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## **1. PURPOSE**

Work Equipment as defined in law covers virtually all equipment and machinery used at work. Many of the highest risks of injury, illness or death at work will arise from the use of work equipment so it is important the risks its use poses are identified, assessed and addressed to help ensure they are prevented or reduced to a minimum acceptable level.

This document identifies the key aspects necessary to help ensure health and safety in the use of work equipment including its: specification, selection, acquisition, design and construction, installation (including commissioning and testing), use, maintenance / servicing, loan / sale for use at work by another employer and final disposal.

It provides comprehensive information on most aspects of safe use of work equipment that can be used by Safety Advisors and other experts in the field of machinery safety. This will help in developing safe systems and risk assessment methods for use on their sites, research centres or in their own areas of work.

It lays down procedures and provides advice and guidance, identifying the need for assessments of suitability and risk, highlighting relevant legal requirements that are pertinent to work equipment.

## 2. SCOPE & DEFINITIONS

### Scope

This procedure applies to the majority of work equipment used by NERC staff, including that on loan, hired for use at work or under trial but not yet purchased. It also applies to all work equipment designed by NERC and / or built by NERC (whether in our own workshops or by a contractor on our behalf) or imported by NERC for use in the UK directly from a country outside the European Economic Area (EEA).

Although mobile powered items of machinery such as lift trucks or other items of workplace transport are clearly items of work equipment, the specific risks they pose merit special consideration and are not covered by this Procedure, although general aspects are relevant.

Likewise, specific hazards posed by items of work equipment provided to allow safe access for work at height, such as ladders or scaffolds and for power presses are not covered by this document, although many general points will still be relevant.

### Definitions (in alphabetical order)

**Dangerous part** is defined as a part of machinery or work equipment that can cause injury by cutting, crushing etc.

**Dangerous substance** is defined as a flammable, oxidising or explosive material as defined in the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002, being either a gas, vapour, volatile liquid or finely divided solid that may give rise to a risk of fire or explosion under the possible conditions of use.

**Emergency stop** is defined as a switch or other mechanism to immediately isolate the dangerous or moving parts of a piece of work equipment and bring them to a stop, possibly supplemented by some form of braking system if run-down time is excessive. It may not be designed as the 'normal' means of stopping the machine and could place excessive strain on components so it may need to be used with care, its use may also circumvent normal machine control logic so re-starting after emergency stop can take extra time and lead to loss of material / data etc. It must be visible, easily accessible and readily activated (eg a mushroom headed switch activated by hitting the head) but must not be located / designed so it is susceptible to accidental tripping. Resetting of the emergency stop should not normally re-start the machine (eg contacts in the control circuitry should 'drop-out') and re-starting should require a further deliberate action on behalf of the operator. The emergency stop may incorporate a key-operated device so that it may only be re-set by a person possessing the key. This may also be an additional form of isolation but only to supplement and not form the prime or only means of safe and reliable isolation.

**Explosive atmosphere** an atmosphere where there is sufficient concentration of a dangerous substance within its flammable range, ie between its lower

explosive limit (LEL) and its upper explosive limit (UEL) that, when mixed with air or other oxidising gas, can support combustion at sufficient levels to allow ignition.

**Flameproof / Ex rated** is defined as electrical equipment that is designed for use in flammable atmospheres. The selection of suitable Ex rated equipment is linked to the **Hazardous Area Classification**, an assessment procedure which defines zones based on the likelihood and extent of any flammable or explosive atmospheres occurring. This allows the most appropriate type of equipment to be used, there being a variety of different means of protection, safe gaps in enclosures and temperature ratings etc. that may be available and suitable for different zones and flammable materials.

**Guard** is defined as a device to prevent or safely restrict access by a person, or part of a person's body, to a dangerous part of machinery that could cause injury etc.

**Hazardous substance** is defined as a substance, which may be a chemical or a micro-organism, which gives rise to a hazard to the health of persons who may be exposed to it as a result of its toxic, sensitising, allergenic, physico-chemical or pathogenic properties as defined by the Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP) 2002 and the Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended). It will also include radioactive material for the purposes of this procedure. May also be referred to as a 'Hazardous Material'.

**Index of Protection**, also known as the **IP rating**, is defined as the protection offered by the enclosure of an electrical device against ingress from external agents. It is composed of 'IP' followed by two digits the first of which describes the degree of protection rate against solid objects (eg dust, the solid particles and parts of the body), the second of which describes the degree of protection offered when the environment conditions are standard. IP ratings do not apply in extreme conditions eg intense heat or cold or underground in mines, etc. where special protection is required. The IP rating scheme is explained in BS EN 60529 'Specification for degrees of protection provided by enclosures. A brief description of the meaning of the numbers is given in Appendix 15

**Installation** is defined as a series of machines linked or connected together such as a production line or analytical apparatus with multiple linked components such as Liquid Chromatograph / Mass Spectrometer assemblies.

**Interlock** is defined as a means of linking a safeguard to the control circuitry of a piece of equipment so that the equipment may not operate (or only operate in a 'safe mode') when the safeguard is not in place. Interlocks must be reliable (eg ideally being hard-wired into the power circuit rather than acting through electronic software), positive acting and be 'failure to safety', as far as is possible. In very high risk situations interlocks may need to be backed up so there is more than one method of ensuring the safeguards are in place and effective.

**Lifting equipment** is defined as work equipment for lifting or lowering loads and includes attachments used for anchoring, fixing or supporting it. Examples of lifting equipment would be cranes, lift trucks, goods lifts,

personnel lifts, construction hoists, mobile elevating work platforms, vehicle inspection hoists, 'block and tackle', jacks, gin wheels, ropes, chain slings, eye bolts etc. as well as items used in rope access working (ref Lifting Operations and Lifting Equipment Regulations 1998).

**Machine** is defined as a piece of work equipment which is an assembly of linked parts, at least one of which moves, usually with some kind of drive unit together with appropriate actuators, control and power circuits, joined together for a specific application.

**Pressure system** a system comprising rigid vessel(s) and / or pipework together with any protective devices which contains or is liable to contain a fluid held at or above 0.5 atmospheric pressure, that fluid being a gas, steam or a liquid which is only maintained in that state due to the pressure acting on it (see Systems Pressure Systems Safety Regulations 2000).

**Work equipment** is defined as 'any machinery, appliance, apparatus, tool or installation for use at work'. It is therefore extremely wide and covers almost any equipment used at work, including:

- hand tools such as hammers, knives, saws
- single machines such as drilling machines, circular saws, photocopiers
- mobile equipment such as a dumper truck or trailer
- apparatus such as laboratory instruments (HPLC)
- lifting apparatus such as a hoist or lift truck
- other equipment such as ladders, pressure water cleaners
- an installation

### 3. PROCEDURE

The definition of work equipment is extremely wide and covers almost any equipment used at work, varying in size and complexity from a hand-held tool such as a hammer to a factory production line with everything in between, including mobile plant and vehicles.

In order to help ensure the risk of injury or ill health is either prevented or reduced to a minimum, acceptable level the following aspects of work equipment need to be taken into account:

- selection and specification
- procuring
- design and construction
- installation
- use, including maintenance and servicing
- decontamination
- loan, donation and sale
- disposal

Appendices are attached to this Procedure which explain in more detail the various aspects of safe use of work equipment. The following summarises the various aspects it is important to address.

Safety with work equipment should start long before it is purchased with careful consideration being given to the **specification** it must be designed and constructed to in order to do its job correctly and safely. Once a specification has been drawn up comes **selection** of an item of equipment that meets the specification and identifying suitable suppliers whose product meets the safety performance required by the specification. Also, not only that it can perform the intended tasks safely but it also fulfils other aspects which are relevant to continued safe use such as reliability, maintainability, spare part supply, service support etc. Next comes **procuring** the work equipment, ensuring it meets statutory requirements and is accompanied by suitable information, followed by its **design and construction**, which must take into account relevant safety standards in its performance and operation and incorporate suitable safeguards. Once an item has been procured it needs safe **installation**, a very important part of the overall process that is often given insufficient attention at the initial planning and costing stage and includes commissioning and testing. This is followed by safe **use**, which may include a whole range of activities other than just its intended operation, including **servicing and maintenance**, work materials, removal of waste or other unwanted by-products such as heat or fumes and **decontamination**. Next will come consideration over what happens when the work equipment is no longer required, including its **loan, hire, donation or sale** and lastly its safe **disposal** if it has no further use.

The prime regulations which apply to work equipment are the Provision and Use of Work Equipment Regulations 1998 (PUWER). However, there are many other codes of regulations which apply either directly to work equipment, such as those for pressure systems and lifting equipment, or indirectly, such as for electricity or hazardous substances.

The main requirements under PUWER are that work equipment is:

- Suitable for the purpose for which it is used or provided
- Only used for operations for which it is suitable
- Maintained in efficient working order and in good repair
- Inspected to ensure it is installed correctly before first use and is safe to operate
- Inspected at suitable intervals thereafter and if something to jeopardise safe operation has occurred
- Restricted in its use, repair, modification, maintenance or servicing, where there are 'specific risks', to designated persons
- Provided with information and instructions for all persons who use it
- Used by persons who have received adequate training for the purposes of health and safety, including its supervisors and managers
- In conformity with Community requirements
- Provided with measures to protect against coming into contact with dangerous parts of machinery
- Provided with measures against specified hazards such as ejected material, rupture/disintegration, fire, unintended/premature discharges of substances etc., explosion
- Protected against causing injury from high or very low temperature
- Provided with controls for stop/start and operating conditions and readily accessible stop and emergency stop controls and that these are clearly visible and identifiable

- Provided with suitable means of isolation from all sources of energy
- Stable
- Provided with suitable and sufficient lighting in the place where it is used
- Constructed and has appropriate measures so it can be safely maintained
- Marked in a clearly visible manner as appropriate for reasons of health and safety
- Incorporated with warnings or warning devices as appropriate for reasons of health and safety

There are additional specific requirements under PUWER for mobile work equipment including roll over protection etc. and for power presses which are not covered in detail in this document.

