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Provision and Use of Work Equipment (PUWER) - Arrangements and Procedures

Operational Owner: *Martin Vinnell, Director of Health, Safety and Regulated Facilities*
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HSD047P The Use of Lifting Equipment in the University of
Cambridge
HSD046P Pressure Equipment

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1 Provision and Use of Work Equipment (PUWER) - Arrangements and Procedures

1.1 Purpose

The purpose of this document is to inform University Departments of the requirements of the Provision and Use of Work Equipment Regulations (PUWER) 1998 and give advice on how to ensure they comply with the legal requirements of this legislation.

1.2 Aim

The University as an employer has a legal obligation to effectively manage ALL work equipment, irrespective of where it is used e.g. workshops, laboratories, office spaces, kitchens, gardens etc., and to ensure that it is both 'safe to use' and is 'used safely' regardless of its age or origin. This includes equipment that is hired, borrowed or manufactured in-house. Work equipment has the potential for serious personal injury and significant damage to property if the work equipment is not managed safely. The principal aim of this document is to reduce the risks to staff and students who use work equipment and to enable Departments, through adoption of the advice given, to assess and minimise the risk to all who use work equipment.

1.3 Objectives

To achieve these aims the University has the following objectives:

- to inform the University of the risks involved when using work equipment and the requirements of the PUWER Regulations
- to explain the safety responsibilities Departments need to fulfil to meet these requirements
- to explain how to manage work equipment within the Safety Management System
- to give advice and tools to the University to enable staff to assess and reduce risk when using work equipment, including risk assessment methods, maintenance and inspection methods, and training
- to provide additional support to the University via the Safety Office to assist Departments with assessment of use of machinery risk
- to provide training to Departments on the safe use of work equipment
- to update this document regularly to ensure Departments are kept up to date with any changes.

1.4 Scope

This document applies to **all** University Departments who use work equipment irrespective of whether the equipment is owned or not, or who provide work equipment to others to use (e.g. for loan or hire). For the purpose of this document, work equipment covers any machinery, appliance, apparatus, tool or installation for use at work.

The advice and templates provided in this document, or equivalent methods, should be adopted by Departments to ensure compliance with the requirements of the PUWER Regulations 1998. Failure to comply with the University's health and safety requirements may lead both to disciplinary action by the University and potential legal action by enforcement authorities.



This document will be reviewed at intervals of not more than every 3 years.

1.5 Legislation and PUWER

The [Health and Safety at Work etc. Act 1974](#) places 'Duties on the employer' as follows:

- **Section 2(1) 'Ensure, as far as is reasonably practicable, the health, safety and welfare of employees.'** It is a requirement that the University protect all people, all of the time, with the ambition to ensure zero harm.
- **Section 2(2)(a) 'Provide and maintain plant and systems of work which are safe and without risk to health.'** This means that the University must maintain equipment and systems that are appropriate. Users should be aware that machinery cannot be made safe only by design. Human factors i.e. the way a machine is being used can contribute to the risks, rather than the design of the machine itself.
- **Section 2(2)(c) 'Provide information, instruction, training and supervision to protect employees.'** The main emphasis as far as machinery equipment safety is concerned is the introduction of requirements for 'systems of work' and the concept of managing residual risks through the application of information, instruction and training.

In addition to the legal obligations detailed above, PUWER requires that equipment provided for use at work:

- is **suitable** for the intended use
- is **safe** for use, **maintained** in a safe condition and **inspected** to ensure it is correctly installed and does not subsequently deteriorate
- any **adaptation** of the equipment is carefully **managed** to ensure safety
- is used only by the people who have received adequate **information, instruction and training**
- accompanied by suitable **health and safety measures** such as protective devices and controls. These will normally include emergency stop devices, adequate means of isolation from sources of energy, clearly visible markings and warning devices
- has **mitigation** from specified hazards or extremes of temperature
- is used in accordance with the **specific requirements** for mobile work equipment and power presses.

PUWER cannot be considered in isolation from other health and safety legislation. These include:

- [The Supply of Machinery \(Safety\) Regulations 2008 \(as amended\)](#)
- [The Lifting Operations and Lifting Equipment Regulations 1998 \(LOLER\)](#)
- [The Pressure Systems Safety Regulations 2000 \(PSSR\)](#)
- [The Personal Protective Equipment at Work \(Amendment\) Regulations 2022 \(PPE\)](#)
- [The Management of Health and Safety at Work Regulations 1999 \(MHSWR\)](#)

This document describes the duties on the University in relation to these Regulations.



1.6 Terminology, Definitions and Abbreviations

The terminology, definitions and abbreviations used in this document are detailed in Appendix 12. However, the following PUWER specific definitions should be noted:

Work Equipment: For the purposes of this document, work equipment covers any machinery, appliance, apparatus, tool or installation for use at work (whether exclusively or not) including:

- 'toolbox tools' such as hammers, knives, handsaws, meat cleavers, etc.
- single machines such as drilling machines, circular saws, photocopiers, dumper trucks, etc.
- apparatus such as laboratory apparatus, etc.
- lifting equipment such as hoist, lift trucks, elevating work platforms, lifting slings, etc.
- other equipment such as ladders, lawnmowers, pressure water cleaners, etc.
- an installation such as a series of machines connected together or enclosure for providing sound insulation or scaffolding or similar access equipment
- departmental vehicles.

Reference should be made to Appendix 1 for a more detailed list of equipment in scope under PUWER.

Low/High Risk Work Equipment: For the purposes of this document, work equipment can be considered as 'low risk' or 'high risk' where:

- *Low Risk Work Equipment:*
 - portable battery powered tools
 - hand tools
 - sack trucks/gas bottle trolleys
 - office equipment e.g. shredders, photocopiers, printers, guillotines
 - smaller pieces of analytical laboratory equipment (weighing scales/balances)
 - lifting equipment
 - access equipment.
- *High Risk Work Equipment:*
 - workshop type equipment (machines) such as lathes, pillar drills, milling machines, saws, machine tools etc.
 - series of machines connected together
 - work vehicles (forklift trucks, vans)
 - power presses and machinery.

Use of Work Equipment: Any activity in relation to work equipment including:

- erecting work equipment, e.g. initial set up or setting up an experiment with existing equipment
- programming work equipment
- installation of work equipment
- using work equipment – setting, starting, stopping including variations for different tasks



- maintaining work equipment
- cleaning work equipment
- modifying work equipment
- dismantling and disposal of old work equipment.

Danger Zone: Any zone in or around machinery in which a person is exposed to a health and safety risk from contact with a dangerous part of machinery or rotating stock bar. We have to look not solely at protecting the operator in normal use, but we need to identify who else could be at risk and ensure that they are protected as well.

