University Code of Practice for Electrical Safety

Introduction

1. Legislation

The legislative basis for ensuring the safe use of electricity (or electrically powered equipment) arises from the Health & Safety at Work Act 1974, the Provision and Use of Work Equipment Regulations 1998, the Management of Health and Safety at Work Regulations 1999 and the Electricity at Work Regulations 1989. The Management Regulations require that the risks arising out of the use of electricity are considered, with the particular measures required by the other legislation identified.

2. Application

The application of the Code of Practice applies to dangerous live voltages. ie those exceeding 50 volts ac or 120 volts dc. Systems designed and constructed for lower voltages need to be covered by a risk assessment.

3. Purpose of Code of Practice

The purpose of this Code of Practice is to provide guidance to Departments and Schools on how danger arising from the use of electricity may be prevented. Danger, in the context of this Code, means that involving a risk of injury arising from the electrical energy. Injury includes electric shock, electric burn, electrical explosion or arcing, or fire or explosion initiated by electrical energy. Other hazards, e.g. physical injury resulting from contact with moving parts of electrically driven equipment or tripping hazards from trailing cables etc. are not covered by this guidance.

When correctly used and maintained, commercial electrical appliances should not give rise to any hazards.

4. Organisation of the Code

This Code has been produced in four separate parts:

1. Introduction

2. Part A deals with the safe use, maintenance, inspection and testing of commercial electrical equipment.

3. Part B deals with electrical equipment and test rigs designed and/or constructed within the University.

4. Part C deals with live working situations, including testing of circuits energised to dangerous voltages (suitable facilities for this are described).

It is envisaged that the Introduction and Part A will be of universal application, whereas Parts B or C will be relevant to a very limited range of Departments or Schools. Appendices are included to expand the detail of particular sections.

Appendix A1 refers to the special requirements of electrical equipment in medical environments.

5. Definition of Responsibility

The fixed electrical installation of the buildings is the responsibility of the Senior Engineer within the Estate Office. The fixed installation includes the wiring up to the socket outlet, or to the isolator in the case of more permanently installed pieces of equipment. No one may work on the fixed installation without permission from the Senior Engineer.
Schools and Departments are responsible for wiring installations and equipment from the socket or isolator outwards.

6. Inventory of Electrical Equipment

All **Schools and Departments are required to keep an inventory** of all of the electrical equipment including all extension leads for which they are responsible. This will help it to comply with the regulations. Each piece of equipment should have a unique number/letter means of identification located in a prominent place and recorded on the inventory. The inventory may be computer or paper based.

PART A

Use, Maintenance, Inspection and Testing of Electrical Equipment

A1 Methods of Working

Where standard commercial equipment is used it should be fitted with the correct size of fuse and be constructed so that no-one can put their fingers on to parts which carry dangerous live-voltages, i.e. those exceeding 50 volts a.c. or 120 volts d.c. when it is operating.
In practice this means that equipment should always be checked before being used and it should be regularly checked and maintained.

It also means that equipment should be used only for those tasks and in the environment for which it was designed (Appendix A2).

Where any electrical equipment is to be used out of doors it should be protected by use of a 30 millisecond, 30 milliamp, residual-current circuit-breaker in the supply which will provide additional protection for the user.

The Senior Engineer must be notified and consulted in advance of the acquisition of any equipment requiring significant quantities of power, to ensure that the necessary supply is available.

A2 Pre-use Checks

Manufacturers of new electrical equipment have an obligation to ensure their equipment is safe for proper use, as long as the correct protection device (normally a fuse) has been fitted. If there are any special operating instructions given by the manufacturer then these must be made clear to all prospective users so they understand the correct `method of use'. New equipment should be checked (Section A3/4) and registered on the departmental or school inventory before use. If older equipment is brought into use it must be checked to ensure it complies with all current safety legislation and a full test and inspection (Section A3/5) should be carried out.
When equipment has been out of a department/school or on loan the department/school must make arrangements to ensure that it is in a safe condition before it is put back into use.

