Inspection and testing of electrical equipment

Hard wired equipment

The periodic maintenance of hard wired electrical equipment should be undertaken by professionally qualified maintenance engineers, either University staff or a contract engineer. Guidance on maintenance is given in the IEE Wiring Regulations. The engineer or manufacturer responsible for a piece of equipment will normally be in a position to specify what periodic inspection and maintenance (including tests for electrical safety) is required and which of these functions, if any, can be carried out by the user. Careful consideration must always be given to the means of isolating such equipment from the supply system prior to testing.

Portable equipment

The term "portable" is not restricted to equipment which is normally moved around; it refers to all equipment which can be attached to an electrical system by a cable and plug.

Within University buildings, schools with technical staff resources will normally undertake the inspection and testing of all items of school equipment; those schools without technical expertise may call upon the Estates Department for assistance. Where the inspection and testing of portable equipment is carried out via Estates Department, schools must provide Estates Department with an up-to-date list of portable electrical items on (at least) an annual basis. Wherever possible, persons using items of privately owned electrical equipment in a University building should ensure that each item is inspected and tested for electrical safety. Students bringing personal items of equipment into residential accommodation must ensure that the item, including the cable, is not mechanically damaged and that the plug is correctly wired and fused. If in doubt, refer to a competent person.

Inspection of portable equipment

Inspections are visual checks of parts of the equipment and are mainly concerned with the cables and plugs. A check list for Inspection is set out in Appendix One.

In general, annual inspections of portable electrical equipment are recommended. However, more frequent inspections may be advisable if the equipment is being used in an environment where there is a high probability of damage, for example, in workshops and in fieldwork, etc.

Hand held power tools, which users have to grip strongly, should be checked before each use using the shorter check list given further on in this document. It is recommended that, wherever possible, this type of equipment is operated from a power breaker residual current protected safety plug, or similar device.

Testing of portable equipment

Testing involves making measurements of some electrical properties of the equipment. Portable appliance testers are available to carry out a number of different tests but normally only two tests will be required. These two tests are:

1. Earth bond resistance test.
2. Insulation resistance test.

Earthed Class 1 equipment has a conductive, usually metal, outer casing and the earth lead of its cable is connected to this casing. The earth bond test checks that the resistance of this connection to earth is sufficiently low. See Electrical appliances guidance note on Earthed Equipment regarding certain metal bodied electric kettles.

Double insulated Class 2 equipment has no need of an earth conductor. It has two sets of insulation to prevent the outer casing becoming live in the event of an electrical fault.

Both Classes of equipment require an insulation test. Only Class 1 can be tested for earth bond resistance.

Other tests offered by certain portable appliance testers include a flash test which is a more stringent test of the insulation and can provide an early warning of insulation problems, a load test to measure the load resistance between live and neutral to ensure that it is not too low for safe operation, an operation test which ensures that an excessive current level is not drawn by the appliance, an earth leakage test which provides a further test of the insulation under its true working conditions and is useful to ensure that appliances are not responsible for nuisance tripping of RCDs, and a fuse test which ensures that the fuse is intact.

Flash tests are optional and great care must always be taken not to damage sensitive equipment with this test. Equipment with solid state circuitry should never be subjected to a flash insulation test.

Recommended frequencies for inspection and testing

The recommended intervals between electrical tests and formal visual inspections which are tabled below are optima and may require to be reviewed in the light of experience. These frequencies are based on the Institution of Electrical Engineers (IEE), 'Code of Practice for In-Service Inspection and Testing of Electrical Equipment' and the Health and Safety Executive's HSG 107 'Maintaining Portable and Transportable Electrical Equipment'.

Equipment	**Visual Inspection Frequency -** See Note [1]	**Testing Frequency -** See Note [1]
Hand held Powertools (drills, etc.) and workshop equipment (see also Visual checks on hand-	6 Months	6 Months

held portable equipment before use).		
Power Cleaning equipment (Vacuum cleaners, polishers, etc.)	6 Months	6 Months
Most [2] equipment in laboratories, including IT equipment.	12 Months	12 Months
Most [2] equipment in accommodation, residences and catering	12 Months	12 Months
Most [2] equipment in offices, libraries and similar accommodation, excluding IT equipment.	24 Months	24 Months
IT equipment in offices, libraries and similar low risk accommodation.	See Note [3] below.	See Note [3] below.
Double insulated equipment (excluding items covered above).	24 Months	None

Notes:

[1] Records should be kept of all formal visual inspections and tests of electrical equipment and a model checklist record (.pdf) for formal visual inspections is available to assist with this. Further details on visual inspections can be found further on in this document.

