



NEBOSH International General Certificate

UNIT IGC2

CONTROL OF INTERNATIONAL WORKPLACE HAZARDS

ELEMENT 4: WORK EQUIPMENT HAZARDS AND CONTROL

SAMPLE MATERIAL

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General Principles for Selection, Use and Maintenance of Work Equipment

Key Information

- Work equipment should be suitable for the task it is being used for and the environment it is used in.
- It is often necessary to restrict the use of work equipment to competent operators only.
- Information, instruction and training should be provided for equipment users, managers and maintenance staff.
- Work equipment should be maintained in safe working order and maintenance activities carried out safely. Routine inspection of equipment is sometimes necessary to ensure its safe condition. Pressure systems require periodic examination and testing.
- Equipment controls should be clearly labelled and accessible; this is particularly important for stop controls and emergency stops.
- Work equipment should be stable, adequately marked with appropriate warning signs and devices, and environmental factors such as lighting and space should be managed.
- Operators must obey rules for safe use.

There are some general safety principles that can be applied to all items of work equipment, irrespective of type.

Types of Work Equipment

Note that in this element we will use the phrase “work equipment” in a very wide sense to include:

- Simple hand tools, e.g. a hammer, screw driver or chisel.
- Hand-held power tools, e.g. a portable electric drill or circular saw.
- Single machines, e.g. a bench-mounted abrasive wheel, photocopier, lathe or compactor.
- Mobile work equipment, e.g. a tractor or mobile crane.
- Machine assemblies, where several machines are linked together to form a more complex plant, such as a bottling plant.

Suitability

All items of work equipment should be suitable for the:

- **Task** it is going to be used to perform, e.g. a chisel is not appropriate for prising lids off tins.
- **Environment** in which it is to be used, e.g. a standard halogen spotlight is not suitable for use in a flammable atmosphere.

Equipment must be carefully selected to ensure that it is suitable for the task and environment on the basis of manufacturers’ information.

In many regions of the world there are regulations that require manufacturers to ensure that the equipment that they produce meets basic safety standards. For example, in the European Union a set of safety standards exists that manufacturers are legally obliged to meet; manufacturers are required to fix a “CE” mark to the equipment and provide a written “Declaration of Conformity” to the purchaser.



CE Mark

Employers in the European Union have to ensure that any equipment they purchase for work use has this CE mark and written declaration.



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Restricting Use

Use of work equipment should, where necessary, be restricted to competent operators only. This relates to all equipment where risk of serious injury to the operator or to others exists (e.g. a metal-working lathe). Repair, modification or maintenance of equipment should be restricted to designated competent people.

Information, Instruction and Training

Work equipment users should be provided with appropriate information, instruction and training:

- Where the equipment is **low risk**, this requirement is simple to fulfill. For example, an office paper shredder can be used by staff who have read the instructions supplied by the manufacturer.
- With **high risk** machinery more has to be done to fulfill this requirement to an acceptable standard. For example, an employer operating an industrial shredder capable of shredding wooden pallets should ensure that all operators receive specific training in the safe use of the equipment as well as written information. They should also check to ensure understanding of that training and information.

Those involved in the **management of operators** should be given adequate information, instruction and training to allow them to effectively manage. As a minimum they should understand the basic principles of safe use of the equipment.

Maintenance staff should be given specific information, instruction and training so that they:

- Can undertake any maintenance activities with a minimum of risk to themselves and others.
- Understand the maintenance requirements of the equipment and are able to keep the equipment in safe working order.

Maintenance, Inspection and Testing

Work equipment should be maintained in safe working condition, according to any legal standards that exist and manufacturers' recommendations.



Engineer carrying out condition-based maintenance

Maintenance can be carried out according to various regimes, such as:

- **Planned preventative maintenance (PPM)** – where servicing work is carried out at prescribed intervals and parts are replaced or changed irrespective of their condition. For example, oil in an engine might be changed every year regardless of the amount of use that the engine has received.
- **Condition-based maintenance** – where servicing is carried out and parts changed only where inspection indicates that use has caused deterioration. For example, the brake pads on a car might be inspected every 10,000km but only changed when they show signs of heavy wear.
- **Breakdown maintenance** – where maintenance is only carried out during repair.

Whatever type of maintenance regime is used for an item of work equipment, maintenance staff must not be exposed to unacceptable risk during maintenance work.

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Maintenance work often creates greater risk for the staff involved because:

- Guards and enclosures have to be removed to allow access.
- Safety devices have to be removed or disabled.
- Equipment has to be partially or completely dismantled.
- Power sources may be exposed (e.g. electrical supply).
- Stored power may be accidentally released (e.g. compressed spring).
- Access may be awkward (e.g. space constraints or work at height).
- Handling of parts may be difficult (e.g. heavy parts).
- Additional hazards may be introduced (e.g. power tools).