It can be seen that the prime requirement for work equipment is that it is suitable for the purpose for which it is used and only used for operations for which it is suitable. There is no specific requirement under PUWER for risk assessment, just 'assessment of suitability'. However, the over-riding requirement under the Management of Health and Safety at Work Regulations (MHSWR) for risk assessment still applies. In practice this means a combined assessment needs to be undertaken, firstly, of the risks presented by the work equipment in its installation / use etc to ensure that these are adequately controlled and, secondly, of the suitability of the work equipment for the tasks in which it is likely to be used.

In addition to ensuring the normal operators of work equipment are safe, it also needs to be safe and without risk to the installers, the cleaners, the maintenance engineers, the service support staff, the dismantlers and to other persons who may come into contact with or otherwise be affected by how its operates.

In choosing controls it should also be ensured that risks created by the use of the equipment are eliminated where possible or controlled by:

- taking appropriate 'hardware' measures, eg providing suitable guards, protection devices, markings and warning devices, system control devices (such as emergency stop buttons) and personal protective equipment; and
- taking appropriate 'software' measures such as following safe systems of work (eg ensuring maintenance is only performed when equipment is shut down etc), and providing adequate information, instruction and training.

A combination of these measures may be necessary, depending on the requirements of the work, the assessment of the risks involved and the practicability of such measures.

#### **4. REFERENCES and BIBLIOGRAPHY**

See Appendix 16

## 5. ROLES AND RESPONSIBILITIES

### Director is responsible for:

- Ensuring local procedures have been implemented as appropriate which cover the risks involved in use of work equipment and meet or extend NERC minimum standards as laid down in this procedure.

### Managers are responsible for

- Appointing competent persons and ensuring they are trained to the required level in the safe use etc of work equipment
- Providing resources to ensure safety aspects identified in assessments can be dealt with
- Ensuring health and safety aspects for safe use of work equipment are taken into account when specifying, selecting and purchasing new items
- Ensuring that assessments on suitability and risk involved in the use of work equipment have been carried out and approved
- Ensuring the delivery, installation, safe use and disposal of work equipment are safely managed
- Ensuring suitable records are kept eg of maintenance, inspection and testing where required, risk assessments, training and acquisition / disposal / loan and sale of work equipment
- Ensuring safe systems of work have been developed, implemented and are being followed in relation to work equipment
- Monitoring and reviewing the effectiveness of safe systems of work
- Taking into account any modifications that may need to be made to the equipment

### Risk Assessors are responsible for:

- Identifying the suitability of the work equipment for the intended operations under the likely conditions of use
- Completing a suitable and sufficient assessment of the risks involved in the use of the work equipment
- Checking the equipment is CE marked as necessary and appropriate safe operating instructions are available
- Drawing up a safe system of work for the item of work equipment
- Identifying any adaptations or modifications that may be required to allow the work equipment to be used safely
- Specifying the levels of experience, competence and training that are required to operate the work equipment safely
- Indicating any maintenance, inspection or testing regime that is applicable to the item of work equipment to ensure it remains in safe operating condition
- Reviewing the safe system of work after it has first been implemented to ensure it is appropriate and making any changes necessary
- Reviewing the risk assessment and associated safe system of work in conjunction with their manager and other relevant users at regular intervals to ensure it is still relevant and appropriate

**Persons designing and/or constructing work equipment or importing work equipment from outside the EEA for use in the UK:**

- Ensuring the work equipment they construct, design or import is designed, constructed and safeguarded to be safe in use.
- Meeting requirements with regard to CE marking of work equipment , technical files and declarations of conformity
- Ensuring work equipment they design, construct or import is suitable for the intended operations for which it will be used and the conditions under which it will be used
- Ensuring suitable safe instructions for use are provided (in English)

**Procurement staff are responsible for:**

- Co-operating with NERC managers in managing the acquisition of appropriate work equipment
- Co-operating with NERC in acquiring equipment by tender and contract
- Ensuring that health & safety are written into contracts where appropriate.
- Ensuring that delivery, installation, testing, commissioning and training are included in the contract as appropriate.
- Resolving conflicts between health & safety and value for money in co-operation with NERC staff who draw up specifications for equipment
- Including removal and disposal of redundant equipment in contracts if necessary.

**Safety Advisors are responsible for:**

- Helping management develop and implement local procedures on safe use of work equipment
- Advising on safety aspects when specifying, selecting, designing, installing, using, decontaminating, maintaining, training in safe use of and disposing of work equipment
- Keeping records of injuries, incidents and investigations involving work equipment
- Helping ensure information, instruction and training on safe use of work equipment is provided
- Auditing safe use of work equipment

**Competent persons are responsible for:**

- Operating work equipment safely and following safe systems of work
- Providing training as appropriate to inexperienced users and supervising such users as required until they have been deemed competent
- Identifying shortcomings in assessments or safe systems of work and notifying their manager of them

**Staff are responsible for:**

- Helping prepare / contributing to assessments of suitability and risk for work equipment as requested by line managers
- Following the conclusions of risk assessments
- Making themselves aware and following the guidance in this procedure where applicable
- Following management instructions on safe use of work equipment



- Minimising risk to themselves and others
- Complying with the safe systems of work devised as a result of the assessment process
- Keeping managers informed of any issues, problems or developments with regard to work equipment

## 6. APPENDICES

Appendix 1: Specification of Work Equipment

Appendix 2: Selection of Work Equipment and Supplier

Appendix 3: Procuring Work Equipment

Appendix 4: Design and Construction of Work Equipment

Appendix 5: Headings for Essential Health and Safety Requirements relating to the Design and Construction of Machinery

Appendix 6: Selection of Work Equipment Safeguards

Appendix 7: Installation of Work Equipment

Appendix 8: Safety in use of Work Equipment

Appendix 9: Work Equipment Hazard Checklist

Appendix 10: Declaration of Contamination Status

Appendix 11: Loan / Hire / Sale / Donation for Use at Work

Appendix 12: Loan or Donation Letter

Appendix 13: Disposal of Work Equipment

Appendix 14: PUWER Flow Diagram

Appendix 15: Index of Protection

Appendix 16: References and Bibliography

## Appendix 1: Specification of Work Equipment

Before purchasing new work equipment consideration needs to be given to the required specification necessary in order for the work equipment to be operated, installed and maintained safely. The over-riding requirement of PUWER is that the equipment is suitable for the purpose for which it is to be used. Suitability will involve three aspects: initial integrity, the place where it will be used and the purpose for which it will be used. An early, initial or preliminary assessment of suitability (as required by PUWER) and risk (as required by MHSWR) of the intended work equipment will help devise a specification for any new work equipment that is proposed to be purchased.

Specification will be key to suitability and establishing this may require consultation with a wide range of colleagues and specialist staff before a final decision is made. Once purchased it is probably too late to rectify fundamental issues which affect safety or, even if possible, modifications are liable to be expensive and difficult to implement and cause considerable delays. Decisions made on cost alone may be regretted and, in the long term, prove false economy. In addition, aspects such as requirements imposed by the location or environment of use must be taken into account when drawing up the specification, such as: will the work equipment fit or be possible to bring into the location; are suitable services available, such as three phase electricity or of sufficient capacity; are any necessary cooling or ventilation systems available? It may cost more to install such services than the purchase price of the work equipment and such 'add-ons' are often not included in the budget. It may not even be possible to provide such services. Other important safety specification considerations include operating voltage. If electrically powered work equipment is to be used under arduous conditions of use, such as in the field, in wet conditions or on construction sites, it could be preferable to specify 110 volt centre tapped earth (CTE) powered equipment. Considering the necessary Index of Protection (IP) ratings will also be important as would zone classification if it will be used where there may be a flammable or explosive atmosphere.

When specifying a new machine the following safety considerations will need to be taken into account:

1. Where and how will it be used?
2. What will it be used for?
3. Who will use it (skilled staff, trainees, students)?
4. What risks to health and safety might result?

