

# Safety in Design and Technology

## Introduction

Safety **legislation** is safety **law**.

Safety **regulations** are **rules** that tell people how to do things and how to behave.

Health and Safety legislation, applies to schools as well as to industry. The law requires schools to ensure a safe working environment for everyone on the school premises. That includes visitors and trades people as well as staff and students. Teachers who are responsible for students in workshops, laboratories and other practical areas have a particular responsibility for ensuring the safety of everyone using their area.

## Designer's Safety Responsibility

Safety is fundamental to the design of products, systems and environments. A designer's decisions will greatly affect the risks faced by the manufacturers and users of products, systems and environments. A competent designer will know what the potential hazards will be during construction, use, maintenance, cleaning and dismantling of a product and how to eliminate the hazards. Designers need to consider the conditions where the product will be used and the people who will use it. The designer's duties are to eliminate hazards where feasible and where hazards cannot be eliminated, to reduce the risks as far as is reasonably practicable and to provide information about any remaining risks to health and safety.



## Students' Safety Responsibility

When students incorporate safety into their design and technology work, they should be:

- planning for safety at the design stage
- recognising the risks to the maker, people near the maker and the end users of the product
- identifying control measures such as defined procedures or alternative ways of doing things that will reduce or eliminate the risk
- minimising risks to the maker and other people prior to the commencement of the design and technological activity
- ensuring safe working practices during the making process
- ensuring a safe working environment for design and technology activities
- ensuring safe storage and transport of all materials and substances
- ensuring that what they have made is safe to use. (See product safety below)



## 2. Students' safety responsibility - staying safe

Students must obey safety rules and respond appropriately to safety signs and floor markings.

Students have a responsibility to use tools and equipment safely and effectively and to ensure that their actions do not endanger themselves or others. Students should identify hazardous situations, report it to the D&T teacher and/or technician and where appropriate, take action to eliminate hazards if possible and minimize any remaining risks to health and safety.

### Personal Protective Equipment (PPE)

Personal protective equipment is required to protect people working in dirty or hazardous environments. The type of personal protective equipment required depends on the work being carried out.

Personal protective equipment for students includes:

- apron, lab coat or overalls (see example opposite)
- safety glasses, goggles and visor
- sturdy shoes
- disposable plastic gloves, leather gloves, leather gauntlets
- leather apron, leather spats, leather arm gaiters
- face mask and respirators
- welding shield.



The photograph above shows a worker on an oil rig wearing overalls and gloves. The worker also wears safety shoes but they are not shown in this photograph.

### Safety glasses, goggles and visor



Safety Goggles



Safety Glasses



Oxy-Acetylene Welding Goggles



Safety Visor

## Sturdy Shoes

Sturdy shoes are essential in a workshop environment. In industry, leather boots with steel toe-caps are often used to protect the wearer's toes from being crushed by heavy falling objects. In circumstances where molten metal is being poured, leather shoes with leather flaps called galoshes that cover the laced opening are essential personal protective equipment.



Sturdy leather shoes



Leather shoes with steel toe caps



Leather shoes with leather flaps / spats protect the wearer's feet from welding splatter and molten metal spillages.

## Gloves: leather gloves, disposable plastic gloves



Disposable plastic gloves



Leather gauntlets



Leather gloves

## Leather apron, leather sleeves, leather spats

Leather apron



Leather apron image courtesy of <http://www.khbtrading.com>



Leather sleeves fit over arms



Leather spats/gaiters fit over the lower legs and safety shoes

## Dust mask and respirators



Dust mask



Dust mask



Respirators with filters



## Electric arc welding shield



An electric arc welding shield and gauntlets are the minimum PPE necessary for arc welding.

Examples of situations where personal protective equipment is required includes:

Typical Activities	Personal Protective Equipment
Working at a bench using hand tools to measure, mark out, cut and shape metals wood and plastics, no dust or flying debris.	Apron, lab coat or overalls, safety shoes.
Working at a bench using hand tools to cut and shape metals wood and plastics, with dust and flying debris.	Apron, lab coat or overalls, face mask, safety glasses, and safety shoes.
Using machines, pedestal drill, lathe, milling machine, etc.	Apron, lab coat or overalls, safety glasses or visor, safety shoes.
Abrading metal, wood and plastic.	Apron, lab coat or overalls, safety glasses or visor, face mask, safety shoes.
Soldering and brazing	Apron, lab coat or overalls, safety glasses or visor, leather gauntlets, safety shoes.
Gas welding	Leather apron, apron, lab coat or overalls, gas welding glasses/goggles, leather gauntlets, safety shoes.
Electric arc welding	Leather apron, lab coat or overalls, electric arc welding shield, leather gauntlets, safety shoes.
Heat treatment of metals	Leather apron, apron, lab coat or overalls, safety glasses or visor, leather gauntlets, safety shoes.
Foundry work / metal casting	Leather apron, leather spats over safety shoes or shoes made especially for metal casting, face mask, visor, (with wire mesh if available), leather gauntlets.
Plastic forming using a strip heater, vacuum former	Apron, lab coat or overalls, safety shoes, leather gloves, safety glasses, goggles or visor.
Plastic polishing	Apron, lab coat or overalls, safety shoes, safety glasses, goggles or visor, face mask.
Resin casting / hand lay-up of GRP	Apron, lab coat or overalls, safety shoes, disposable plastic gloves, glasses, face mask.
Using acrylic cements	Apron, lab coat or overalls, safety glasses, goggles or visor, safety shoes.
Etching and pickling	Apron, lab coat or overalls, safety glasses, goggles or visor, face mask, disposable plastic gloves, safety shoes

### Examples of Personal Protective Equipment (PPE) used in D&T

 <p>Apron</p> <p>Sleeves rolled up</p> <p>Strong school shoes</p>	 <p>Visor</p> <p>Apron</p> <p>Leather gauntlets</p> <p>Strong school shoes</p>	 <p>Safety glasses or goggles</p> <p>Face mask</p> <p>Leather apron</p> <p>Leather gauntlets</p> <p>Strong school shoes with leather spats over them</p>
Using hand tools only	Soldering and brazing	Casting aluminium

# Risk Assessment

Anything that can cause an accident is a hazard. A risk is the likelihood of a misfortune occurring caused by a hazard.

Carrying out practical work in design and technology is hazardous and we should protect ourselves and other people by taking actions to remove or minimise the risks to our health and safety. To make a risk assessment we should:

- decide the nature of the hazard
- estimate the likelihood of an accident happening
- estimate how serious such an accident would be
- judge the acceptability of using the process, technique or substance
- accept the risk or alter the procedure
- state what action should be taken to minimise or eliminate the risk
- record the assessment.

A risk assessment may be a written assessment of hazardous activities and situations, or it may be set out in a table, as shown below. The assessment of the risk to people's health and safety may be shown as a high, medium or low risk, or the level of risk may be given a number, e.g. 1 to 5 with 1 being a low risk and 5 being a high risk.

Risk Assessment			
Hazardous Activity / Situation	Risk	Assessment	Action / Control Measure
Drilling a Ø4 mm hole in 6mm thick steel.	Getting clothes caught in revolving drill chuck.	high risk	Tuck tie in shirt, roll up sleeves, wear protective apron/lab. coat.
	Getting long hair caught in revolving drill chuck.	high risk	Tie back long hair.
	Drill bit getting stuck in work and the work spinning.	high risk	Clamp material being drilled to the drill table.
Leaving a chuck key in a chuck.	Chuck key flying out of chuck when the machine is switched on.	high risk	Never leave a chuck key in a chuck. If available, use a spring loaded chuck key that will not stay in a chuck unless held there.
Chuck key is fixed to a drilling machine by a length of chain.	Leaving chuck key in a chuck. The machine being started when a student is still tightening the chuck, the chain wraps around the student's fingers and ....	high risk	Never fix a chuck key to a machine by a chain or any other means.

Risk assessments should be recorded at the design and planning stage of any design and technology work. Safety Officers responsible for carrying out risk assessments in schools and industry should also:

- ensure that everyone knows what the risk assessment says
- ensure that recommended actions to reduce or eliminate the risks are carried out
- ensure that everyone knows what to do if an accident occurs.

For further information:

- Look at the Health and Safety Executives "Five Steps To Risk Assessment" at <http://www.hse.gov.uk/pubns/indg163.pdf>
- Fun look at health and safety at [http://www.risk-ed.org/pages/hazard\\_frameset.htm](http://www.risk-ed.org/pages/hazard_frameset.htm)
- Use CLEAPSS, Model Risk Assessments for Design and Technology in Secondary Schools and Colleges to check the risks involved with using various D&T tools, processes and materials.

# Safety Rules and Defined Procedures

Safety rules are defined procedures, i.e. safety rules tell students how they must behave and how they must do things.

