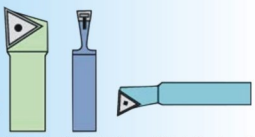
ULTIMHEAT® UNIVERSITY

How to use a lathe and lathe tools
Comment utiliser un tour et ses outils

Lathe tools

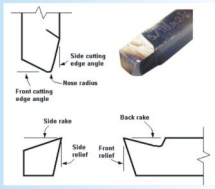
(a) Side tool :It can process to cut an outside surface and an edge surface. Since the material is set at the right of lathe, then this tool can only cut the right of the material.
(b) Cutting off tool : It is used at parting and grooving processes. Its pointed end is slim, then it is too weak. Don't add a strong side-force to the tool. This tool must send vertical direction only.
(c) Boring bar: It is used to cut at an inside surface. It can make a big hole, which cannot be process by a drill, and a high accurate hole.



(a) Side Tool (b) Cutting-off (c) Boning Bar

Grinding Tool Bits

Grinding lathe tool bits is not easy .You need to create a cutting edge that is sharp, extends out so that the cutting edge and not the side of the tool contacts the work, but that still has enough support to maintain sufficient strength to cut metal.There are two cutting edges on the tool bit: The front cutting edge and the side cutting edge, Between these cutting edges is a rounded section of cutting edge called the nose.



A/Description of a lathe tool

1/ The side cutting edge
The side cutting edge does most of the cutting. As the too bit moves along the work piece the side cutting edge removes most of the material.
2/ The front cutting edge
The front cutting edge cuts when the tool is advanced into the work.
3/The nose
The nose is a critical part of the cutting edge, because it produces the surface finish of the work piece.
4/ The side rake
The side rake produces the side cutting edge that cuts into the work piece.
5/ The side relief
The side relief provides clearance for the side cutting edge. Without side relief, the side of the tool bit would hit the work piece and not allow the cutting edge to penetrate the work piece.
6/The back rake
The back rake produces the front cutting edge that cuts into the work piece.
7/ The front relief front
The front relief front relieve provides clearance for the front cutting edge. Without front relief, the front of the tool bit would hit the work piece and not allow the cutting edge to penetrate the work piece.

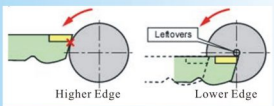
B/How to Grind Tool Bits

Use a bench grinder with a high quality fine grit wheel to sharpen your tool bits. Keep a small cup of water near your grinder. Grinding generates heat, which can cause two problems. The tool bit will become too hot to hold. Overheating can also affect the heat treatment of the tool bit, leaving the cutting edge soft. Use a protractor to measure the angles. They are critical, and you must stay within one degree

1/ Grind the Front Relief and the Front cutting edge angle
The first step in creating a tool bit is to grind the front relief. For most work, the Front relief angle is 10° .
While you are grinding the front relief, you are also creating the front cutting edge angle. Make this angle about 10° also, so that the corner formed by the front cutting edge and the side cutting edge is less than 90° .
2/ Grind the Left Side Relief
Form the left side relief next. Again, create about a 10° angle. You don't need to form a side cutting angle. The side cutting edge can be parallel to the side of the tool blank.
3/ Grind the Top Rake
The top of the tool bit is ground at an angle that combines the back rake and the side rake. The side rake is most important, because the side cutting edge does most of the work. For cutting steel and aluminum, the side rake should be 12° and the back rake should be about 8° . For cutting brass, the rake angles should be 0° .
4/ Round the Nose
A small nose radius allows you to turn into tight corners. A large nose radius produces better surface finishes. Create a nose radius that is appropriate for the tool bit you are creating.
5/ Indexable Turning tool
These tools use indexable inserts made from carbide, they are called indexable because you can change insert and the new insert take the exact position of the insert it replaces. You can resume work with no further adjustment. Indexable inserts are pre-sharpened and cannot be grinded

C: Adjusting Tool Bit Height

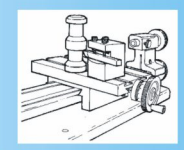
The cutting edge of the tool bit must be set to the center height of the lathe spindle.The best way to do it is to have a tool height Gauge that is always used with the same lathe. This gauge is turned from blank with one shoulder at the right height and one shoulder to handle it. This makes the task of setting the tool tip to cut at the center height of the lathe an easy one. This gauge is simply set on the table and the tool checked against the predetermined center height ledge. Another simple way is to place a thin strip of metal, such as a steel rule or feeler gage, between the work piece and the point of the tool bit. If the height is correct, the strip of metal will be held vertical. If the top is leaning toward you, the tool bit is too low. If the top is leaning away from you, the tool bit is too high.



D : Turning

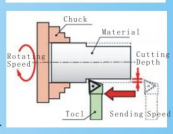
Three Important Elements

In order to get an efficient process and beautiful surface at the lathe machining, it is important to adjust a rotating speed, a cutting depth and a sending speed. Please note that these important elements cannot be selected easily, because these suitable values depend of materials, size and shapes of the part.



