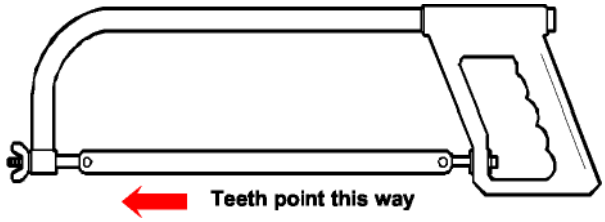
SHAPING METAL – WASTING

SAWING

Hacksaws are used for hand sawing metals. The frame is adjustable to take blades of different length.



Hacksaw Blades

The blades can be easily replaced when worn. Flexible, **High Carbon Steel** blades are used for general work on mild steel and non-ferrous metals. Rigid, **High Speed Steel (HSS)** blades are used for cutting hard steel.

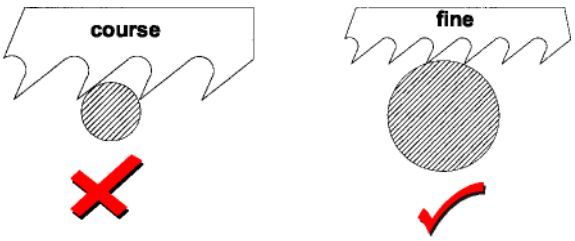
Blades can be purchased with different size teeth:

Coarse - 14 or 18 TPI (teeth per inch) - thick metal.

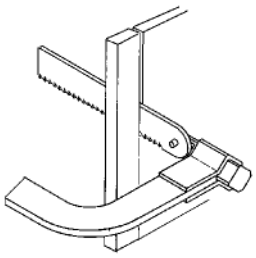
Medium - 24 TPI- general work.

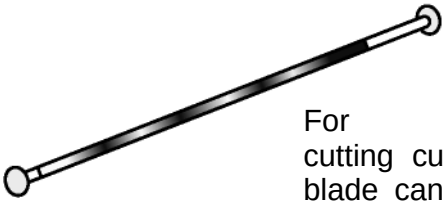
Fine - 32 TPI - thin metal.

If a coarse tooth blade is used on thin metal, the metal will catch between the teeth and the blade will jam.

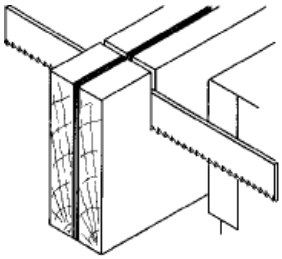


For long cuts, the blade can be attached at right angles to the frame, so that the frame does not get in the way.



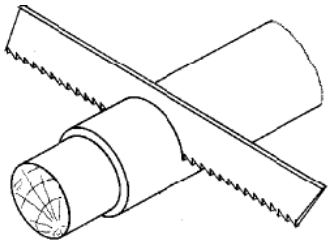


For cutting curves, the standard blade can be replaced by a **Tension file**, a round file held in the frame by special clips.

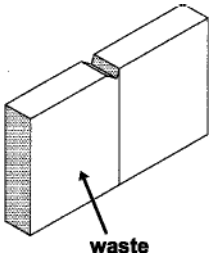


Thin metal can be cut easily by sandwiching it between two pieces of wood and then sawing through both the wood and the metal.

Thin wall tubing will collapse unless it is supported by placing a close fitting piece of dowel inside. Both the tube and the dowel are sawn.



To stop the saw blade from sliding over the metal when starting a cut, use a triangular file to file a groove on the waste side of the line. The saw teeth should fit into the groove.



1. Why is a hacksaw frame adjustable?
2. Specify the blade that you would use for cutting 50mm off a 200mm length of 3mm diameter mild steel.
3. Why should a 32TPI blade be used for cutting thin metal?
4. Show how you would set up the hacksaw to cut a long strip off a sheet of brass.
5. What would you use to cut a curved cut in a sheet of copper?
6. Illustrate how you would cut a thin sheet of aluminium without it bending.
7. How can you solve the problem of holding and sawing a length of thin walled brass tubing without it getting squashed?
8. How can you start to cut a piece of mild steel in exactly the right place?