Defined procedures are intended to prevent accidents, e.g. before using a drilling machine, you must:

- check that the drill is tight in the chuck
- check that the chuck key is not left in the chuck
- check the speed setting of the drilling machine
- check that guards are in place
- roll up your sleeves
- remove rings and anything else that could get caught in the revolving chuck
- tuck your tie into your shirt
- wear goggles or a visor
- make sure that the material to be drilled is held firmly and safely, preferably clamped to the drill table
- never wear gloves or hold the material being drilled with a rag as it may get caught in the revolving chuck and very, very seriously damage your fingers.

Defined procedures reduce or eliminate risks if people know the defined procedures for hazardous situations and proceed as defined. In other words, safety rules work when people know the safety rules and obey them. School workshop safety rules are designed to ensure the Health and Safety of people in the school workshop environment. Examples of defined procedures in response to risk assessments may be seen in the workshop safety rules and CLEAPSS, Model Risk Assessments for Design and Technology in Secondary Schools and Colleges.

# Hazard Warnings and Instructions

Hazard warnings and instructions can be given using words, pictures, lights, floor markings and other signals. Some typical workshop safety signs are shown below.



## Safe Materials

Materials should be safe for students to use for their design and technology activities; however, some materials such as etching solutions are hazardous. Those that are hazardous but have an acceptable level of risk, should be used in a safe manner in accordance with defined procedures.

A material such as aluminium may become hazardous as it is processed, e.g. when it is melted and the molten metal is poured or when thin sheet aluminium is cut with tinsnips. Materials may also become hazardous when the finished product is used e.g. by poisoning or by suffocation.

Students should refer to CLEAPSS Model Risk Assessments for Design and Technology in Secondary Schools and Colleges for more information.

## Safe Storage Of Materials

Materials should be stored so that:

- no obstruction is created
- there is no danger of them tipping over
- they are easily accessible
- there is no danger of fire or explosion
- they are clearly labelled, preferably in the manufacturers original container and information is available about how they can be safely handled
- if a fluid must be decanted into another container, the container should be suitable for the material and should be secure and clearly labelled.

## Safe Storage of Tools

Tools should be stored so that:

- no obstruction is created
- they are easily accessible
- there is no danger of tools falling or tipping over
- they are not damaged or blunted
- movement around the workshop is minimised
- they can be easily checked to ensure that they are all returned to the correct storage location after use
- people do not have access to tools that they are not competent to use and have authority to use.

## Tool Safety

A tool is safe to use when:

- its design has no inherent faults
- it is well maintained
- it is controlled in a competent manner
- it is used for its intended purpose.

Design and technology hand tools and machine tools are designed to cut, to abrade, to polish, to heat etc, so have parts that pose a risk to students' health and safety. The moving parts of machine tools are wherever practicable shielded by guards, some of which incorporate micro switches that switch the machine off when the guard is opened or removed. However some moving parts of machinery are exposed out of necessity, so



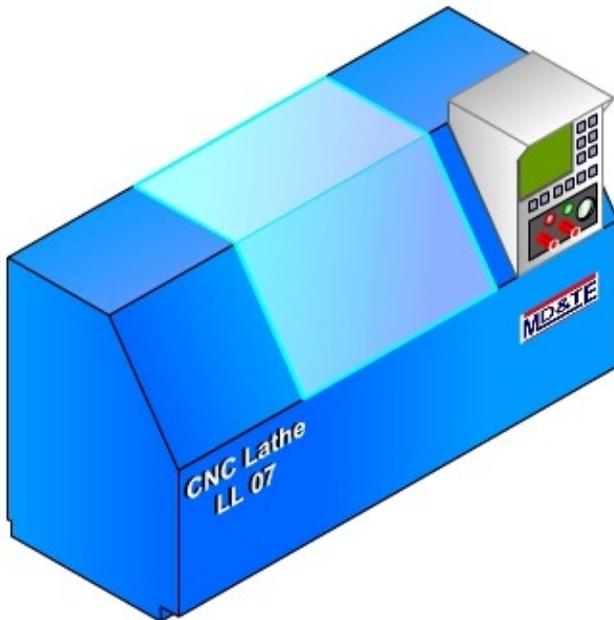
the operator must be competent to use the machine, must be strong enough to control the machine and must wear the recommended personal protective equipment (PPE) such as goggles.

Electric cables on power tools are particularly prone to damage and should be checked before the tool is used.