Rotating Speed

It is expressed by the number of rotations (rpm) of the chuck of a lathe. When the rotating speed is high, processing speed becomes quick, and a processing surface is finely finished. However, since a little operation mistakes may lead to the serious accident, it is better to set low rotating speed at the first stage.



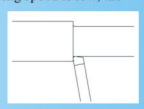
Cutting Depth

Cutting depth of the tool affects the processing speed and the roughness of surface. When the cutting depth is big, the processing speed becomes quick, but the surface temperature becomes high, and it has rough surface. Moreover, a life of bit sharpness also becomes short. If you do not know a suitable cutting depth, it is better to set to small value.

Sending Speed (Feed)

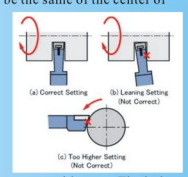
The sending speed of the tool also affects to the processing speed and the roughness of surface. When the sending speed is high, the processing speed becomes quick. When the sending speed is low, the surface is finished beautiful.

Follow these steps to turn a work piece:



1. Put a tool bit in the tool holder and adjust the cutting edge to center height.
2.1 Side tool: Angle the tool so that the front cutting edge forms an acute angle with the axis of the work piece, as shown in the illustration below.
2.2 Cutting-off Tool : A cutting-off tool, which is often called a parting tool or grooving tool, is one of the important cutting tools for the lathe processing. Generally, the cutting-off tool touches to the material vertically, and is moved to the vertical direction only. As a fundamental rule, it must not be send the side direction, because its point is thin and weak. Also, in the case of using the cutting-off tool, the rotating speed and the sending speed must be lower, and the cutting depth must be small compared with the general processing using the side tool. Please note that it is needed much cutting oil in during the processing.Setting of the Cutting-off Tool

The side faces of a cutting-off tool is near parallel, thogh the edging point is somwhat thick. When the tool set with a small leaning as shown in Figure 2(b), the side face touchs to the material. If we notice a bad sharpeness or a bad sound, we must reset the leaning of the tool in careful. When the cutting-off tool is set higher than the center of a material as shown in Figure 2(c), the edge does not touch the material. The cutting-off tool should be set to little lower than the center, as the same of a side tool. Of course, a fundamental rule is that the height must be the same of the center of the material
3. Move the carriage
so that the tool bit is near the right end of the work piece.



4.Adjust the rotation speed.
Adjust the speed to an appropriate speed for the material and diameter you are working on. The lathe RPM (rotation par minute) is calculated as follow $n=v_c*1000/\pi*d_e$
n : rotation speed in rotation per minute, v_c : cutting speed (m/min), π : constant : 3,14159, d_e : blank or pipe or part diameter (mm)

This chart give basic average values of cutting speed and rotation speed for some materials:

Material name	Cutting speed, using high speed steel tools (meters/sec)	Rotation speed for 10mm dia part (rpm)	Rotation speed for 25mm dia part (rpm)	Cutting speed, using carbide tools (meters/sec)	Rotation speed for 10mm dia part (rpm)	Rotation speed for 25mm dia part (rpm)
Alloy steel/ carbon steel	20	650	250	60	1900	750
Stainless steel	30	950	400	90	2800	1100
bronze	30	950	400	90	2800	1100
Soft steel	35	1100	450	100	3300	1300
brass	85	2700	1100	250	8000	3200
aluminum	180	5700	2300	500	17000	6800

Adjust the liquid coolant flow on the place you will turn, Tool sharpness efficiency is seen from color of ships of the material and from the processing surface. The greatest indicator of cutting speed is the color of the chip. When using a high-speed steel cutter, the chips should **never** be turning brown or blue. Straw-colored chips indicate that you are on the maximum edge of the cutting speed for your cutting conditions. When using carbide, chip colors can range from amber to blue, but never black. A dark purple color will indicate that you are on the maximum edge of your cutting conditions. By using appropriate liquid coolant , the rotation speed can be increased.
In addition, it is also important to hear the sound. For example, when the sound is too high, the processing is not suitable. It is caused by the bad edge of the tool, too higher rotating speed of the lathe, or vibrating of a thin material. Using appropriate lathe speed, the blanks will be turned with little or no vibration, no noise, no overheat, allowing the tools to produce a clean surface.
5. Using the cross slide feed handle, slowly advance the tool bit into the work until it just touches the surface of the work piece.
6. Move the carriage to the right, so that the tool bit is past the end of the work piece.
7. Using the cross slide feed handle, advance the tool bit about 0.2 mm
8. Using the carriage hand wheel, move the carriage slowly to the left. As the tool bit meets the work piece, it starts cutting.

CAUTIONS

When we use a lathe, operator must take great care of the following dangers:
- Don't keep a chuck handle attached by the chuck. Next, it flies at the moment of turning a lathe.
- Don't touch the bit table into the rotating chuck. Not only the bit but the table or the lathe will be damaged.