

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

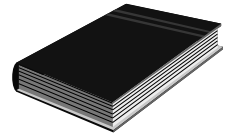
CODE: BBS

TEMPER AND GRIND A CHISEL

INDEX

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SOURCE REFERENCES

Demonstration by a competent person, e.g. a Training Officer.

OBJECTIVE

You will be learning towards the outcome “Temper and grind a chisel”. Whilst learning towards the outcome you will be required to achieve the following:

- Grind and temper a flat chisel.
- Correct usage and safely cut material.

On completion of this module, the learner must be able to:

- Grind and temper a flat chisel correctly.
- Use a flat chisel correctly and safely to cut material.

During this process you must adhere to certain specified requirements as listed in the Module.

ASSESSMENT AND EVALUATION CRITERIA

You will be assessed, when you are confident that you may achieve the outcomes as listed, to determine your competence as measured against the required criteria. This assessment will be in line with accepted best practices regarding assessment.

- A practical assessment will be set at the end of the module and must be completed without using reference.
- The learner will be required to first grind and then temper a flat chisel. The learner will then use it to cut through a 10mm mild steel bar. The following standards must be achieved:
 - The ground cutting edge must be $60^{\circ} \pm 3^{\circ}$.
 - The apex must be within $\pm 1\text{mm}$ of the centre.
 - The cutting edge must be square within $\pm 3^{\circ}$ to the body of the flat chisel.
 - The cutting edge of the tempered chisel must not show any signs of chipping, indentations or burring after cutting a 10mm round bar with it.
 - There must not be any mushrooming on the striking end of the chisel.
 - The tools and equipment must be undamaged.
- All the safety precautions must be adhered to.



DICTIONARY

- Annealing** : The process of heating steel and then permitting it to cool slowly, thereby causing it to become soft and of uniform structure throughout.
- Hardening** : The process of heating steel to a medium cherry red and then cooling it rapidly, usually by plunging it into water or oil, and sometimes by a blast of air.
- Tempering** : The process of reducing the hardness of steel and increasing its toughness to any desired degree.

HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM**BBS****TEMPER AND GRIND A CHISEL**

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Use pedestal grinder.	<ul style="list-style-type: none"> • Eye injuries due to flying particles when grinding. 	<ul style="list-style-type: none"> • Wear appropriate, enclosed safety goggles.
	<ul style="list-style-type: none"> • Injuries when loose clothing gets caught in rotating wheel. 	<ul style="list-style-type: none"> • No loose clothing. Wear cap or hair net in case of long hair.
	<ul style="list-style-type: none"> • Disintegration of cracked or damaged wheel can cause serious injury. 	<ul style="list-style-type: none"> • Always inspect wheel before commencing work. • Stand aside and allow wheel to run at full speed for a short while.
2. Use hand tools.	<ul style="list-style-type: none"> • Using damaged tools or wrong tools for the job can cause injury and damage to equipment. 	<ul style="list-style-type: none"> • Always use the correct tool for the job. • Ensure tools are in good condition. • Use tools correctly. • Wear appropriate PPE where necessary. • Always take good care of tools. Maintain, clean and store it properly.
3. Inspect and maintain oxy-acetylene equipment before use.	<ul style="list-style-type: none"> • Burn injuries from ignition of gas leaking from regulators, damaged hoses and torch attachments. 	<ul style="list-style-type: none"> • Ensure regulators and attachments are properly secured and leak proof. • Check hoses for damage and replace if necessary (do not repair). • Ensure flash back arresters are installed.
4. Use oxy-acetylene equipment.	<ul style="list-style-type: none"> • Possible serious injury and death if flash back causes gas bottles to explode. • Danger of eye injuries and burns. 	<ul style="list-style-type: none"> • Use appropriate PPE, e.g. correct type protective tinted goggles, leather aprons, leggings, gloves, safety shoes, etc. • Do not wear nylon or other easily inflammable clothing.