A3 Maintenance

A3.1 Responsibility

It is the **Department's or Schools responsibility** to ensure that **its electrical equipment** and appliances recorded **on its inventory remain in a safe condition**.
Where equipment is on extended loan to the Department then responsibility for formal inspections and/or testing must be agreed with the lending Department.

The Electricity at Work Regulations 1989 requires that electrical equipment and appliances etc must be maintained to prevent danger. The type and frequency of maintenance is dependent upon the circumstances but needs to be sufficient. It is for the user of the equipment to decide what is required, (since this is not defined in the Regulations).

A3.2 Definition of Maintenance Required

Non statutory guidance has been produced by the Health & Safety Executive[1, 2 and 3] with additional guidance includes that produced by the Federation of the Electronics Industry[4]

and the Code of Practice for In Service Inspections and Testing of Electrical equipment and the IEE Code of Practice.
Routine maintenance will determine whether equipment is either fully serviceable or if remedial action is necessary. It does not mean waiting until a serious fault (possibly dangerous) develops before sending it for repair.

Visual inspection, testing, repair and replacement form part of the overall maintenance strategy for keeping equipment in a safe condition. Maintenance checks on electrical equipment are most effective when applied at three levels:

(a) checks by the user;
(b) formal visual inspections by a person appointed to do this; **(recorded in the inventory)**
(c) combined visual inspection and test by a competent person. **(recorded in the inventory)**

Remedial action will be needed where required following checks and tests.

A3.2.1 Record of Maintenance
A maintenance record must be kept in the inventory by entering the date and result of each formal inspection and test. The frequency and thoroughness of the maintenance may have to be increased if experience, (eg historical records from previous maintenance), show that failures with the potential for danger, could otherwise arise. A suitable form is included as Appendix A3. Where schools or departments use databases to store their records or external contractors are used to carry out the tests and inspection the format may vary, but the information should be consistent with that on the internal form.

A3.2.2 Maintenance of Fixed Equipment
School or Departmental equipment which effectively forms part of the fixed installation should be examined and subjected to combined inspection and (Section A3/5) tests on a 5 yearly basis, unless experience indicates a more frequent need. Further advice can be obtained from the Senior Engineer.
The Estate Office is responsible for the maintenance of the fixed installations

A3.2.3 Portable Equipment
Portable or moveable equipment should be subject to a maintenance regime which varies depending upon the type of equipment, its use and its location. The regime should reflect the risk of dangerous faults developing. Appendix A4 gives guidance.

A3.3 User Checks (visual)
The user should always visually inspect or check the work equipment at every use. (A quick look for obvious damage)

All individuals should report defects in their work equipment. The following list illustrates the range of checks which users should be able to carry out as a routine part of their work:

INSPECTION	EXAMPLES OF FAULT
Damage (apart from light scuffing) to the insulating sheath around the cable	
Damage to the plug	A cracked casing or bent pins
Joints in the cable other than by use proprietary cable connectors (extension leads)	Unsafe joints would include those using temporary connectors or makeshift connections protected with insulation tape
The outer insulation sheath of the cable is not effectively secured where it enters the plug, equipment or any joint	Obvious evidence would be if the coloured insulation of the internal cable cores was showing
Damage to the external casing of the equipment	Loose parts or screws, dents and/or cracks
Evidence of over-heating	Burn marks or discolouration to plugs, cables or casings
Evidence of inappropriate use	It is wet or excessively contaminated with chemicals, oil, dirt etc.

The above checks should include extension leads and associated plugs and sockets as well as the equipment itself. **They should be carried out by the user during use**, with any faults reported so that remedial action may be taken. Defective equipment should be labelled as faulty and its associated plug removed if it is not repaired immediately.

A3.4 Formal visual inspections

The most important component of a maintenance regime is usually the formal visual inspection carried out routinely by a competent person. These inspections can detect the majority of potentially dangerous faults. They would include visual checks similar to those undertaken by the user but in a more formal and systematic manner. Additionally the plug cover should be removed where possible and a check made that the fusing is appropriate to the appliance, so that the cord grip and cable terminations are secure and correct, that the earth connection is made where appropriate and that there is no sign of internal damage, overheating or ingress of liquid or foreign matter. The formal visual inspection should not include taking the equipment apart which should be confined, where necessary, to the combined inspection and testing.