1.7 PUWER Process Decision Tree

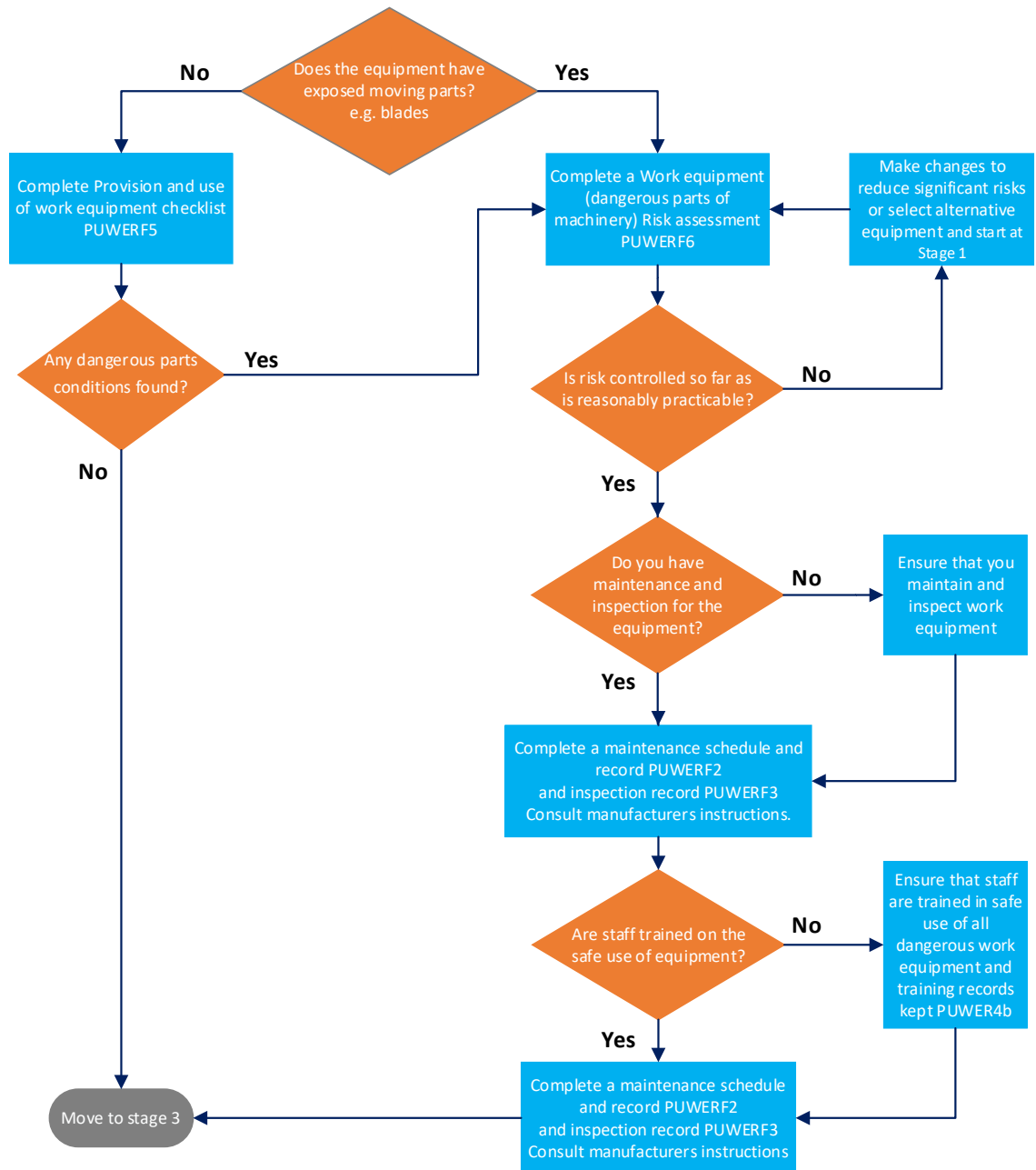
The following PUWER process decision tree should be followed when selecting, before using and when reviewing, work equipment.



Stage 1: When selecting work equipment



Stage 2: Before using work equipment



Stage 3: Review

Review risk assessments at least every 5 years or as use/location changes.
Include work equipment, training record, maintenance record reviews in Departmental safety inspections and record actions.
Investigate accidents involving work equipment.
Report significant findings to the DSO and Departmental safety committee.

2 Implementation

If work equipment is used in your Department it is essential that the Head of Department (HoD) has arrangements and procedures in place to ensure the safety of, and safe use of, the work equipment. This should also include the production of an Asset Register of all work equipment covered by PUWER (see Appendix 2 for an example Asset Register). It should be noted that the definition of 'use' is wide and includes **all** activities involving work equipment.

2.1 Roles and Responsibilities for Work Equipment

In any safety procedure it is important to recognise who is responsible for ensuring the procedure is applied. The HoD must ensure that there are named individuals who cover the roles outlined in the table below.

Role	Responsibilities
Head of Department	Has overall responsibility for ensuring the implementation of the requirements of PUWER
Designated Responsible Person for Machinery Safety (DRPMS) <i>N.B. the DSO or Workshop/Lab Manager could take on this responsibility¹</i>	Is responsible for implementing PUWER and other associated Regulations within the department.
Departmental Safety Officer (DSO)	Is responsible for ensuring <u>documented</u> procedures are in place for: ✓ the risk assessment of all work equipment including the review of assessments at regular intervals ✓ work equipment/user training and the maintenance of up-to-date training records ✓ the statutory inspection of work equipment which is booked and completed prior to expiry and includes the maintenance of statutory inspection records under LOLER, PUWER and PSSR ✓ planned scheduled maintenance of work equipment ✓ the inspection of work equipment as part of departmental safety inspections and audits

¹ It is understood that certain staff may hold a number of concurrent roles and the Designated Responsible Person for Machinery Safety (DRPMS) role. This is not considered to be a conflict of interest or compromise the integrity of the system. Any member of staff who feels conflicted should speak to their Head of Department.

Role	Responsibilities
	✓ the reporting of all accidents/incidents relating to work equipment, including investigations as necessary and risk assessment review following each incident ✓ lone working.
Workshop/Lab Managers	Must complete the requisite training to ensure the required competence for undertaking work equipment risk assessments. They are responsible for: ✓ maintaining asset lists for work equipment in their area ✓ completing and recording work equipment risk assessments ✓ ensuring training is completed by every user ✓ maintaining up to date training records, which where necessary include provision for refresher training ✓ restricting access to work equipment to only trained operators ✓ ensuring a maintenance schedule is in place and completed for each piece of equipment ✓ the maintenance of statutory inspection records under LOLER, PUWER and PSSR ✓ ensuring PPE is issued and used where necessary ✓ withdrawal / isolation of unsafe equipment to prevent it from being used.
Work equipment operator	Is responsible for ensuring: ✓ they read, sign, and adhere to work equipment risk assessments and only work on equipment where this has been completed ✓ complete and keep a record of equipment specific training before operating equipment ✓ use work equipment safely in accordance with instruction and training ✓ report to the Workshop/Lab Manager any hazards and defective equipment immediately ✓ assist with/help write and review equipment risk assessments from an operator's perspective ✓ promptly report accidents/incidents and assist with investigation as necessary ✓ follow lone-working procedure at all times ✓ wear PPE issued for working with equipment and ensure it is maintained and safely stored when not in use.

Role	Responsibilities
All staff/students/ visitors	Must ensure: ✓ they do not enter workshops/labs without authorisation from the supervisor ✓ they report any knowledge of unauthorised access/use to the Workshop/Lab Manager or DSO ✓ the prompt reporting of accidents/incidents and near misses involving equipment to the DSO.



3 Arrangements to Meet PUWER Requirements

It is essential that work equipment and how it is used is considered in your Departmental Health and Safety arrangements and procedures. The arrangements to meet the requirements of PUWER should form part of the Safety Management System, and should be based on the 'Plan-Do-Check-Act' (PDCA) process which ensures that people who own the risk manage the risk and that any process leads to continuous improvement; as outlined in Section 4 of the University Health and Safety Policy [hsd016m \(cam.ac.uk\)](https://www.cam.ac.uk/hsd016m).

The Health and Safety Executive Guidance (HSG65) explains the PDCA process fully (see [Managing for health and safety \(hse.gov.uk\)](https://www.hse.gov.uk/Managing%20for%20health%20and%20safety/)).

The key elements to the arrangements under the Regulations are as follows:



3.1 Suitability of Work Equipment

What the Regulations require	✓ Work equipment is constructed or adapted to be 'suitable for the purpose' for which it is used or provided. ✓ When selecting work equipment, due regard is given to working conditions and any additional risks posed by its use. ✓ Selection of work equipment is subject to risk assessment.
Safety points to consider	1. When obtaining new equipment (either bought, hired, loaned, second hand etc.), it is checked for suitability for the task including, design purpose, electrical protection, zoning, safe working loads, Declaration of Conformity, specification for spare parts, maintenance and inspection requirements etc.² 2. All equipment is suitable for its environment, e.g. use in wet/humid conditions etc. 3. All new, second hand or built in-house work equipment is risk assessed for its intended use. Risk assessments must include consideration of initial integrity, the place it will be used, the purpose for which it will be used.³ 4. Where changes are made to the design, function or safety of work equipment the extent of the changes made must be risk assessed (e.g. significant new hazards or control measures). Refurbished and modified machinery must be safe and meet the full requirements of PUWER.
Documentation/form needed	1. A register of all work equipment covered by PUWER, if not covered under other inspection regimes e.g. PSSR (see Appendix 2 for an example register) 2. Suitability of Work Equipment Checklist PUWERF1 (Appendix 3)
Specific guidance for further information	HSE Buying New Machinery INDG271

² It is essential that prior to 'use' e.g. when selecting equipment, the Supply of Machinery (Safety) Regulations 2008 are considered.

