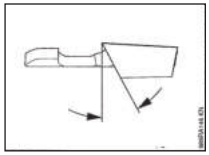
**Top Plate Cutting Angle**



The top plate cutting angle is the forward slope of the top plate cutting edge relative to the bottom of the cutter. Depending on the chain type, it is 50° to 60°.

The top plate cutting edge is the main cutting edge on the cutter and its angle is therefore the most important of all. It must be maintained exactly. Although it is difficult to measure, the angle will automatically be correct if the other specified angles are observed.

**Filing Angle**



The filing angle is measured from a line at right angles to the guide bar to the top plate cutting edge.

**Sharpening Saw Chain**

Trying to cut wood with a dull chain means a loss of power and cutting speed, higher fuel consumption, an excessive rate of wear on the guide bar, the sprocket, and the engine, and fatigue for the operator.

A properly sharpened chain will "feed" itself into a cut when only slight pressure is applied. If a chain has to be forced into a cut by bearing down on the saw, the cutters either are too dull or have been damaged. Dull chain is also evident when only fine sawdust is pulled from the cut, rather than chips of wood.

Make sure your chain is always correctly tensioned if you sharpen it on the saw. It is difficult to accurately file a loose chain.

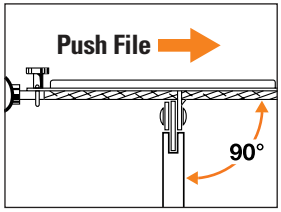
Use only the correct file size, guide, and file gauges recommended for specific types of chain. See the chart in the back of this booklet.

Always file to the correct angles recommended for specific types of chain.

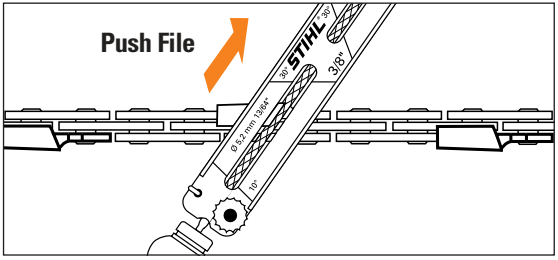
**Have your chain resharpened by a servicing dealer after sharpening it about five times yourself.** Even with the correct hand tools, you run the risk of filing incorrect angles. A dealer has the equipment to precisely file chain, and a professional sharpening will make the chain last longer.

**Instructions:**

File your chain frequently, yet take away as little material as possible each time. If the chain is damaged, file back beyond the damaged area.




Looking toward the end of the bar




Looking at the top of the bar

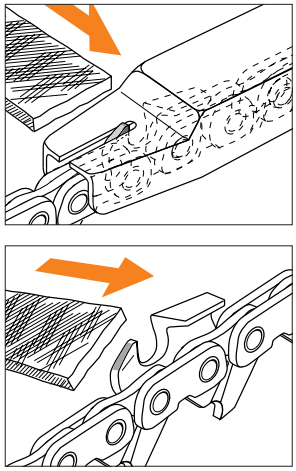
**Sharpening cutters.** Start by finding the cutter with the shortest top length (the "master cutter"). Sharpen it to the correct angle and then file all the other cutters to match its length. (Use a caliper to measure the cutters.)

File all the cutters on one side of the chain first, then file the cutters facing the opposite direction.

When filing the cutter, be sure to use the correct round file and always direct it from the inside to the outside of the cutter. (That is, sharpen only on the forward stroke – lift the file off during the backward stroke.)

**Filing depth gauges.** Check the depth gauge for the correct height every time you sharpen the cutters.

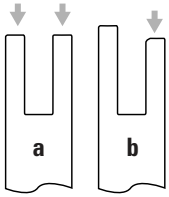
If the depth gauge sticks up above the filing gauge, first file it level with a flat file. Then make sure that all the other depth gauges are filed to the same height. Finally, slightly file each leading edge to round the corner back to its original shape.



Use a depth gauge tool for accurate measurement and filing. These tools, to fit different gauges of saw chain, are available from your STIHL dealer.

**Guide Bars**
**In General:**

Guide bars wear faster in the area where most of the cutting is done – on the underside of the bar. You should check the guide bar often for bent or worn guide rails and cracked, burred edges. Badly damaged bars must be replaced. With proper lubrication and light filing, you can prevent most damage and make the bar last longer.