NOTE: Before doing the practical work contained in this module, the learner must study the content of the above HIAC form again and then sign the statement below.

The above risks, which will be encountered in this module, are fully understood and will be controlled during the practical work.

Signature of learner:

Signature of Training Officer:

Date:

1. PREPARE A CHISEL FOR TEMPERING

ITEM / TASK: Introduction.

DESCRIPTION:

- A. Although it will not happen very often, there might come a time when you will have to temper a flat chisel or centre punch.
- B. Before tempering a flat chisel, it should first be ground into shape.

ITEM / TASK: Grind the chisel.

DESCRIPTION:

- A. Before tempering an old used flat chisel, it must first be re-ground to look like the flat chisel shown in Fig 1.

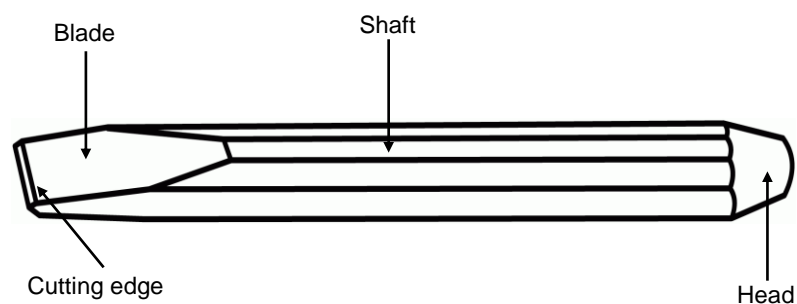
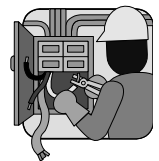


FIG 1.

- B. Any mushroom burrs on the striking end, as shown in Fig 2, must be ground away. They could break off during hammering and cause injuries.



FIG 2.

C. The blade must be thinned down and the cutting edge re-ground as shown in Fig 3 below.

NB:

The cutting edge angle of a flat chisel varies for the different types of materials to be cut. Table 1 below gives the cutting edge angles to cut different materials.

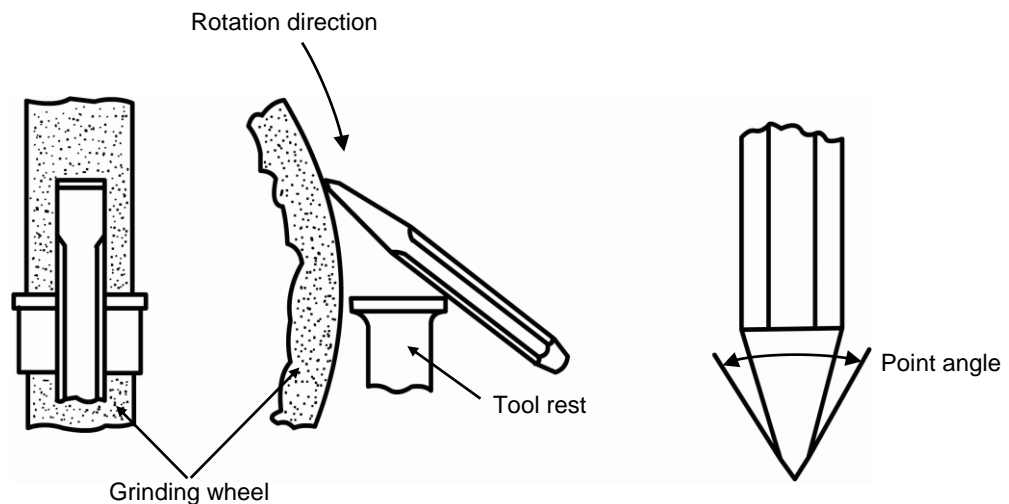
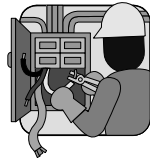


FIG 3.

TABLE 1.