³ The focus should be on identifying 'who is at risk, when they are at risk, how they are at risk', and solving those issues.



3.2 Maintenance of Work Equipment

What the Regulations require	✓ Work equipment is maintained in efficient working order and in good repair. ✓ Maintenance logs are kept for high-risk equipment. ✓ Maintenance is carried out by competent persons, with correct knowledge, skills and experience. ✓ A maintenance programme which is based upon: (a) intensity of use – frequency and maximum working limits (b) operating environment – outdoors, wet, etc. (c) variety of operations – is the machine performing the same task all the time or does it change? (d) risk of malfunction or failure. ✓ Maintenance can be planned preventative, condition based, or upon breakdown.
Safety points to consider	1. Maintenance schedules have been produced for each piece of high-risk equipment. 2. Maintenance programme conforms to manufacturer's guidance (if available) and HSE Specific Machinery Guidance. 3. Maintenance is carried out by competent staff with the correct knowledge skills and experience. 4. Records are kept of maintenance. 5. Maintenance records are checked by supervisors during inspections and action is taken to resolve any lack of maintenance identified.
Documentation/form needed	Maintenance Schedule / Log PUWERF2 (Appendix 4)
Specific guidance for further information	1. Work equipment and machinery - HSE webpage 2. HSE PUWER Approved Code of Practice and Guidance L22



3.3 Inspection of Work Equipment

What the Regulations require	✓ Ensure that when installation conditions require inspection for the safety of work equipment, these are completed and recorded. Inspection includes both after installation and before it is put into service and after assembly at another location. ✓ Ensure that where there is potential for deterioration, equipment is inspected at suitable intervals. ✓ The inspection programme should be based on supplier guidance, statutory requirements (e.g. lifting equipment thorough examination), intensity of use, environmental conditions, past history, expert advice, human factors (users), consequence of failure, and known or suspected serious damage. ✓ Where there is substantial change in the nature of use, major modification or repair involving a piece of equipment, a new risk assessment is completed, instead of an inspection.
Safety points to consider	1. Each piece of work equipment should be assessed to see what inspection is required and a programme schedule drawn up. 2. Inspection expectations are clearly communicated to users. 3. Inspections are recorded. 4. A system is in place to isolate/remove any defective equipment from service immediately (e.g. quarantine or tagging system). 5. Workplace inspections include inspection of log reviews.
Documentation/form needed	1. Equipment Inspection Programme Template: PUWERF3 (Appendix 5) 2. Inspection logs
Specific guidance for further information	1. HSE Safe use of Woodworking Machinery L114 (includes further details of inspection and logs) 2. IET Code of Practice for In-service Inspection and Testing of Electrical Equipment (5th Edition)

3.4 Specific Risks

What the Regulations require	✓ Ensure the use of equipment with specific risks (e.g. lasers, electrical, unguarded hazards etc.) is restricted to those who are given the task of using it. ✓ Ensure that repairs, modifications, maintenance and servicing is restricted to those designated and specifically trained/competent to carry this out where competency is based on knowledge of the equipment, knowledge of the process, knowledge of the environment.
Safety points to consider	1. Equipment training programmes are in place for operators and engineers. 2. Equipment is isolated, or has restricted access by location, and/or a key holder/access policy is in place. 3. Lock-off and isolation procedures are in place to make equipment safe during maintenance, when unsafe conditions develop or when a temporary situation makes it unsafe to use the equipment. 4. Induction training is in place which emphasises local hazards to operators. 5. Equipment training logs are checked before equipment is allowed to be used by an individual.
Documentation/form needed	1. Access policy – forms part of the arrangements section in Departmental Health and Safety Policy 2. Equipment Training Records PUWERF4a and PUWERF4b (Appendix 6)
Specific guidance for further information	HSE PUWER Approved Code of Practice and Guidance L22

3.5 Guarding Dangerous Parts of Work Equipment

What the Regulations require	✓ Where machinery has moving parts, guarding must be used to control risk and minimise injury.
Safety points to consider	1. Ensure that machinery has guarding. (a) Fixed guards should always be used when possible, these are fixed with screws and bolts which need tools to remove them. (b) Where regular access is needed to parts of a machine and a fixed guard is not possible, an interlocked guard is used. (c) On some machinery, an automatic guard or safety device e.g. photoelectric system is used instead of a guard. If this is the case, ensure it works before use. (d) If guards cannot give full protection, use jigs, holders, push sticks etc. to move the work piece. Are these available? Do staff know how to source/make them? 2. Consider the best materials for guards – plastic is easy to see through but can be easily scratched or damaged. If wire mesh or similar is used ensure the holes are not big enough to allow access to the danger area. As well as preventing such access a guard can also be used to prevent harmful dust, fluid etc. from escaping. 3. Check that guards are convenient to use and not easy to defeat. If they are, consider modification (you can always improve guarding even on new machines). 4. Ensure that guarding is highlighted in machinery use training and included is risk assessment and safe operating procedures. 5. Ensure that guarding checks are included in workplace inspections.
Documentation/form needed	Guarding should be considered in risk assessments PUWERF5 (Appendix 7) and PUWERF6 (Appendix 8)
Specific guidance for further information	HSE PUWER Approved Code of Practice and Guidance L22 (see p36)



3.6 Protection against Specified Hazards

What the Regulations require	✓ Where a person could be exposed to any of the specified hazards listed below, the hazard is prevented or adequately controlled using measures other than PPE or information, instruction, training and supervision. Measures include where appropriate, measures to minimise the effects of the hazard as well as to reduce the likelihood of the hazard occurring. Specified hazards: (a) Any article or substance falling or being ejected from the work equipment e.g. Swarf. (b) Rupture or disintegration of parts of the work equipment e.g. abrasive wheel bursting. (c) Work equipment overheating or catching fire e.g. due to a thermostat failing. (d) The unintended or premature discharge of any article or of any gas, dust, liquid, vapour or other substance which is produced, used or stored in the work equipment e.g. a pressure build-up leading to bursting and an unplanned ignition of a flammable gas.
Safety points to consider	1. Equipment must have clear markings and warnings for reasons of health and safety.⁴ 2. Work equipment must be stabilised or clamped where necessary to ensure they do not move or rock during use. This should be done each time the equipment is repositioned. 3. Risk assessments contain detail of any of the specified hazards including consequences of exposure and control measures to prevent/minimise them. 4. If it is not reasonably practicable to eliminate exposure, monitoring, control systems and ventilation have all been considered as a control measure in addition to PPE and training. 5. Risk assessments do not rely totally on manufacturer's guidance but also consider the environment that they are being used in e.g. high temperatures, vibration or flammable atmospheres.

⁴ Equipment must have clear markings and warnings for reasons of health and safety (e.g. Start/Stop controls, hazard warning symbols, maximum speed for rotating parts, frequency of inspection etc.). Markings must be visible and inclusive to all who need to see them by considering the diversity of the workforce. Warnings can be visual or audible and must be associated with the equipment it is intended for.