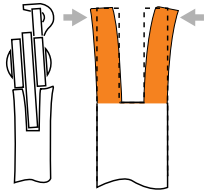

**Appearance**
a) Evenly worn bar rails - minimum depth has been reached.
b) Unevenly worn bar rails.

**Instructions:**

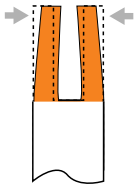
Clean the bar grooves often.

Whenever you remove the bar, turn it over so that it will wear evenly.

Check the groove depth after a bar has been used for a while. Old guide bar rails wear and the groove can become too shallow for saw chain drive links to pass through the groove properly. On solid nose guide bars, measure the groove depth where the heaviest cutting is done. On sprocket nose bars, measure the depth at the nose. If the depth is less than it should be, the nose should be replaced.



**Appearance**
Splayed bar rails (groove spread).



**Appearance**
Pinched bar groove.

Inspect chain often to make sure that the tie straps are riding evenly on the guard rails of the guide bar.

Lightly file burrs to remove them.

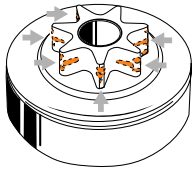


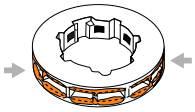


Drive sprockets must always match the saw chain "pitch" which is being used. A servicing dealer is best equipped to match and replace corresponding chains and sprockets.

If the wear marks on the sprocket are significantly more than .02 inch or .5 mm, you should replace the sprocket.

Never install a new chain on a worn sprocket. A properly maintained sprocket will usually last through two chains.





**Appearance**
Excessive wear on teeth.

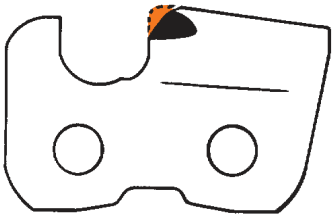
**TIP:**

A general rule of thumb is to replace one sprocket for every two chains, one bar for every two sprockets and every four chains (4=2=1).

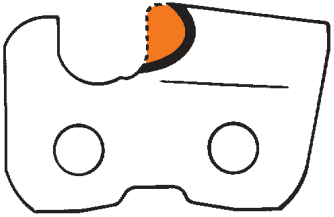
4 chains
2 sprockets
1 bar

# Troubleshooting Chain Wear

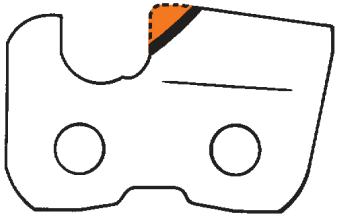
Following are some of the most common problems.



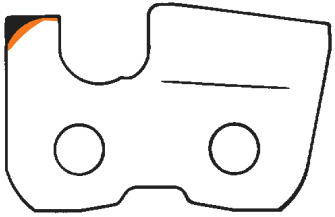
**Condition:**
Damaged top and/or side on cutter. Chain won't cut straight.
**Cause:**
Cutter has hit material other than wood.
**Remedy:**
File cutter to remove the damage. File other cutters to same size.



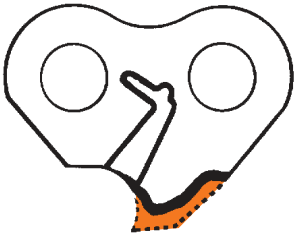
**Condition:**
Hook in side cutting edge or top cutting edge feathered. Cutters dulling quickly.
**Cause:**
File held too low or diameter of file too small.
**Remedy:**
File to correct angle with proper file.



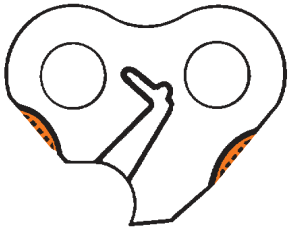
**Condition:**
Cutter angle blunt on top edge or sloping back on side edge. Chain must be forced to cut.
**Cause:**
File too large or held too high.
**Remedy:**
File to correct angle with proper file.



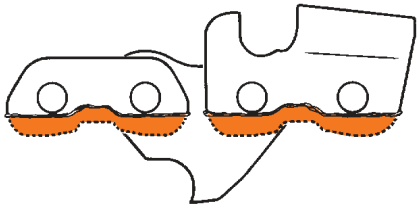
**Condition:**
Blunt depth gauge. Chain cuts rough, excess vibration.
**Cause:**
Improperly filed depth gauge.
**Remedy:**
Round off front edge of depth gauge to original shape and check height.