CUTTING EDGE ANGLES TO CUT DIFFERENT MATERIALS	
MATERIAL TO BE CUT	POINT ANGLE
Cast Iron	60°
Mild Steel	55°
High Carbon Steel	65°
Brass	50°
Copper	45°
Aluminium	30°

**DO THE PRACTICE ON THE NEXT PAGE BEFORE
CONTINUING WITH THE REST OF THE MODULE.**



PRACTICE

Collect an old flat chisel from your Training Officer and prepare it for tempering.

The chisel edge must be ground to the point angle specified.

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

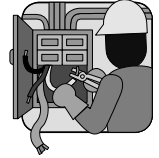
2. TEMPER A CHISEL

ITEM / TASK: Definition of technical terms.

DESCRIPTION:

The definitions below are applicable to the work of the blacksmith, and all relate to altering the characteristics of steel through various heating and cooling processes.

- **Annealing** is the process of heating steel and then permitting it **to cool slowly**, thereby causing it to become soft and of uniform structure throughout.
 - Sometimes steel will not become soft enough if left to cool in open air. In such cases it is essential to conceal the heated steel in lime until it is cold. If lime is not available, ash or cement powder may be used.
- **Hardening** is the process of heating steel to a medium cherry red colour and then **cooling it rapidly**.
 - Ordinary tool steel is usually cooled by plunging it into water, while high-speed tool steel is cooled in a blast of air, or in oil.
 - The degree of hardness depends on the amount of carbon in the steel, the temperature to which it is heated, and the speed it is chilled.
 - For hardening high-carbon tool steel, it should be heated to temperatures of 760°C to 815°C. If the latter temperature is greatly exceeded the steel will be burnt.
- **Tempering** is the process of reducing the hardness of steel and increasing its toughness to any desired degree.
 - If a hardened piece of steel is slowly heated, it will gradually become softer as the temperature rises. When the desired hardness is reached, any further rise in temperature and consequent softening of the steel can be stopped by dipping it into water or oil.



ITEM / TASK: Drawing the temper.

DESCRIPTION:

- A. When tempering steel tools, the various degrees of hardness are indicated by a series of prismatic colours that appear on the surface of the steel under certain conditions.
- B. To draw the temper on a piece of steel, e.g. a chisel, proceed as follows:
- First clean one of the surfaces with emery cloth until bright.
 - Allow one end of the piece of steel to rest on a red-hot piece of iron and observe the effect of the heat on the steel. It will soon be noticed that colours begin to appear on the surface of the steel.
 - A very pale yellow colour starts at the hot part and creeps toward the other end. Followed by darker shades of yellow, brown, purple and blue. By the time the yellow reached the cooler end of the steel, the hot end will have a deep slate (dark grey) colour.

NB:

This process is referred to as drawing the temper.

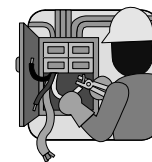
- C. The colours produced in tempering steel tools are caused by oxidation on the surface of the steel. The amount and character of oxidation, and therefore the colour, vary with the temperature and indicates the degree to which the steel has been heated.
- D. Table 2 on the next page shows the **temper colours** in their regular order beginning with the colour indicating the greatest hardness of steel.
- E. If the tip of the steel shows a certain colour, i.e. purple (refer to Table 2), and then dipped into cold water to cool rapidly, the tip will have a hardness and toughness that makes it suitable for certain specific applications.

Note:

A practical example of tempering is contained in the next section, which deals with the tempering of a flat chisel.

TABLE 2.