	6. If a consequence of use could give rise to risks e.g. a hazardous substance being discharged, pressure burst etc., there are measures in place to contain the risk, e.g. directed to a safe place, contained. 7. Training for use of machines includes how to operate the machines to minimise the likelihood of the risk occurring and the safeguards needed to prevent exposure to risk.
Documentation/form needed	Risk assessment PUWERF5 (Appendix 7) and PUWERF6 (Appendix 8)
Specific guidance for further information	HSE PUWER Approved Code of Practice and Guidance L22 (see p39 and p41 re. abrasive wheels)



3.7 Controls

What the Regulations require	✓ Every piece of work equipment has a start control and controls for controlling speed, pressure or other operating conditions, where such conditions after the change in speed etc. result in risk to health and safety which is greater than or of a different nature from such risks before the change. ✓ The selection and siting of operating controls for work equipment should reduce the risks to operators.
Safety points to consider	1. Two handed or 'hold to run' controls are used where possible and are located at a safe distance from the danger zone. 2. Stop and start buttons are easily accessible. 3. Control switches are clearly marked and show what they do. 4. Operating controls are designed and located to avoid accidental operation e.g. shrouding. 5. Where appropriate, machines have emergency stops (e-stops) within easy reach – multiples have been considered on larger machines where a single stop may be hard to reach so that they can be operated quickly in an emergency. Consider the best location for the e-stop e.g. knee or floor operated may be better. 6. If retrofitting emergency stop controls to a machine (that did not previously have one), ensure that fitting them will not cause other risks e.g. some machines need power to operate the brakes. 7. Ensure that machines can only be restarted after a stoppage with a start control. It should not be possible to start a machine simply by resetting a device e.g. interlocked guard.
Documentation/form needed	Controls should be considered in risk assessment PUWERF5 (Appendix 7) and PUWERF6 (Appendix 8)
Specific guidance for further information	HSE PUWER Approved Code of Practice and Guidance L22 (see p43)

3.8 Information, Instruction and Training

What the Regulations require	✓ Users and operators are given adequate and comprehensive health and safety information and where appropriate written instructions. ✓ All users and supervisors are given adequate health and safety training in methods to be adopted in equipment use, any risk which such use may entail and precautions to be taken.
Safety points to consider	1. A training specification is written for each piece and type of equipment (see detail of how to do this in HSE L114 and Appendix 6). 2. Manufacturer's instructions and safety information are included within the training specification. 3. Training explains the dangers, how to reduce the danger and information about any additional health risk and how to reduce them (e.g. inhalation of dust). 4. Training is given to every operator for each piece and type of equipment before use. 5. Safety Do's and Don'ts are completed for each piece of dangerous equipment in the risk assessment and communicated to users in training. Users have access to these risk assessments when operating machines. 6. Safety training records are checked during inspections and any inconsistencies addressed.
Documentation/form needed	1. Equipment Training Records PUWERF4a and PUWERF4b (Appendix 6) 2. Reference to training record checks to be included in workplace inspections
Specific guidance for further information	1. HSE PUWER Approved Code of Practice and Guidance L22 2. HSE Safe Use of Woodworking Machinery L114

3.9 Conformity with Community Requirements

What the Regulations require	✓ All work equipment put into use (post 1993) must comply with other directives (e.g. Machinery Safety Directive, Pressure Equipment Directive, Environmental Noise Directive etc.). ✓ All work equipment has a CE/UKCA marking which indicates Declaration of Conformity proving the product meets the relevant legislation. Most new work equipment that is classified as machinery will also fall within the scope of the Supply of Machinery (Safety) Regulations. Under these regulations equipment must undergo conformity assessment and be appropriately CE/UKCA marked before being placed on the market or brought into use.
Safety points to consider	1. If equipment is built in house, contact the Safety Office to see how the Declaration of Conformity can be achieved. 2. Check and record other requirements when considering the use and/or purchase of work equipment. 3. Check for CE/UKCA marking and a certificate of conformity when purchasing any machinery or equipment.⁵ 4. Ensure that there are clear instructions in English.
Documentation/form needed	The Safety Office can assist with documentation.
Specific guidance for further information	1. Lifting Operations and Lifting Equipment - See the University guidance: HSD047P 'The Use of Lifting Equipment in the University of Cambridge' hsd047p (cam.ac.uk) 2. Pressure Systems - See the University guidance: HSD046P 'Pressure Equipment' hsd046p (cam.ac.uk) and HSD194P 'Working Safely with Pressure Systems' hsd194p (cam.ac.uk)

⁵ The responsibility for ensuring purchased equipment meets required standards should be with the person requesting/ordering the equipment and Declaration of Conformity Documentation should be requested with the equipment to ensure the University only purchases work equipment of acceptable standards. Operating Manuals should also be asked for as this will give guidance on how to use it, safety features & maintenance guidelines.



	3. Mobile Work Equipment - See HSE guidance L22.⁶ 4. Woodworking Equipment - Because of the inherent risks associated with woodworking machines separate guidance is available from the HSE: Safe Use of Woodworking Machinery Approved Code of Practice and Guidance L114
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⁶ Roll-Over Protective Structures (ROPS) should be fitted to mobile work equipment where necessary to minimise the risk to persons, should roll over occur.

4 Risk Assessment of Work Equipment

Under the Management of Health and Safety at Work Regulations 1999, all potentially hazardous equipment, whether new or second-hand, should be assessed irrespective of its age or origin.

What the Regulations require	✓ All work equipment must be subject to risk assessment. ✓ Where a significant risk is determined, a written record should be kept of the risk assessment. ✓ Risk assessments should be completed before use, when the location/use changes, and when an incident/accident occurs with a machine.
Safety points to consider	1. The Department has adopted the PUWER risk assessment procedure in this guidance or has an alternative method to this standard or above. 2. Each piece of work equipment is risk assessed. 3. Risk assessments are included in training and made accessible to all operators. 4. The formal risk assessment should be reviewed regularly and depending on the complexity and hazardous nature of the equipment, at a maximum of five-year intervals. Risk assessments must be repeated if the equipment is subsequently modified or deteriorates in any way that could affect safety. 5. An in depth risk assessment is made of all dangerous equipment and safety Do's and Don'ts identified. 6. Risk assessment checks are an integral part of all inspections.
Documentation/forms needed	1. Any work equipment with moving parts whether it is powered by electricity, internal combustion engine, compressed air or other energy source has a safety check list completed PUWERF5 (Appendix 7) 2. Any dangerous work equipment identified must undergo a more in depth risk assessment PUWERF6 (Appendix 8).
Specific guidance/further information	1. Managing for Health and Safety (HSG65) (hse.gov.uk) 2. HSD044M University Risk Assessment Handbook

5 Scientific and Laboratory Equipment including Specialist Research Equipment

In a University environment it is inevitable that there will be scientific and laboratory equipment including specialist research equipment and rigs that are designed and constructed 'in-house'. However, PUWER still applies to these and therefore they must conform to the necessary essential requirements as the University must be able to demonstrate that equipment, machinery, rigs or apparatus constructed, assembled or modified by the University is safe. To achieve this, the broad principles and requirements of the Supply of Machinery (Safety) Regulations should be adopted which require the production of a 'Technical File' that documents the design, manufacture and requirements for safe operation of work equipment.

5.1 Scientific and Laboratory Equipment

Certain laboratory work equipment presents specific hazards and risks that need to be risk assessed and managed. Safe use of equipment in a laboratory often requires special consideration due to the nature of the work, the environment and materials used. To ensure safety of those working or maintaining this equipment, strict cleaning and decontamination procedures may be required to minimise exposure to biological or chemical agents.

Safety points to consider:

- Fridge/freezers - must be internally spark free when used for storage of flammable chemicals.
- Equipment containing compressed gases, pressure vessel, low or high temperatures - consider the hazards, regulators, labelling, pre- checks, PPE, handling and storage.
- Centrifuges – failure/deterioration due to lack of maintenance of rotors or improper balancing can cause a number of hazards.
- Ultra-sonicators or other rotating equipment – exposure to high volumes of audible sounds can cause health issues.
- Use of lasers, electromagnetic radiation – consider PPE and signage.
- Electrically powered equipment (e.g. hot plates, vacuum pumps), high voltage and high-powered equipment - ensure equipment is installed correctly and maintained appropriately.
- Microwaves – should be non-domestic models i.e. specially designed for laboratory use with built in safety features.
- Placement of equipment - allow space for safe access and maintenance.
- Minimise the use of disposable sharp puncturing devices where possible, use safe techniques and ensure safe disposal.
- Humidity – condensation can enter electrical equipment placed in a cold room.

5.2 In-House Specialist Research Equipment and Rigs

Work equipment specially designed and constructed 'in-house' for use 'in-house' should be designed and constructed in accordance with relevant legislation and comply with the Essential Health and Safety Requirements (EHSR's) as detailed in [Schedule 2](#) to the Supply of Machinery (Safety) Regulations 2008.



EHSR's cover:

- physical safety, including health effects of a product in all its various aspects (selection of materials used, means of control, safeguards, containment of fragmenting work pieces, emissions from the product)
- protection against other hazards (errors due to incorrect replacement of parts, temperature extremes, fire and explosion, noise)
- maintenance (safe means of adjusting, lubricating, cleaning)
- principles of safety by design taking into account foreseeable use and misuse
- information for end users (markings, warnings, instructions).