Where the formal visual inspection frequency and the electrical testing frequency coincide, the formal visual inspection will be incorporated into, and therefore part of the electrical test. Where they don't coincide, visual inspections will need to be carried out by Schools, etc. at local level.

[2] On occasion, specific items of equipment may require an individual risk assessment, which takes into account intrinsic characteristics, mode of use, environment, etc., to arrive at an appropriate inspection / test interval, which may differ from that noted in the table.

[3] On the basis of a detailed risk assessment by Estates Department, and in consultation with the Health and Safety Executive, the University Health and Safety Committee has decided that IT equipment in offices and similar low risk environments can be removed from the PAT testing regime, though user checks (visual) at a local level will continue to have an important role in ensuring the safety of this equipment. User checks are concerned only with the visually accessible parts of the equipment, cable, plug and any extension cable. Further details on user checks can be found further on in this document.

IT equipment sited in more challenging environments, e.g., laboratories, workshops, multiple use computer areas (student computer labs) etc., and for use in fieldwork activities will continue to be tested as indicated in the table above.

New equipment

There is no requirement to carry out tests or formal visual inspections on new items of electrical equipment prior to the equipment being put into first use, however a user check should be carried out to identify any obvious visual evidence of damage. Further details on user checks can be found further on in this document. If there are any signs of damage, the equipment must not be used and referred back to the supplier/manufacturer, and/or thoroughly tested for electrical safety.

Recording the results

The Electricity at Work Regulations require that the results of electrical safety tests are recorded. A computer will often be a suitable medium for record keeping. The advantage of the more expensive portable appliance test instrument is that each has a memory in which the results of a large number of tests can be stored. This stores the date of each test, the unique number assigned to each piece of equipment, and the pass/fail and numerical results. Data from the memory can be sent to a printer or can be exported directly to a computer.

It is necessary to identify each piece of school equipment with a unique number. It may be convenient to label the equipment with its number but it is not necessary to do this, provided that each test result can be unmistakably connected to the piece of equipment.

Inspections will also require to be recorded and it may be most convenient to do this in the same format used for the tests. Alternatively, it may be more convenient to rely on the system for labelling equipment as a means of recording inspection. Suitable labels are available for this purpose from commercial suppliers.

All "failed" equipment should be removed immediately for repair or disposal.

Checklist for inspection of portable electrical equipment

There are two different types of visual examinations which may be carried out on portable electrical equipment, user checks and formal visual inspections.

User Checks

Use checks are simple checks which are concerned only with the visually accessible parts of the equipment and its cable, plug and any extension cable and these may be carried out by anyone. User checks should be carried out at regular intervals and especially after equipment has been relocated or unused for any significant length of time. User checks do not require to be recorded although Schools may prefer to do so.

User checks on IT equipment in low risk environments should be carried out when equipment has been relocated and a note of this check should be

recorded on the PAT Checklist form available at http://www.docs.csg.ed.ac.uk/Safety/policy/PAT_Checklist_P3.pdf.

Formal visual inspections

Formal visual inspections differ in that they require the inside of the plug to be examined in addition to the points noted in the User checks. As this requires access to the plug these checks should be carried out by those with some degree of technical competence and awareness. Details on the recommended frequencies for formal visual inspections are available above.

Records should be kept of formal visual inspections and a simple model checklist record (.pdf) is available which can be used to assist Schools, etc. record this information.

Where a fault is identified during either type of examination, the item of faulty equipment must be immediately taken out of service and labelled to indicate that the equipment must not be used [DO NOT USE - Equipment Faulty]. The equipment should be repaired using the normal maintenance system within the School (School Technician, Estates Department, contract maintenance engineer, etc.).

Visual checks on hand-held portable equipment before use

The Table below highlights the points to be checked:

		User Check	Formal Visual Inspection
Cable	Signs of mechanical damage, overheating or corrosion	√	√
	Hardening of outer insulation	√	√
	Kinking of cable	√	√
	Coiling of long lengths of cable	√	√
	A situation where future mechanical damage or corrosion is likely	√	√
	Signs of mechanical damage or corrosion	√	√
	Signs of overheating, e.g. discolouration or distortion	√	√

Plug	Cable clamp holding cable securely, where appropriate	√	√
	Wires connected to correct terminals and of the correct length		√
	Un-insulated ends of wires completely covered by the screws		√
	Securing screws suitably tight		√
	Fuse of correct rating fitted		√
Equipment	Metal casing damaged	√	√
	Grommet, or other protection at place where cable passes through the casing, damaged or missing	√	√
	Plastic casing of double insulated equipment damaged	√	√
	Damaged or defective switches	√	√