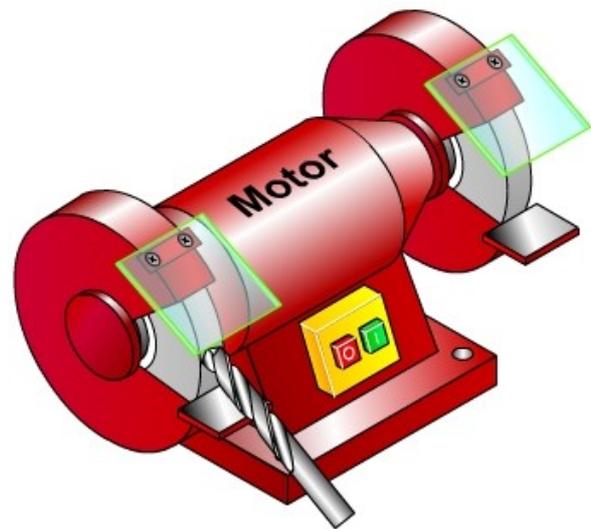
## Safety Features on Tools

Safety features on tools help prevent people from being cut by the tool, being caught in the moving parts of machine tools, from being injured by debris flying from machined material and from being injured by electric shock. Safety features include guards, dust and fume extraction devices and residual current devices (RCD) circuit breakers and key locked isolator switches.

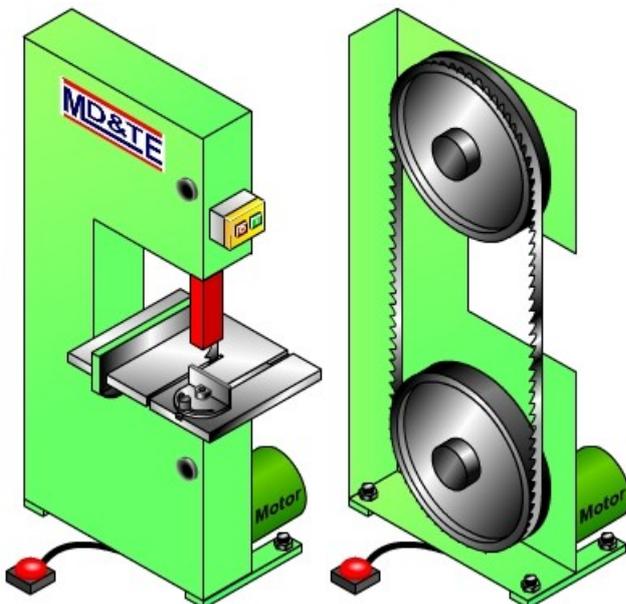
**CNC Lathe**



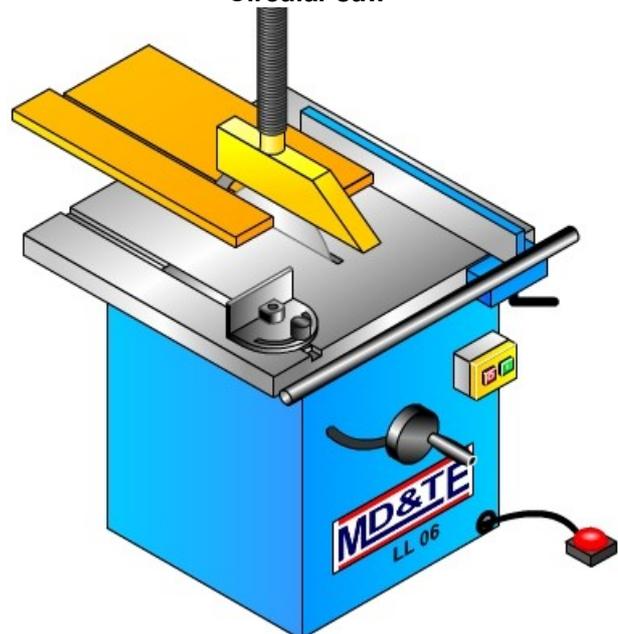
**Bench grinder**



**Band saw**



**Circular saw**



Computer numerically controlled (CNC) machines are controlled by computer control software. Humans do not have to intervene while the machine is running so all the moving parts may be completely enclosed behind safety screens and guards.

Machines operated directly by Humans have guards and safety screens that protect the operator from the moving parts and from flying debris.