EHSR's can be met by:

1. risk avoidance by design
2. protection against risks that cannot be eliminated
3. warning of any residual risks that remain.

5.2.1 Product Design

The design stage should consider all risks and evaluate and implement ways to mitigate them (see Appendix 10 for a list of considerations). Any residual risks must be communicated to those who will be using the equipment. Inherently safe design measures are the first and most important step in the risk reduction process.

The production of a 'Technical Compliance File or Technical File' for the equipment is encouraged. Technical files for research equipment or rigs in a University setting can take a variety of forms as the equipment is not usually being placed on the market. However, they should include a description of the equipment, functions, safety-related devices (e.g. stop controls), test reports, circuit diagrams, identification of the ESHR's associated with the equipment, a description of the critical operating parameters (temperatures, speeds etc.), records of risk assessments against specific standards, training documents, software information, flow charts and commissioning procedures.

It is essential that suitable instructions and training for use are provided and Standard Operating Procedures written. The maintenance of the equipment will depend on the equipment purpose and frequency of use as well as the complexities of the research equipment. Any modifications to the research equipment which effects the integrity of the system will require approval from the DRPMS. Some specialist equipment assemblies will contain sub-systems that are UKCA/CE marked and such sub systems must be considered as POWER equipment separately.

What the Regulations require	✓ Machinery meets all Essential Health and Safety Requirements. ✓ A 'Technical File' is produced. ✓ Machinery is issued with a Declaration of Conformity or Declaration of Incorporation (if it is placed on the market). ✓ UKCA/CE marking is affixed to the machinery (if it is being placed on the market). ✓ Operating instructions are provided.
Safety points to consider	1. Carry out a risk assessment to identify the risks (EHSR's should be used to ensure all possible hazards have been addressed). 2. Eliminate significant risks. 3. Provide safeguards. 4. Provide information about residual risks not able to be designed out. 5. Determine the maintenance frequency. This will depend on the equipment purpose and frequency of use and the complexities of the equipment.
Documentation/forms needed	1. Safety checklist for 'in-house' constructed equipment PUWERF7 (Appendix 11). 2. Safety checklist PUWERF5 (Appendix 7) 3. Any dangerous work equipment identified must undergo a more in-depth risk assessment PUWERF6 (Appendix 8).
Specific guidance/further information	<u>The Supply of Machinery (Safety) Regulations 2008 (as amended)</u>



6 Medical Devices

Where a medical device is also a machine it is excluded from the scope of the Machinery Directive although it still must meet the relevant EHSR's. Enforcement for this equipment falls to Medicines and Healthcare Products Regulatory Agency (MHRA).

According to the Medical Device Directive (MDD) a medical device is described as any instrument, apparatus, appliance, software, material or other article used alone or combined for humans to:

- diagnose, prevent, monitor, treat or alleviate disease
- diagnose, monitor, treat, alleviate or compensate for injury or handicap
- investigate, replace or modify the anatomy or physiological process
- control conception.

All medical devices must meet the EHSR's and be compliant to the MHRA requirements.



7 Further Information

Further information is available on the HSE website at:

<http://www.hse.gov.uk/work-equipment-machinery/puwer.htm>

L114 Safe use of woodworking machinery

[Safe use of woodworking machinery. L114](#)

University Safety Office - safety@admin.cam.ac.uk

Appendix 1 Work Equipment in Scope and Exemption Listings

The listings below consider which types of work equipment are in scope and which are exempt. Please note this is not an exhaustive list.

Work Equipment	In Scope	Exempt
'Toolbox Tools' such as hammers, knives, handsaws, meat cleavers	Yes <i>But consider as a 'toolbox' rather than single tools</i>	
Single Machines such as drilling machines, circular saws, photocopiers, dumper trucks	Yes	
Machine Tools	Yes	
Hand Tools (Powered or requiring manual effort to use (e.g. hammers, knives, handsaws, portable drills, hot air guns, screwdrivers, crowbars, spanners, sanders, saws, grinders, axes, hacksaws	Yes	
Lifting Equipment (hoists, lift trucks, elevating work platforms, lifting slings)	Yes (and LOLER)	
Ladders	Yes	
Pressure Washers	Yes (and PSSR)	
Lifting Mechanisms	Yes (and LOLER)	
Mechanisms connected together (e.g. scaffolding)	Yes	
Boiler Systems	Yes (and PSSR)	
Welding Equipment	Yes	
Abrasive Wheels	Yes	
Laboratory apparatus (including Bunsen burners etc.)	Yes	
Laboratory Fridges/Freezers	Yes	

Work Equipment	In Scope	Exempt
Catering Fridges/Freezers	Yes	
Pressurised Coffee Machines	Yes	
Powered Catering Equipment	Yes	
Domestic Fridge, Microwaves, Kettles, Coffee Machines etc.		Yes
Extension Flexes		Yes
Fan Heaters		Yes
PC's, Printers, Monitors, Height Adjustable Desks, Office Chairs		Yes
Structural items (walls, stairs, fences)		Yes
Private Cars		Yes

Appendix 2 Example Asset Register for a Lab/Work Area

Asset Register						
Asset No.						
Description of Asset e.g. Lathe						
Asset Category ⁷						
Serial Number						
Supplier						
Manufacturer						
Expected life						
PO Number						
Suppliers Invoice Number						
Cost or Value if donated						
Date Acquired						
Installation/Commissioning Date						
Building						
Room Number						
Asset Owner/Keeper						

Asset History						
Asset No.						
Legislative Compliance Area e.g. PUWER / LOLER / PSSR						
Risk Assessment / SOP Reference No.						
Maintenance Frequency						
Date of last Inspection						
Carried out by:						
Date of last Service						
Carried out by:						
Disposal Date						
Method of Disposal						
Reason						

⁷ Asset categories could include workshop machinery, workshop power tools, instruments, office equipment, access equipment, catering equipment etc.

Appendix 3 Suitability of Work Equipment Checklist PUWERF1

Use the checklist below to evaluate safety considerations for new, second-hand, hired, loaned or leased equipment.

PUWERF1: Suitability of work equipment checklist		
Name of equipment:		
Intended use:		
Location of use:		
	Y / N / N/A	Notes
Regulatory Compliance:		
Does it meet the requirements of the Supply of Machinery (Safety) Regulations?		
Is the equipment CE/UKCA Marked with suitable Declarations of Conformity/Declarations of Incorporation?		
Is there a pre-installation checklist provided?		
Is the Technical File information available from the manufacturer (including assembly instructions if required)?		
Is there marking and labelling of the product for traceability (e.g. asset tag)?		
If applicable, was assembly and/or installation carried out by a suitably competent person?		
Space / Environmental Considerations (as recommended by the manufacturer):		
Is the floor/bench/shelf suitably rated to support the weight of the equipment? Advice may be required from a structural engineer.		
Has the route between point of delivery and point of installation/use been assessed? Are there any special requirements needed to enable safe movement of the work equipment? Consider access, pinch points, change of level, door openings, manual handling etc.		

Can the equipment be accommodated and safely maintained in the intended space? Consider footprint and what space you may require around it.		
Are there any special requirements for flooring or benching (e.g. chemical resistant flooring)?		
Is there sufficient lighting for people to work safely?		
Is temperature / humidity control required? If so, what tolerance is specified by the manufacturer?		
Is heat rejection required (mechanical extract, cooling water, air-conditioning)?		
Are there a sufficient number of data points in the correct location?		
Have the power requirements been assessed and found to be adequate?		
Is a dedicated electrical supply required? Are there any special electrical protection requirements (RCD, isolating transformer, extra-low voltage)?		
Is any form of back-up power supply required (generator/UPS)?		
Will the equipment require compressed air or other gases (Nitrogen, CO2, Oxygen, Argon)?		
Will Oxygen depletion or gas monitoring be required?		
Does the equipment require any monitoring and alarm systems (e.g. temperature, flood protection, power)? If yes, is there adequate response available.		
In-use Considerations:		
Are there any user-specific safety requirements (consider size, weight, reach etc. to avoid undue strain on the user)? Is there enough room for someone to work at the equipment and reach all the controls?		
Have the forms of energy produced by the equipment (e.g. radiation, vibration, noise) been considered? Is the environment suitable for the addition of this energy?		
Has the lowest vibration/noise rating been selected? If not, explain why. What measures have been put in place?		

