SCHOOL OF ENGINEERING
Electronics Workshop

LOCAL SAFETY RULES

To be read in conjunction with the School's safety handbooks, policies and guidance: School Policies, Guidance & Resources | School of Engineering | The University of Aberdeen (abdn.ac.uk)

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Areas covered by this document	
Electronics Workshop	FN 029/0309
All other areas in which work is carried out	

1. Electricity

The dangers from electrical installations or equipment are broadly of two kinds:

- Injury to persons
- Damage to buildings and equipment

1.1 Electric Shock

Electric shocks occur when contact with a live conductor causes sufficient current to pass through the body to cause an injury. As a rough guide voltages exceeding 50V ac or 120V ripple free dc should be considered hazardous in a dry, unconfined, non-conductive location. These voltages must be reduced if the location is wet, confined or conductive. A simple rule is to consider all voltages above 30V either dc or ac as potentially hazardous.

The effect of electricity on the body depends on the strength of the current and the path the current takes. The heart is the most critical organ and current flowing from hand-to-hand or hands-to-feet can be considered as passing through the heart. The size of the current depends on both the voltage of the supply and the resistance of the skin. Skin resistance is very much reduced when the skin is wet.

This table gives typical effects for various currents:

Current	Effect on the body
1mA	Threshold of feeling.
5mA	Maximum ‘safe’ current.
10-20mA	‘Let-go’ current limit.
50mA	Severe pain. Inability to let go; possible paralysis.
100-300mA	Ventricular fibrillation leading to death.
3-8Amps	Sustained cardiac contraction. Burns. Possible respiratory arrest.
8Amps+	Severe burns, probably fatal.

The most common cause of death from electric shock is ventricular fibrillation (failure of the heart to pump blood) and not respiratory failure unless the shock is via the head.

The electrical resistance of the body can vary enormously from person to person and in the same person at different times and under different conditions (stress, environmental etc.). This resistance can be as high as 10kΩ or as low as a few hundred ohms, depending on whether the skin is dry or moist.

Even with a resistance of 10kΩ the 230Vac mains supply will result in a current of more than 20mA, which could be lethal. In fact, much lower voltages can be dangerous and death has been recorded from only 60V.

It will be appreciated that the above remarks apply essentially to current passing through the body, e.g. from hand-to-foot or hand-to-hand. It is possible for part of the body, e.g. finger to short two conductors of differing potential or a charged capacitor or a battery. This will not necessarily result in electric shock as described above but can inflict severe burns.

1.2 Treatment for electric shock

Immediate action is required. Check whether the subject is in contact with the supply. If so, then switch off the appliance or disconnect the supply at the mains outlet or withdraw the plug. Only if this is not possible, then arrange to pull the subject away using suitably insulating material (piece wood, wooden broom, scarf, etc.).

Even if the subject is still conscious, check for pulse in the wrist and neck. If no pulse can be felt, then further immediate action is necessary.

Immediately call for medical assistance by dialling 9-999 and asking for an ambulance, emphasizing that it is a ‘cardiac arrest’. Do not waste time on this - send someone else if possible.

Send for a qualified First-Aider and for someone qualified in the use of a defibrillator.

1.3 Burns

Burns can be caused by the passage through the body of a heavy current. Burns can also be caused by the intense heat generated by the arcing from a short circuit (a high capacity 1.5v battery is sufficient to cause burns when short-circuited). The actual depth of the burn is likely to be greater than it appears, with damage to underlying tissue, although its area may be small.

All cases of burns require immediate medical attention either from a qualified First-Aider, the Hospital’s Accident and Emergency Department or the persons own doctor depending on severity.

1.4 Radiation induced injuries

Electrical apparatus frequently emits electromagnetic radiation which can be dangerous. The majority of equipment that workshop personnel will be working on will be of an insignificant level however the dangers must be considered.

Ultra-Violet radiation: UV radiation from lamps (as used in PCB manufacture or as a biological sterilizer) or electric welding is absorbed by the outer layers of the eye and conjunctivitis can result. When working with UV sources suitable eye protection must be worn. In the case of the PCB exposure unit which is shielded around the source it is sufficient to avoid looking directly into the source (the bulb). Exposed skin must be covered with gloves or kept out of the direct light.

Micro-wave, radio-wave radiation: Microwave and radio-frequency radiation can be absorbed by the body, particularly the nerves and the eyes. Serious internal damage can occur if any part of the body is exposed to microwave energy. The skin and internal organs can literally 'cook' and prove fatal.

