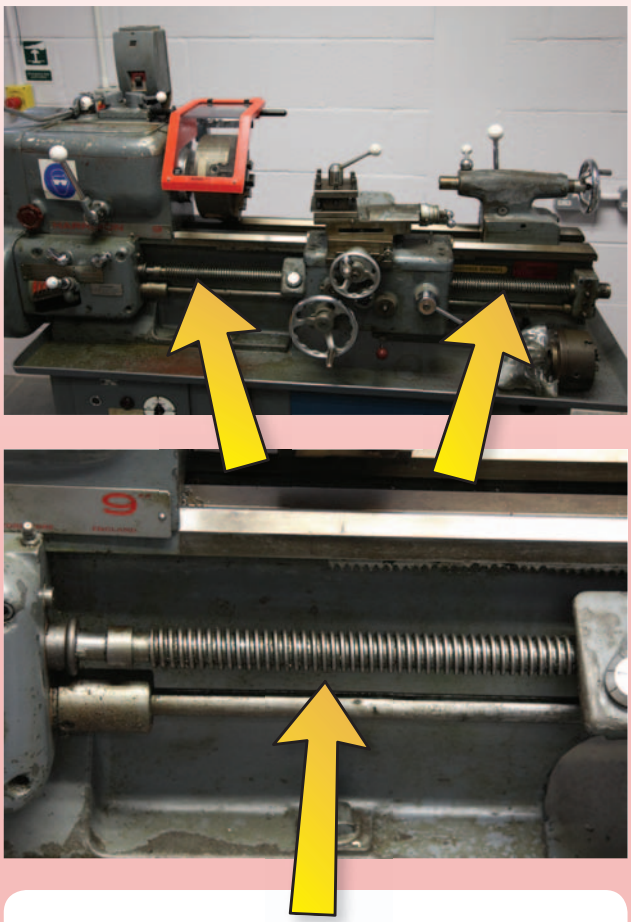
Make your lead screw safe

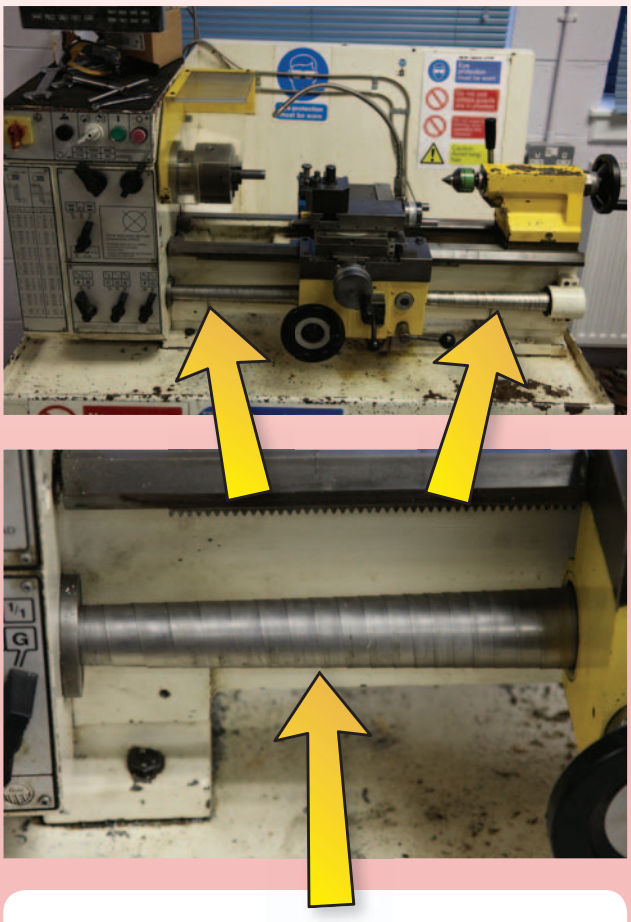
Sometimes, lead screws on school Centre Lathes may be covered by overhanging bedways. However, if the lead screw is exposed on your machine an appropriate guard should be provided according to the updated British Standard 4163:2014, Page 78. Rotating exposed lead screws provide a dangerous entanglement or trapping hazard to student aprons, long hair or loose jewellery.