Will the equipment require the use of any hazardous substances? If yes, apply the principles of ALARP and detail what measures have been put in place (ATEX / Zoning / DSEAR risk assessment / alarms etc.).		
Does the equipment require any form of fume or dust extraction system?		
Will the equipment require the use of ionising or non-ionising radiation?		
Other Considerations:		
Has the equipment been properly commissioned or re-commissioned by the manufacturer or supplier upon installation/relocation?		
Do you need to advise the University Insurers due to the value of the equipment?		
Does the equipment need to be under the Competent Persons Scheme under LOLER or PSSR etc.		
Is there provision for planned preventative maintenance?		
Proposed by:	Authorised by (<i>this should be the person with responsibility for implementing PUWER</i>):	
Date:	Date:	

Appendix 4 Maintenance Schedule / Log PUWERF2

PUWERF2: Maintenance Schedule / Log				
Name of Department:				
Name of Equipment:				
Specific identification marking:				
Location of equipment:				
Frequency of maintenance:				
Maintenance checks required: (to be determined by supervisor or as stated in User Manuals)		Date completed	Satisfactory (Y/N)	Remedial works required (Y/N)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
Remedial actions identified:		Tick if completed	Date completed	Signed
1.				
2.				
3.				
Additional notes:				

Appendix 5 Equipment Inspection Programme Template PUWERF3

PUWERF3: Equipment Inspection Programme				
Name of Department:				
Name of Equipment:				
Specific Identification Marking:				
Location of Equipment:				
Inspection Programme Detail* (to be determined by Workshop/Lab Manager)		Frequency	Inspection log kept?	Log location
1.	<i>Pre use inspection by operator (insert details)</i>	<i>Each use</i>	<i>Y</i>	<i>Daily log sheet</i>
2.	<i>Routine inspection by Workshop/Lab Manager (This should include operational inspection (is the equipment being used safely?) (insert details)</i>	<i>Monthly</i>	<i>Y</i>	<i>Manager inspection log</i>
3.	<i>Routine inspection by the Engineering team (safety critical devices) (insert details)</i>	<i>Monthly</i>	<i>Y</i>	<i>Engineering log</i>
4.	<i>Statutory inspection by independent engineering contractor (insert details)</i>	<i>e.g. 6 monthly (as determined by Statute)</i>	<i>Y</i>	<i>Certification</i>
5.	<i>Defect reporting system (insert details)</i>	<i>As occurs</i>	<i>Y</i>	<i>Defect log</i>

* N.B. There are no standard forms for inspection logs however, the inspection programme detail should be decided by the Workshop/Lab Manager (suggestions are given in the form above). It could include hand-held device programmes, physical log sheets or logbooks.



Appendix 6: Equipment Training Records PUWERF4a & b

PUWERF4a: University of Cambridge Equipment Operator Training Log							
Department name and location:							
Name of Authorised trainer:							
I certify that: a. I have carried out training, as indicated on the equipment listed. b. I am satisfied that the people named below have demonstrated competence in the operation of the equipment listed and have met all the training objectives for each named piece of equipment, including: <i>(Trainer to complete)</i> <i>Examples include:</i> (i) the correct selection of equipment for type of work to be done (ii) purpose and adjustment of guards and safeguards (iii) correct selection and use of safety devices (push-sticks, push spike, jigs and work-holders) (iv) practical understanding and application of legal requirements (v) safe working practices to include feeding, setting, cleaning and taking off.							
Signed:							
Date:							
Operator	Equipment						
	(insert equipment names along this line)	e.g. Circular rip saw					
(insert operator names in this column e.g. John Smith)							

PUWERF4b: University of Cambridge Equipment Operators Individual Training Record						
Department name and location:						
Name of Operator:						
I certify that: a. I have carried out training, as indicated on the equipment listed. b. I will adhere to the safety rules when operating equipment, carry out checks as necessary and report defects to my supervisor						
Signed:						
Date:						
Equipment Record						
Equipment or equipment class	Trainer name	Date of training	Training modules completed	Special conditions of use	Authorised by	Other info (e.g. when retraining is required)

Appendix 7: Safety Checklist PUWERF5

The PUWERF5 checklist should be used for all potentially hazardous equipment other than simple and straightforward items.

[Please use Appendix 8 for assessment of equipment classified as machinery⁸ under the regulations (with moving parts powered by electricity, internal combustion engine or other such energy source).]

PUWERF5: Provision and Use of Work Equipment Safety Checklist	
Equipment Description:	
Equipment Location:	
Assessor:	
Date of assessment:	
Review date (at least every 5 years):	

		In place? Y / N / N/A	Remedial action required? Y / N	Is detail included in the remedial action table below Y / N / N/A?
Information, Instruction and Safe Use				
1.	Written instructions cover:			
	a. any unusual hazards or complicated features			
	b. where appropriate, emergency shutdown?			
2.	Instruction in readily comprehensible form (written or verbal) on all hazards has been communicated to all who use the equipment?			
3.	Written instructions provided by the manufacturer have been passed to users?			

⁸ The term machinery refers to an assembly of parts, one or more of which are fitted with a drive system (moving) and are joined together for a specific application.

		In place? Y / N / N/A	Remedial action required? Y / N	Is detail included in the remedial action table below Y / N / N/A?
4.	Training – all users have been given adequate training in correct use, risks and precautions?			
5.	A training record is kept verifying training completed?			
6.	The equipment is being used in accordance with the manufacturer's instructions?			
7.	If the equipment has been adapted, the adaptation is suitable and safe?			
8.	The equipment is used in a suitable environment (e.g. ventilation, humidity, damp or flammable conditions)?			
9.	a. The start/stop controls are clearly marked on the equipment?			
	b. Start/stop controls functional?			
10.	Other operating controls and the contents of containers are clearly marked?			
11.	There are clear warning notices or markings (e.g. to wear personal protective equipment, restrictions of use), and a list of authorised users where appropriate?			
Maintenance				
12.	There are appropriate intervals for checking:			
	a. electrical safety			
	b. any safety devices?			
13.	If inadequate, maintenance could cause the equipment, guards or other protection to fail in a dangerous way, is there a system of planned preventive maintenance in place, including where appropriate the periodic replacement or refurbishing of items before they reach the end of their usual life?			

		In place? Y / N / N/A	Remedial action required? Y / N	Is detail included in the remedial action table below Y / N / N/A?
14.	Clear maintenance instructions have been given to those responsible for maintaining the equipment?			
15.	The equipment and system of maintenance are designed to minimise the risks which may arise during maintenance			
Specific Hazards				
16.	Protection is adequate in relation to:			
	a. Items falling from the equipment			
	b. Items being ejected			
	c. Equipment overturning			
	d. Equipment collapse			
	e. Overheating or fire			
	f. Disintegration			
	g. Explosion			
17.	The equipment has been made stable by an appropriate method (e.g. by bolting, clamping or tying, etc.)?			
18.	Is there sufficient general and where necessary, local lighting?			
19.	Is there protection against contact with hot or very cold temperatures?			
	a. If so, is it appropriate?			
20.	In the case of pressurised equipment, is there a Written Scheme of Examination? (see HSD046P)			
21.	If a fume or dust is released when the equipment is used is there:			
	a. annual Local Exhaust Ventilation, testing (or at 14 months max)			
	b. a COSHH-specific assessment for the equipment?			

		In place? Y / N / N/A	Remedial action required? Y / N	Is detail included in the remedial action table below Y / N / N/A?
Dangerous Parts				
22.	Does the equipment have exposed moving parts? N.B. If Y, complete the Dangerous Work Equipment (Machinery) Risk Assessment PUWERF6			
Remedial Action Required		Target Date	Date Completed	Signed
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				



Appendix 8: **Dangerous Work Equipment (Machinery) Risk Assessment Template PUWERF6**

This form should be used for the assessment of equipment classified as ‘machinery’ under PUWER (with moving parts powered by electricity, internal combustion engine or other such energy source).