The highest microwave energy level to which operators should be subject is 1 mW/cm^2 and intensities exceeding 10 mW/cm^2 must always be avoided. If technicians have had bones pinned with metal at any time, or have cardiac pacemakers, they must not to expose themselves to microwaves as they may cause substantial internal damage before being aware that she/he is in danger.

Sources of microwave radiation can of course be from ovens, and transmitters. Many telephone and satellite transmitters are sited on University roofs and it is important not to walk past, stand or work anywhere near the front of these. If work is necessary near a transmitter then the supervisor must be contacted in order to assess the danger and if necessary to arrange for the transmitter to be closed down. No sources of microwave will be worked on without first contacting the supervisor.

Induction Heaters: Any metal object in or near an induction heater will receive energy and heat up extremely rapidly. No ring or other metal trinket should be worn when in the vicinity of an induction heater nor should any metal be held in the hands as burns may occur in fractions of a second. In general no part of the body should come within 2 feet (60cm) of an induction heater coil. There is an additional danger to those with metal bone pins, pacemakers and these individuals should avoid such heaters.

X-Rays: Electronic equipment containing Cathode Ray Tubes (CRT's) can emit X-Rays. These can be harmful although shielding is usually provided in modern equipment, and the dangers are low especially due to the infrequency of the work on this type of equipment.

More dangerous are the 'true' X-Ray sources such as found in departments such as Chemistry. Adequate safeguards must be in place to prevent the danger of exposure to X-Rays. The supervisor must be contacted to assess the danger before commencing work on X-Ray equipment. No work involving X-Ray equipment will be worked on without first contacting the supervisor.

2. Buildings and Supplies

All electrical installations normally fixed as part of a building (e.g. sub-stations, mains outlets, switchgear, power circuits, permanent lighting, emergency lighting, fire alarms, fuse boards etc.) are the responsibility of the Estates Section. In order to maintain, alter and upgrade these installations the Estates Section employs qualified electricians or, if necessary, outside approved electrical contractors. All work is executed in accordance with the latest edition of the IEE regulations and British Standard Code of Practice.

Persons other than the above operatives must on no account alter or interfere with any of the installations. No attempt to repair fuses or circuit breakers

should be made. Any fault, blown fuse or tripped circuit breaker must be reported immediately to the Estates Section and the matter will receive the attention of the Estates Electricians.

Only Estates personnel are permitted to connect/disconnect equipment to permanently wired outlets.

3. Hazardous Areas

Certain areas where personnel are required to work on electrical equipment are hazardous and can be broadly split into two types:

- those where water or aqueous chemicals can enter electrical equipment
- those where there is a risk that flammable vapours or dust can be ignited by electrical equipment.

In both cases work should be carried out in the workshop if at all possible.

3.1 Wet area - Field work, greenhouses, aquariums and animal houses

The electrical dangers associated with these areas are those of damp, wet or corrosive conditions with non-insulated structures and flooring. The dangers are one of shock and short circuit. All equipment must therefore be designed for the purpose and suit the environmental conditions.

Connections must be waterproof and secure with earth connections being particularly important.

RCD's must be used when working on equipment in these areas.

3.2 Cold Rooms

Cold rooms provide a particular problem. While the atmosphere is frequently very dry, condensation can occur, particularly when equipment is removed from the room. Ensure that equipment removed from a cold room has 'warmed up' before attempting to use it.

3.3 Areas with flammable or explosive atmospheres

These areas require equipment to be spark-proofed and which does not get hot. Adequate earth connection is vital. Normal electrical equipment must not be used in these areas. Equipment requiring maintenance must be removed from these areas before commencing work.

4. Isolation From Mains And Protective Devices

4.1 Isolation

Except in circumstances where live working (section 2.7) is absolutely necessary, equipment being worked on must always be isolated from the supply.

Where the equipment is connected to the power source by a plug, the plug must be removed and a lockable cover fitted over the plug. The key to the padlock will be retained by the person carrying out the work. Alternatively the plug can be taken back to the working area so that it is permanently visible to the maintenance personnel.

Where the equipment is connected by a permanent outlet, the outlet must be isolated and locked off with a suitable padlock and the person carrying out the work must retain the key. Where two or more people are working together each person must use a separate padlock and key. In all cases lockout devices must be returned at the end of the job.