However certain metalwork lathe designs are not suitable for guarding the lead screw, and in this case, as an alternative to guarding of the lead screw, the drive to the lead screw must be completely disconnected (by the removal of an internal gear from the lead screw drive mechanism). This action should only be completed by your authority's approved machine maintenance contractor.

If an exposed lead screw is required, a special risk assessment showing how the additional hazards presented by the unguarded shaft will be removed or reduced using appropriate control measures must be retained in your Technical Education Department's Health and Safety folder (paragraph 14.2.2 - BS 4163:2014).



This lead screw is exposed with no guard and presents an entanglement risk when rotating.



This lead screw has been properly guarded using a Spiroflex lead screw cover guard.

Electrical equipment - NSFW?

A lot of the equipment you buy for use in a school science lab will be mains powered. How do you know that it's suitable for work?

Recognised suppliers of science equipment

Anyone with desktop publishing or web design skills can give the impression of being a reputable vendor of science equipment. Most schools will have a number of teachers or technicians who have been around long enough to know who the big names are. That is not to say that a new company cannot be trusted to produce safe equipment. Nor can we assume that one of the established companies is beyond marketing or producing something that should not be used by children. Recent experience has shown that even some of the most respected names slip up. Fortunately, reputable suppliers have shown a great willingness to work with SSERC to put things right.

Supermarket specials

You could be forgiven for thinking that something put on sale to the general public would have to be extra safe. Unfortunately, it does not work that way. Take kitchen blenders. If you go into a professional kitchen, you may well see something that looks like your own blender but there will be a couple of important differences. The professionals' machine will have a recessed start button and a very prominent "mushroom" stop button. The reason is that this machine, compared to one at home, will get much more use in a high pressure (and if TV is to be believed, profanity-ridden) environment. Do not assume that something on sale to the general public is, therefore, suitable for the completely different circumstances found in a busy school science lab.

For these reasons, we have written this guide to give you some pointers concerning what to look for.

Plugs and leads

In an effort to save money, a number of manufacturers have been supplying equipment with plug top power supplies with interchangeable blades. The idea is that one power supply covers a variety of world markets and is adapted to do so via the provision of different plates with attached pins. Some of these designs are good - the locking mechanism is robust and any live contacts are covered until the plug top is snapped into place. Others, like the one in Figure 1, are poor.

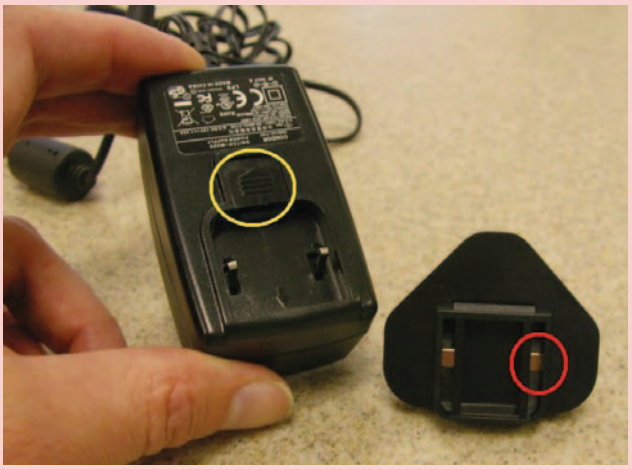


***Figure 1** - Plug top with detachable blade.*

The blade locking mechanism does not inspire confidence and, though slightly recessed, the live conductor could easily be touched with a coin, key or similar. If you come across something like this, make sure you risk assess it. Can you trust your pupils not to detach the blade or, if it becomes detached in normal use, not to touch the live part? If not, don't use it. In any event, please do let us know. Gratifyingly, all the suppliers who sent out kit like this have relented and begun supplying one piece plug top supplies. Watch out too for equipment with European-style plugs supplied with "shaver-style" UK adaptors.

Now have a look at Figure 2.

***Figure 2** - what's wrong with this plug?*

Figure 3 *- Pupils might be tempted to stick things into vent holes.*

Figure 4 *- Well-designed mains fuse holder.*

Compare this plug's width at the bottom with one bearing the British Standards Kitemark. It is much narrower, making it more likely that you will touch a pin when inserting or withdrawing it. The pins are half insulated, which is good in the case of live and neutral but bad in the case of earth. It could be possible to insert this into socket and for the earth pin not to make contact with a conductive part. What you probably noticed before anything else, though, is that there is no fuse. All of this is completely unacceptable. Again, we're pleased to say, the supplier agreed and replaced the lead.