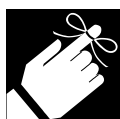
TEMPER COLOURS AND CORRESPONDING TEMPERATURES OF STEEL		
COLOUR	TEMP IN °C	KIND OF TOOL
Very pale yellow	220°	Scrapers, light turning tools
Pale yellow	230° to 240°	Razors, surgical instruments hammer faces, ivory & bone - cutting tools
Full yellow or straw	245°	Drills for iron, boring, cutting
Brown	255°	Shears, flat drills, punches & dies, rock drills
Dark brown	265°	Axes, planes, eye knives, stone - cutting tools, plane irons
Purple	280°	Twist drills, table knives, large shears, wood borers, coopers tools
Dark blue	290°	Cold chisels
Full blue	295° to 305°	Springs, wood chisels, wood saws, screw drivers, stone-cutting chisels, fine saws, needles
Light blue	315°	Too soft for tools
Grey	371° to 398°	Too soft for tools



ITEM / TASK: Temper a flat chisel.

DESCRIPTION:

- A. Chisels are usually made from either alloy steel or straight carbon steel. Straight carbon steel should be hardened and tempered in water and alloy steel should be hardened and tempered in oil.
- B. Method of tempering a flat chisel:
- Prepare an oxy-acetylene torch and clean the surface of the anvil.



REMEMBER to observe the safety procedures relating to the use of oxy-acetylene equipment. Refer to the HIAC Form.

- Heat the chisel to a medium red colour. The heated portion must extend rather far back along the stock of the chisel.
- Plunge the tip into water/oil for a distance of about 40mm back from the cutting edge.
- Remove the chisel from the water/oil as soon as the tip has lost its colour.
- Polish the tip rapidly by rubbing it with emery cloth. The heat remaining in the stock will gradually "run" to the point and draw the temper.
- Observe the desired colour on the bright part. Use Table 2 for colours.
- When the desired colour appears at the point of the chisel, dip the chisel into the water or oil to fix the temper.

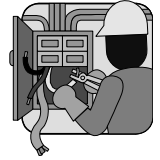
NB:

Cold chisels are usually tempered to a dark blue colour.

- Touch up the cutting edge of the chisel on a pedestal grinder if necessary.
- Keep the blade cool, by frequently immersing it in cold water. If the point of the chisel overheats, it could lead to a loss in the degree of hardness.



3. USE A HAMMER AND CHISEL



ITEM / TASK: Correct method of using a hammer and chisel.

DESCRIPTION:

- Hold the chisel firmly enough to guide it, but also loosely enough to prevent the shocks from the hammer blows from being absorbed by your hand.
- Look at the point of the chisel, keep the elbow of your striking arm close to the body and chip away from your body. (Fig 4)

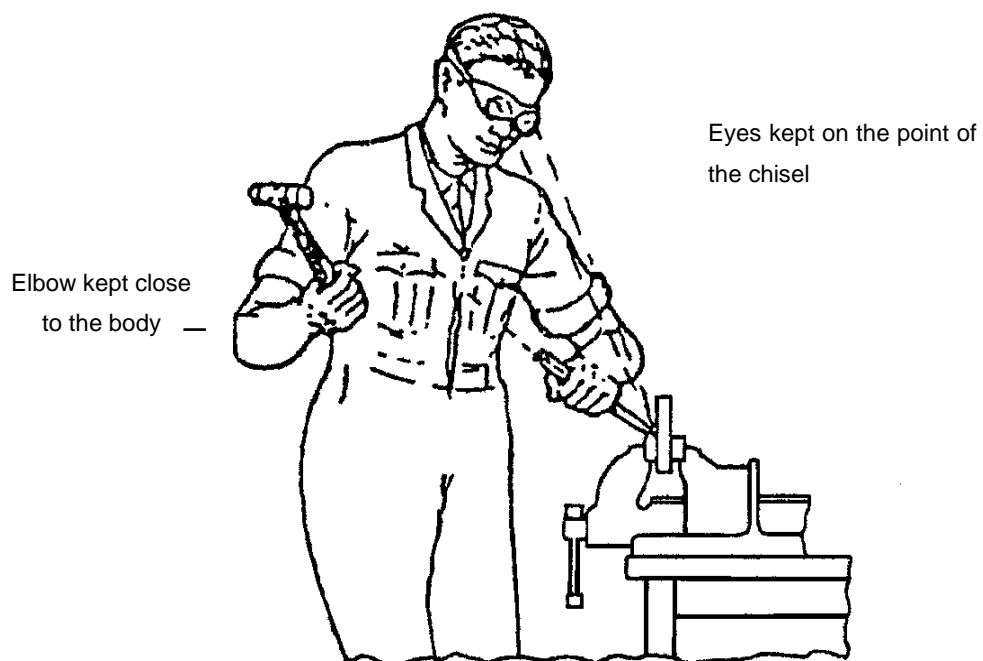
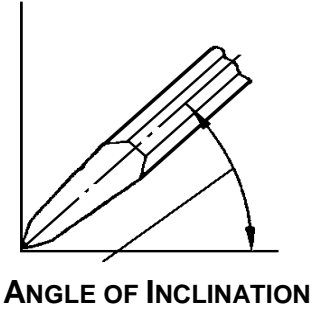