After leaving the work area, even for a short while, you must check that the equipment is still isolated before recommencing work.

Notices such as ‘Danger - Men working on conductors’ must be posted on all isolated equipment.

4.2 Transformers and low voltage supplies

Transformers provide a means of isolating equipment from the mains supply. Portable tools used in hazardous areas such as building sites should normally be powered from a 110Vac transformer centre tapped to earth (limiting a shock to earth at 55Vac). However as most tools used by workshop personnel are rated at 230Vac, a 230Vac double wound isolating transformers is an alternative; although in view of the weight and bulk of the transformers, it may be more convenient to use an RCD adapter. The 230Vac isolating transformers are a valuable aid in test benches when danger exists from the live chassis of equipment under repair.

It should be noted that isolation transformers do not protect against electric shock altogether. The output terminals of the isolation transformer could have the same lethal potential if touched.

Auto transformers and Variacs do not provide isolation from the mains and must never be used for the purposes of providing isolation.

Voltages below 50V are generally safe (in dry conditions) but can be a danger when several are wired in series to give a higher voltage.

4.3 Batteries

Either single or banks of batteries can be used to provide power supplies isolated from the mains. Such supplies are as dangerous as a mains supply of equivalent voltage and must be treated with appropriate precautions.

Since high currents can flow if batteries are short circuited, care must be taken to ensure that short circuits cannot occur. Short circuiting batteries pose an explosion risk as well as a risk of burns. If a lead-acid batteries explode then persons in the vicinity will be showered with acid.

Lead-acid batteries can release hydrogen and other noxious gasses during charging and so must be charged in a well ventilated area. The charging should not be higher than the specified rate to prevent overheating.

4.4 RCD Protected Outlets, Adapters and Other Protective Devices

RCD adapters are available for use out-with the workshop which itself is protected by built in RCD's. These must be carried as part of the standard toolkit and used always when working on portable mains equipment (IE fitted with 13A plug) with exposed live terminals.

It must be noted that whilst an RCD protected outlet does give added protection against electric shock from the mains, it does NOT guard against electric shock altogether. For example most electronic, and some electrical equipment are isolated from the mains via a transformer. On occasions the voltage on the output of the transformer or the voltage generated by the electronic circuitry, such as in a TV, may be high enough to represent a danger. A person touching a dangerous voltage which is isolated from the mains can receive a shock which will not trip an RCD. So always keep this in mind when using RCD's both here in the workshop and elsewhere. Do not assume it is safe to go straight in to a piece of equipment just because an RCD is present.

Gloves are available which are tested up to 15000v but are marked for 3000v working. These should be considered for use in preventing accidental contact and not for actual live manipulation of wires or terminals. These must be inspected before use for cuts or abrasions.

5. Medical Equipment

Electronic equipment designed for hospital use or where deliberate electrical connections are made to the body for the purposes of stimulation or recording of biological potentials require a specialist service. Whilst minor repairs, for example connectors, can be undertaken, the workshop cannot undertake any design, manufacture or certification of such equipment.

6. Workshop Practices

- Electrical/electronic equipment constructed by Central Workshop Services must be built in a workmanlike manner with care and attention taken to both the electrical and mechanical construction.
- The equipment must be designed, constructed, repaired and maintained to the highest possible standards and take into account the intended end use, and the environmental conditions that it will be exposed to. The safety of the end user of the equipment is paramount
- As far as possible the equipment should fail to safety. Access to live parts should not be possible without removing a screwed down cover. Mains leads should be of the correct current carrying capacity, be

mechanically secured (a knot or a tie wrap is not sufficient as the cable can twist).

- Where the appliance requires an earth to be fitted, the earth lead must be soldered or crimped to an earth tag firmly screwed down to an earth terminal on the chassis. The earth terminal must not be used for any other purpose.
- All accessible metal part must be constructed so that they are provided with a permanent and reliable earth continuity path to the main earth terminal. Painted surfaces must have the paint removed at junctions to provide an adequate path.
- Internal wiring and other live conductors must be insulated and secured to prevent conductors coming in contact with any exposed metal surfaces. Power outlets from the chassis must be arranged so that the sockets do not expose bare live pins when disconnected.
- Care must be taken to select the correct value of fuse. When connecting mains plugs to commercial equipment, the manufacturers handbook should be consulted.
- Where an instrument has been supplied with a non-standard mains lead (i.e. American colour coding) then the cable should be replaced with a standard UK cable.
- Outside of the Workshop, portable power tools, hand inspection lamps etc., should be used with appropriate double wound isolating transformers or RCD’s (earth leakage circuit breakers).
- Charging of lead-acid batteries should be carried out in a well ventilated area to prevent build-up of explosive or irritant gasses.
- Capacitors may store their charge for some considerable time after the power has been removed. This can be lethal if high-grade capacitors are charged to significant voltages. Capacitor must be stored in a discharged state. Discharging must be done using an appropriate resistance and not by shorting the terminals.
- All electrical/electronic equipment produced or repaired by workshop personnel must be tested and labelled for electrical safety before release. Whenever possible the tests should be conducted by a person other than the designer/constructor/repairer. The tests required are earth continuity, and insulation. More stringent tests including earth leakage may be necessary if the apparatus is designed for direct patient contact as in, for example, EEG recorders.