The competent person may be a member of staff who has sufficient information and knowledge and who has been given the task of carrying out the inspection. Training dependent upon the person's expertise should be provided (a suitable course is available centrally). To avoid danger they should also know when the limit of their knowledge and experience has been reached and who to ask for advice. **Departments and Schools should produce written guidance** summarising the checks to be made, the procedures to be followed when faults are found and when unauthorised equipment is found in use. A single set of general guidelines as described above will suffice for most circumstances.

Certain pieces of complex equipment may require specific instructions to ensure that nothing is overlooked. These can be kept with the other documentation relating to the

equipment, e.g. user manuals and other safety information. The general guidelines must make reference to these items of equipment.

A3.5 Combined inspection and tests

Some types of equipment (see Appendix A4) will require testing to reveal faults which would not be obvious through visual inspection. Such faults include loss of earth integrity, e.g. broken earth wire within a flexible cable and deterioration in the insulation of cables or equipment. Testing will be required:

(a) when there is a reason to suspect that the equipment may be defective but this cannot be confirmed by visual inspection;

(b) when a repair or modification has been made;

(c) at the appropriate regular maintenance periods (Appendix A4).

Inspections carried out in conjunction with testing would include those checks described in the previous sections with the addition of checking of the correct polarity, fusing, termination of cables and cores and suitability of the equipment for its environment.

The testing element requires a greater level of competence from the inspector than for formal visual inspections. Through appropriate choice of test equipment, most non technical and technical Departments and Schools should be able to identify individuals who could carry out the necessary tests "in house" if required.

The lowest level of competency required involves a person not skilled in electrical work routinely using a simple pass/fail type of portable appliance tester. The individual would of course need to receive training in the correct use of the device. This type of meter will cover the requirements of most Departments and Schools. Non technical Departments and Schools could perform these tests but would normally need to obtain specialist help for equipment which fails. Central training in inspection and testing for competent persons is available.

The second level of competency is where a person with certain electrical skills uses a more sophisticated instrument which gives actual readings requiring interpretation. Such a person would need to be competent through technical knowledge or experience related to the type of work. This type of testing would only be appropriate to more complicated systems as found in some engineering or scientific departments and schools where it is likely that staff with the appropriate degree of knowledge and experience will be available.

Appendix A1

Medical Environments

Use of Electrical Equipment in Laboratories and Low Risk Workshops

Appropriate standards are:-

British Standard BSEN60601:2006, "Medical Electrical Equipment - General Requirements for Safety"

Appendix A2

Selection of Equipment

Selection of equipment appropriate to the demands to be placed on it and the environment in which it may be used covers:

1. The construction of electrical equipment, including appliances, cables, plugs and sockets etc such that the equipment and any protective features of the electrical system, e.g. fuses, earths, trip devices and switches can withstand both the electrical loads involved and any hostile features of the environment in which it will be placed, i.e. chemical attack, physical abrasion or crushing, temperature extremes, water ingress or flammable gases, vapours etc.

2. The inappropriate use of extension leads can pose particular risks; they should be used only on a temporary basis and not as a permanent extension to a fixed installation. Where used, an extension lead should be considered to be a separate item of portable equipment, inspected and tested accordingly.

   Where extension cables are used, they should be routed and secured to walls or other fixed equipment to prevent pedestrian trip hazards and damage by equipment, machinery, furniture, spillages of liquid etc. Extension leads should always be 3-core, i.e. have an earth conductor, even if used with Class II (non-earthed) equipment.

   Guidance recommends that extension leads longer than the following should not be used.

   - $1.5mm^2$ core cable no longer than 15 metres.
   - $2.5mm^2$ core cable no longer than 25 metres.

   Where the use of 'slightly' longer extension leads is required they should be protected by a 30mA residual current device (RCD). Equipment plugged into longer extension leads should not exceed the safe current rating/volt drop of the particular extension lead, which could be less than the stated value on the rating plate. This should be ascertained by a suitably qualified person (electrician).