The environment it will need to operate in and any special safety requirements imposed could include:

- Sterile or clean
- Arduous (eg a construction or field site)
- Dusty
- Wet (or submerged)
- Highly conductive
- Exposed to the elements
- Cold / hot
- On a vehicle, ship or plane
- Flammable or explosive
- Noise and vibration

The proposed location for the work equipment may need services or special facilities which may not all be present so their installation could need to be considered as part of the project and its costing. Examples of services or special facilities to consider when drawing up a specification include:

- Ventilation – air change rates, pressure regime and extraction of fumes
- Lighting
- Electricity – AC or DC / power / voltage / frequency / phasing / capacity / earthing / assured (generator back-up) / uninterruptible (battery back-up) / surge or spike-free / static / lightning protection
- Process cooling
- Temperature (hot and cold) and maximum permissible range
- Humidity
- Compressed air
- Special gases
- Drainage

The materials the work equipment will be used with may affect the specification and any special requirements these impose taken into account, which may include:

- Special handling precautions
- Production of hazardous vapours, fumes, dusts or aerosols
- Utilisation of hazardous materials including their storage and handling
- Production of hazardous waste
- Disposal of hazardous waste

The ability to easily and safely install, replace, remove, service and maintain the equipment and the building itself can be affected by the following factors:

- The fit into the building eg sizing to go up floors / through doors / around corners
- Floor / point loading
- Manual / mechanical handling (eg can it be dismantled into manageable parts)
- Delivery of service materials eg salt or reagents for water treatment plant

Is portability, ruggedness and resistance to vibration an issue – does it need to be transported once obtained eg taken to sea?

Are there workplace or ergonomic considerations to be taken into account?:

- Lighting
- Working conditions for operators
- Adequate space
- Working position / posture (including seating)
- Location of controls
- Repetitive movements and / or excessive effort to operate
- Psycho-social factors such as stress, ability to communicate
- Human factors
- Manual handling
- DSE considerations
- Feeding / removal of materials

## Appendix 2: Selection of Work Equipment and Supplier

Once a safety specification for the work equipment has been drawn up this informs the decision on what work equipment to select and which is the best item to purchase. Ideally there will be a choice of alternative suppliers or models when a number of aspects can be taken into consideration before a procurement progresses. These will include:

- The nature of the work equipment, eg is it a mass produced item or a bespoke one?
- The nature of the supplier / manufacturer, eg have you purchased their equipment previously, do they have a good track record, are they reputable in supplying equipment of this nature?
- Will spare parts be supplied or easily available for the expected lifetime of the work equipment?
- Does the supplier provide service support or training for in-house engineers?
- What is the cost of spares (and are there alternative suppliers)?
  - Where are they located and, if not in the UK, do they have a UK support system? If the supplier is located outside the European economic area (EEA) this may cause problems, especially if the equipment is not CE marked (see appendix 4 on 'design and construction')
- Does the organisation have other equipment supplied by the same manufacturer? This may make retention of spares and repair / servicing / maintenance much easier and probably safer.

If there is only one supplier or the equipment is custom made, either in-house or by a preferred contractor, then extra care is required to ensure the specification is robust and covers all eventualities otherwise there could be shocks and additional expense at a later stage. Also, a judgement on whether or not a good working relationship can be established must be made. Prior experience, taking references or talking to other customers may help in making a choice.

Tell the proposed supplier(s) or manufacturer(s) where the machine will be used, what you will be using it for and who will be using it, this being especially important if it is used in a unique manner or is custom built, then ask them:

- What health and safety risks are posed by their machine?
  - What are the work equipment's dangerous parts and how are they guarded?
- What controls are fitted and how do they, and the control system, in general work?
- Are additional controls, such as emergency stops, required at installation?
- Will heat and/or any hazardous fumes or dusts be produced and if so, what additional controls (such as cooling or extract ventilation) are required?
- What are the levels of noise (ideally no more than 70dB [A] and certainly no more than 80 dB [A]) produced?
- What is the magnitude of vibration produced (ideally below 2.5 m/s<sup>2</sup> for hand arm vibration and 0.5 m/s<sup>2</sup> for whole body vibration) produced?
- Are there any hot or cold parts and how are they protected?
- Are there any other special hazards eg lasers, radiation, microwaves?
- What electrical safety features are incorporated, including IP and Ex ratings, means of isolation, means of safe maintenance eg when control panels or distribution panels are open and other electrical requirements?

- Are there any other sources of energy that may present a risk eg hydraulic, pneumatic?
- Is there clear information about installation, maintenance and breakdown procedures?
- What problems have arisen with similar machines supplied elsewhere and will you inform me if problems arise with other users?

When you have this information compare how well health and safety risks are controlled by the different manufacturers and suppliers and the various merits of different models and options.

If purchasing from a supplier rather than direct from the manufacturer, assess how expert the supplier is, what level of support and advice they can give and how likely it is they will still be in business or retain the distribution rights for the lifetime of the equipment.

Other aspects, which may not all be directly safety related but will have a bearing on overall safety that should be considered before making a final choice include:

- Equipment from same supplier already in use, hence familiarity of design / operation with staff and possible negotiation of better terms and conditions
- Ease of decontamination, maintenance and servicing
- Spares supply
- Development / maintenance of positive relationship with a preferred supplier
- Disposal at end of life
- Will the supplier take away existing work equipment the new item will be replacing, especially if there are any special hazards eg built-in radioactive sources
- Competence and qualifications of staff
- Financial stability
- Additional works – eg commissioning, testing, validation, guarding, signage

### Appendix 3: Procuring Work Equipment

It should be noted that certain duties fall on suppliers of work equipment. If the procurer imports the equipment from outside the EEA or acts as the middleman providing it to the end user, then they may unintentionally become the supplier and acquire all the duties that entails. This may be a particular issue if the Shared Services Centre purchases the work equipment on behalf of NERC and then provides it for our use.

Once the specification and selection have been decided and it has been checked all aspects of the health and safety of the work equipment have been catered for, then procurement or acquisition can proceed. It is important to ensure that the relevant documentation is obtained when the work equipment is delivered which will include:

- Instructions on safe installation
- Operating instructions (in English)
- Details of maintenance procedures, maintenance schedules and how to deal with breakdowns, problems, decontamination etc.
- Declaration of Conformity Assessment documentation

It should also be identified what specialist commissioning and testing is required to ensure the equipment has been installed, working correctly and within specification before it is taken into use. If necessary, the provision of this specialist commissioning and testing should be included as part of the procurement contract if it is to be provided by the work equipment supplier. Alternatively, if this service is to be provided by an independent body, then separate provision and costing for it will need to be made and the supplier informed if successful completion of these steps is part of final completion and payment.

Also, check what training the supplier / manufacturer can or will provide on safe use / maintenance and whether the purchase contract includes such a provision and if it is adequate or if extra provision is required that needs to be taken into account.

If it is second-hand equipment that is being acquired it must be ensured that it is safe and has the necessary documentation as to safe use, including CE marking where necessary.

If equipment is being hired from a third party for use by NERC, the hirer (ie the person who owns the equipment and is offering it for hire) has a duty to ensure it safe for use at the point of hire / loan. Also, to make reasonable attempts to find out how it will be used, who will be using it and provide advice on how it should be used. However, the duty to ensure safety, so far as is reasonably practicable, once in use is the responsibility of the hiree (ie the person who will be using the hired equipment).

Any equipment supplied for use in the UK needs to be CE marked in accordance with the Supply of Machinery (Safety) Regulations 2008. If equipment is procured from outside the EEA directly the purchaser then becomes the supplier in UK legal terms and takes on responsibility for ensuring it is safe for use at work. This could require obtaining or providing a declaration of conformity which shows the

machine meets the Essential Health and Safety Requirements (see Appendix 5 for general headings) or Type Approval.

If it is second-hand work equipment that is being acquired it should be noted that equipment first supplied into the EEA before 1993 does not require CE marking, provided it has not been substantially refurbished (defined as being to an extent that almost all the replaceable parts are new). However, any second-hand work equipment must still be safe and subject to the requirement for assessment of suitability and risk before it is first taken into use. It should be noted that for certain second-hand machinery, eg woodworking machines, there may be need to be improvements such as enhanced braking incorporated before it can be safely used.

It should be noted that even if a machine is under trial or demonstration on a site and not yet purchased, it would still be subject to the requirements for assessment before it is first used and possibly electrical safety testing.

If work equipment is being hired or loaned / borrowed from another employer / University / research institute etc, it is important to ensure the work equipment is safe to use before it is brought onto site. Whilst there are duties on the hirer and supplier (even if it is loaned or borrowed and no money exchanges hands), it is still the duty of the person who hires or borrows the work equipment to make sure it is used safely.

What to do when taking delivery of a new machine:

- Check that it has CE marking (where necessary) and ask for a copy of the EC declaration of conformity if one has not been provided
- Check that the supplier has explained what the machine is designed to be used for and what it cannot be used for (unless it is 'off the shelf' machinery)
- Make sure a manual has been supplied which includes instructions for safe use, assembly, installation, commissioning, safe handling, adjustment and maintenance
- Make sure the instruction manual is written in English
- Make sure information has been provided about any remaining risks from the machine, and the precautions that need to be taken to deal with them. These may include electrical, hydraulic, pneumatic, stored energy, thermal, radiation or health hazards
- Check the data about noise and vibration levels have been provided and, where necessary, explained
- Ensure that any warning signs are visible and easy to understand
- For a complex or custom-built machine arrange for a trial run so you can be shown the safety features and how they work
- Check to see if you think the machine is safe
- Make sure any early concerns about the safety of the machine are reported to the supplier

**REMEMBER: NEVER ASSUME THAT MACHINERY IS SAFE JUST BECAUSE IT HAS CE MARKING**

## **Appendix 4: Design and Construction of Work Equipment**

### **Supply of machinery requirements**

All work equipment should be designed and constructed to be safe in use. The Supply of Machinery (Safety) Regulations 2008 (and its predecessor regulations which first came into force on 1<sup>st</sup> January 1993) implement the EC Machinery Directive and require new machines to be CE marked to indicate they comply with certain essential health and safety requirements (see appendix 5). These Regulations apply to all machinery supplied for use within the EEA but do not apply to all work equipment since many items will not fit the definition of a machine. The Supply Regulations apply to all new equipment put into service, even when NERC designs and manufactures equipment for its own in-house use (although only if used within the EEA and not on means of transport such as ships or planes and certain other exempted applications, although these may have their own machinery safety requirements). Although the definition of supply under the Consumer Protection Act 1987, which amends section 6 of the Health and Safety at Work Act 1974 as it applies to supply of articles for use at work, would not cover equipment manufactured in house for internal use, this is not the case for the Supply of Machinery (Safety) Regulations 2008. These regulations impose place requirements on persons placing machinery on the market and putting machinery into service. Whilst the former would not apply to equipment designed and manufactured in-house for in-house use, the latter would. There is an exemption from the Supply Regulations for 'machinery specially designed and constructed for research purposes for temporary use in laboratories' but most laboratory machinery would not meet the 'temporary use' clause.