7. Live Working

The main danger is electric shock causing death or injury to self or others nearby who may come in contact with live terminals. Other dangers are burns or explosions.

The Electricity at Work Regulations prevents live working unless it is not possible to repair or test an appliance or installation without the power being applied.

In order to diagnose a fault in electrical/electronic apparatus it is normally necessary to take test measurements at various places within the circuit with the power applied. Whenever possible the application of probes to the test points should be done with the unit switched off and only powering up when everyone is clear of the equipment. This is not always possible and therefore careful controls are required in order to remove risk of accidental contact with live terminals. In working with live equipment it is for test purposes only, no connection or disconnection of live terminals should be made.

The decision as to whether it is necessary to work with the equipment live is left to the individual technician with the necessary competency and authorization to perform such work.

Only fully trained, competent and authorised persons may commence live working on equipment of any kind. A list of those authorised is displayed in the workshop.

7.1 High Current Supplies

Power supplies, including batteries, of a high current rating can be a danger if the terminals are short circuited. Molten metal can splash into the technicians eyes or severe burns can occur. It is important when working on this type of equipment that the terminals cannot short together.

7.2 High Voltage (650-3KV) and Extra-High Voltage (>3KV) Supplies

High voltage supplies in excess of 40kV are common place on scientific equipment. These are particularly dangerous if they have a low source impedance (i.e. if they can provide a current high enough to be a danger). Where a current is limited by a suitable series resistor to less than 5mA the supply is often thought of as being inherently safe. However, there is no clear dividing line of current capacity above which the equipment can be said to be lethal and below which it is said to be inherently safe. Below 1mA supplies are not likely to be dangerous. Any capacitors may retaining a lethal charge.

All such high voltages must be considered as potentially lethal. No person shall undertake lone working on high or extra-high voltage equipment with exposed live terminals.

7.3 Medium Voltage Supplies (250-650V)

Much of the equipment used in this category are 415V, 3-phase devices including: motors, variable frequency drives, furnaces & machine tools. Many are hard wired in to the building supply or are fitted with sockets to enable disconnection.

All such supplies are potentially lethal. No person shall undertake lone working on medium voltage apparatus without first discussing the work with a supervisor/colleague.

7.4 Low Voltage Supplies (50-250V)

Voltages exceeding 50Vac or 120V ripple free dc should be considered hazardous in a dry, unconfined, non-conductive location. These voltages must be reduced if the location is wet, confined or conductive. A simple rule is to consider all voltages above 30V either dc or ac as potentially hazardous.

7.5 Trainees and other Persons with Limited Skills or Experience

Some technicians lack the necessary skills to work live and so pose a threat to their own health as well as to others and require close supervision. Trainees and other persons so designated must not begin live work unless supervision is available. A list of those authorised to conduct such work is maintained and displayed in the workshop, if your name is not on it then do not start work.

7.6 Place of Working

Whenever possible the preferred place of working on live equipment is the workshop.

7.7 Equipment

The correct test equipment must be used when working live. The equipment and probes must be of sufficient capacity for voltage and current and be in good condition. Where possible high voltage probes should be attached with any electrical power removed and charge storage devices discharged.

Protective devices should be used if possible but not be wholly relied upon (see section on RCD Protected Outlets and Other Protective Devices).

7.8 Precautions

a) Consider any dangers. This will normally be done quite quickly by the individual technician. Questions to ask yourself could consist of the following:

- Can the work be done with the equipment dead?
- Am I authorised to conduct live working at this potential?
- Should I be accompanied by a colleague and is someone available to assist in an emergency?
- Is it absolutely necessary to work on or near equipment that is live at dangerous voltage or current levels?
- Have suitable precautions been taken to avoid injury?
- Am I competent to carry out this work unsupervised?
- Is there room to move or stand back in case of a problem or is there a risk of being knocked by a passer-by?