Holes and vents

SSERC has worked with the British Standards Institution [1] to draw up guidelines for manufacturers of educational equipment. The hope is that this will be incorporated in BS EN 61010. At the moment, it is a standalone publication called TS 68250. As you would expect from a British Standards publication, test procedures are tightly defined. Regarding holes and vents in a piece of electrical equipment, as a rule of thumb, you should not be able to touch a part of the apparatus that would be hazardous live when in use with a probe made from an unfurled paper clip (Figure 3). As before, if you have equipment that does not meet this criteria, risk assess and decide whether you can trust pupils not to misuse it.

Fuses

In addition to a fuse in the plug, which is designed to protect the flex, a piece of apparatus may also have a built-in mains fuse. If this can be removed without the use of a tool, the equipment will fail its Portable Appliance Test (this is a criterion for mains equipment used in schools by pupils). Figure 4 below shows a well-designed fuse holder. The fuse cannot be removed by hand. Some sort of a tool, even an improvised one such as a coin, would be needed.

Dual voltage settings

Some "off the shelf" kit can be switched from 230 V to 110 V so that it can be used in America. Running an appliance at 110 V from a 230 V socket could cause dangerous overheating. If the equipment is for pupil use, check to see whether it can be switched from one voltage to another without the use of a tool. If so, do not let pupils use it. Taping over the voltage selector is not good enough - it is too easily circumvented. We know of some institutions that have used strong epoxy adhesives to fix voltage selectors to the desired setting. If you do this, you must be absolutely satisfied that pupils cannot unpick the glue and that it would not work loose with time. If a satisfactory fix can be made, its inspection should be part of the annual testing regime.

Cable security

Mains cables passing into the casings of appliances should be secured and should not abrade against the casing. The obsolete power supply in Figure 5 shows very bad practice. What is not evident from the picture is that there is a knot in the cable inside the casing to prevent it being pulled out. This is not good enough. There should be a proper cable grip - not merely a grommet - to hold it in place. An unsecured cable could break loose inside the equipment, causing parts to become live. A cable constantly rubbing against the edges of the entrance hole could wear, exposing a live conductor. We were taken aback recently to see an example of a cable passing unsecured into a casing on a piece of kit from a company generally highly regarded for the quality of their equipment. Note that we came across a case where a technical education department were getting students to design and make mains powered table lamps. Beautiful though many of the lamps were, we had to advise the school to discontinue

the practice. Many of the lamps showed flaws related to cable security and, even for those which didn't, understandably nobody in the school felt competent to pronounce them as safe.

Rating plates

Somewhere on the body of a mains appliance you should expect to see rating information. If it is missing from a modern device, ask why. Figure 6 shows information on a metal-bodied power supply. Figure 7 shows the rating plate on a plastic-bodied plug top supply.

Note the "square within a square" symbol next to the CE mark. This shows that the appliance is "Class II". It does not need an earth wire because it either has two layers of insulation (double insulation) or reinforced insulation. Such insulation is designed to prevent any single fault causing an accessible part to be at a dangerous voltage. Most commonly, this symbol will appear on appliances that have non-metal casings. If you see this symbol on an appliance that has metal parts, be suspicious. They may be completely isolated from all hazardous live components or they may not. This does not apply to low voltage equipment run from a plug top power supply - it will be the supply that is double insulated. The low voltage kit does not need to be. Beware mismatches - for example, equipment with a two-core detachable cable but no Class II symbol.

CE Marks

The CE (Conformité Européenne) mark does not mean that a product has been independently tested and found to conform to the safety criteria outlined in a European directive. It is a self-certification scheme whereby a manufacturer asserts that their product does so. Some manufacturers employ independent assessors but others do not. Electrical equipment for use in schools must conform to the Low Voltage Directive. The bottom line with CE marks is that there should definitely be one, but its presence does not guarantee that the equipment is suitable for use in a science class.

