Sharpening Handbook

Because *sharp enough* … usually is not

Chapter 8

Firefighting & Landscaping

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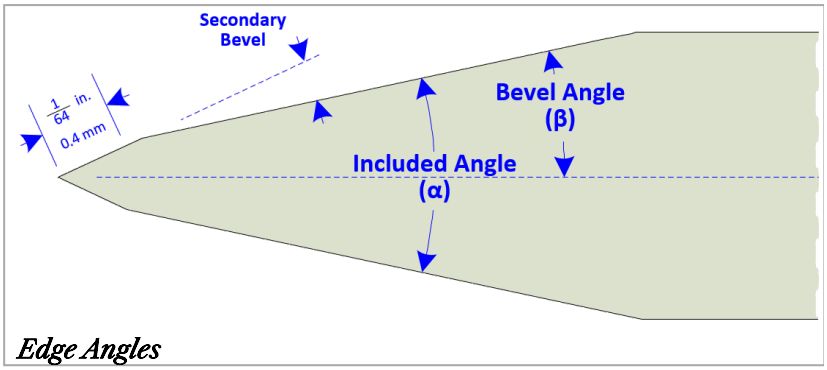
SharpeningHandbook.info

The full handbook, and the latest version of this chapter, are on the web at **SharpeningHandbook.info**. This chapter: November 2026.

Axes & Hand Axes

The **U.S. Forest Service**'s manual, One Moving Part: The Forest Service Axe Manual (on the web site) notes that an ax must do three things to cut efficiently:

1. Sever wood fibers
2. Displace wood chips
3. Release from the wood



Edge Angles

> *Give me 6 hours to chop down a tree and I'll spend the first 4 sharpening the ax.*
> Abraham Lincoln

Guidelines shown below are for **Included Angles (α)**.

Notes are also available on a different web page for Micro / Secondary Bevels (see Chapter 1).

General Guidelines

Ax Type	α		Secondary Bevel	Sharpness
	Soft Wood	Hard Wood		
Carpenter Axes	20°	25°	5°	5
Carving (hand) Axes	20°	25°	5°	6
Clearing Axes	35° - 40°		*n/a*	5
Felling Axes	35°		*n/a*	5
Gardening (hand) Axes	35° - 40°		*n/a*	4
General Axes	**25°**	**30°**	**5°**	5
Hunting Axes	30°	35°	5°	5
U.S. Forest Service Axes	34° - 42°		8° - 11°	5

Notes & Comments

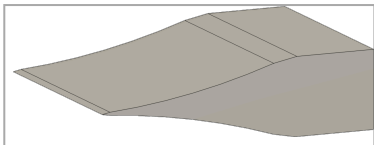
Carpenter Axes

Grind the edge so there is a longer side facing the wood.

Carving (hand) Axes

Andrea Cortés recommends that the bevel needs to be wide: 9-10mm (⅜").

Andrea also recommends using an increasing progression of grits to smooth the grind to a polished surface. This can result in a secondary bevel (as shown in the picture to the right), or a flat grind, depending on which is preferred by the tool's user.


Secondary Bevel

Clearing Axes
A clearing axe is designed for cutting down brush and small trees. These axes typically have thin, replaceable blades. But they can be resharpened.

Gardening (hand) Axes
Gardening hatchets are often used to cut roots when planting or performing other gardenign activities. During such activities, the cutting edge often encouters rocks and is quickly damaged, regardless of the α angle. A greater α angle can enable the gardener to work longer before having to resharpen the tool (e.g., wait until the end of the day).

General Axes
This is a guideline. Exact angles are not required.

I have found that, when sharpening on the Tormek, it is quite easy to resharpen the tool quickly, and a secondary bevel is not necessary (in fact, it can make the process more difficult).

If pursuing an approach with no secondary bevel, increase the α angle by 5°.

U.S. Forest Service Axes
The U.S.D.A.'s **Forest Service** has an excellent manual, One Moving Part: The Forest Service Axe Manual (on the web site), which recommends these angles. This manual also recommends a convex grind.

For double-bit axes, this manual also recommends

> *The Forest Service's preferred method is to leave one edge thinner and sharper and the other edge thicker so that it doesn't have as sharp a cutting angle. Ax nomenclature refers to the thinner, sharper edge as the "keen" edge and the thicker edge as the "stunt" edge. The difference in cutting edges allows axmen to use the proper edge for the type of wood they cut. The keen edge sinks deeper into wood that is free of knots and allows the axman to remove bigger chips. The stunt edge is better in harder, dense wood, such as tree limbs or knots, and allows the axman to work without bending, chipping, or otherwise damaging the cutting edge of the ax.* (pg. 15)

Shaping the edge
New axes are probably sharp, but the axman may want the angle on the edge(s) adjusted to match those in the table above. Thusly, initial shaping of the edge is to be quite probable.

Option A: Use a Tormek
Shape axe blade edge(s) on the Tormek using the AX-40 Ax Jig (which replaced the SVA-170 Ax Jig) and the SG-250 grindstone graded coarse, or the DC-250 grinding wheel.

Rotation of the Grindstone: When sharpening axes, use the vertical position with the grindstone rotating towards the blade. This keeps the axe jig properly aligned to the grindstone. (If you use the horizontal position, the grindstone will tend to pull the axe away from the jig.) Also, the vertical position sharpens faster.

Option B: Use a Machinist's Hand File
The sharpener can use machinist's 12-14" bastard file.

Option C: Use an Angle Grinder

Alternatively, an angle grinder can be used with a 120 grit flap disc. If this method is used, the sharpener must be sure to not overheat the edge, removing the temper from the steel and weakening the edge.

High speed bench grinders are NOT recommended. The U.S. Forest Services says to not use grinders at all.

It is too easy to take the temper out of the blade, and if the temper is lost, the user will get very poor service from the ax. If the sharpener does not have access to a wet grinding system, then a file or stone approach should be used (as outlined in the manual noted below). Angle grinders with flap discs don't cause such a build-up of heat if used in a limited fashion (e.g., for sharpening and not shaping the angle).

Sharpening the edge

Option A: Use a Tormek

Shape axe blade edge(s) on the Tormek using the AX-40 Ax Jig and the SG-250 grindstone grade finely, or the DF-250 or DE-250 grinding wheels.

Option B: Use Machinist's Hand Files

The sharpener can use machinist's hand files. Consider starting with a 8-10" medium (or second) cut file. Finish with a 6" smooth cut file, then use this file to remove the burr.

Option C: Use a Whetstone

Whetstones are available in many options for sharpening axes.

Convex Grind

There are some who recommend that the overall grind be convex (*see also, An Ax to Grind: A Practical Ax Manual (on the web site) from the U.S. Forest Service*). I have found that using a secondary bevel removes that need, but the Tormek AX-40 Ax Jig can accomplish this grind.

Microbevels

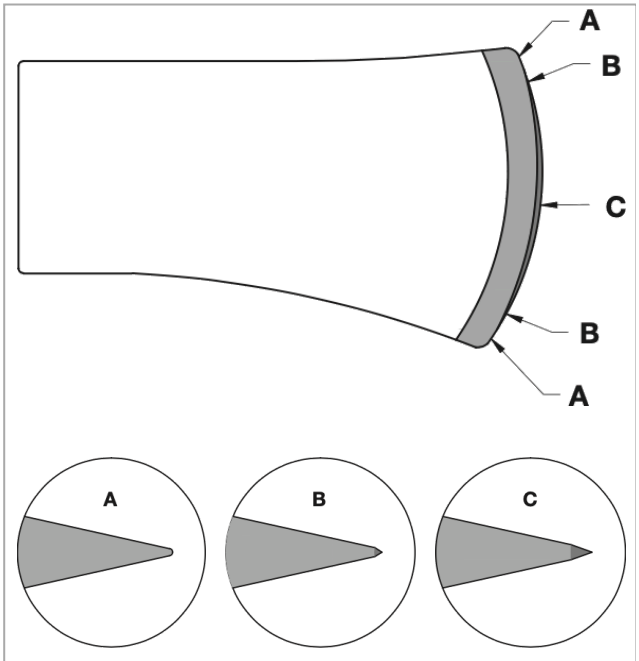
When applying microbevels, consider the approach outlined by the U.S. Forest Service. This approach applies more of a microbevel at the center of the cutting edge (C), than at the tip or toe (A).

This is diagrammed in the images to the right.

Sharpness Scale

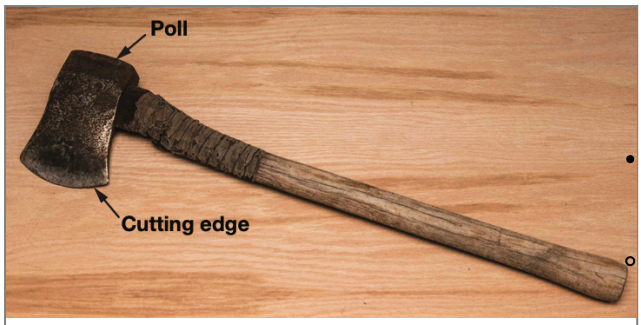
Other Maintenance

If the axe's poll has gotten mushroomed out, it needs to be cleaned up. Leaving the mushroomed surface will make for danger when using the axe, just as with cold chisels.