- Is the area cluttered with perhaps bottles of chemicals?
- Are you familiar with the appliance?
- Are the voltages/currents excessive such as in X-Ray or Laser equipment?
- Is the test equipment adequate?
- Is someone available to assist in an emergency?
- Could the lights be accidentally switched off by leaving you in the dark?
- Does the area need to be cordoned off to prevent others from entering and risking themselves or the person working?

b) Set in place adequate precautions to prevent danger to yourself and others. These may include:

- The use of RCD's or isolating transformers.
- The use of lockouts, barriers and signs.
- The use of suitable insulation to cover dangerous terminals.
- Powering the circuit from a lower voltage. EG in some electronic devices you can by-pass the appliances built-in mains driven power supply and instead attach a bench power supply thus eliminating the mains voltages form the device.
- Be sure to familiarise yourself with the type of equipment under test. EG does it generate high voltages internally?
- Whenever possible attach probes to H.V. terminals when the equipment is dead.
- Use safety glasses where a danger of arcing exists.
- Do not work alone and ensure that someone is aware that you are working on live equipment and the location and nature of the equipment. This should consist of telling the supervisor and the person responsible for the area you are working. If necessary work in pairs.
- Do not leave exposed live terminals unattended even for a moment. If you must leave the power on whilst not in attendance then dangerous terminals must be adequately covered by replacing and securing the covers. Persons within the area must be made aware of the danger by the use of signs such as 'Danger - Electric Shock Risk' or 'Danger - Live Conductors' placed adjacent to the equipment and where necessary kept out by the use of suitable barriers. Equipment being tested overnight must have all their terminals securely covered and adequate warning signs and barriers used.
- If there is a chance of insufficient light in the event of a main lighting failure then have a spare lamp operating from a local socket separate from the main lighting circuit.

c) Ensure that the test equipment you use:

- Is suitable for the purpose.
- Is not damaged and that all protective elements are intact. EG has someone removed the earth from the oscilloscope?

- Meets required standards. Equipment purchased for your use should always meet the required standards. You must not use your own equipment unless it has first been approved by the supervisor.

8. Non-Live Working (Permanently Connected Mains Connections)

The major hazard is accidental switching on of the isolators by persons other than the technician carrying out the work. This may be because the technician has left the area for any reason and an individual unknowingly switches on the power to get a service running again. The technician then assumes that the equipment is still in the same condition as when left and is then exposed to the danger of electric shock. Further dangers include the risk of charged capacitors.

Other non-electrical dangers are the changing of saw blades on a circular saw, changing the head on a milling machine or chuck on a lathe etc. This type of work involves working with the hands in and around the rotating mechanism. If the power is accidentally applied then serious damaged can be done to the individual.

8.1 Precautions

- Switch off the power at the isolator and lock it off with appropriate padlocks. If more than one person is working then it is preferable that each should have their own padlock.
- Verify using an appropriate tester that the equipment is in fact dead.
- Discharge any capacitors using a recognized method. **Do not short with a screwdriver.**
- Use appropriate notices such as ‘Danger - People working on electrical circuits’

9. Working Within the Workshop

The major hazards around the workshop are injuries from rotating or other machinery; slipping, tripping or falling; solder fumes; paint, lacquer and solvent fumes; electric shock; burns & fire; injury through lifting.

9.1 Precautions

- Keep walkways clear from obstructions and clear spills immediately.
- Use steps or ladders to reach places above head height. Do not use stools or chairs.
- Use fume extractors whilst soldering so as to draw the solder fumes away from the face.
- Use eye, face and hand protection where a risk of damage or contamination is possible whilst operating machinery or where a risk of explosion exists as in changing high pressure lamps or vacuum tubes (CRT’s).