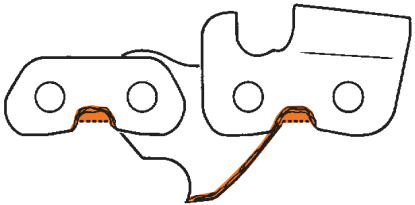
**Condition:**
Damage or broken drive link tangs.
**Cause:**
Chain runs too loose or has “jumped off“ bar.
**Remedy:**
File off burrs. Tighten chain tension. Replace broken parts if damaged too much to file. Inspect guide bar and drive sprocket.



**Condition:**
Front or back of drive link peened (battered around the edge).
**Cause:**
Worn sprocket, sprocket pitch does not match chain pitch, insufficient chain tension.
**Remedy:**
Replace sprocket. Replace saw chain and tension correctly.



**Condition:**
Peening or premature flattening on bottom of cutters and tie straps.
**Cause:**
Loose chain tension. Dull cutters. Lack of lubrication. Chain has been forced to cut.
**Remedy:**
Chain must be replaced if badly worn. Check chain tension and cutter sharpness more frequently. Check guide bar for wear or damage.



**Condition:**
Burring and peening in notch of tie strap.
**Cause:**
Worn chain sprocket.
**Remedy:**
Replace sprocket and chain.

**Special Cold Weather Care**

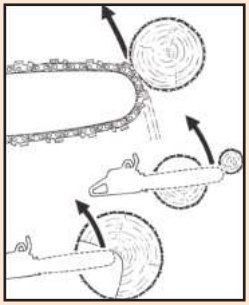
If a chain is tensioned in very cold weather, it will sag when it reaches the normal operating temperature. Always keep the chain tension tight while cutting and loosen it after operation, or it will cool, contract and break, possibly damaging the bar, the crankshaft, and the bearings on the crankshaft.

At extremely low temperatures, normal chain oil will "set" (become too thick to flow). A winter grade bar and chain oil should be used.

Increase the oil flow while cutting in cold weather. Cutting frozen wood increases friction on both the cutters and tie straps, and can cause them to wear or break.

**WARNING**

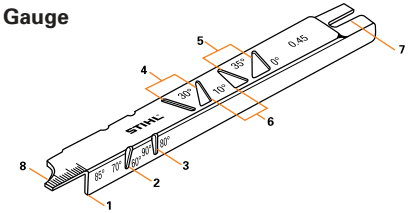
**Kickback**



Kickback may occur when the moving saw chain near the upper quadrant of the bar nose contacts a solid object or is pinched. The reaction of the cutting force of the chain causes a rotational force on the chain saw in the direction opposite to the chain movement. This may fling the bar up and back in an uncontrolled arc mainly in the plane of the bar. Under some cutting circumstances the bar moves towards the operator, who may suffer severe or fatal injury. Kickback may occur when the nose of the guide bar is pinched unexpectedly, unintentionally contacts solid material in the wood or is incorrectly used to begin a plunge or boring cut. It may also occur during limbing. The greater the force of the kickback reaction, the more difficult it becomes for the operator to control the saw. Many factors influence the occurence and force of the kickback reaction. These include chain speed, the speed at which the bar and chain contact the object, the angle of contact, the condition of the chain and other factors.

| Chain Pitch Type | File | File Profile |
|---|---|---|
| 1/4" | 5/32" (4.0 mm) | Round |
| 3/8" | 5/32" (4.0 mm) | Round |
| .325" | 3/16" (4.8 mm) | Round |
| 3/8" | 13/64" (5.2 mm) | Round |
| .404" | 7/32" (5.5 mm) | Round |
| 3/8" Square Ground Cutter | | Tapered or Triangular |
| .404" Super, Square Ground Cutter | | Tapered or Triangular |
| Depth Gauge File | | Flat |

**Filing Gauge**




1 = 85° sighting edge for Micro™ cutter (RM, RC, PM, PMN, PMM)
2 = 60° sighting edge for Super cutter (RS)
3 = 80° sighting edge for special ripping chain
4 = Sighting edge for 30° filing angle
5 = Sighting edge for 35° filing angle
6 = Sighting edge for 10° filing angle
7 = Cut-out for depth gauge setting
8 = Bar groove cleaner and scale for groove depth (mm)

**Guide Bar Dressing Tool**



# Notes

Chain Saw Model #

Equipped with:

Saw Chain Type:

Guide Bar:

## Date of Chain, Sprocket and Bar Replacement

| Chain | Chain | Sprocket | Bar |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |