Sharpening Handbook

Because *sharp enough* … usually is not

Chapter 1

Introduction

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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.

About this Book

Printing this book. This book is made from the Sharpening Handbook web site, SharpeningHandbook.info. You may print it, or any part of it, for your own personal use. No rights are granted to print it, or any part of it, for sale.

This book, made from the web site, is meant as a reference tool for those who already know how to sharpen specific tools. It is meant to mirror the value provided for machinists by

- Fred Colvin (en.wikipedia.org) and Frank Stanley in American Machinists' Handbook (en.wikipedia.org) or
- Erik Oberg and Franklin Jones in Machinery's Handbook (en.wikipedia.org)



I like the technique shown in the picture from Biagio Pupini titled, *"Man supervising another sharpening an axe with a boy turning the wheel"* (a pen and ink drawing, circa 1535, and shown to the right); however I can't find the room for such a grindstone in my shop. Also, my sons have moved out.

Instead, I use the Tormek wet grinder with associated jigs for sharpening when it makes sense to do so. When it does not, I have noted that in this site.

I have not used other systems like the the Accu-Finish or Sorby ProEdge machines, so I can't speak to what would change using them. If you have some information worth logging on this site, then please eMail me at the address shown below.



There are a few topics which are key to the safety of the sharpener, or are key for the sharpening process. Those are denoted using a red razor blade as shown to the left.

If you are seeking information about how to sharpen tools, please refer to the sharpening books, videos, & web sites noted on the web site. There are many others and they may be quite good. I recommend these based on their proven approaches, and I have also found them to be safe when followed as instructed.

> Nothing will ever please me, no matter how excellent or beneficial, if I must retain the knowledge of it to myself. And if wisdom were given me under the express condition that it must be kept hidden and not uttered, I should refuse it. No good thing is pleasant to possess, without friends to share it.
>
> From Seneca the Younger's "Moral Letters" to Lucilius, letter 6 titled, *"On Sharing Knowledge"*

Information presented here is given without any commercial gain. God has been very good to me and my family, and this is a way of giving back in a small way. I also choose to fund this web site privately so that the information won't be skewed towards any vendor, and so that it can be presented freely to those who would like to use it.

If you have ideas or thoughts, please send them to me. I want this to be a quick reference for sharpening, and notes that help make that faster or more effective would be greatly appreciated (and will probably be added).

I have only shown information for tools I sharpen, or information given to me by others who sharpen their own tools. If you have information about tools not shown, please do send them to me so they can be added.

I've added a quote to each page with the hope of making you smile. Many ring true to me, especially those from old sergeants and old shop teachers. None-the-less, if you are offended by one of the quotes, please do let me know.

You can contact me at SharpeningHandbook @ Gmail.com.

I hope you find this information useful.



With kindest regards,
Rich Colvin

The legal stuff:
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Tormek AB have been kind enough to let me reference information from their Tormek Handbook. Notes have been made to the use of their copyrighted material.



And, remember: The goal of sharpening is to produce sharp tools, and these tools can injure you if mishandled. Safety measures should be followed to protect yourself and those in your shop. Be sure to read and follow all instructions from the manufacturer, and and utilize proper safety equipment. Never consume alcohol or anything that could impair your judgement before sharpening tools, or using sharp tools.

Sharpness Scale

This **Sharpness Scale** is used as a way to define relative sharpness, especially for tools which are not needing to be "razor sharp".

Please also note, these are for linear edges, not for pointed objects (e.g., needles).

General Guidelines					
Rating	Definition	Measurement			Comments & Examples
		Edge Radius	BESS[1]	REST[2]	
0	**Totally blunt**	Width ≥ 2mm Width ≥ $^{1}/_{16}$"			Flat edge ⇒ Practice Swords
1	**Blunt**	≥ 2.5mm ≥ $^{3}/_{32}$"			Rounded edge
2	**Dull**	0.5mm - 2.5mm $^{3}/_{128}$" - $^{3}/_{32}$"	2,000		Rounded edge ⇒ Butter knife
3	**Dirty sharp**	< 0.5mm < $^{3}/_{128}$"			Dull edge, coming to a "point" ⇒ Gardening tools for digging into dirt ⇒ Masonry drill bits ⇒ Metalworking bench tools
4	**Heavy duty sharp**				⇒ Metal lathe tools
5	**Generally sharp**				⇒ Drilling bits, other than masonry bits ⇒ Gardening tools for cutting (e.g., secateurs)
6	**High speed sharp**		200 - 400	2N - 4N	⇒ Handsaw blades ⇒ Scissors ⇒ Woodturning tools
7	**High volume sharp**		100 - 200	1N - 1.8N	⇒ Kitchen knives ⇒ Woodturning skews
8	**Razor sharp**		50 - 100	0.5N - 1N	⇒ Razors ⇒ Woodworking bench tools
9	**Surgical sharp**		≤ 50	≤ 0.4N	⇒ Surgical scalpels
10	**Sharpest physically possible**	1 atom wide at cutting edge			This is more theoretical than can be actually achieved. There is nothing known to be in this category at this time.

Notes

1. **BESS** is an acronym for Brubacher Edge Sharpness Scale. BESS-calibrated edge sharpness testers show edge apex radius in nm. Commercial safety razors score 50 on the tester and have a

50 nm apex radius. A score of 100 equates to a 0.1 micron edge apex width.

2. **REST** is an acronym for the Cutlery & Applied Trades Research Association (CATRA)'s Razor Edge Sharpness Tester. It is a measure of the push-cutting force in Newtons (en.wikipedia.org).

More Information

Web Sites

- Science of Sharp (scienceofsharp.com)

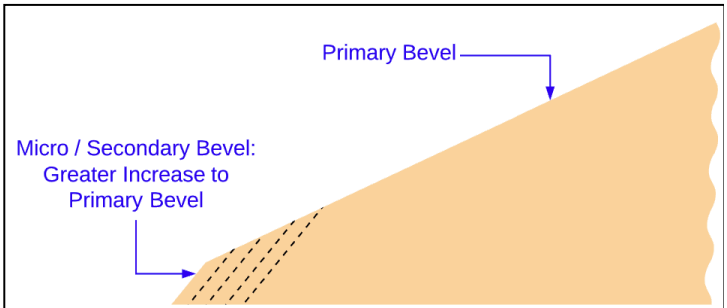
Micro Bevel Angles

Why use a Micro Bevel (also known as a secondary bevel)?

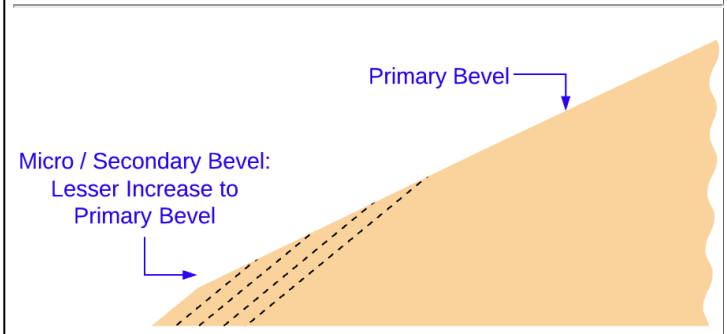
The sharpening process is typically multi-step:

1. The tool is sharpened on a grindstone which is "rougher" -- a grit in the range of 600 - 1,000.
2. The tool is then honed on a grindstone (or other media) with a much higher grit -- something in 4,000 grit and finer range (some hone on grindstones up to 13,000 grit).

The honing step can be quite onerous if the size of the surface to be honed is large (every mm^2 counts). Fortunately, by increasing the angle for the honing step, the area needing to be honed can be kept small.



High Angle Micro Bevel



Low Angle Micro Bevel

Micro bevels thusly are used to make sharpening (and re-sharpening) of the tool faster, getting the craftsman back to work sooner.

What Micro Bevel angle should you use?

The selection of the Micro Bevel angle is not critical for the tool's sharpness, but it does impact the time required for re-honing the tool.

- There are some who opt for Micro Bevels which are very close to the primary bevel (a low increase) -- angles increased in the range of +1° to +2°.
- Others opt for Micro Bevels which are a greater increase to the primary bevel -- angles increased in the area of +5°, even up to +10°.
- I generally use +2° to +5°, with higher bevel angles on harder steels.

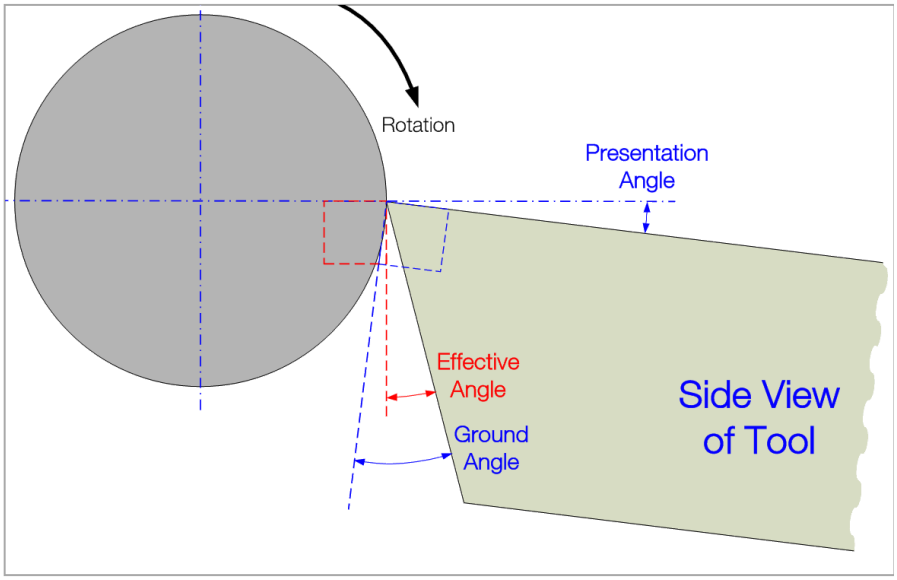
The tool edge depicted on the right has a Micro Bevel, and shows dashed lines for the next 4 times it will be honed. As is shown, the lower angle Micro Bevel makes for a larger surface area as the re-honing activities proceed. It is a bit exaggerated, but does show how the Micro Bevel angle affects the re-honing activity.

Want more information on honing?

There is a very good guide on honing which was written by Charles Holtzapffel titled, Turning and Mechanical Manipulation, Vol. 3 - Abrasive and Other Processes not Accomplished with Cutting Tools. This was originally published in 1850 by Charles Holtzapffel, and was later updated by Charles' son, John Jacob Holtzapffel in 1894. The 2d edition has 796 pages, of which 300 were revised from the first edition by John Jacob.

Ground vs. Effective Angles

The angle with which the cutting tool is presented to the object can change the effective angle for the way a tool works (e.g., the relief or clearance angle). The diagram to the right shows a typical configuration for a cutoff tool.



Presentation Angle - It is typical to present a cutoff tool at an upward angle. For this example, we'll use 5°.

Effective Angle - This is the effective angle of the cutting, relative to the object's centre line. For a cutoff tool, the relief angle is typically around 7°, so that is what we will use for this example.

Ground Angle - The Ground Angle is the sum of the Effective Angle (5°) and Presentation Angle (7°). For this example, this would be:

$$5^\circ + 7^\circ = 12^\circ$$

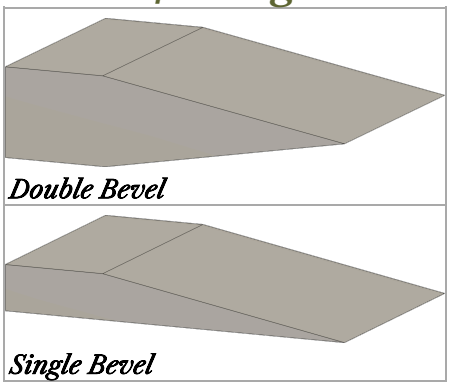
So, in this example the machinst would grind the tool with an angle of 12° relative to the top of the tool.

Grind Profiles

The shape of the grind cut into a tool is a decision best made by the individual using the tool, based on their own experience. That said, some general guidance regarding profiles is below.

The pictures of the grind profiles are exaggerated to help with communication. They do not reflect the actual amount of concavity or convexness.

Scandi / Flat grind



This bevel shape does provide a good guide to stabilize the cutting action, however it is so long that it may be difficult to pull out of the cut (i.e., for stop cuts).

Recommended For
- Certain types of chip carving need this
- Luthier knives are often ground flat like this

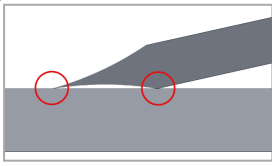
It can be double-beveled as shown in the upper picture, or have a single bevel as shown in the lower picture.

When single beveled, this is commonly called a “chisel grind”. These are not common, except for fine-cutting knives like sushi or grafting knives. And, they can be made for either left or right handed use.

If you use a flat grind, then consider using a slightly lower value for **α**.

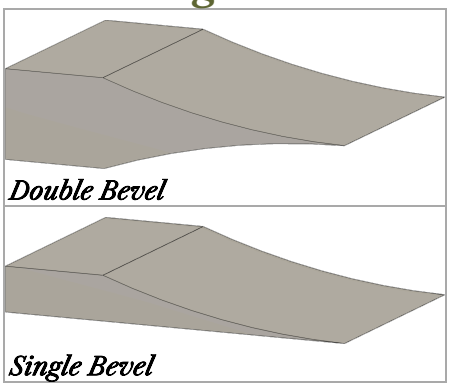
This YouTube video discusses using the Tormek MB-100 Muti Base for achieving a flat grind using the side of the grinding wheel. The diamond grinding wheel is recommended; however I have used the MB-100 on the SB-250 and SG-250 grindstones.

Using the side of the grinding wheel is also key when flattening the back of a single beveled blade.



When using flat stones for final sharpening (e.g., grits >2000), a hollow grind can make this easier. As shown in the picture to the left, the two points circled in red provide positive locations for setting the grinding action. It also reduces the amount of grinding needed as there is less metal meeting the grindstone.

Concave grind



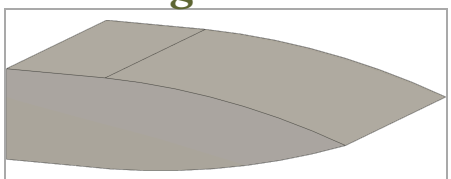
This is the grind achieved when using the perimeter edge of round grindstones (e.g., on a Tormek), though the concavity is quite small, especially on such a small grinding surface width. As an example, for a 2mm thick blade sharpened at an **α**=20°, the concavity is approximately 0.02mm (0.001”).

Recommended For
- Woodturning tools
- Tools with thin blades
- Tools to be honed on flat, high grit stones

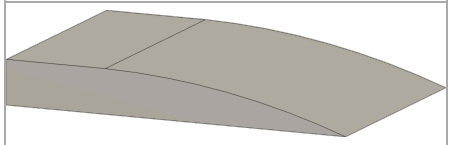
Some carvers do not like to use concave grinds; however many have found that for some operations like wood turning, the concavity really does not matter for their work, and that fhe concavity makes for honing an edge in a much easier manner (I.e., the concavity allows the edge to be balanced easily on a flat, high grit stone). This is especially a useful process for plane blades and bench chisels.

(The picture is certainly exaggerated for the amount of concavity.)

Convex grind



Double Bevel



Single Bevel

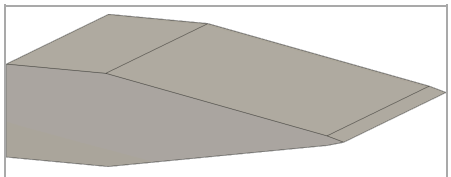
This grind is not recommended for the general carving knife; however it is recommended by some for chip carving. It does allow for great flexibility; however it does not provide adequate anchoring for the cutting action.

Recommended For

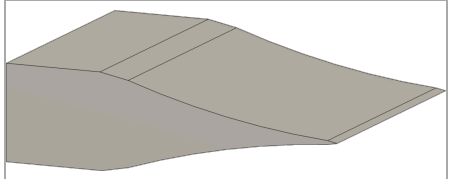
- Some carvers greatly prefer this
- Recommended for axes

A convex grind is commonly found on the tips of knife blades where the blade is expected to see high lateral forces (e.g., tactical knives).

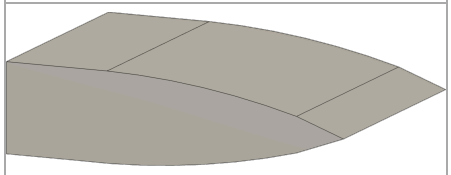
Grind with Micro-Bevel



Flat with Micro-Bevel



Concave with Micro-Bevel



Convex with Micro-Bevel

Micro-bevels could be applied to any of the above-listed grinds; however it is most common with Scandi/Flat grinds and Concave Grinds.

Recommended For

- Tools which are re-sharpened often (e.g., wood turning tools)
- Tools which are re-honed often (e.g., wood carving and bench woodworking tools)

Many carvers do not like to use a carving knife with a micro bevel grind. Their argument is that it does not give them a large enough bevel for anchoring the cut; however if the bevel on the micro-bevel is long enough, it is quite usable. Also, this grind shape allows for great flexibility.

(*Additional notes are also available on a different web page for Micro / Secondary Bevels* *(see Micro Bevel Angles, in this chapter).*)