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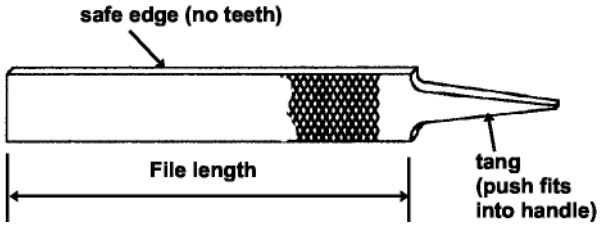
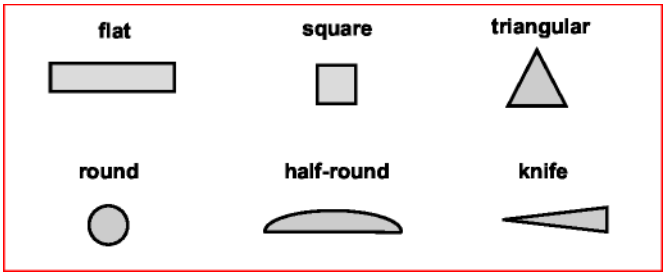
FILING METAL

Files are used for removing small amounts of metal and for smoothing a surface after it has been sawn. They are made from **High Carbon Steel** and come in many shapes, sizes and grades of cut.



The most common files are named after their cross-section.



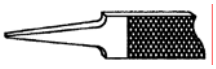
The roughness of a file is known by its **cut**.

Bastard Cut

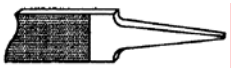
Used first to get rid of most of the waste quickly. Leaves a rough finish.

Second Cut

Used to file closer to the line and for general work. Leaves a reasonably smooth finish.



Smooth & Dead Smooth Cut



Used to file to the line and to provide a smooth finish.

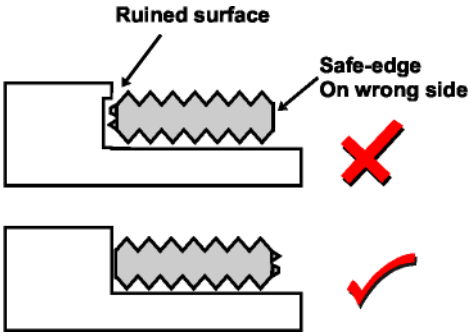
Needle files (Swiss files)

These are small, dead smooth cut versions of normal files, cast with solid handles. They are used for fine work.

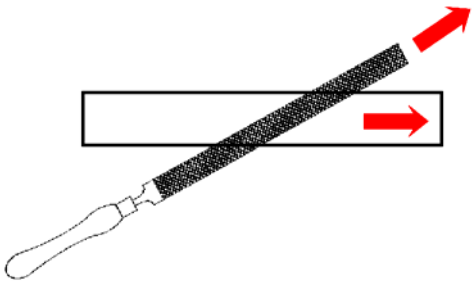
KEY WORDS **Tang: Half round: Safe-edge: Drawfiling**

Safe-edge Files

Some flat files have a safe-edge. The safe-edge is useful to use when filing into a corner. It stops the file from filing into the other surface.

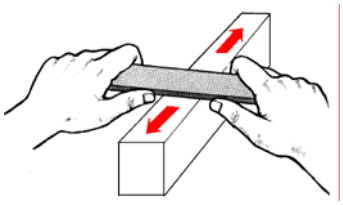


When filing a long edge, push the file forwards and slide it sideways at the same time.



Drawfiling

Drawfiling is using the file sideways to give a very smooth finish to an edge.



Safety Note: Never use a file without a handle, or with a loose handle, because the tang is likely to go into your hand when you push the file forwards.

1. What is the purpose of a file's tang?
2. Draw the cross-sections of **six** of the most common types of file.
3. What are the three cuts of file that you might use when filing a piece of mild steel to a marked line? What order would you use them in and why?
4. Illustrate the use of the safe-edge of a file.
5. How can a narrow file be made to smooth a large surface?
6. Name and illustrate the filing method that gives the smoothest finish.
A Create a safety poster, showing what can happen if a file is used without a handle or with a loose handle.