3. The manner in which the equipment is going to be used or worked on;

4. Maintenance of the equipment to prevent any defects from arising which might result in danger.

Appendix A3

Portable Electrical Appliance Inspection and Testing Record Sheet

This appendix is now available as a separate document. This document is in Word format in order to facilitate editing of the form.

- Appendix A3 Link (Word)

Appendix A4

Guidance for Initial Inspection and Testing Intervals

	Type of Environment	Type of Equipment **Note (1)**	Class I (i.e. earthed equipment)		Class II **Note(3)** (i.e. double or all insulated equipment)	
			Formal Visual Inspection	Combined Inspection and Testing	Formal Visual Inspection	Combined Inspection and Testing
1	Construction Sites 110v Equipment used out of doors or in	S	1 month	3 months	1 month	3 months
		M#	1 month	3 months	1 month	3 months
2	Commercial Kitchens	S		12 months		12 months
		M		12 months		12 months
3	Equipment in public areas for use by	S		48 months		48 months
4	Laboratories , Workshop	S		24 months		24 months
		M		12 months		12 months
5	Halls of Residence	S		12 months		12 months
		M		12 months		12 months

	Type of Environment	Type of Equipment **Note (1)**	Class I (i.e. earthed equipment)	Class II **Note(3)** (i.e. double or all insulated equipment)
6	Offices	S	48 months	48 months
		M	12 months	12 months

Notes

(1) S Stationary Equipment (see guidance overleaf)

M Movable Equipment

(2) All new equipment requires a formal visual inspection. The formal visual inspection may form part of the combined inspection and test when they coincide, and must be recorded.

(3) If the class of the equipment is not known, enquires should be made of the manufacturer or supplier. If this relates to equipment bought directly from a supplier outside of the European Union then an assessment must be made of it for compliance with the Electrical Equipment (Safety) Regulations 1994, which amongst other things will establish the class

(4) The results of combined inspections and tests are recorded.

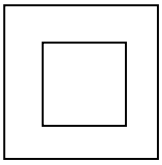
110v earthed centre tapped supply. 230v portable or hand-held equipment must be supplied via a 30mA RCD and inspections and tests carried out more frequently.

Definitions

Class I
Commonly called "earthed equipment". Protection against electric shock does not rely on basic insulation only. There is a means for the connection of exposed conductive parts (metal casing etc) to a protective conductor in the fixed wiring of the installation (the earth connection of the supply socket). The power cable to the appliance will include an earth continuity conductor to be connected to the earth connection of the fixed installation.

Class II
Commonly called "double insulated" or "all insulated" equipment. Protection against electric shock does not rely on basic insulation only. Additional safety precautions such as supplementary insulation are provided. There is no provision for the connection of

exposed metalwork of the equipment to a protective conductor in the fixed wiring of the installation. (i.e. the wiring does not have to include an earth continuity conductor). The equipment will be labelled with a symbol showing a small square within a larger square:



Guidance on types of Electrical Equipment
The following types of electrical equipment covered by this Code of Practice:

Stationary Equipment

(i) having a mass exceeding 18kg and is not provided with a carrying handle, e.g. refrigerator, washing machines, freezers, microwave ovens, or

(ii) comprising information technology equipment includes electrical business equipment such as computers, VDU's, printers, photocopiers, shredders, electric plotters, data terminal equipment, mains powered telecommunications equipment, electric typewriters, power packs, mail processing machines, multiple-socket extension leads dedicated to an item of stationary machinery.

Moveable Equipment (sometimes called transportable)

(i) having a mass of less than 18kg and not fixed, e.g. electric heaters, or

(ii) equipment with wheels, castors or other means to facilitate movement by the operator as required to perform its intended use, e.g. air conditioning units, or

(iii) an appliance of less than 18kg in mass that is intended to be moved while in operation or an appliance that can be easily moved from one place to another, e.g. toaster, food mixer, vacuum cleaner, floor buffer, desk fan, kettle, low voltage charger units, portable audio-visual equipment, trailing extension leads, laboratory equipment that is regularly moved between locations (e.g. sonicators, mixers, lamps,) multiple-socket extension leads in general use etc, or

(iv) portable equipment intended to be held in the hand during normal use, e.g. hair dryer, drill, soldering iron, grinder.