UNIVERSITY
of
GLASGOW

Student's Safety Handbook

School of Engineering

ABC

A student was playing electric guitar in a rehearsal. It was his own equipment but another student had badly fitted a plug to the microphone amplifier: connections were only finger-tight, and the earth lead was loose, leaving the equipment unearthed. The loose earth wire touched the live conductor in the plug, so the metal casing of the microphone was at 240 V. The guitarist held the microphone, touched the earthed metal strings of his instrument with the other hand, and was killed.

Before modifying a TV set to take headphones, a technician in a technical college did not realise that the set was of the live-chassis type. When the set was in use, the headphones and jack-plug were live at 350 V DC. A student using this equipment received a severe shock and burns, and was knocked unconscious. As he collapsed, the TV set fell on top of him and his shoulder blade was broken.

Checking the fuses in a 415-V switch-fuse unit, two electricians used a multi-meter. To save removing the fuses (the proper procedure), they defeated the interlock on the unit's cover, to measure internal voltages. Improvised leads were used as probes, which did not attach securely to the meter; one pulled loose. One man held both ends of this lead, thinking he had the free ends of the two leads, and applied them across the 415 V, causing a line-to-line short-circuit. Both technicians suffered severe flash burns.

These accidents occurred to ordinary people in ordinary activities, through ignorance of safe practices or bypassing proper safety procedures.

1 Safety at work

Safety in the workplace is obviously important.

It's not just a matter of avoiding accidents. It requires a safety-conscious attitude, and habitual practice of appropriate procedures.

It's not just a good idea, either. The UK Health and Safety Executive requires the University to inform and guide students and employees in these practices. You'll find similar requirements in any company you work for. Some students will be familiar with safety procedures from previous or part-time jobs; for others, "safety culture" may be new.

In your laboratories the staff have made every effort to ensure that equipment is as safe as possible, and that appropriate procedures are developed and made known.

Clearly, we all need to follow these procedures.

This booklet has been prepared to provide basic guidance to you, as a student, on matters of safety. Please read and understand it. In addition, certain laboratories have specific safety procedures which must always be understood and followed.

Understanding safety helps you protect not only yourself against mishaps, but also your friends and colleagues.

If you have questions or observations, please mention them to any member of staff.

2 Instructions

You will find safety instructions in three important places:

(1) this booklet

(2) the University and School's safety websites:

http://www.gla.ac.uk/schools/engineering/informationforstaff/safety/

http://www.gla.ac.uk/services/seps/

(3) safety codes for specific laboratories

- **Every student must read this booklet and the School's safety handbook**, which is on the web at:

http://www.gla.ac.uk/schools/engineering/informationforstaff/safety/

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3 Safety throughout your course

In the early part of each academic session there will be a general safety lecture which all new undergraduates must attend.

As part of *Engineering Career Skills III* you will undertake exercises in safety engineering, including a formal risk assessment.

In your labs you will find safety instructions and procedures posted on notice-boards, and written into the instructions for particular experiments.

Above all, as a member of the technical community of this Department, you should develop the habit of "thinking safety" at all times, and extend your vigilance to cover not only your own safety but also the safety of those around you.

4 Lab body language

Let's get this right first. There is a list of "do's" and "don't's".

Always Do

- be alert, gentle, quiet, and observant;
- read instructions, including safety instructions;
- ask the instructor when you don't understand something;
- keep your bench (and especially wiring) neat and tidy;
- have a circuit diagram handy on the bench;
- tie your hair back if it's long enough to get caught;
- check the location of emergency switches, fire escapes, phones, fire extinguishers, and first-aid boxes.

Don't ever

- run or fool around in the lab.;
- work alone in the lab.;
- wear a tie...or any other loose clothing or jewellery that could get caught or touch circuits or chemicals;
- bring bags and coats into the lab unless they can be stowed;
- take food or drink into the lab;
- switch equipment on before you are authorized to do so;
- modify or interfere with the correct operation of equipment;
- remove the earth lead from <u>any</u> instrument or equipment.