Hierarchy of Control

The University has a duty to **ensure effective control measures**, which prevent access to any dangerous part of machinery (or rotating stock bar), and which stop the movement of any such part before any person enters a danger zone⁹. One of four hierarchical measures must be applied (where 1 = most effective and 4 = least effective). These are:

1. The provision of fixed enclose guards or
2. Other guards or protection devices or
3. Jigs, holders push-sticks or similar protective appliances or
4. The provision of information, instruction, training and supervision as is necessary.

The hierarchy should be used in every work equipment risk assessment when considering control measures, and where possible the highest control must be selected.

APPLYING THE HIERARCHY EFFECTIVELY

Step 1

- Identify all the danger zones on the equipment.
- List these and record ‘who will be at risk and when’ including maintenance, inspection, cleaning and clearing blockages etc.
- Remember to consider the foreseeable and abnormal issues as well.

Step 2

- Identify which danger zones can be guarded with fixed guarding. These are usually going to be those where access behind the guard does not occur during usual work on the machine or on a daily basis.
- The fixed guarding must be suitable for the application in terms of size, position, strength, material selection, mesh size etc.
- The fixed guard must be secured with devices that require a tool for removal.

⁹ When considering the ‘danger zone’ not only should consideration be given to protecting the operator in normal use, but also identifying who else could be at risk and ensure that they are protected as well.



Step 3

- The danger zones that cannot be protected with fixed guards, must then be evaluated for alternative safeguards such as interlocked guards, light curtains, pressure pads deflection devices, powered guards etc.
- The assessor must recommend the most effective safeguard for each application.
- The assessor must evaluate the application of guards that 'prevent access' and systems that 'identify presence and stop the machine'.
- These devices and safety systems must be evaluated for their 'reliability' and 'integrity' using a Safety Integrity Level (SIL) rating (**see Appendix 9**).

Step 4

- If access to the danger zone cannot be prevented following Steps 2 and 3, then the assessor should look for methods to distance the operator from the danger zone e.g. using jigs, holders or push sticks.
- Every centimeter that the operator is distanced from the exposed danger zone reduces the likelihood of contact.

Step 5

- If access to the danger zones cannot be prevented using Steps 2 and 3, and the operator cannot be kept a safe distance from the danger zone through the application of Step 4, then the assessor should look at the process of operator selection and training to ensure their health and safety can be maintained through proper and comprehensive training and supervision.
- Selecting the right operator with the right level of competence and training is an integral part of managing safety with work equipment.
- The training content starts with the remaining residual risk left after the safe guarding process. As a minimum, safety Do's and Don'ts should be written following risk assessment of each machine.

Risk Rating System

The following risk rating system should be used when completing the Dangerous Work Equipment (Machinery) Risk Assessment form POWERF6.

$$\text{SEVERITY RATING} \times \text{PROBABILITY RATING} = \text{RISK RATING}$$

Severity	Rating of hazard	Probability of realisation	Rating of likelihood
Permanent Incapacity or death	5	Inevitable	5
Major injury or severe incapacity	4	Very likely	4
3 or more days off work	3	Likely	3
Less than 3 days off work	2	Unlikely	2
Up including First Aid treated injury	1	Highly improbable	1

PROBABILITY	SEVERITY					
		1	2	3	4	5
	1	1	2	3	4	5
	2	2	4	5	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Level	Risk Rating	Action to be taken
Low/Tolerable	1,2,3,4,5	Leave until last, risk may be allowed to remain with control measures
Medium/Moderate	6,7,8,9,10	Leave until later/give timeframe for action in remedial measures section (1 month maximum)
High/Intolerable	12,15,16,20,25	Act now/isolate do not use until action taken

PUWERF6: Dangerous Work Equipment Risk Assessment				
Equipment Description (including location and work activity / purpose of use):				Assessment Number:
Mode of operation:				
Identification information:				
Danger Zones (Hazards)		Risk Level (L/M/H)	Current Control Measures (apply hierarchy of control)	Residual risk rating
1.				
2.				
3.				
4.				
5.				
Statement of Residual Risks				
1.				
2.				
3.				
4.				
5.				
Management Improvement Plan				
Remedial Measure		By Whom	By When	Completion Acknowledgement (when complete reassess the risks) *
1.				
2.				
3.				
4.				
5.				

Safety Training Notes	
The Do's	
1.	
2.	
3.	
4.	
5.	
The Don'ts	
1.	
2.	
3.	
4.	
5.	
Risk Assessor:	
Designation:	
Date of Assessment:	
Date for Assessment Review:	

* If substantial improvements have been made a new risk assessment will be required.



Appendix 9: Safety Integrity Level Rating for Safety Devices (Functional Safety of Control Systems Modern EN/ISO Standards)

Functional Safety, as defined by IEC standard 61508, is the safety that control systems provide to an overall process or plant. The Safety Integrity Level (SIL) is a relative level of risk reduction provided by a safety function. In simple terms, SIL is a measure of the impact that a Safety Instrumented Function (SIF) has over the risk associated with a specific hazard i.e. is performance. The higher the SIL level is, the more efficient that function will be at reducing the risk it mitigates. In other words, SIL can be seen as an indicator of the acceptable failure rate for a safety function.

SIL rating is a fundamental parameter to consider when comparing products; it is also an increasingly important requirement in various public and private tender invitations for the supply of mechanical systems and electrical and electronic products.

SIL ratings correlate to the frequency and severity of hazards. They determine the performance required to maintain and achieve safety — and the probability of failure.

There are four SILs: SIL 1, SIL 2, SIL 3, and SIL 4. The higher the SIL, the greater the risk of failure. And the greater the risk of failure, the stricter the safety requirements.

Step 1 Determine the **class of the equipment**:

Class = Frequency rating **FR** + Probability of harm **PH** + Probability of avoiding harm **AH**

	Score	Frequency
Frequency FR (frequency and exposure time risk parameter)	5	More often than an hour
	4	Between an hour and a day
	3	Between a day and 2 weeks
	2	Between 2 weeks and a year
	1	More than once a year

	Score	Severity
Probability of Harm PH	5	Very High
	4	Likely
	3	Possible
	2	Rarely
	1	Negligible



	Score	Probability
Probability of avoiding harm AH	5	Impossible
	3	Rarely
	1	Probable

*Class calculation (FR+PH+AH)

	FR	PH	AH	Total
Score				

Step 2 Determine **severity of harm**:

	Score	Severity
Severity of Harm SH	4	Fatal or irreversible injury no recovery
	3	Major Injury (recoverable)
	2	Reversible Injury
	1	Minor Injury

Step 3 Determine **SIL** level needed using the table below:

	Class				
Severity of Harm Score	3-4	5-7	8-10	11-13	14-15
4	SIL 2	SIL 2	SIL 2	SIL 3	SIL 3
3			SIL 1	SIL 2	SIL 3
2				SIL 1	SIL 1
1					

Ensure any safety device chosen as a control measure in each risk assessment has the correct SIL rating.



Appendix 10 Considerations when Designing a Research Rig

- Consider the size and location of the rig.
- Consider the materials and equipment to be used. Are there any compatibility issues?
- Will access be required to electricity, a water supply, compressed air? Will temperature management be required? Will lasers be used?
- Will there be toxic fumes produced? Do you need extraction? How will you do that? Do you need help from FM or external contractor?
- Do you need to use gases? Consider safety, storage, PPE, training.
- What parts do you need?
- Do you have the approved risk assessments in place for chemicals/materials/gases you want to use?
- What are the risks & how can you design them out?
- What safety systems & engineering controls might you need in place (interlocks, Lock-Out Tag-Off system, stop controls)?
- Is there an inspection schedule in place? Are there recorded pre-checks?
- Does the rig need to be housed/contained inside a cabinet/cell?
- Is it set up so that it will not work if a safety element has been compromised?
- What access restrictions might be required to the area around the research rig?
- What PPE is required when using the research rig?
- Are there clear warnings signs?
- Ensure there is a risk assessment and safe operating procedure as part of the Technical File for the research rig. Is there a process for updating the risk assessment following modifications?
- Ensure there is a management of change system in place so substantial changes to processes are identified and risk assessed.
- Has recorded training been provided for all those who will use the research rig including the use of any safety control measures?