The CE marking and declaration of conformity may give some indication that the equipment has been designed, constructed and safeguarded to meet essential requirements and accepted standards but does not guarantee it will be safe when in use. This may be because NERC will use it in a different way to that which the manufacturer / supplier envisaged / intended or because the design was not appropriate or 'suitable' in the first place. More information on CE marking, declarations of conformity and technical files are given at the end of this appendix. Just because an item of equipment is CE marked does not mean it is safe in use so there is still a requirement to undertake assessments of suitability and risk.

### **PUWER requirements**

The Provision and Use of Work Equipment Regulations require that work equipment is constructed or adapted to be suitable for the purpose for which it is used or provided. Also, it is only to be used for operations and under conditions for which it is suitable. This means that the design and construction of the work equipment needs to be considered against: its initial integrity, the purpose it will be used for and the place / actual conditions of use. However, suitability on its own does not necessarily ensure safety in use and there is an additional requirement under the Management of Health and Safety at Work Regulations to undertake a risk assessment which will also take into account all aspects of safe use as well as suitability including maintenance, installation, environment, training and so on. Appendix 6 gives some guidance on selection of safeguards and the hierarchy that should ideally be applied.



When designing and constructing a new piece of equipment in-house or with a specialist contractor the consideration of suitability for the work and conditions will be a fundamental part of the process and the selection of standards of construction, safeguards and design to be met will be the duty of the designer. If the work equipment is only for in-house service or research purposes, the duty to ensure safety is no less than for commercially supplied equipment or routine applications. If it is supplied by a third party or for use within the EEA it will need to be CE marked and it may be necessary to engage experts to undertake the necessary steps and provide a declaration of conformity.

Details of the headings under the Essential Health and Safety Requirements under the declaration of conformity are given at Appendix 5.

## **Standards**

There are over 400 transposed harmonised standards relating to machinery:

These are divided into:

A Standards: which apply to all machinery and provide essential information for machine manufacturers. The key A standards are EN 414 'Safety of machinery – rules for the drafting and presentation of safety standards', BS EN ISO 12100-1:2003 'Safety of Machinery – Basic concepts, general principles for design' and BS EN ISO 14121-1 Safety of machinery – principles for Risk Assessment.

B Standards: which are subdivided into:

- B1 covering safety standards for design eg electrical equipment, safety distances, safety related controls, which always apply.
- B2 covering safety components and devices eg light curtains, mechanical guards, pressure mats and two-hand controls, which apply when required

C Standards: which cover safety precautions and devices for specific types or groups of machinery.

The former British Standard 5304 'Safeguarding of Machinery' is no longer current but is still published as a Code of Practice and gives an excellent introduction to the concepts of machinery guarding with very useful advice on selection and application of different safeguards.

## **Upgrading of existing equipment to meet the requirements of PUWER**

New equipment supplied since PUWER came into force must comply with the regulations. The regulations do not technically require equipment in use before 1998 to be retrospectively upgraded to meet the current standards, although it does for second-hand equipment supplied since 1998. However, as there are general requirements under PUWER for work equipment to be suitable and to protect dangerous parts etc. there may still need to be improvements in safeguards applied to existing machinery as a result of a risk assessment. One example is the braking of woodworking machinery whereby retrospective fitting of

braking to certain classes of woodworking machinery may be required so they meet the CEN 'ten second' standard to stop the rotating or moving tool in a sufficiently short time to bring the equipment to a 'safe condition in a safe manner'. This is covered by the HSE ACoP on 'Safe Use of Woodworking Machinery' and there is a timetable for implementing at different classes of woodworking machines, the last deadline of which was 5 December 2008. However, even here the need is tempered by the conclusions of the risk assessment which can take into account other factors eg which show there is no added safety benefit.

## **Other applicable legislation**

PUWER makes general requirements for all work equipment, which encompasses a huge range of items. There are other sets of regulations which may make specific requirements to certain classes of work equipment or make requirements for specific applications of work equipment. For classes of work equipment with specific sets of Regulations applying to them, compliance with their requirements will normally ensure that compliance with PUWER is assured. There are also other sets of general regulations which may make certain requirements for certain aspects of work equipment usage.

A non-exhaustive list of regulations with specific requirements applying to work equipment is:

- Pressure Systems Safety Regulations 2000
- Lifting Operations and Lifting Equipment Regulations 1998
- Work at Height Regulations 2005 (ladders, scaffolds etc are not covered by this Procedure)
- Control of Noise at Work Regulations 2005
- Control of Vibration at Work Regulations 2005

Regulations with more general application to work equipment include:

- Management of Health and Safety at Work Regulations 1999 (eg for risk assessment)
- Construction (Design and Management) Regulations 2007 (eg for erection or dismantling of work equipment)
- Health and Safety (Display Screen) Regulations 1992 (eg for ergonomics)
- Workplace (Health Safety and Welfare) Regulations 1992 (eg for lighting)
- Health and Safety (Safety Signs and Signals) Regulations 1996 (eg for signs on work equipment)
- Personal Protective Equipment at Work Regulations 1992 (eg for operation or maintenance of work equipment)
- Control of Substances Hazardous to Health Regulations 2002 as amended (eg for emission of hazardous materials)
- Electricity at Work Regulations 1989 (eg for connecting work equipment to mains supply, its isolation and maintenance)
- Manual Handling Regulations 1992 (eg for assembly / disassembly, maintenance and operation of work equipment)
- Dangerous Substances and Explosive Substances Regulations 2002 (eg for use in flammable or explosive atmospheres).

## CE marking, Technical Files and Declaration of Conformity

The process of CE Marking involves the following steps:

1. Establish what Directives apply\*
2. Undertake and record a risk and hazard assessment for the machine
3. Apply the appropriate harmonised standards
4. Test and assess against the requirements of these standards
5. Implement quality control procedures for the manufacture of the machine
6. Create a Technical File for the machine
7. Issue a Certificate of Compliance
8. Issue a Declaration of Conformity
9. Apply the CE Mark

\* *The Machinery Directive (2006/42/EC); The Low Voltage Directive (72/23/EEC); The EMC Directive 89/336/EEC amended by 91/263/EEC; 92/31/EEC and 93/97/EEC; The Pressure Equipment Directive (97/23/EC); The ATEX Directive (94/9/EC)*

### Technical File

A technical file consists of the following:

- an overall drawing of the machinery or safety component together with drawings of the control circuits;
- full detailed drawings, accompanied by any calculation notes, test results, etc required to check the conformity of the machinery or safety component with the essential health and safety requirements;
- a list of:
  - the essential health and safety requirements;
  - transposed harmonised standards;
  - standards; and
  - other technical specifications which were used when the machinery or safety component was designed;
- a description of methods adopted to eliminate hazards presented by the machinery or safety component;
- if desired, any technical report or certificate obtained from a competent body or laboratory<sup>1</sup>;
- if conformity with a transposed harmonised standard is declared, any technical report giving the results of tests carried out at his choice either by himself or by a competent body or laboratory<sup>1</sup>;
- a copy of the instructions for the machinery or safety component.

The manufacturer must carry out necessary research or tests on components, fittings or the completed machinery or safety component to determine whether by its design or construction the machine or safety component is capable of being erected and put into service safely.

### EC declaration of conformity

The precise format of the declaration of conformity is not set down but must contain the following particulars:

- business name and full address of the 'responsible person';
- where the 'responsible person' is not the manufacturer, the business name and full address of the manufacturer;
- description of the machinery or safety component, in particular the style and serial number;
- all relevant Directives complied with by the machinery or in the case of a safety component, the safety function fulfilled by the safety component;
- where appropriate<sup>2</sup>, name and address of the approved body and number of the EC type-examination certificate;
- where appropriate<sup>2</sup>, the name and address of approved body to which the technical file has been forwarded;
- where appropriate<sup>2</sup>, the name and address of the approved body which has drawn up a certificate of adequacy;
- where appropriate, the transposed harmonised standard used;
- where appropriate, the national standards and technical specifications used;
- identification of the person empowered to sign on behalf of the 'responsible person';

and, as appropriate, must state conformity with the essential health and safety requirements or with the example of machinery or safety component that underwent EC type-examination.

<sup>1</sup>*This declaration must be drawn up in the same language as the instructions (see Annex B, point 1.7.4) and must be either typewritten or handwritten in block capitals.*

<sup>2</sup>*Only appropriate for those types of machinery or safety component listed in Annex D.*

## **Appendix 5: Headings for Essential Health and Safety Requirements (EHSRs) relating to the Design and Construction of Machinery**

Ensure a risk assessment is carried out, machinery then designed and constructed taking into account the results of the risk assessment.