- Wear eye protection when machinery such as drills or lathes are operating.
- Keep long hair, ties ETC away from rotating machinery. Hair should be tied-up. Ties should preferably be removed or at worst kept within the overall and tucked into shirt. Clip-on ties can be used.
- Disconnect power to machinery when changing tools ETC by locking off the isolator with a padlock.
- Dispose of sharp material appropriately, use the metal ‘swarf bins’ adjacent to the lathes/milling machines.
- Use aerosols such as butane, solvents, lacquers and paints in well ventilated areas and not in the paint store. The paint spray booth is the designated area for spray painting. As well as the fumes which can be harmful these are generally flammable. An example of a risk of fire from an aerosol is the use of switch cleaner on contacts which may arc causing sparks, allow time for the propellant to evaporate before applying power. This could mean times up to 15 minutes in areas with little air flow.
- Before using a power tool or any portable electrical appliance check that it is in good condition by inspecting the cable and plug for cuts, fraying or breakage. Look for the ‘Tested’ label. Do not use it if it does not have an up-to-date ‘Tested’ label or if the cable/plug appear damaged. The criteria for an up-to-date test label would be if the tested date is within 12 months.
- Always fill gas soldering bolts in a well ventilated area and do not near any naked flames. They should be used solely for the purpose they were bought for and not as a cigarette lighter. They should not be carried in the pocket in case of fuel leakage.

10. Working Away from the Workshop

The major problem here is unfamiliarity with the surroundings. Many areas are accessed by us. These include chemistry labs, biological labs, animal labs, electrical labs. All of these present us with particular hazards which must be considered.

10.1 Precautions

a) Always check with a responsible person before commencing work. If you can’t check then do not start work. A responsible person is the TRM/TRO/Team Leader or the person in charge of the area or apparatus. Generally an undergraduate is not considered a responsible person.

b) Ask specifically about any hazards associated with the equipment or the area. For instance if a label stating ‘Biological Hazard’ is apparent then ask what the precautions are before starting work.

c) When leaving the area, even for a short period, ensure that any work unfinished is left safe by locking off the isolator and labelled appropriately so as to prevent injury to others. If necessary tell the responsible person.

d) When finished the work ensure everything is left in a safe condition, ensuring that all wires are safely terminated and isolated, all covers are replaced and that where appropriate the earth terminal is sound. The appliance should be tested for earth continuity and insulation and labelled accordingly.

e) Notify the responsible person when the work has completed and ensure that he/she is satisfied with the completed work.

11. Lasers

Reference must be made to the School's guidance on Lasers.

NO PERSONS SHALL WORK ON A LASER WITHOUT HAVING ADEQUATE TRAINING AND/OR KNOWLEDGE.

APPENDICES

A. Definitions

Authorised person	A fully qualified person authorised by the TRO, or nominee, to carry out specific functions.
Competent person	A person over the age of 18 with sufficient technical knowledge and experience to enable them to avoid danger in carrying out their duties.
Extra-low voltage	A voltage not normally exceeding 50V between conductors, and not exceeding 30V R.M.S or 50Vdc between any conductor and earth.
Low voltage	A voltage in a system, normally exceeding the extra-low voltage but not exceeding 250V R.M.S whether between conductors or to earth.
Medium voltage	A voltage in a system normally above 250V R.M.S., but not exceeding 650V.
High voltage	A voltage in a system , normally above 650V but not exceeding 3kV RMS.
Extra-high voltage	A voltage in a system normally above 3kV R.M.S.

B. Chemicals In the Workshop

Standard chemicals used in workshops can pose a potential risk to health and safety. Hazardous chemicals should be provided with Safety Data Sheets (SDS). These SDS are held within the Workshop and are freely available to study. Before using any chemicals for the first time, instructions and precautions on the container must be read along with the MSDS. Inexperienced personnel must receive training in the use of chemicals or other substances which pose a hazard to health. Where in doubt seek guidance from a supervisor or the Local Safety Coordinator.

Exposure to hazardous chemicals most frequently occurs when:

- Painting.
- Cleaning.
- Degreasing.
- Lubricating.
- Use of adhesives.

The most common health effects are:

- Dermatitis from metal working fluids and oils.
- Lung problems from isocyanate paints and glues.
- Poisonings such as lead poisoning and rarely cancer from mineral oils.

To minimise hazards:

- Read safety data sheets.
- Read precautions on containers.

- Seek advice.
- Avoid skin contact and inhalation.
- Use in well ventilated conditions using fume extraction where necessary.
- Wear appropriate PPE.
- Wash frequently with soap and water.
- Dispose in accordance with manufacturers recommendations and environmental regulations.

B1. Cleaning And Degreasing

Many cleaning and degreasing substances used are harmful if not used properly, either through direct skin contact or through breathing in mist or vapour given off, commonly causing dermatitis and narcotic effects. Some cleaners give off vapour which is easily ignited.