## Safe Working Practices

Safe working practices include:

- obeying safety rules and instructions
- storing coats and bags in a designated area at the edge of the workshop and not creating clutter and tripping hazards
- carrying tools and materials so that they do not pose a hazard to anyone, e.g. pointing hot metal and sharp tools downward
- organising work areas so that there is a minimum amount of movement around the room
- arranging benches, machines and cupboards so that there is plenty of room around them
- using hand tools and machines correctly
- being considerate to others, e.g. not shouting, rushing around, pushing etc.
- leaving equipment and work areas clean and tidy at the end of a lesson.



Tools should always be used in accordance with manufacturers' instructions. The manufacturers' instructions should identify the tool's limitations and how it should be used safely.

## Safe Working Area

A safe working area can be created by:

- students and other users of the area behaving in a responsible manner
- allowing sufficient space for work to be carried out unhindered
- allowing movement to be carried out unhindered
- keeping coats and bags in a designated area at the edge of the workshop
- making sure that there is minimum movement to fetch and carry tools and materials,
- removing or tidying away clutter
- reducing noise to a minimum
- ensuring good ventilation
- ensuring good lighting conditions
- ensuring that hazardous materials are stored properly and securely and used with the aid of appropriate safety equipment
- ensuring that fixed machine tools are properly bolted down in designated positions
- ensuring that moving parts on machinery are fitted with appropriate guards and that these guards are properly adjusted for the purpose for which the machine is being used
- ensuring that personal protective equipment is available and stored in appropriate locations
- ensuring that fume cupboards, welding arc screens and other appropriate safety devices match the requirements of the processes being carried out and are available.

## Product Safety

The health and safety requirements of the end users should be considered when designing and making products. Products designed and made in design and technology lessons should be safe for people to use. Any product manufactured in the United Kingdom that will be sold in the UK or abroad, comes under "The General Product Safety Regulations 2005".

A PDF copy of the regulations may be downloaded from  
[http://www.legislation.gov.uk/ukxi/2005/1803/pdfs/ukxi\\_20051803\\_en.pdf](http://www.legislation.gov.uk/ukxi/2005/1803/pdfs/ukxi_20051803_en.pdf)

Part 2 of the General Product Safety Regulations 2005, states:

### General safety requirement

- 5.—(1) No producer shall place a product on the market unless the product is a safe product.  
(2) No producer shall offer or agree to place a product on the market or expose or possess a product for placing on the market unless the product is a safe product.  
(3) No producer shall offer or agree to supply a product or expose or possess a product for supply unless the product is a safe product.  
(4) No producer shall supply a product unless the product is a safe product.

### Other obligations of producers

- 7.—(1) Within the limits of his activities, a producer shall provide consumers with the relevant information to enable them—  
(a) to assess the risks inherent in a product throughout the normal or reasonably foreseeable period of its use, where such risks are not immediately obvious without adequate warnings, and  
(b) to take precautions against those risks.  
(2) The presence of warnings does not exempt any person from compliance with the other requirements of these Regulations.  
(3) Within the limits of his activities, a producer shall adopt measures commensurate with the characteristics of the products which he supplies to enable him to—  
(a) be informed of the risks which the products might pose, and  
(b) take appropriate action including, where necessary to avoid such risks, withdrawal, adequately and effectively warning consumers as to the risks or, as a last resort, recall.  
(4) The measures referred to in paragraph (3) include—  
(a) except where it is not reasonable to do so, an indication by means of the product or its packaging of—  
(i) the name and address of the producer, and  
(ii) the product reference or where applicable the batch of products to which it belongs;  
and  
(b) where and to the extent that it is reasonable to do so—  
(i) sample testing of marketed products,  
(ii) investigating and if necessary keeping a register of complaints concerning the safety of the product, and  
(iii) keeping distributors informed of the results of such monitoring where a product presents a risk or may present a risk.

## Product safety summary

Product designers and manufacturers must not sell unsafe products. Product designers and manufacturers must provide information about any risks to health and safety posed by their product, take action to minimise the risks and if necessary, withdraw the product from the market. Products should be safe to touch, safe to taste, safe to view, safe to listen to and should be electrically, mechanically and ergonomically safe. Products should be issued with guidance about how to use the product safely and information about the limitations of the product.

Other obligations include supplying the name and address of the manufacturer and where appropriate, a product reference or information about the batch of products to which the product belongs.

Samsung and other manufacturers provide PDF copies of their product handbooks and instruction manuals. These handbooks contain safety information about the product and user instructions. Samsung product handbooks and instruction manuals may be downloaded from their web site at  
<http://www.samsung.com/uk/support/download/supportDownloadMain.do> .