The following pieces of legislation contain standards to which various items of work equipment should be designed and constructed and should be consulted where relevant (N.B. this is not an exhaustive list):

Title

- General Product Safety Regulations 2005
- The Supply of Machinery (Safety) Regulations 2008
- The Electrical Equipment (Safety) Regulations 2016
- The Low Voltage Electrical Equipment (Safety) Regulations 1989
- The Electromagnetic Compatibility Regulations 2016
- Gas Appliances (Enforcement) and Miscellaneous Amendments Regulations 2018



- The Noise Emission in the Environment by Equipment for Use Outdoors Regulations 2001
- The Construction Products Regulations 2013
- The Electro-medical Equipment (EEC Requirements) Regulations 1988
- The Personal Protective Equipment (Enforcement) Regulations 2018
- The Medical Devices Regulations 2002
- The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016
- The Lifts Regulations 2016
- The Radio Equipment and Telecommunications Terminal Equipment Regulations 2000
- The Plugs and Sockets (Safety) etc. Regulations 1994
- The Pressure Equipment (Safety) Regulations 2016
- The Simple Pressure Vessels (Safety) Regulations 2016
- The Cableway Installations Regulations 2018

Appendix 11 **Safety Checklist for ‘In-house’ Constructed Equipment POWERF7**

The University must demonstrate that any machinery/rigs/apparatus constructed by the University is safe to use. To do this it must meet the requirements of the Essential Health and Safety Requirements of the Machinery Directive. The checklist below will assist you to establish if equipment made ‘in-house’ meets those requirements.

Equipment Name:		
Location of use:		
Person Responsible:		
Safety Requirement	Yes / No / N/A	Comment / Action
Valid Approved Risk Assessment		
Listed on the Asset Register		
UKCA Marking and Declaration of Conformity Documentation		
Adequate Technical File		
Safe materials used		
Correct design for handling		
Adequate assembly and stability		
Adequate lighting		
Ergonomics considered		
Adequate operating positions/seating		
Adequate control systems and devices		
Protection from mechanical hazards		
Protection against failure of power supply		
Protection against sharp edges or surfaces		
Protection against moving parts		
Protection against falling/ejected objects		
Adequate guarding and protective devices		
Adequate warnings and markings		
Protection against electrical hazards, fire, radiation, explosion, extreme temperatures, noise and vibration		
Protection against being trapped or slipping, falling		
Protection against emissions of hazardous materials		
Safe access for maintenance and cleaning		
Adequate maintenance and cleaning procedures		
Adequate training programme		
Adequate Standard Operating Procedure/Instructions for Use		
Adequate Personal Protective Equipment		



Appendix 12 Terminology, Definitions and Abbreviations

Terms etc. used in this document are defined as follows:

AH: Avoiding Harm

ALARP: As Low As Reasonably Practicable

CE/UKCA: The CE mark is a European conformity mark which indicates that a product meets the essential health and safety requirements (EHSR's) of the relevant EU directives and standards for that product. The UK Conformity Assessed (UKCA) mark is required for all goods being placed on the market in Great Britain (GB) from January 1, 2023

Competent Person (CP): A person who has sufficient training, experience or knowledge to competently and safely use and manage work equipment or laboratories and facilities that contain work equipment that they are competent in using

Control System: A system or device which responds to input signals and generates an output signal which causes the equipment under control to operate

COSHH: The Control of Substances Hazardous to Health Regulations

Dangerous Part: Part of machinery or work equipment that can cause injury by cutting, crushing etc.

Danger Zone: Any zone in or around machinery in which a person is exposed to a health and safety risk from contact with a dangerous part of machinery or rotating stock bar.

Declaration of Conformity (DoC): A legal document which must accompany all CE marked products sold in the European Union. All new products supplied to end users will have a Declaration of Conformity proving the product meets the relevant legislation. It is a sign that a product has been designed and constructed for compliance with relevant essential requirements and has been through appropriate conformity assessment processes. A DoC is not a quality certificate or a guarantee of safety. Purchasers should retain the DoC as they provide documentary evidence that the product complied with safety requirements applying to that product, so they have met their duty under Regulation 10 of the PUWER Regulations. The conformity assessment will involve producing a technical file, containing design drawings and specifications, standards used during the design of the equipment, description of the methods used to eliminate the hazards and a copy of the instructions for the equipment. The Manufacturer would keep this file for 10 years after the last unit was made

Department: This term is used generically to apply to all University of Cambridge management entities



DSO: Departmental Safety Officer

DRPMS: Designated Responsible Person for Machinery Safety

Essential Health and Safety Requirements (EHSR's): Broad objectives for health and safety in the Machinery Directive stating how the Designer and Manufacturer should construct applicable products for safety and compliance. These Essential Health and Safety Requirements (EHSR's) cover all aspects of health and safety of equipment for example physical safety (safeguards) and information (warnings)

FR: Frequency Rating

Guard: Device to prevent or safely restrict access by a person or person's body

Head of Department (HoD): This term includes Heads of academic departments and of other academic institutions, Chairs of Faculty Boards that are not divided into departments, Heads of a Centre, Institute or other body under the supervision of the General Board or Council, such as a Non-School Institution (other than the Unified Administrative Service), and the Heads of Divisions within the Unified Administrative Service, and is the person who has authority for the implementation of University Health and Safety Policy

HSG65: Health and Safety Executive Guidance 65 'Managing for Health and Safety'

LEV: Local Exhaust Ventilation

LOLER: Lifting Operations and Lifting Equipment Regulations

Machinery: Refers to an assembly of parts, one or more of which are fitted with a drive system (moving) and are joined together for a specific application e.g. metal-working drills, circular saws, lifting equipment (including lifting tackle and lifting equipment that is not powered)

Mode of Operation: Refers to the Manufacture, Assembly, Transportation, Installation, Commissioning, Operation, Maintenance, Inspection Disposal

PH: Probability of Harm

Power Press: A machine for mass production which usually has a rotating flywheel

PPE: Personal Protective Equipment

PSSR: Pressure Systems Safety Regulations



PUWER: Provision and Use of Work Equipment Regulations

ROPS: Roll-Over Protective Structures

Safety Management System: A systematic and proactive approach to managing safety risks

SH: Severity of Harm

SIL: Safety Integrity Level rating

So far as is reasonably practicable: The degree of risk in a particular situation balanced against the time, trouble, cost and physical difficulty of taking measures to avoid the risk

Work Equipment: Any machinery, appliance, apparatus, tool or installation for use at work (whether exclusively or not) including:

- 'Toolbox tools' such as hammers, knives, handsaws, meat cleavers, etc.
- Single machines such as drilling machines, circular saws, photocopiers, dumper trucks, etc.
- Apparatus such as laboratory apparatus, etc.
- Lifting equipment such as hoist, lift trucks, elevating work platforms, lifting slings, etc.
- Other equipment such as ladders, lawnmowers, pressure water cleaners, etc.
- An installation such as a series of machines connected together or enclosure for providing sound insulation or scaffolding or similar access equipment
- Departmental vehicles
- Any equipment which employees provide for their own use at work.

Low/High Risk Work Equipment: For the purposes of this document, work equipment can be considered as 'low risk' or 'high risk' where:

- Low Risk
 - Portable battery powered tools
 - Hand Tools
 - Sack trucks/gas bottle trolleys
 - Office equipment
 - Smaller pieces of analytical laboratory equipment (weighing scales/balances)
 - Lifting equipment
 - Access equipment
- High Risk
 - Workshop type equipment (machines) such as lathes, pillar drills, milling machines, saws, machine tools etc.



- Series of machines connected together
- Work vehicles (Forklift trucks, vans)
- Power Presses and Machinery

Use of: Any activity in relation to work equipment including:

- Erecting work equipment, e.g. initial set up or setting up an experiment with existing equipment
- Programming work equipment
- Installation of work equipment
- Using work equipment – setting, starting, stopping including variations for different tasks
- Maintaining work equipment
- Cleaning work equipment
- Modifying work equipment
- Transporting work equipment
- Dismantling and disposal of old work equipment.



Safety Office
Greenwich House
Maddingley Road
Cambridge
CB3 0TX

Tel: 01223 333301
Fax: 01223 330256
safety@admin.cam.ac.uk
www.safety.admin.cam.ac.uk/

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