The responsible person shall:

- determine the limits of the machinery
- identify the hazards
- estimate the risks
- evaluate the risks
- eliminate the hazards or reduce the risk

### **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS**

#### **1. GENERAL REMARKS**

- 1.1. Definitions
- 1.2. Principles of safety integration
- 1.3. Materials and products
- 1.4. Lighting
- 1.5. Design of machinery to facilitate its handling
- 1.6. Ergonomics
- 1.7. Operating positions
- 1.8. Seating

#### **2. CONTROL SYSTEMS**

- 2.1. Safety and reliability of control systems
- 2.2. Control devices
- 2.3. Starting
- 2.4. Stopping
  - 2.4.2. Operational stop
  - 2.4.3. Emergency stop
  - 2.4.4. Assembly of machinery
- 2.5. Selection of control or operating modes
- 2.6. Failure of the power supply

#### **3. PROTECTION AGAINST MECHANICAL HAZARDS**

- 3.1. Risk of loss of stability
- 3.2. Risk of break-up during operation
- 3.3. Risks due to falling or ejected objects
- 3.4. Risks due to surfaces, edges or angles
- 3.5. Risks related to combined machinery
- 3.6. Risks related to variations in operating conditions
- 3.7. Risks related to moving parts
- 3.8. Choice of protection against risks arising from moving parts
  - 3.8.1. Moving transmission parts
  - 3.8.2. Moving parts involved in the process
- 3.9. Risks of uncontrolled movements

## 4. REQUIRED CHARACTERISTICS OF GUARDS AND PROTECTIVE DEVICES

- 4.1 General Requirements
- 4.2. Special requirements for guards
  - 4.2.1. Fixed guards
  - 4.2.2. Interlocking movable guards
  - 4.2.3. Adjustable guards restricting access
- 4.3. Special requirements for protective devices

## 5. RISKS DUE TO OTHER HAZARDS

- 5.1. Electricity supply
- 5.2. Static electricity
- 5.3. Energy supply other than electricity
- 5.4. Errors of fitting
- 5.5. Extreme temperatures
- 5.6. Fire
- 5.7. Explosion
- 5.8. Noise
- 5.9. Vibrations
- 5.10. Radiation
- 5.11. External radiation
- 5.12. Laser radiation
- 5.13. Emissions of hazardous materials and substances
- 5.14. Risk of being trapped in a machine
- 5.15. Risk of slipping, tripping or falling
- 5.16. Lightning

## 6. MAINTENANCE

- 6.1. Machinery maintenance
- 6.2. Access to operating positions and servicing points
- 6.3. Isolation of energy sources
- 6.4. Operator intervention
- 6.5. Cleaning of internal parts

## 7. INFORMATION

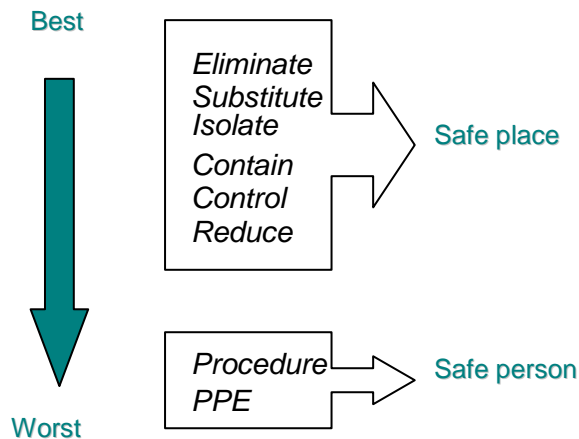
- 7.1. Information and warnings on the machinery
  - 7.1.1. Information and information devices
  - 7.1.2. Warning devices
- 7.2. Warning of residual risks
- 7.3. Marking of machinery
- 7.4. Instructions
  - 7.4.1 General principles for the drafting of instructions
  - 7.4.2. Contents of the instructions

## Appendix 6: Selection of Work Equipment Safeguards

### Selection of controls

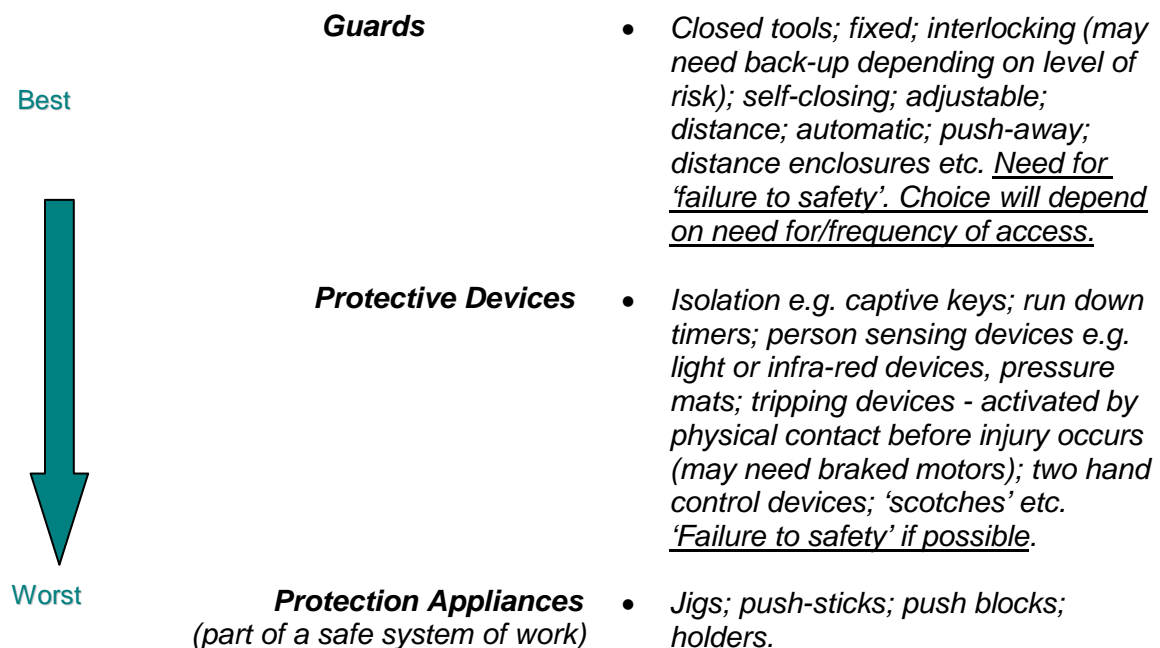
When reviewing work equipment for suitability and undertaking risk assessments for its safe use and selecting controls / guarding methods, the following hierarchies should be applied:

#### Hierarchy of Controls



- Can the hazardous activity / process / use of equipment be justified?
- Can it be avoided or done by a safer method or equipment?
- Can the hazardous use of equipment be isolated or contained (e.g. in cabinet/room/enclosure)?
- Can the hazardous activities with the equipment be controlled at source e.g. by guards, ventilation controls etc.?
- Can the hazardous use of equipment be reduced in time / extent etc.?
- Can safe working practices be introduced?
- If PPE is to be used, is it the last means of resort and used to further reduce hazard?

#### Guarding Hierarchy



##### **Guards**

- Closed tools; fixed; interlocking (may need back-up depending on level of risk); self-closing; adjustable; distance; automatic; push-away; distance enclosures etc. Need for 'failure to safety'. Choice will depend on need for/frequency of access.

##### **Protective Devices**

- Isolation e.g. captive keys; run down timers; person sensing devices e.g. light or infra-red devices, pressure mats; tripping devices - activated by physical contact before injury occurs (may need braked motors); two hand control devices; 'scotches' etc. 'Failure to safety' if possible.

##### **Protection Appliances (part of a safe system of work)**

- Jigs; push-sticks; push blocks; holders.

Reliability, testing and maintenance of controls, guards and interlocks must be taken into account.

Information, instruction, training and supervision on safe use of controls / safe working methods must be given.

## **Appendix 7: Installation and Commissioning of Work Equipment**

The correct installation of work equipment is a vital part of helping ensure its safe use. Installation needs to cover items such as the services (eg type and availability of power, number / nature / location of outlets, availability and amount of general ventilation), special facilities (eg drainage / gas supply / extract / cooling / heating) as well as controls (eg number, location, and use in emergency, signage) and means of safe isolation.

Aspects such as facilitating safe maintenance and servicing are key eg installing work equipment in a suitable location and manner to allow adequate access. Space and clearance to get the work equipment into place and then to allow adequate room to do the maintenance operations thereafter must be ensured.

The environment in which the work equipment needs to operate is an important part of getting the installation correct. This will include aspects such as temperature, cleanliness, finishes for ease of cleaning, tripping hazards, leak tightness and lighting as well as emergency and loss prevention issues such as fire detection, protection against flood, back-up systems etc.

Part of the installation process will include commissioning and testing to ensure it meets specification and can be operated correctly and safely in the installed location.

Installation may be given scant thought when specifying and selecting work equipment. Often inadequate provision for it is made in estimates and costings yet it will be critical to successful and safe operation of the work equipment.

The requirements of PUWER include the need to ensure that where the safety of the work equipment depends on the installation conditions, that it is inspected after installation and before being put into service for the first time or after assembly at a new site or in a new location.