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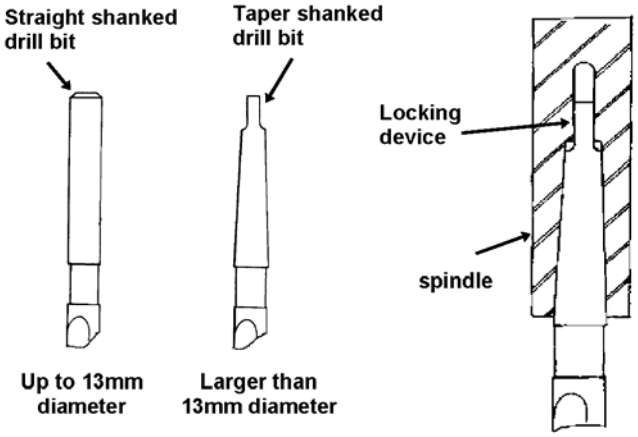
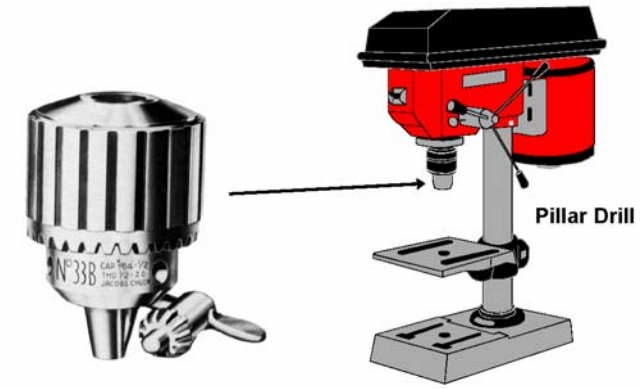
DRILLING METAL

Metals are drilled by **Jobber Drill Bits**, made from HSS.

The smaller diameter bits have a straight shank and are held in a **chuck**. The larger diameter bits have a tapered shank and are held directly in the pillar drill spindle. The thin part at the end locks into the spindle and cannot slip under pressure, like a straight shank could in a chuck.



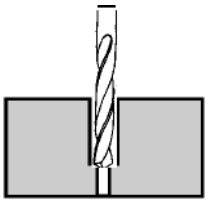
A 'Jacobs' Chuck



Note: For efficient cutting - Small diameter bits should turn at a fast speed. Large diameter bits should turn at a slow speed.

Pilot Holes

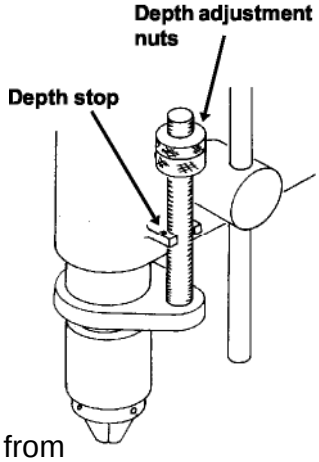
For holes in metal of 8mm diameter or larger, it is better to use a smaller drill bit first (4 or 5mm dia.). The smaller drill is less likely to wander off the centre punch mark. It also provides a hole that can guide (pilot) the larger drill.



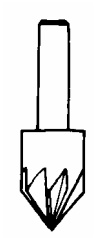
A pilot hole guiding a larger drill bit

Depth stop

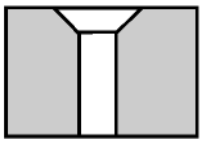
The depth stop on a pillar drill is useful for drilling holes to a given depth and for drilling a number of holes that have to be the same depth. The adjusting nuts hit the stop and cannot move down any further.



Countersink Bit



The bit is made from HSS. It is used to widen a previously drilled hole so that a countersunk screw head or rivet head can lie level with the surface.

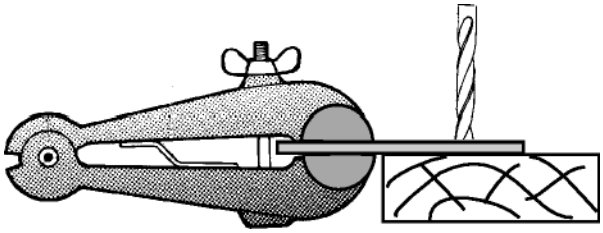


Cone Bit

Used for cutting and enlarging holes in thin sheet metal. This design does not catch in the metal and gives perfectly round holes.

Hand Vice

A hand vice should be used to safely hold thin metal (up to 3mm thick), while it is being drilled.



KEY WORDS Shank: Chuck: Pilot hole: Depth stop: Hand Vice: Cone bit:

1. What is the purpose of a chuck on a pillar drill?
2. What is the advantage of the taper shank design for larger diameter drill bits?
3. Explain what a pilot hole is used for.
4. You need to drill three holes that are 6mm diameter and 10mm deep. How can you be sure that they will be identical?
5. A jobber bit will cut a near triangular hole in thin sheet metal, instead of a round hole. How can you deal with this problem?
6. Illustrate a way of holding thin metal safely for drilling.