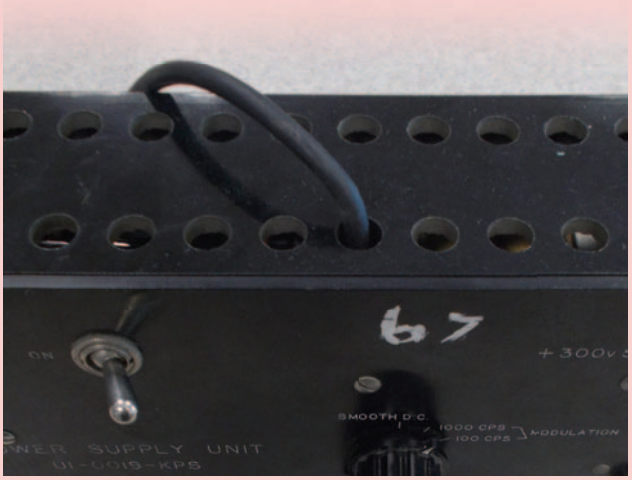


Figure 5 *- No cable grip.*

Thank you

All the issues raised in this article have been brought to our attention by conscientious teachers and technicians who have worried that something was not quite right about a piece of kit. Our sincere thanks for doing so. Keep up the good work!

Reference

[1] See SSERC Bulletin 241 "The Story of a Standard".

Figure 6 *- Rating information on a metal-bodied PSU.*

Figure 7 *- Rating information on a plastic-bodied plug top PSU.*

Radiation protection news

Disposal

In Bulletin 248 we reported on an anomaly in disposal regulations for radioactive sources. It was legal to put all currently recommended sources in the dustbin, apart from the protactinium generator and 370 kBq caesium sealed source and for them to be disposed of to landfill. Unfortunately, it was not legal for the bin lorry to transport the waste. This has now been rectified, although the restrictions on the protactinium generator and caesium source remain. Note that in the case of the caesium source, if schools keep it for a not-untypical 30 years, it will be able to be dustbin-disposed at that time if current legislation is not changed. Please contact SSERC if you want to dispose of a source.

Always ask SSERC...

- If you want to buy a new source;
- If you want to dispose of a source;
- If you want to transport a source.

You will not find guidance about disposal and transportation on our website (other than "contact SSERC") because these are areas we always want to be involved in. With source purchase, you have no option - we must be involved.

Case study

An on-the-ball technician at one of our recent Radiation Protection courses realised that his school owned a source that should not have been bought. The school had not sought permission from the Scottish Government to buy the source, something done via SSERC, and the supplier failed to ask for a permission letter. The item in question was a 370 kBq caesium/barium eluting source. Unlike the 33 kBq model, this is not on the list of those recommended by SSERC and would have required an expensive permit to keep and use. At the time of writing, it looks as if the situation has been resolved with the help of SEPA. This could, however, have proved to be very costly for the school.

Explosions in school

It is reasonable to assume that if the words explosion and school appear in the same sentence, then something has probably gone badly wrong. Such events are thankfully rare but not unknown. The HSE has recently prosecuted a school in Bristol after a technician was badly injured in an explosion.

The technician who was injured was preparing Armstrong's mixture, a highly sensitive explosive mixture of red phosphorus and potassium chlorate. Mixtures such as this can only legally be prepared by someone with an explosives license but even with one we would strongly recommend that this particular mixture (along with quite a few others) is simply not suitable for schools. The preparation of anything explosive in a school is an activity that should be approached with the greatest caution and only if there is a clear educational benefit that outweighs the risks. If you are in any doubt as to whether something is suitable to prepare or use in schools, contact SSERC.

Another cause of occasional fracturing of containers that can verge on explosions, though not so common these days, is organic waste bottles. If these get topped up piecemeal, there is always the possibility of something inappropriate being poured in which can lead to heating, vapourisation and subsequent shattering of the bottle.

We recommend that schools avoid having a standing organic waste bottle of this sort. The more things that are added to a mixture, the more chance there is of something unexpected happening.

If you have left over solvents, the best thing is to evaporate them in a (ducted) fume cupboard as soon as is convenient. If you do not have a ducted fume cupboard then they can be evaporated in a secure area outside in a shallow tray. If this is not possible then after each procedure, collect up the waste, put it in a bottle, labelled with the contents and the date, seal it and put it somewhere safe until the next chemical uplift. It is also sensible in this case to re-think the experiments that are carried out to see if there is a possibility of reducing the waste at source.

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