## Appendix 8: Safety in Use of Work Equipment

The risk assessment for safe use of work equipment should consider all the operations which have to be done with the work equipment. This includes installation, normal use, breakdown, set-up, servicing, maintenance, cleaning, removal of blockages, dismantling, removal, disposal etc.

A checklist containing a list of possible hazards with work equipment is given at Appendix 9. This may help in assessing risks presented by the work equipment and identifying hazards that require specific safeguards to be put in place. It should be noted that no checklist can hope to be completely exhaustive and that just because a hazard is not on the list does not mean it does not exist. The list may also stretch the concept of 'hazard' since it also includes activities or practices which comprise a group of hazards.

The following steps may help in risk assessment:

- Look at the equipment and decide what can cause risks and how they may arise
- Consider what measures can be implemented to prevent or reduce these risks
- Check what measures are already in place
- Decide whether any more measures need to be implemented
- Then do it

An aid to helping ensure all aspects of the use of the work equipment are considered is the mnemonic PEME (People, Equipment, Material, Environment) and this can help guide you through the thought processes for risk assessment:

### PEOPLE

- Who will use the equipment including their level of competence and have those who cannot speak or read English or with disabilities or special requirements such as young persons and expectant mothers been considered?
- What behaviours are possible eg the likelihood of horseplay or other foolish / careless acts?
- Experience
- Supervision
- Training and Qualifications
- Ergonomic issues – how the person interacts with the machines / activities
- Maintenance / Service Engineers eg is a permit to work required?

### EQUIPMENT

- Inherent risks
- Controls and links to other systems eg BMS, fire alarm, security
- Hierarchy of guards (see Appendix 6) and how well the guards are designed eg are they robust, do interlocks fail to safety, are the guards inconvenient to use or easily defeated, are there sufficient back-ups matched to the level of risk?
- Power supply whether electrical, mechanical (eg drive belts or rotating power take off shafts), hydraulic or pneumatic. Emergency back-up, assured supply, voltage spikes, lightning
- Signage

- Isolation for maintenance and in emergency as well as links / interlocks to other systems such as ventilation, power supply (on reinstatement of supply following interruption)

#### MATERIAL

- Are any hazardous materials required to be used?
- What hazardous exposures may result and how will it be controlled
- How will materials be safely delivered and removed?
- How will wastes be safely dealt with and disposed of?
- Does the equipment need decontamination before servicing (see form at Appendix 10), after use, before next use

#### ENVIRONMENT

- Adequate space?
- Ventilation
- Finishes
- Access
- Cleanliness?
- Lighting
- Temperature and humidity
- Spills and leaks

#### ***Before first use check:***

- Do any parts look dangerous?
- Are there guards and are they in place?
- Can the machine operate with the guards removed?
- Are the controls easily understood?
- Can dust or fumes escape from the machine?
- Is it excessively noisy?
- Is there excessive vibration?
- Are any exposed parts likely to be extremely hot or cold?
- Are there any live electrical parts which are exposed or easy to get at?
- Are there special features, e.g. slow speed running for use when setting up or cleaning ('inching')?
- Are the manufacturer's instructions clear and comprehensive?

#### **What can be done to reduce the risks?**

- Use the right equipment for the job – this may require planning ahead and checking that suitable equipment is available
- Make sure the machinery is safe:
  - Check it is CE marked, but do not place total reliance on this
  - Is there a declaration of conformity
  - Make sure you have the instructions (in English)
- Guard dangerous parts (see Appendix 6):
  - Use fixed guards if possible
  - If regular access is required which negates against use of a fixed guard, use interlocked guards
  - Use protective devices where the use of fixed or interlocked guards is difficult

- Check guards are convenient to use, not easy to defeat and do not overly inhibit work (which means an incentive to defeat, remove or otherwise circumvent)
- Think about materials of construction eg plastic is easy to see through but may get scratched in use; if wire mesh or bars are used ensure gaps are not large enough to allow access to the danger areas. Guards may also be combined with other functions such as dust extraction
- Make sure guards allow the machine to be cleaned and maintained and do not introduce other hazards such as blockages which may increase chances of their being defeated / removed
- Where guards cannot give full protection eg at circular saws, use protective appliances such as jigs, holders, push sticks etc to move the workpiece but keep the hands / fingers a safe distance away from the danger area
- Make sure the work equipment is correctly maintained and in good condition eg blades, tools and bits are sharp and appropriate for the material being worked on
- Select the right controls:
  - Position 'dead man's handles' or two hand controls at a safe distance from the danger area
  - Make sure start and stop buttons are readily accessible
  - Ensure control switches are clearly marked to show their function
  - Make sure operating controls are designed and positioned to avoid inadvertent operation eg use shrouded foot operating switches or hinge covers on start buttons
  - Use timed interlocks or trapped key systems to allow rundown and prevent operators entering the danger area before the machine has fully stopped
  - Have emergency stops within easy reach
  - Ensure re-starting after stopping requires use of the start control rather than simply re-setting a trip (emergency stops which require a key to re-instate them after tripping may be useful).
- Make sure hand tools are safe:
  - Hammers – avoid split broken or loose shafts and worn or chipped heads
  - Files – these should have a proper, secured handle and never be use as levers (they are brittle and will snap)
  - Chisels – the cutting edge should be sharp and to the correct angle. Do not allow the head of a cold chisel to spread to a mushroom – grind off the sides regularly. Use a blade guard for storage.
  - Screwdrivers – never use them as chisels and never use hammers on them (unless designed for this)
  - Spanners – avoid splayed jaws, scrap any that show signs of damage / slipping, have the correct sizes and take care not to overstrain eg by using excessive extension handles.
  - Saws – use a blade guard for storage
- Regular inspection by a competent person – keeping records
  - Check guards are in place and in good working order and after repairs, adjustments or modification
  - Check maintenance is up to date and completed
  - Routine checks eg daily and weekly on fluid levels, guards etc

- Preventive maintenance ie according to a planned preventive maintenance (PPM) schedule before it has broken down
- Lifting equipment (lifts, cranes, slings etc), pressure systems and local extract ventilation will require thorough examination by a competent person at laid down intervals
- Carry out maintenance safely:
  - Make sure the work equipment is safely isolated; ideally locked out and tagged out with power disconnected. Work on live equipment should be avoided if at all possible and, if required, subject to careful justification, authorisation and risk assessment eg by a permit to work procedure
  - For lines / pipes under pressure or containing hazardous material, isolate by closing and locking off valves (ideally more than one), depressurise and drain (a pressure gauge and / or test cock on line between isolating valves can help ensure isolation is sound before disconnecting 'critical' services) and disconnect or blank off
  - Support disconnected or loosened parts which could fall
  - Allow moving equipment to stop
  - Allow hot equipment time to cool or cold equipment time to warm up
  - Take great care with equipment and parts that have contained flammable solids / liquids / gases / dusts and thoroughly decontaminate, remembering that flammable liquids can remain in seams and joints of vessels and evaporate to create a flammable atmosphere if heated eg during welding or cutting
  - Ensure safe access if work on equipment is carried out at height
- Information, instruction, training and supervision:
  - Give operators the information they need and check they understand the instructions etc
  - Instruct on how to avoid risks eg correct starting procedure, how to safely clear blockages and other typical problems
  - Inexperienced staff will need higher levels of instruction and supervision before being allowed to go it alone
  - Supplement instruction by training so the staff understand the whole process and the reasons behind the precautions / safe working procedures / risk assessment conclusions
  - Ensure competence (knowledge, skill and experience) to operate the work equipment
  - Never assume an employee knows how to safely use an item of work equipment, especially if new or they claim to have operated similar equipment previously – good supervision requires you check this (by questioning) then see it demonstrated.
  - The greater the danger, the higher the level of training required
  - Young persons may be very skilful when moving and handling powered equipment but lack the experience / judgement to know when things will go or are going wrong and they are putting themselves and others at risk – supervision is important.

## **Decontamination**

Decontamination of work equipment which has been used with or exposed to hazardous material is important before access by maintenance / servicing staff or before that article is removed to another location, whether for repair or otherwise. Non-laboratory staff with no appreciation of the hazards of the materials used in

the equipment or of the relevant precautions required may be exposed or placed at risk from any hazardous contaminants. The hazardous contaminants must therefore be removed, made safe or clear instructions provided as to the precautions required. This must be identified on a declaration of contamination status form and suitable precautions identified. An example of a suitable form is given at Appendix 10.

## Appendix 9: Work Equipment Hazard Checklist\*

|                                 |                          |   |                                     |                                  |                          |
|---------------------------------|--------------------------|---|-------------------------------------|----------------------------------|--------------------------|
| <b><u>Mechanical</u></b>        |                          | <b><u>Radiation</u></b>                           | <b><u>Materials/Substances</u></b>  | Failure of controls              | <input type="checkbox"/> |
| Crushing                        | <input type="checkbox"/> | Noise (personal or env.)                          | Toxic or harmful material           | Emergency stop                   | <input type="checkbox"/> |
| Shearing                        | <input type="checkbox"/> | Vibration   | Vapours/gases                       | Inadvertent use (unshrouded)     | <input type="checkbox"/> |
| Cutting/Severing                | <input type="checkbox"/> | Infra-red   | Particles/aerosols                  | 'Inching' (eg speed/duration)    | <input type="checkbox"/> |
| Entanglement                    | <input type="checkbox"/> | Ultra-violet                                      | Biohazardous                        | Need for remote isolation        | <input type="checkbox"/> |
| Drawing in or trapping          | <input type="checkbox"/> | Microwave   | Explosive/energetic                 | Need for local isolation         | <input type="checkbox"/> |
| Impact                          | <input type="checkbox"/> | Other electro-magnetic                            | Corrosive                           | Interlocking (eg not hardwired)  | <input type="checkbox"/> |
| Stabbing or puncture            | <input type="checkbox"/> | Ionising ( $\alpha$ , $\beta$ , $\gamma$ or $x$ ) | Flammable                           | Failure to danger                | <input type="checkbox"/> |
| Friction/Abrasion               | <input type="checkbox"/> | Strong magnetic field                             | Mixing of incompatibles             | Inadequate back-up systems       | <input type="checkbox"/> |
| Falling/moving object           | <input type="checkbox"/> | <b><u>Ergonomic</u></b>                           | Generation/disposal of waste        | Automated systems                | <input type="checkbox"/> |
| Ejected material                | <input type="checkbox"/> | Poor posture                                      | <b><u>Workplace Environment</u></b> | Software error                   | <input type="checkbox"/> |
| Overspeed/Underspeed            | <input type="checkbox"/> | Arm and leg anatomy                               | Unsuitable location                 | Inadequate alarms/warnings       | <input type="checkbox"/> |
| <b><u>Electrical</u></b>        |                          | High repetition                                   | Inadequate/difficult access         | Inadequate signage               | <input type="checkbox"/> |
| Direct/Indirect (fault) contact | <input type="checkbox"/> | Poor location of controls                         | Ventilation                         | Auto/remote start issues         | <input type="checkbox"/> |
| Electrostatic                   | <input type="checkbox"/> | Excessive effort                                  | Lighting                            | Need for deadman's control       | <input type="checkbox"/> |
| Short circuit/overload          | <input type="checkbox"/> | Stress/mental overload                            | Temperature                         | Interaction with other systems   | <input type="checkbox"/> |
| Source of ignition              | <input type="checkbox"/> | Body size variation                               | Cleanliness/housekeeping            | Restart after power interruption | <input type="checkbox"/> |
| Ejection of molten particles    | <input type="checkbox"/> | Human error                                       | Flooring (non-slip, anti-static)    | <b><u>Energy Sources</u></b>     |                          |
| Voltage/frequency/phase         | <input type="checkbox"/> | Workplace Design                                  | Obstructions                        | Stored energy                    | <input type="checkbox"/> |
| Interruption of supply          | <input type="checkbox"/> | Visual fatigue                                    | Slips/trips/falls                   | Long run-down time               | <input type="checkbox"/> |
| Need for continuous supply      | <input type="checkbox"/> | Manual Handling                                   | Visibility                          | Pressure:                        | <input type="checkbox"/> |
| Speed of reinstatement          | <input type="checkbox"/> | DSE considerations                                | Work Surfaces                       | • Hydraulic                      | <input type="checkbox"/> |
| Thermal radiation               | <input type="checkbox"/> | Feeding/removal of parts                          | Strength of support                 | • Pneumatic                      | <input type="checkbox"/> |
| <b><u>Thermal</u></b>           |                          | Seating   | Stability of equipment              | • Steam                          | <input type="checkbox"/> |
| Hot or cold surfaces            | <input type="checkbox"/> |   | Outside (height/wind/leaks)         | • Other                          | <input type="checkbox"/> |
| Heat/cool local environment     | <input type="checkbox"/> |   | <b><u>Control and Process</u></b>   | Over-pressurisation              | <input type="checkbox"/> |
| Effect of temperature           | <input type="checkbox"/> |   | Poor design of controls             | Dissipation of Energy            | <input type="checkbox"/> |
|                                 |                          |   | Start/stop (clear, accessible)      | Need for braking                 | <input type="checkbox"/> |

*\*Note: this list is an aide memoire and not necessarily exhaustive - completion does not mean all potential hazards have been covered*

## Appendix 10: Declaration of Contamination Status Form

### Declaration of contamination status

**From** (owner of equipment): \_\_\_\_\_ **To:** \_\_\_\_\_

Address \_\_\_\_\_ Address \_\_\_\_\_

Reference \_\_\_\_\_ Reference \_\_\_\_\_

Telephone no. in case of emergency \_\_\_\_\_

Type of equipment \_\_\_\_\_ Manufacturer \_\_\_\_\_

Description of equipment \_\_\_\_\_

Other identifying marks \_\_\_\_\_

Model No \_\_\_\_\_ Serial No \_\_\_\_\_

Reason for work \_\_\_\_\_

**Is the item contaminated?**                      **Yes\***                      **No**                      **Don't know**

State type of contamination: biohazardous (including potentially infected material), chemicals, radioactive material or any other hazard: \_\_\_\_\_

**Has the item been decontaminated?**                      **Yes<sup>†</sup>**                      **No**                      **Don't know**

† What methods of decontamination / removing hazards have been used? Please provide details

Cleaning \_\_\_\_\_

Disinfection \_\_\_\_\_

Other \_\_\_\_\_

**Is any contamination remaining?**                      **Yes<sup>x</sup>**                      **No**                      **Don't know**

<sup>x</sup>Give reason, details and precautions required so it can worked on safely \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**This equipment has been decontaminated or a suitable safe method of work specified:**

Name \_\_\_\_\_ Signature \_\_\_\_\_

Position \_\_\_\_\_

Date \_\_\_\_/\_\_\_\_/\_\_\_\_ Tel \_\_\_\_\_

## **Appendix 11: Loan / Hire / Sale / Donation of Work Equipment for use at work by other Employers**

If NERC allows non-employees such as students, university researchers, visitors or contractors to use its work equipment ('has control to any extent of work equipment') then it also has responsibility to ensure it is safe to use. In addition NERC needs to make reasonable attempts to find out what the equipment will be used for and provide advice on its safe use. This would include ensuring it has been inspected and checked since it was previously loaned out; remains in safe working condition; is accompanied by any instructions necessary for its safe use and, if necessary (eg for complicated, specialised equipment or that which has particular aspects necessary to ensure its safe use), that suitable training and instruction on its safe use is given. However, the safe use of the equipment is the responsibility of the person who has taken it on loan or hired it in.

It is not advisable to allow contractors or employees of other employers to borrow or use NERC equipment without careful consideration of the issues involved. This might include the need to drawing up suitable agreements as to maintenance and testing of equipment (eg electrical safety testing), laying down minimum competence levels for users, providing safety instructions and information, specifying training required etc..

PUWER does not create duties on persons who sell work equipment for use at work. However, duties on persons who design, supply or sell work equipment are created by other legislation such as section 6 of the HASAWA 1974 (as amended by the Consumer Protection Act 1987) and by the Supply of Machinery (Safety) Regulations 2008 to ensure it is safe to use at work. One example would be that if NERC designs or manufactures equipment which is then sold or supplied for use at work by another employer, we must ensure it is safe for use, which within the EEA may include providing a certificate of conformity and CE marking. The best way to meet these duties, if it is not possible to do so utilising in house expertise and resource (which is liable to be onerous), is to engage a specialist contractor who will either manufacture the work equipment and / or ensure the necessary assessments and certificates of conformity are produced.

The duty to ensure equipment supplied for use at work is safe may also affect NERC if we donate or sell second-hand work equipment to another organisation. The best way of avoiding or minimising the responsibility for this is by supplying, donating or selling work equipment through a specialist third party, such as a legitimate equipment manufacturer or supplier, who then takes on responsibility to ensure it is safe to use at work before it is moved on to another user. One example would be returning equipment to the original manufacturer / supplier in exchange for credit or a discount on new equipment.

If it is sold or donated to another employer for re-use at work then an option is to obtain some form of disclaimer (a possible template letter is at Appendix 12). However, a disclaimer is unlikely to entirely dispense NERC's responsibilities to ensure it is safe for use at work and the supply of maintenance records, instruction booklets and other documentation on its safe use would still be advisable. High risk equipment should not be donated without special consideration of the issues. Work equipment that has been used with hazardous or dangerous substances should be accompanied by a declaration of contamination status form.



## Appendix 12: Loan or Donation Letter

[Name and address of Centre / Survey]

Date:

[Name and address of Recipient]

Dear [Name of Recipient],

### Sale/Donation\* of Second-hand Equipment

The second-hand equipment described in the schedule below (the "Equipment") is sold / donated\* to you on the following conditions:

1. The Equipment sold/donated is subject to agreement by the Recipient that he will inspect, service and maintain the Equipment to ensure that, so far as is reasonably practicable, the Equipment will be safe and without risk to health when properly used for the purpose for which they it is designed to be used.
2. The Equipment is provided at the Recipient's risk and in a state of condition 'as is' with no representation or warranty, express or implied, made as to the utility, safety or activity of the Equipment. [Name of Centre/Survey] shall not be liable for any loss, harm, illness or other damage or injury arising from the recipient organisation's receipt, handling, use or storage of the Equipment.
3. The Equipment is marked with an identifier eg serial number which is specified in the schedule below.

### The Schedule

Description of Equipment:

Identifier (e.g., Serial or Plant Number):

Yours faithfully,

Signature: .....

Name (Capitals) .....

I agree to the sale/donation\* of the following Equipment [insert brief description & identifier] on the above conditions.