FIG 4.

- Table 3 on the next page shows the ideal angle of inclination of the chisel in relation to the type of material being cut.
- Fig 5 on the next page shows some of the more commonly used chisels and their application.

TABLE 3.

THE ANGLE OF INCLINATION ON THE CHISEL IN RELATION TO THE MATERIAL BEING CUT		
MATERIAL TO BE CUT	ANGLE OF INCLINATION	
Cast Iron	37°	
Mild Steel	34½°	
High Carbon Steel	39½°	
Brass	32°	
Copper	29½°	
Aluminium	22°	

Chisels

Applications

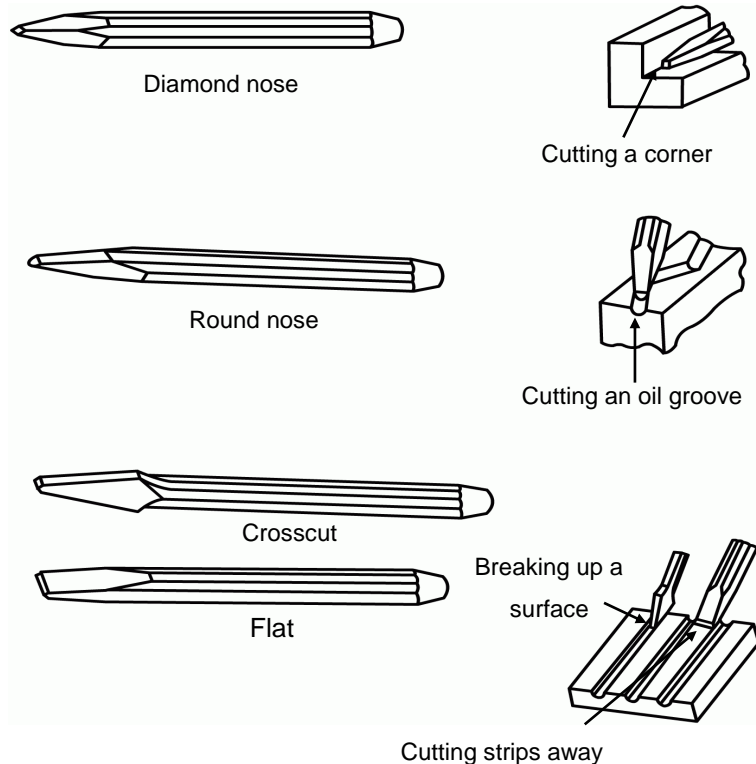
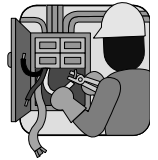


FIG 5.



PRACTICE

Practice tempering and grinding flat chisels. Use them to cut through a 10mm round mild steel bar without the cutting edge becoming chipped, burred or indented.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



REMEMBER ALWAYS WORK SAFE

Once you have passed the entire practices, you are now at liberty to request a **Formative Assessment** from your Assessor.