5 How to conduct experiments safely

§ Read instructions thoroughly. If in doubt, <u>ask</u>.

§ Be clear what you are going to do, before you do it. Imagine what consequences to expect from every operation.

§ Take the time to make a detailed record. It is better to err on the side of

recording too much detail, rather than too little.

- § Try to process your data as soon as you record it.[1]
- § Never ever work on live circuits.
- § Never ever have shafts rotating without safety guards.
- § Take extreme care with hand tools, especially soldering irons and electric drills. We take these tools for granted because they seem so familiar. But many nasty accidents arise with them, so follow proper procedures, and wear safety glasses.
- § If equipment is getting too hot, switch it off. The maximum touch temperature of any equipment should never exceed about 50□C. Even that is much too hot.
- § Take special care with electrolytic capacitors, batteries of all kinds, and power transistors. All of these can cause vicious accidents—burns, blindness, fires.... Even when the circuit voltage is as low as 12V, enough energy can be stored to cause serious injury, to say nothing of the release of dangerous chemicals if casings are breached.
- § Treat lasers with extreme respect. Special precautions are enforced. (See below)
- § Special precautions are also enforced with liquid nitrogen and even more stringent rules with other laboratory gases and chemicals. Keep away from gas cylinders unless you have authorization and supervision.

6 Lasers

The labs for some courses involve the use of lasers. Lasers emit light in the ultra violet, visible and infrared part of the electromagnetic spectrum. They emit a narrow, intense beam of light which can damage the skin and eyes. Lasers are classified according to the optical power they emit and the wavelengths at which they operate. There are four classes of laser: Class 1 presents no risk of injury and Class 4 has a high risk. The lowest class of laser that can be used for an experiment is used, usually class 1 or 2, you don't need to worry about having to deal with a class 4 laser. If you need to use a laser you will be told the classification of the laser and the safety precautions that need to be taken when using the laser. It should also be remembered that lasers are powered by electricity, so general electrical safety rules must also be followed.

7 Chemicals

Among other hazards you might encounter are chemicals such as acids and organic solvents, which are used in the fabrication of electronic devices. The use of hazardous chemicals comes under the Control of Substances Hazardous to Health

[1] One of the worst practices for engineering students is to try to “get the results quickly” and postpone the processing and writing-up until later. If you leave the lab early with unfinished work, you’re not doing your job properly. *Don’t even think about* this lousy habit, and more importantly, don’t practise it.

Regulations, called COSHH Regulations for short. Every chemical that is used in the department is assessed to see if it is hazardous. Any chemical deemed to be hazardous has a COSHH form completed about it and a "scheme of work" is developed so that the chemical can be used safely. If you need to use any chemicals the associated hazards will be explained to you and you will be given full training on how to handle them safely.

8 What to do in an emergency

Everything we've discussed so far is about *preventing* accidents. This section is about your response if there *is* an accident. Much of this is standard first-aid: only a few principles are summarized here:

Electric shock

If someone is receiving an electric shock, he/she may not be able to let go. **Don't touch them. Switch off the power first.**

If you can't switch off the power, use a plastic belt or any insulating implement to try to separate the person from the source.

If the person is unconscious, first make sure his/her breathing passage is clear. With the person lying on his/her back, lift the chin and press the forehead backwards, so that the jaw lifts the tongue away from the airway. If there is no breathing, apply artificial ventilation (generally by mouth-to-mouth resuscitation).

Also check the pulse. If there is none, mouth-to-mouth resuscitation and chest compression should be applied alternately.

Nervous shock

Raise the legs, loosen clothing, keep warm, and don't eat or drink.

Electrical burns

If the skin is not broken, cool with cold water and/or a dressing.

Cuts and lacerations

Control bleeding by pressure through a clean dressing