For the Recipient: [Name of Recipient Organisation]

Signature: .....

Name (Capitals): .....

Position: .....

\*delete as appropriate

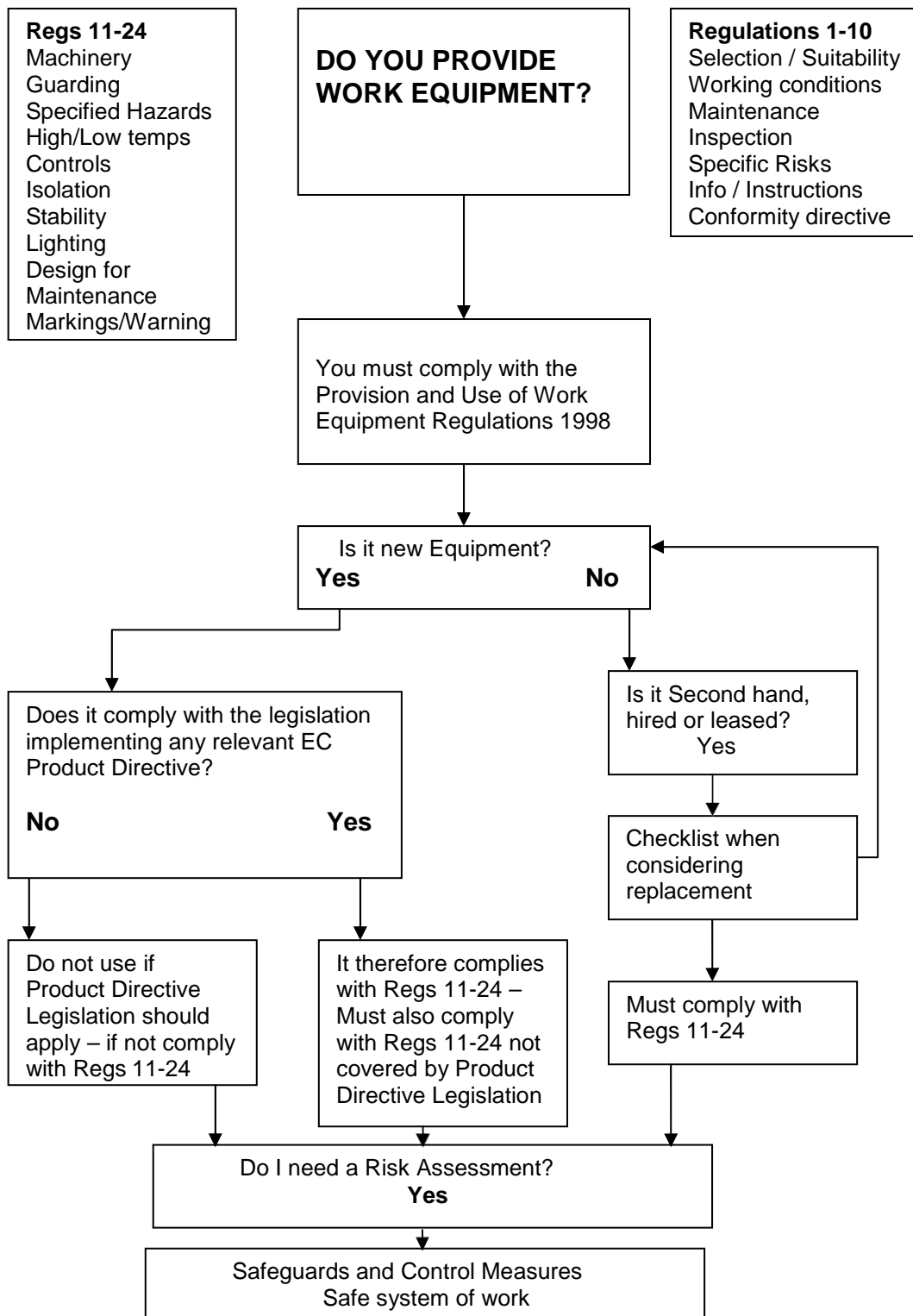
## Appendix 13: Disposal of Work Equipment

When it is wished to dispose of work equipment that is no longer wanted, the following aspects of the disposal should be taken into account:

- Decontamination – all hazardous or dangerous substances should be removed if it can be done safely and without excessive cost / effort. If there still remains some residual contamination this must be taken into account in choosing the route of disposal and ensuring it is dealt with safely and in an environmentally sound manner. It may be that only certain components need to be removed eg batteries containing lead or cadmium lamps containing mercury before disposing of the rest.
- Prevention of unauthorised re-use – some items may need to be destroyed or made unusable if there is a possibility they could be re-used and it is deemed that further use is inappropriate or may be unsafe.
- Removal of labels, NERC markings and hazard warnings – if equipment has been decontaminated and is safe for disposal, any warning signs that are no longer applicable and may be misleading or cause unnecessary concern, should be removed. This might include signs or labels showing where the equipment originated from if this could create issues.
- WEEE Regulations – the provisions of the Waste Electrical and Electronic Equipment Regulations must be complied with. If new electrical or electronic equipment is purchased, the producer registration number will help disposal at the end of the product life. Otherwise waste electrical and electronic equipment must be segregated and disposed of via an approved route, which will not include general waste.
- Re-use – if an item of equipment is no longer required for use on the site or within the Research Centre but still has a useful working life left and remains in safe working order, then re-use within another part of NERC may be worth investigating. This can be the best environmental option and allow investment to be maximised. If re-use within NERC is not possible or worthwhile and it is sold, loaned or donated for re-use elsewhere then the matters specified in Appendix 11 must be taken into account.
- Recycling – if the redundant work equipment is not to be re-used then elements of it may be recycled. The WEEE Regulations will form part of this but other items of work equipment may contain parts that can be recycled eg metals and your disposal arrangements should encourage this, provided there are no other risks associated eg residual contamination.
- Refrigerators – these pose several risks:
  - Exposure to residual contamination if used in laboratories. Redundant laboratory fridges should never be sold or pressed into service for domestic applications where they may be used to store food or other consumables

- trapping children or other persons if they are inappropriately stored awaiting final disposal with their door and any locking mechanism left intact. The door of redundant refrigerators should be removed or locks made inoperable.
  - ozone depletion from refrigerant gases or from CFC materials contained in their insulating foam.
- Removal of refrigerant gases – all redundant refrigerators should be degassed and have their refrigerant gas removed before final disposal, which can be done on site before disposal with the waste gas collected and either re-used or sent for correct disposal eg by incineration for CFCs.
  - Redundant refrigerators should only be disposed of via suitable specialist organisations
  - Use of accredited contractors – ensure details of the disposal of redundant work equipment and any steps taken to make it safe are kept. Only use suitably accredited and authorised disposal contractors. Allowing staff to take home redundant equipment is unwise unless it is patently safe and a loan or donation form is obtained (see Appendix 12). For hazardous or special waste it will be necessary to keep waste transfer notes and obtain certificates of final disposal from the waste disposal contractor
  - Radioactive sources – some waste work equipment may contain radioactive materials and sources, even if this is not immediately obvious from the exterior of the equipment. Likely examples are ionising smoke detectors and certain laboratory equipment such as scintillation counters. Such items must not enter normal waste streams unless the radioactive source is first removed. The Radiation Protection Supervisor will have a record of all equipment containing radioactive sources (unless exempt like smoke detectors) and will need to record disposal of sources. It is very poor practice to remove and store radioactive sources without first making arrangements and ensuring funding for their disposal. Long term storage of redundant sources in anticipation of future disposal is not acceptable. This is liable to be ultimately expensive and can lead to loss of control or breaches of permits. If buying new equipment containing radioactive sources to replace old ones, purchase negotiations should attempt to include collection and disposal of the old sources by the supplier as part of the purchase price.
  - Removal from maintenance / service records – ensure that when disposing of redundant work equipment, maintenance records are updated as showing the equipment is no longer present on site. This can save on maintenance contracts for non-existent equipment and time wasted searching for equipment that is no longer present.

## Appendix 14: PUWER Flow Diagram



## Appendix 15: Index of Protection

| <b>First Number<br/>(protection<br/>against solid<br/>objects)</b> | <b>Definition</b>   | <b>Second Number<br/>(protection<br/>against liquids)</b> | <b>Definition</b>  |
|--|---|---|--|
| 0  | No protection   | 0   | No protection  |
| 1  | Protected against solid objects over 50 mm (eg accidental touch by hands)   | 1   | Protected against vertically falling drops of water  |
| 2  | Protected against solid objects over 12 mm (eg fingers)                     | 2   | Protected against direct sprays up to 15° from the vertical  |
| 3  | Protected against solid objects over 2.5 mm (eg tools and wires)            | 3   | Protected against direct sprays up to 60° from the vertical  |
| 4  | Protected against solid objects over 1 mm (eg tools, wires and small wires) | 4   | Protected against sprays from all directions – limited ingress permitted                           |
| 5  | Protected against dust – limited ingress (no harmful deposit)               | 5   | Protected against low pressure jets if water from all directions – limited ingress permitted       |
| 6  | Totally protected against dust  | 6   | Protected against strong jets of water eg for use on ship decks – limited ingress permitted        |
|  |   | 7   | Protected against effects of temporary immersion between 15 cm and 1m. Duration of test 30 minutes |
|  |   | 8   | Protected against long periods of immersion under pressure   |

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