Worksheet 26c

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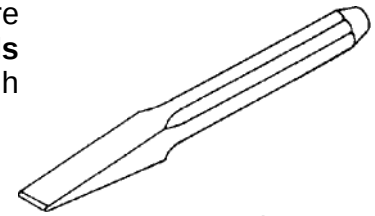
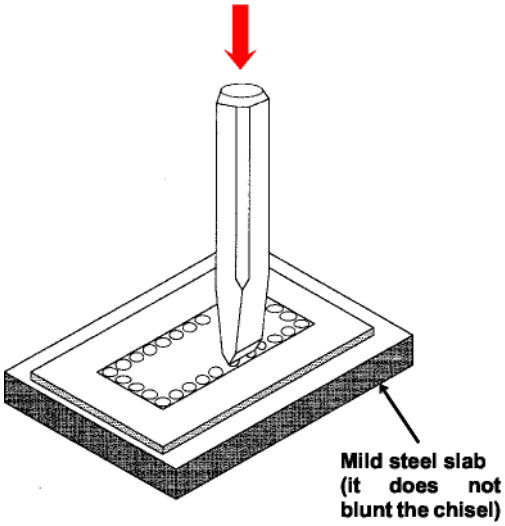
CHISELLING

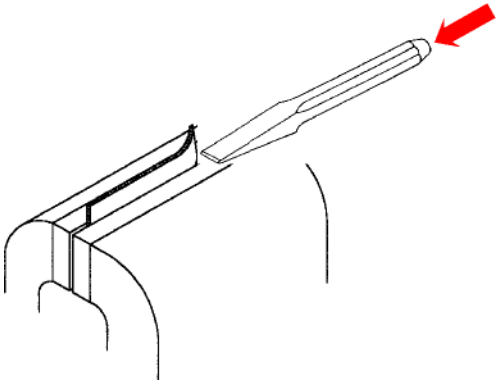
Chisels for metal are known as **Cold Chisels** and are made from High Carbon Steel.



The diagram below shows a cold chisel being used to chop out a rectangular shaped hole. The area for the hole has had small holes drilled all the way around the inside of the line (**chain drilling**). The chisel is hit with a hammer to cut between the holes until the inside is cut free. The edges are then filed with a safe-edge file.



A cold chisel can also be used to trim the edge of sheet metal. This leaves a new edge that needs minimal filing. The metal is placed in the vice so that the line to be cut to is level with the top of the vice jaws. The chisel is then rested on the top of the vice jaws and hit with a hammer.

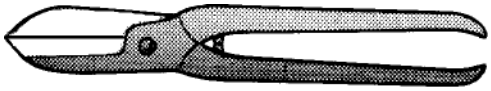


TINSNIPS

Tinsnips work like scissors and use a shearing action to cut thin sheet metal.

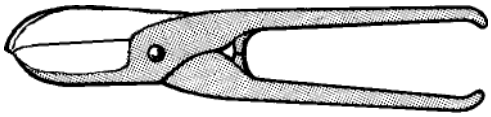
Straight Snips

Used for cutting along straight lines.



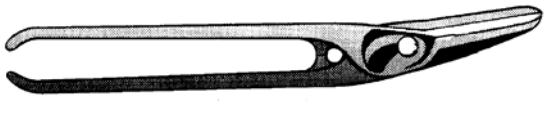
Curved Snips

The blades are curved to allow the snips to cut along curved lines.

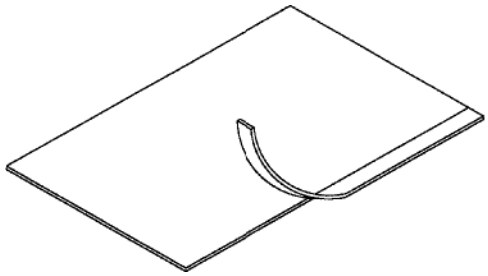


Universal Snips

The blades are designed to allow the snips to cut along both straight and curved lines.



When tinsnips are used the waste metal bends into a curved shape.



1. What are cold chisels made from?
2. Illustrate the term chain drilling.
3. How can a cold chisel help make a rectangular hole in a piece of sheet metal?
4. What is the advantage of using a cold chisel to trim the edge of a piece of sheet mild steel?
5. When would you choose to use a curved blade pair of tinsnips?
6. What is the disadvantage of using tinsnips to cut between two shapes that you want to keep?
7. What does the name ‘universal’ mean when applied to a pair of tinsnips?