To minimise hazards:

- Compare manufacturers data sheets and use the least harmful
- Read safety data sheets
- Avoid spills and evaporation by keeping lids on containers
- Mark contents clearly
- Wear appropriate protective equipment such as gloves, overalls, eye and foot protection to prevent contact with fluids.

When using liquids:

- Work in well ventilated areas and avoid working in confined spaces
- Where necessary to work in a confined space special precautions are necessary and a risk assessment required

B2. Decanted Chemicals

Some chemicals may be supplied in larger containers kept in chemical stores and decanted into small bottles for local use. These smaller bottles or containers must be properly marked with the contents and labelled with their particular hazards for example Flammable.

B3. Common Chemicals in Everyday Use

Chemicals commonly found in the workshop are listed here. The information here is not a substitute for the MSDS which should be available in the Hangar. Most of the chemicals listed here are used in small quantities as solvent cleaners or thinners. Paraffin may occasionally be used in small quantities as a coolant/lubricant at the drill.

B3.1 Acetone

Extremely flammable liquid and vapour. Vapour may cause flash fire. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects central nervous system.

Hazard Statements
H225 - Highly flammable liquid and vapor
H319 - Causes serious eye irritation
H336 - May cause drowsiness or dizziness
EUH066 - Repeated exposure may cause skin dryness or c

B3.2 Ethanol (Ethyl Alcohol)

Flammable. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects central nervous system.

Hazard Statements
H225 - Highly flammable liquid and vapor
H319 - Causes serious eye irritation

B3.3 Isopropyl Alcohol

Flammable. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects central nervous system.

Hazard Statements
H225 - Highly flammable liquid and vapor
H319 - Causes serious eye irritation
H336 - May cause drowsiness or dizziness

C3.4 Paraffin (Kerosene)

Classified as flammable and as harmful due to the aspiration hazard. Prolonged and repeated skin contact can lead to irritation and dermatitis.

Hazard Statements
H319 - Causes serious eye irritation

B3.5 White Spirits

Flammable. Harmful: May cause lung damage if swallowed. Toxic to aquatic organism.

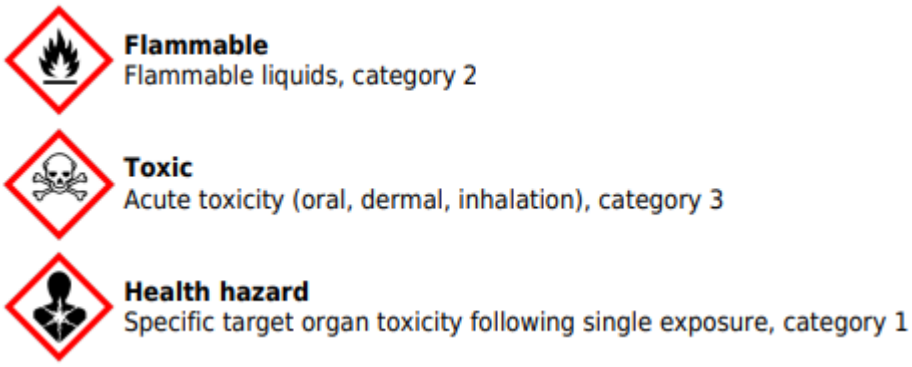
Hazard Statements
H226 Flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H336 May cause drowsiness or dizziness.
H411 Toxic to aquatic life with long lasting effects.

B3.6 Methanol (WARNINGS!)

Methanol is commonly mistaken for ethanol however the serious hazards (toxicity) associated with Methanol means it should not be used as a solvent in the Workshop and there are safer alternatives.

Hazard Statements

H225 - Highly flammable liquid and vapor H319 - Causes serious eye irritation.



C. Further reading

Eng_HS_ElectricalSafety.pdf (abdn.ac.uk)

Eng_HS_ChemicalSafety.pdf (abdn.ac.uk)

Risk Assessments | School of Engineering | The University of Aberdeen (abdn.ac.uk)

Maintaining portable electrical equipment (hse.gov.uk)

Safety in electrical testing at work (hse.gov.uk)

EN 60601 - Medical Electrical Equipment and Systems | BSI (bsigroup.com)

The IET Shop - Code of Practice for In-service Inspection and Testing of Electrical Equipment, 5th Edition

Review Record

Issue	Who	Date	Reason for Review
2	ES	26/01/2023	General update.