Topic Focus

Additional precautions may be required during maintenance work:

- Maintenance should only be carried out by competent staff.
- Power sources should be isolated and physically locked off (secured).
- Stored power should be released or secured to prevent accidental discharge.
- Where power cannot be isolated additional precautions required are:
 - Cover live parts with insulating material.
 - Use additional PPE such as insulating rubber gloves.
- If dangerous moving parts have to be accessed additional precautions required are:
 - Run at very slow speed rather than normal operating speed.
 - Fit maintenance guards that have been made specifically to allow minimum access to required areas only.
- Precautions should be taken to allow safe access, especially when working at height.
- Handling aids and equipment should be used to reduce manual handling risk.

A safe system of work should be developed for when maintenance work is carried out and this may require the use of a permit-to-work and adequate levels of supervision (remember your Unit IGC1 studies).

For some items of work equipment it is foreseeable that deterioration of safety critical parts might occur and it is possible for these parts to be inspected without dismantling the equipment. It may be necessary to introduce some form of inspection regime. For example, the tyres on a vehicle might gradually become excessively worn and it is an easy matter for the driver of the vehicle to carry out a pre-use inspection to check their condition.

In certain instances this routine inspection should be combined with a more detailed periodic examination and testing. For example, pressure systems, such as boilers and air receivers, must be thoroughly examined and tested because they are subject to very heavy stresses and if parts were to fail they would fail catastrophically, leading to explosion. Periodic examination and testing of pressure systems should be carried out by a competent engineer.

Equipment Controls and Environmental Factors

Equipment controls, such as stop and start buttons, should be:

- Well designed so they are easy to use.
- Placed at suitable locations on the equipment.
- Easily identifiable.
- Kept in good working order.
- Compliant with relevant standards.

It is particularly important that stop controls are easy to see and reach and that they override all other controls.

Many machines should also have emergency stops fitted. These are controls that bring the equipment to a safe stop as quickly as possible. Emergency stops can be buttons or pull cords and should be positioned on or by the equipment, within easy reach of operators. For large machines this means that several emergency stop buttons may be fitted at various locations around the machine.



Emergency Stop Button



Element 4: Work Equipment Hazards and Risk Control

In addition to the requirements we outlined earlier, there are some other basic physical requirements that work equipment should meet.

It should:

- Be stable – this may mean bolting it to the floor or fitting outriggers, jacks or stabilizers.
- Be appropriately marked – with labels on control panels, safe working loads, maximum speeds, direction of movement, etc.
- Have appropriate warnings – such as warning signs by dangerous parts and in some cases visible and audible warnings such as flashing beacons and klaxons to warn of the start up or movement of machinery.

The physical environment around work equipment must also be considered, in particular lighting and space.

Lighting considerations:

- Adequate general workplace lighting should be provided around equipment for the safety of both operators and others in the vicinity.
- Local lighting, such as spotlights positioned above machinery, might be required to give higher levels of light on critical areas.
- Lighting should be suitable for the type of equipment in use; avoid lights that flicker when illuminating rotating machinery because of the “stroboscope effect” where the rate of flicker coincides with the rotation rate of the machinery giving the impression that the machinery is rotating very slowly when in reality it is rotating quickly.
- Lighting should be suitable for the environment (e.g. intrinsically safe lighting used in a flammable atmosphere).

Space considerations:

- Operators should have adequate space to move around work equipment safely.
- Other people should be able to move around safely without coming into close proximity to dangerous parts or presenting a hazard to the operator.

Operators

You will remember from your studies of Unit IGC1 that employees have a duty to take reasonable care of their own health and safety and that of others who might be affected by their acts or omissions. This is particularly relevant with regard to the operation of work equipment.

Operators should:

- Only operate equipment they are authorised to use.
- Operate equipment in accordance with instruction and training.
- Only use equipment for its intended purpose.
- Carry out any necessary safety checks before using equipment.
- Not use the equipment if it is unsafe.
- Report defects immediately.
- Not use equipment under the influence of drugs or alcohol (this includes some medication which causes drowsiness).
- Keep equipment clean and maintained in safe working order.



Revision Questions

1. Why are maintenance workers sometimes at greater risk than operators when working on machinery?
2. What are the general health and safety responsibilities of machine operators?

(Suggested Answers are at the end of Unit IGC2.)



Hand-Held Tools



Key Information

- Simple hand tools can cause injury through user error, misuse or mechanical failure.
- Safe use of hand tools requires user training, compliance with safety rules, and routine inspection and maintenance of the tools.
- Portable power tools present greater risks because of the severity of injury that might be caused and the additional hazards presented by each tool.
- Safe use of power tools requires the same basic approach as that for hand tools, but with greater emphasis on user competence, supervision and maintenance, with additional precautions being introduced to combat each of the hazards associated with a tool and its power source.