Varying microbevels on the axe's edge

Images courtesy U.S. Forest Service



Axe Parts

Image courtesy U.S. Forest Service

More Information

Books & Papers

- Manuals published by the United States Forest Service (yes, the Smokey Bear (en.wikipedia.org) people !).
  - Newer version: One Moving Part: The Forest Service Axe Manual (on the web site), October 2020. This manual has a lot of really great information on the use, care, and maintenance of axes.
  - Older version: An Ax to Grind: A Practical Ax Manual (on the web site), July 1999
- U.S. War Department's TM 9-867 Maintenance and Care of Hand Tools (on the web site), April 1945.
- The Razor Edge Book of Sharpening (archive.org), 2000, by John Juranitch
- These documents are excellent references about hand files and their use.
  - File Facts (on the web site) from Simonds Saw and Steel.
  - The Guide to Files and Filing (on the web site) from Nicholson.

Videos & Presentations

- Tormek Live Sharpening Class - Part 2. Axe & scissors sharpening (YouTube video). Sèbastian and Wolfgang from Tormek will go through sharpening of axes and scissors.
- How to sharpen an axe with Tormek T-4 Bushcraft (YouTube video)
- Sharpen axes with the Tormek Axe Jig SVA-170 (YouTube video)

Published Articles

- Tune up an all-purpose hatchet into a carving axe (finewoodworking.com), by Andrea Cortés (andreacortes.com). Andrea provides an accessible tooling alternative to start spoon carving.

> **Sharpness Scale** - see Chapter 1.
> **Ongoing maintenance** - see Chapter 4, *Garden Tools*.
> **Grindstones and Other Sharpening Media** - see Chapter 2.

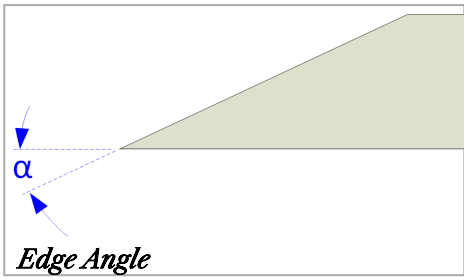
Firefighting Combi-Tools



Combi-tool
Image courtesy Council Tool

Guidelines shown below are for **Included Angles** (α).

A 6" smooth cut machinist's hand file (see Chapter 20) is useful to carry with you. Use it with a draw filing approach to resharpen the shovel as needed throughout the tool's usage for the day.



If this tool is used for landscaping, the directions below for tool maintenance are especially important to ensure the longest tool life.

> *Backdraft has the right-of-way.*
> Anonymous

General Guidelines		
Type	α	Sharpness
Shovel End	40°	3
Pick End	35°	

Notes & Comments

Shovel End

Be sure to sharpen the top / convex side of the shovel (the factory bevel should already be there).

Pick End

This could be up to 40°, depending on the soil in the area (e.g., particularly if it is quite rocky).

Sharpen the upper edge (as shown in the Pick end picture to the right; the factory bevel should already be there).

Thank you to Craig *"Rooster"* Roost of Council Tool in compiling the information for this.



Shovel end *Pick end*
Images courtesy Council Tool

Grind Shape & Experience

The shape of the grind used is a call best made by the tool's use, based on your own experience. Additional notes are available on separate web pages for Grind Profiles (see Chapter 1), and Micro / Secondary Bevels (see Chapter 1).

Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Garden Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

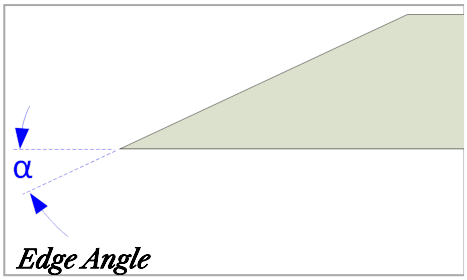
Firefighting Rakes



Firefighter's rake
Image courtesy Council Tool

Guidelines shown below are for **Included Angles** (α).

If this tool is used for landscaping, the directions below for tool maintenance are especially important to ensure the longest tool life.



An accident brings tears, fire safety brings cheers.
Anonymous

General Guidelines	
α	Sharpness
25°	3

Notes & Comments

The user of this tool could set differing angles so that the left sides of each triangle is different thant the right sides.

Thank you to Craig *"Rooster"* Roost of Council Tool in compiling the information for this.

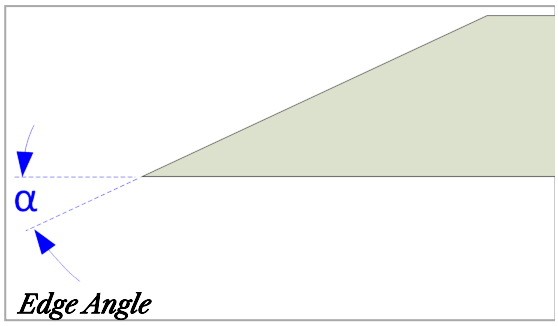
Grind Shape & Experience

The shape of the grind used is a call best made by the tool's use, based on your own experience. Additional notes are available on separate web pages for Grind Profiles (see Chapter 1), and Micro / Secondary Bevels (see Chapter 1).

Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Garden Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

Firefighter's Shovels

Unlike gardening shovels (see Chapter 9), firefighter shovels are sharpened on the top edge (the concave side).



> *A mind is a terrible thing to baste.*
> Anonymous

A 6" smooth cut machinist's hand file (see Chapter 20) is useful to carry with you. Use it with a draw filing approach to re-sharpen the shovel as needed throughout the tool's usage for the day.

General Guidelines	
α	Sharpness
40°	3

Notes & Comments

As noted above, firefighter shovels are sharpened on the top edge (the concave side).

Thank you to Craig *"Rooster"* Roost of Council Tool in compiling the information for this.

These tools are typically stamped ouf of metals which are not terribly hard. Consider this when selecting sharpening tools: if too much heat is generated in the sharpening activity, this can easily remove whatever temper was added to the metal.

Shaping the edge

Shaping the edge: New shovels I have purchased have an angle (α) of 90°. Therefore, initial shaping of the edge is to be expected.

A machinist's hand file such as a 12-14" bastard file is often sufficient for this task.

If you use an angle grinder, consider using a 120 grit flap disc. A metal grinding wheel may be needed for large-scale shaping. In either case, be sure to not overheat the metal too much: it weakens the metal.

Sharpening the edge

Use a machinist's hand file.

1. Start with a 8-10" medium (or second) cut file.
2. Finish with a 6" smooth cut file, then use this file to remove the burr.

More Information

Books & Papers

- U.S. War Department's TM 9-867 Maintenance and Care of Hand Tools (on the web site).

Web Sites

- What is draw filing? (wonkeedonkeetools.co.uk)

> **Sharpness Scale** - see Chapter 1.
> **Ongoing maintenance** - see Chapter 4, *Garden Tools*.
> **Grindstones and Other Sharpening Media** - see Chapter 2.

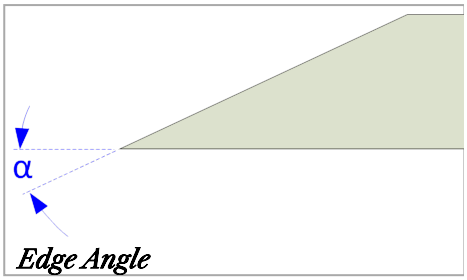
McLeod Tools



McLeod tool
Image courtesy Council Tool

This tool is used in firefighting for cleaning up burnt areas. The U.S. Parks Service also use this tool for clearing up areas for hiking trails.

Guidelines shown below are for **Included Angles** (α).



A 6" smooth cut machinist's hand file (see Chapter 20) is useful to carry with you. Use it with a draw filing approach to resharpen the shovel as needed throughout the tool's usage for the day.

Fun fact: The nut which holds the tool's head onto the shaft can be removed using the wrench supplied with most chainsaws.

If this tool is used for landscaping, the directions below for tool maintenance are especially important to ensure the longest tool life.

All men are created equal, then a few become firemen.
Anonymous

General Guidelines

Type	α	User Stroke	Sharpness
Firefighting	35°	Swung or Pulled	3
Landscaping	30°		

Notes & Comments

Firefighting

This could be up to 40°. Best to not sharpen the tines, though they should be straightened if bent.

Landscaping

This could be up to 40°, but if a larger angle is needed, it is best to start at 35°. The landscaper may be hot and sweaty, but they are not wearing the clothing like a firefighter, so they will surely be expected to better care for the tool.

As above, it is best to not sharpen the tines, though they should be straightened if bent.

Thank you to Craig *"Rooster"* Roost of Council Tool for his help in compiling the information for this tool.

Grind Shape & Experience

The shape of the grind used is a call best made by the tool's use, based on your own experience. Additional notes are available on separate web pages for Grind Profiles (see Chapter 1), and Micro / Secondary Bevels (see Chapter 1).

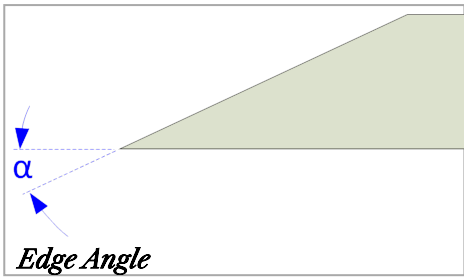
Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Garden Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

Rhino Tools



Rhino tool
Image courtesy Council Tool

This tool is used for cleaning up burnt areas. Guidelines shown below are for **Included Angles** (α).



A 6" smooth cut machinist's hand file (see Chapter 20) is useful to carry with you. Use it with a draw filing approach to re-sharpen the shovel as needed throughout the tool's usage for the day.

If this tool is used for landscaping, the directions below for tool maintenance are especially important to ensure the longest tool life.

> *A good firefighter knows how, an educated firefighter knows why.*
> Anonymous

General Guidelines				
User Stroke	**α_1**	**α_2**	**α_3**	**Sharpness**
Swung or Pulled	35°	30°	40°	3

Notes & Comments

Swung or Pulled

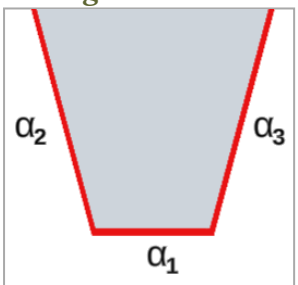


Image courtesy Council Tool

The idea behind the 3 different angles is that each would be used for different purposes. The ideas behind those angles are noted below so that you can make decisions based on your own preferences.

α_1: this is set at a good angle for using this with a swinging action, or a dragging pull.

α_2: this is set at a good angle for using this with a cleaving or chopping action. The more acute angle will make this easier. Using something as shallow as 25° is not recommended as this will dull too easily.

α_3: this is set at a good angle for using this with a dragging pull.

Depending on the user's handedness (left vs. right), the values for α_1 & α_2 could be swapped for easier use.

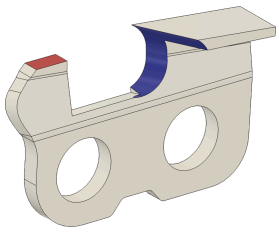
Thank you to Craig *"Rooster"* Roost of Council Tool in compiling the information for this.

Grind Shape & Experience

The shape of the grind used is a call best made by the tool's use, based on your own experience. Additional notes are available on separate web pages for Grind Profiles (see Chapter 1), and Micro / Secondary Bevels (see Chapter 1).

Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Garden Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

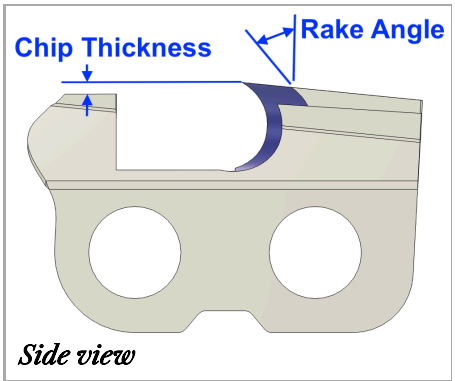
Saw Chains for Chainsaws



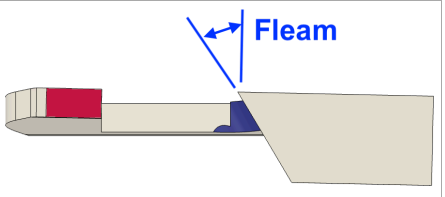
Saw chain

When a chainsaw's saw chain is sharpened using files, it is sharpened using a round file (sized for the chain). This is used to address the part marked in blue.

Oftentimes, a flat, mill file is also needed to reduce the size of the chip gauge (AKA, a "raker"). This is shown in the pictures marked in red.



Side view



Top view

Saw chains need to be sharp, but not surgical sharp. A good guide is based on the sharpness scale shown to the right.

Sharpness Scale

4

> *I took a walk in the woods and came out taller than the trees.*
> Henry David Thoreau

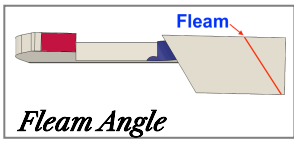
General Guidelines

Saw Chain Type	Fleam	Drop	Rake	Chip Thickness	
				Depth Gauge	
	Vise Rotate Angle	Down Angle	Head Tilt Angle	Pitch < 0.404"	Pitch = 0.404"
Crosscut					
Round ground chisel tooth	25°	0° or 10°	55°	0.025" 0.65 mm	0.030" 0.76 mm
Chisel tooth	30°				
Semi-chisel tooth	35°				
Rip	10°	10°	50°	0.025" 0.65 mm	0.030" 0.76 mm

Notes & Comments

Round ground chisel tooth

Fleam / vise rotate angle is often indicated on the saw cutter as shown in the picture to the right. Match that angle.



Fleam Angle

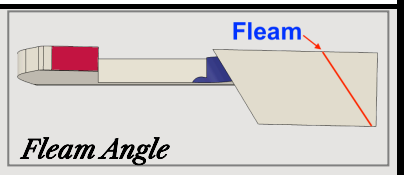
Drop / down angle is chain-dependent, but 10° is most common.

Rake / head tilt angle typically ranges between 50° to 60°, but 55° is most common.

Notes:

1. When using the Oregon Products or Tecomec Bench Grinder, the term equivalencies for the Grind Angles Chart are shown in blue the table above. The Grind Angles Chart should also be consulted for the relevant angles, based on the chain you are sharpening.
2. These are some good general guidelines. Specific saw chains may require different angles.

Steps for Sharpening Saw Chains

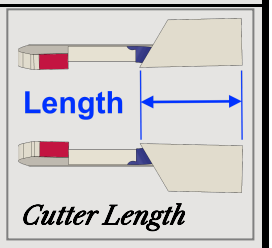
Step	Comments
1. Clean the saw chain	If the chainsaw's saw chain has become gunked up, it can be immersed in a carburetor cleaning solution, and then scrubbed with a wire brush. Spray carburetor cleaner (in an aerosol can) can quickly remove any solvent remaining on the saw chain. **Safety Note**: It is recommended that you clean the saw chain *before* sharpening it. This is safer, and you are less likely to dull the blade by the cleaning activities. Also, it will be easier to see what you are doing during the sharpening activities. Finally, be sure to follow the safety guidelines for use and disposal of any cleaning chemicals.
2. Sharpen the **Cutters**	The tops of some saw chain cutters have an line at an angle which is used to indicate the manufacturer's recommended Fleam / Vise Rotate Angle. This is shown as a red line in the picture to the right (*click on the picture to see a bigger version*). 
2.a. Inspect the chain to find the cutter most in need for regrinding.	When ground, the length on this cutter will set the amount ground from all the cutters. This ensures a consist chain which saws cleanly, neatly, and (hopefully) safely. Mark the top of this cutter with a red Sharpie (or use whichever colour you prefer).

<table>
<tr><th>Step</th><th>Comments</th></tr>
<tr><td>2.b. Sharpen all the left hand (or right hand) cutters.

Start sharpening with the cutter marked red in the prior step.</td><td>If sharpening the cutters by hand, a round file guide is recommended.

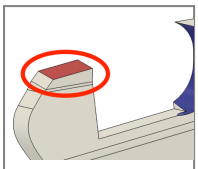
If sharpening the cutters using a grinder,
Ensure the grindstone's shape is appropriate. Use the wheel dresser to reshape it as necessary.
Be sure to manage the heat during the process. Saw chains are typically not hardened steel and if the grinding is too agressive, the teeth will lose temper.
Ensure the chain vise holds the saw chain securely, and also allows the chain to slide easily during the sharpening; adjust as necessary.
<table><tr><th>Saw Chain Pitch</th><th>File Diameter</th></tr><tr><td>1/4” 0.250”</td><td>5/32” 4 mm</td></tr><tr><td>0.325”</td><td>3/16” 4.8 mm</td></tr><tr><td>3/8” 0.375”</td><td>13/64” 5.2 mm</td></tr><tr><td>0.404”</td><td>7/32” 5.5 mm</td></tr></table></td></tr>
<tr><td>2.c. Sharpen all the opposite hand cutters.

Start sharpening with the cutter to the left of the one marked red.</td><td>When grinding the cutters, it is important that the left and right cutters are equal length. It is a good practice to measure the cutters you just sharpened, and set the length of these cutters to be the same. Aim for a difference in lengths around ±0.01” (±0.25 mm).



Cutter Length

A micrometer is a good tool for measuring this.</td></tr>
</table>

Step	Comments
3. Set the height for the **Chip Gauges**  *Chip Gauge*	If the saw is generating fine (not chunky) sawdust, the chip gauge / raker will need to be filed down to increase the chip thickness. The chip gauge is the metal part of the saw chain which projects up in front of the cutter and sets the chip thickness. When filing down the chip gauge, be careful to not take off too much. If it is too short, the chainsaw will become too aggressive, and will also be dangerous to use.  *Depth Gauge Tool* A **depth gauge tool** is really needed for setting the chip gauge's height correctly. If grinding the chip gauges using a grinder, • Set the thickness for one of them first by hand. This one is used to set the depth for grinding the others. • Ensure the grindstone's shape is appropriate. Use the wheel dresser to reshape it as necessary. • As noted above, be sure to manage the heat during the process.
4. Oil the saw chain.	In a dusty environment, this can attract dust to the chain, so it may be better to only add a light coat of oil.

File Size to Use

The file size needed, based on the chain used, should be as noted in the table below. It is best to consult your machine's manual though.

Saw Chain Pitch	File Diameter	Grinding Wheel Diameter	Vendor Chain Part Numbers	
$^{1}/_{4}$” 0.250”	$^{5}/_{32}$” 4 mm	$^{1}/_{8}$” 3.2 mm	**Carlton**: E1MC **EM**: S00 **Husqvarna**: H00 **Oregon**: 25	**SARP**: 16 **Stihl**: 13, 13RM, 71 **Windsor**: 50K
0.325”	$^{3}/_{16}$” 4.8 mm	$^{1}/_{8}$” 3.2 mm	**Carlton**: K1C, K1L, K2C, K2L, K3C, K3L **EM**: S21, S27, S28 **Husqvarna**: H21, H22, H23, H25, H26, H27, H30, H78 **Oregon**: 20, 21, 22, 33, 34, 35, 80, 95, M21, M22	**SARP**: 520, 523, 528, 920, 923, 928 **Stihl**: 23, 25, 26 **Windsor**: 50JL, 50JLG, 58JL, 58JLG, 63JL, 63JLG

Saw Chain Pitch	File Diameter	Grinding Wheel Diameter	Vendor Chain Part Numbers	
3/8" 0.375"	13/64" 5.2 mm	1/8" 3.2 mm - *or* - 3/16" 4.7 mm	**Carlton**: A1EP, A1LM, A2EP, A2LM, A3EP, AA3LM, N1C, N4C **EM**: S36, S41, S44, S45, S46, S48, S49, S51, S52, S53, S54 **Husqvarna**: H42, H45, H46, H47, H48, H48S, H50, H51, H54, H80, H81, H82, H83, H475	**Oregon**: 72, 73, 75, 90, 91 **SARP**: 357, 357P, 357S, 980, 980D, 983, 983D, 988, 988D **Stihl**: 33, 35, 36, 61, 63 **Windsor**: 43RG, 50AG, 50APL, 50APLG, 50R, 50RG, 58AG, 58APLG, 63AG, 63APL, 63APLG
0.404"	7/32" 5.5 mm	3/16" 4.7 mm	**Carlton**: B2EP, B2LM, B3EP, B3H, B3HR, B3RM10, B3RM35, B3S, B5M **EM**: S64, S65, S66 **Husqvarna**: H57, H64, H65	**Oregon**: 16, 18, 19, 26, 27, 58, 59, 68 **SARP**: 463, 757, 757MK, 858, J63, MKII2000 **Stihl**: 40, 46 **Windsor**: 58B, 63B, 63BL, 63BR, HC, 2HC

Safety Note: When using a hand file for filing a saw chain, ensure that you also use a file handle. Husqvarna makes one (shown in the picture to the right) which is nice as the two angled edges are at 25° and 30° so it is easy to use that as a reference for the fleam angle.



Husqvarna's file handle

This handle fits 4.0-4.5 mm round files and 6-8" flat files.

I prefer this handle style for sharpening saw chains over the wooden file handles.

Toolkit for Saw Chain Sharpening

Oregon Products makes a very useful field sharpening kit. (Though they don't seem to show it on their web site; I bought mine via Amazon.)

Such a kit needs to include:

- Commonly used hand files for sharpening the saw chain used on your chainsaw:
  - Round file - 4mm or 5/32"
  - Round file - 4.8mm or 3/16"
  - Round file - 5.2mm or 13/64"
  - Round file - 5.8mm or 7/32"
  - Flat file - 6", single cut
- File handle
- Guide/jig for sharpening the cutters, preferrably one which has marks for the fleam at 25°, 30°, & 35° to make the process easier
- Depth gauge tool for filing the chip gauge's height

Grinding Wheels for Saw Chain Grinders

The grinding wheels for the saw chain grinders are:

Grinding Wheel	Comments
Pink	This is the grindstone traditionally supplied with new machines.
Green	General-purpose grindstone which balances speed of cutting with wheel wear.

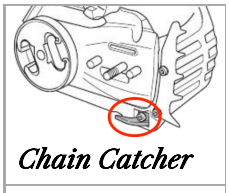
Grinding Wheel	Comments
Gray	Uses an abrasive material design to grind chains with hard coating materials applied to the cutter. This material creates a harder surface than a standard steel cutter. The gray wheel will grind much cooler and with less burning than the pink or green grindstones. However, it is softer and will not last as long.
CBN	Grinding wheels coated with CBN will cut without the heat buildup experienced by the traditional grindstones (any colour). They should be used on steel saw chains.
Diamond	Grinding wheels coated with diamonds will also cut without the heat buildup experienced by the traditional grindstones (any colour). They should be used on saw chains with teeth which are carbide.

Chainsaw Maintenance

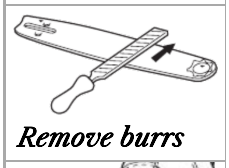
Do not forget to also maintain the chainsaw.

1. After removing the chain:
   i. Clean the area behind the clutch cover / sprocket cover.
   ii. Clean the guide bar.
   iii. Clean the guide bar's chain groove.
   iv. Check that the oil channel in the guide bar is not obstructed. Clean if necessary.
2. Inspect the guide bar, looking for any significant damage:
   i. Cracks in the guide bar,
   ii. Dents in the guide bar,
   iii. Excessive wear, especially in the chain's groove,
   iv. The guide bar tip sprocket turns freely,
   v. The lubricating hole in the tip sprocket is not blocked, and
   vi. The guide bar is straight.

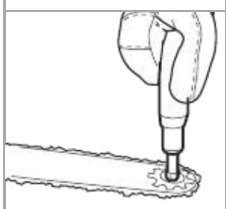
   If the guide bar is badly damaged, replace it.
3. Inspect the chain catcher to ensure it is not damaged and that it is firmly attached to the body of the chain saw. Replace if necessary (*see also, top picture to the right*).
4. Dress the guide bar. A jointer & edger (leevalley.com) used for hand saws makes this easier and more consistent along the edge. (Do not use a handle on the file when doing this; the jointer/edger handle holds the file.)
5. Remove any burrs on the sides of the guide bar (*see also, middle picture to the right*).
6. Some chainsaws require you to lubricate the guide bar tip sprocket (if there is one) with bearing grease (*see also, bottom picture to the right*). Others want you to ensure the oil channel supplies oil to the sprocket.
7. When re-installing the guide bar, flip it over 180° from the way it was originally installed. This prolongs the life of the guide bar.
8. After re-installing the chain, ensure the chain does not bind. Also ensure it is not too loose, indicating that the groove is excessively worn. Either of these scenarios indicate that the bar should be replaced.
9. If you are putting the chainsaw away for the season (or even for an extended period), remove the fuel.



Chain Catcher



Remove burrs



Lube sprocket bearing

More Information

Books & Papers

- “The Complete Guide to Sharpening” (2003), by Leonard Lee
- “The Fundamentals of General Tree Work” (1996), G.F. Beranek.
- “The Good Woodcutter's Guide: Chain Saws, Woodlots, and Portable Sawmills” (1998), by Dave Johnson.
- The Razor Edge Book of Sharpening (archive.org) (2000 - PDF file), by John Juranitch
- The vendor's user manual which came with your chainsaw.

Videos & Presentations

- Oregon 520-120 and 410-120 Electric Chain Grinder Instructions (YouTube video)

Web Sites

- How Saw Chain Works (educatedclimber.com), by Educated Climber

> **Sharpness Scale** - see Chapter 1.
> **Ongoing maintenance** - see Chapter 4, *Metalworking Tools*.