A. Research what is meant by shearing action and illustrate your findings.

KEY WORDS **Cold chisel: Chain drilling: Tinsnips:**

Worksheet 26d

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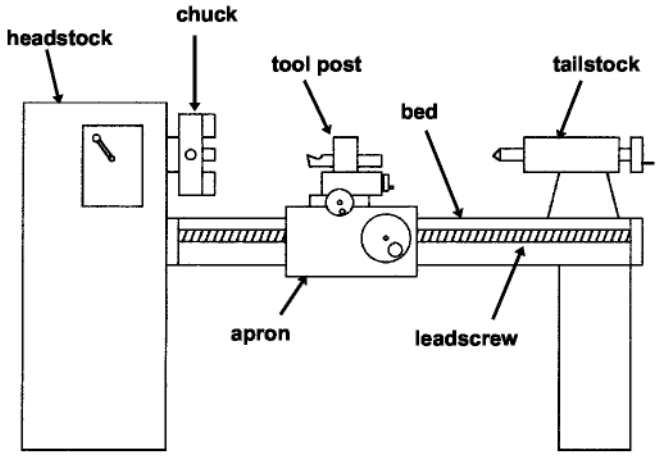
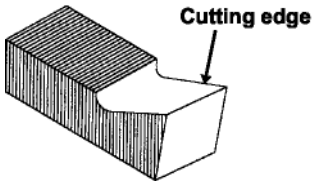
LATHEWORK

A metalwork lathe is a machine used for a number of **turning** processes.

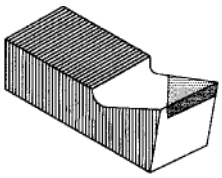


The cutting is done by a **single point cutting tool**. The tool is made from HSS or from tool steel with a hard wearing, tungsten carbide tip.

HSS tool



Tungsten tipped tool

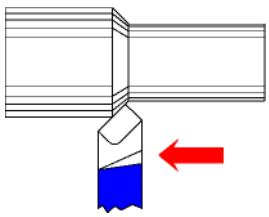


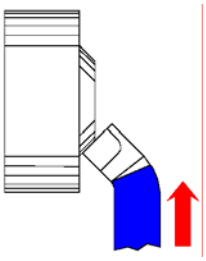
Processes

A lathe is a very accurate piece of machinery and all turning processes can be carried out to an accuracy of **one 100th of a millimetre**.

Turning down

This reduces the diameter of a rod.



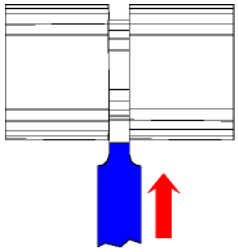


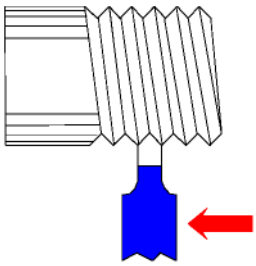
Facing off

This shortens the length of a rod and provides a smooth flat end at right angles to the side.

Parting off

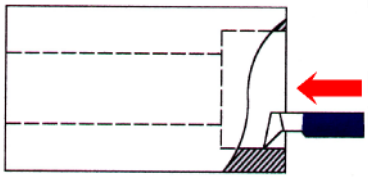
This is a way of cutting off a length of the rod. The diagram shows the parting process half finished.





Thread cutting

By using a correctly shaped tool, screw threads can be cut.



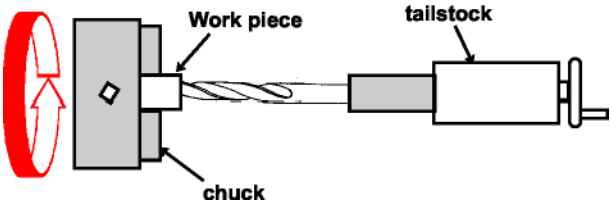
Boring

Boring is enlarging a hole by cutting away the inside wall.

Drilling

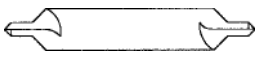
Holes drilled into the ends of rods are perfectly centred and run along the axis of the rod.

Note: The chuck revolves the work, while the drill bit is held still in the tailstock.



Centre drill

The centre drill is used for starting a hole. It provides a short pilot hole for the main drill bit.



KEY WORDS **Facing off: Parting off: Boring: Centre drill:**

1. Draw a labelled view of a metalworking lathe.
2. What materials are cutting tools made from?
3. How accurately can a lathe work?
4. Illustrate **four** turning processes.
5. Describe the process of boring.
6. What are the differences between drilling using a pillar drill and drilling using a lathe?
7. How do you start the process of drilling a hole, when working with a lathe?

Worksheet 26e

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