Hazards and Controls for Hand-Held Tools

Simple hand tools, such as a hammer, chisel or screwdriver, present relatively simple hazards:

- The tool may shatter during use, throwing off sharp metal fragments (e.g. a hammer head or chisel blade).
- The handle may come loose during use (e.g. axe head comes off handle).
- The tool may be blunt leading to use of excessive force which causes loss of control (e.g. blunt knife).
- Simple human error, where the user misjudges movement (e.g. hits own thumb with hammer).
- The tool may be misused, i.e. used in an inappropriate way or for an inappropriate task (e.g. a screwdriver used as a crowbar).

Some relatively simple precautions can therefore be applied to ensure safe use of hand tools:

- Tools must be **suitable** for the **task** that they are going to perform and for the **environment** in which they are to be used, e.g. non-sparking tools (do not produce sparks when struck) are suitable for use in a potentially flammable atmosphere.
- Users should be given appropriate **information**, **instruction** and **training**. Many workers serve some form of apprenticeship or spend several years in training where they acquire an understanding of safety in the use of the tools for their trade, but not all workers come to the workplace with this knowledge (which may seem like common knowledge to others).
- Tools should be **visually inspected** routinely before use to ensure they are in an acceptable condition. This should be done by the user. Spot checks by line management will ensure that users comply. Substandard tools should be maintained or discarded.

- Tools should be **maintained** in a safe condition, e.g. blades should kept sharp and handles firmly attached.
- **Supervision** is important to ensure that safe working practices are adhered to and misuse does not become commonplace.



There are even hazards associated with simple tools such as hammers



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Hazards and Controls for Portable Power Tools

Portable power tools create greater risk than simple hand tools because:

- The forces generated by the tool are far greater, so the potential for very severe injury or death exists (a ruptured disc from a disc cutter will cut an arm off, which is not going to happen with use of a hand saw).
- Power tools have additional hazards not present with simple hand tools.

Additional hazards from portable power tools are:

- Electricity – that may result in electric shock, burns, arcing or fire.
- Fuel – usually petrol, which creates a fire and explosion risk.
- Noise – which may cause hearing loss.
- Vibration – which may cause hand arm vibration syndrome.
- Dust – which is harmful if inhaled.
- Ejection – of material (e.g. brick fragments) or tool parts (e.g. cutting disc fragments).
- Trip hazards from power cables.



Construction worker using portable power tool

Because the risks created by portable power tools are greater than those associated with hand tools, the safety precautions are more stringent. Management should ensure that:

- Tools are carefully selected to ensure **suitability** for **task** and **environment**.
- **Instructions** and safety rules are available in the form of manufacturers' handbooks or in-house safe working procedures.
 - Operators are **trained** and given **information** on safe use of the tool. Operator competence is a key control that should be verified.
 - Operators are **supervised** to ensure safe use.

- Tools are routinely **inspected** by the operator before use. Additional formal inspections should be carried out by the supervisor or maintenance staff. Substandard tools must be repaired or discarded.
- Tools are **maintained** in safe working order. This might be done according to a maintenance schedule.
- Maintenance must be carried out by competent personnel only and records should be kept. The tool might be labelled to indicate the date of next maintenance.

In practice, safe use of a portable power tool requires that:

- Tools and parts are only used for their intended purpose within their design specification (e.g. the maximum speed of a cutting disc should not be exceeded) and in an environment that they are suitable for.
- Necessary guards and safety devices are always used (e.g. the self-adjusting guard fitted to a portable circular saw).
- Necessary personal protective equipment is always used (e.g. eye protection when using a chain saw).
 - Trailing power cables or pipes are carefully positioned so that they do not present a trip hazard and will not be damaged by the tool or passing vehicles, etc.
 - Care is taken to ensure that ejected parts do not present a risk to others near by. This may require that the area is fenced or cordoned off or that the tool is only used at specific times.
- Dust exposure is controlled, either by damping down or by the use of respiratory protective equipment by the operator and others near by.
- Noise exposure is controlled, e.g. by using hearing protection (see Element 8).
- Vibration exposure is controlled, e.g. by job rotation or limiting the duration of tool use (see Element 8).

Additional precautions are necessary when storing and handling petrol. It should be **stored** in an appropriate, labelled metal container in a well ventilated secure area away from ignition sources. It should be **handled** with care in a well ventilated area (preferably outside) away from ignition sources. Any spillages should be dealt with immediately (see Element 6).

Additional precautions must be taken when using electrical equipment. Battery-operated tools might be used, or a low voltage supply (e.g. 110v rather than 240v). Damage to the electrical flex must be avoided.

The tool, flex and plug should be routinely inspected by the operator prior to use. It should also be given a formal electrical safety inspection and thorough examination and test (see Element 5).



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Hints And Tips

If any part of the course material proves difficult, skip over that section and carry on with the easier bits. Come back to the difficult bit later.



Revision Questions

3. (a) From what do the risks in the use of hand tools arise?
 - (b) From what do the additional risks of portable power tools arise?
 4. Why might each power tool be marked?
- (Suggested Answers are at the end of Unit IGC2)