

SECTION 3(6)

ELECTRICITY AT WORK

CONTENTS

	Page No
Introduction	1
Principal general duties	1
Competent persons	3
Frequency of Inspection and Testing	4
Inspection of Portable Equipment	5
Testing	6
Documentation	8
Privately owned equipment	9
Implications for managers	9
Special note for education premises	9
Further information	9
Appendices	
Tests for portable appliances	11
Health and Safety Executive Guidance note GS23 Electrical Safety for Schools (Electricity at Work Regulations 1989)	13
Equipment Register*	19
Portable electrical appliance test record	*24

(Total numbered pages in this section: 20)

***Originals of check lists and other documents suitable for photocopying and use or distribution are given in Section 5.**

INTRODUCTION

The Electricity at Work Regulations 1989 lay down broad guidelines about safety of electrical systems and electrical equipment. The detailed interpretation of these Regulations requires employers to consult appropriate codes of practice and to apply the codes according to the assessed needs of the workplace.

The Regulations apply to and are enforceable in respect of all places of work where electricity is used. Breach carries with it the same penalties as for the Health and Safety at Work etc. Act 1974 itself. Part II of the Regulations specifies duties applicable to all places of work; whilst Part III applies only to mines. Many (though by no means all) of the duties require implementation, so far as is reasonably practicable - a less than strict duty, depending on a risk benefit trade-off.

Bracknell Forest Services based at the Depot is an approved NICEIC contractor and therefore qualified to offer complete inspection and maintenance services as well as advice in respect of all electrical installations and portable equipment. Contact should be made with the relevant Building Works Manager.

PRINCIPAL GENERAL DUTIES

Systems and Work Activities

Injury may arise from electric shocks, electric burn, a fire of electrical origin, electric arcing or explosion initiated or caused by electricity. The main duty on employers is to ensure that the system for distribution of electricity is constructed and maintained so as to prevent danger. Moreover, work activities, the use and maintenance of systems, as well as work near a system, must be carried out in such a way as not to create danger (Reg. 4).

The law requires that all systems are maintained so as to prevent risk of injury. A regular inspection programme of equipment is considered to be an essential part of any maintenance programme (see "Inspection and Maintenance" below).

Strength and Capability of Electrical Equipment

No electrical equipment must be used where its electrical strength and capability may be exceeded in such a way as to give rise to overload and, therefore, danger i.e. risk of injury (Reg. 5).

If the type of equipment and use is such that there is any doubt then an assessment must be undertaken to ensure that it is suitable for the job and not subjected to electrical stress which it is not capable of handling.

Avoid the use of multi-point adapters. Also avoid using extension leads and leads with multi-plug socket outlets wherever possible. If extension leads are used they must be suitably fused and care should be taken not to overload or use coiled on a reel. Lead lengths should not exceed 12m for 1.25mm², 15m for 1.5mm², and 25m for 2.5mm² core size. 2.5mm² core size is not suitable for use with a 13A plug.

Adverse or Hazardous Environments

Electrical equipment must not be exposed to adverse or hazardous environments unless it is of such construction or suitably protected so as to prevent danger (Reg. 6). Such environments include reasonably foreseeable mechanical damage; effects of the weather; natural hazards; temperature; wet, dirty or corrosive conditions; pressure; and flammable or explosive substances (including dusts, vapours, gases).

Serious injuries have occurred during excavation and other work near underground and overhead power lines. Precautions against such occurrences must include mapping, recording, marking cable runs on-site, the use of cable locating devices and safe digging practices.

Single phase, centre point earthed, 110V systems should be used so far as possible on construction sites where there is a constant risk of damage, exposure to wet conditions and breakdown of earthing arrangements. 25V equipment is needed for confined wet conditions.

Insulation/Earthing

All conductors must either be suitably insulated so as to prevent danger or have such precautions taken, including suitable positioning, as will prevent danger (Reg. 7).

To counteract the possibility that a conductor (other than a circuit conductor) may become charged, either as a result of use of the system or a fault in the system, such conductors must be earthed or other suitable precautions taken (Reg. 8).

Connections/Excess of Current/Cutting off Supply

Every connection in a system, e.g. connections to terminals, plugs and sockets, must be electrically and mechanically suitable for the purpose for which they are to be used (Reg. 10).

Means for Protecting from Excess of Current

Efficient, suitably located means for protection from excess of current must be provided (Reg. 11). Suitable fuses or preferably circuit breakers capable of interrupting the current or reducing it to a safe level must therefore be provided for protecting every part of a system.

Any residual current devices (RCDs) should be operated by means of the test button at least monthly to ensure that they remain effective and a record made. The relevant procedure should specify this to be carried out by a person nominated in writing. Any portable equipment for external use should be supplied through an RCD. These must not be considered as a substitute for proper inspection, testing and maintenance.

Means for Cutting Off the Supply and for Isolation

Suitable means (if necessary, including a means for identifying circuits) must be provided for cutting of the supply of electrical energy to electrical equipment and for the isolation of any electrical equipment which is itself a source of electrical energy (Reg. 12).

In practice, this means using a switch or "stop button" in a suitable location, easily accessible and clearly marked. The means of isolation must ensure that there is no way in which the isolation can fail electrically and where appropriate must include proper means of preventing unauthorised interference.

Equipment Made Dead/Work on Live Conductors

Where electrical equipment has been made dead, precautions must be taken to prevent danger; and while work is carried out on or near that equipment, from its becoming electrically charged (Reg. 13). Precautions would include identifying the circuit and/or equipment, disconnection from every source of electrical energy with isolating gaps sufficient for the voltage levels present and preferably that switches are safely locked in the off position and isolation secured, ensuring that notices are posted at the place of isolation, proving the circuit and/or equipment is dead, suitably earthing all conductors if practicable and protecting for inadvertent contact with nearby live parts. In addition, permits to work may be necessary - especially on high voltage systems.

Decommissioned equipment must be suitably marked and steps taken to ensure that it is dead and cannot inadvertently become re-energised or dangerously charged.

No person (i.e. not just an employee) must work on or near any live conductor (other than a conductor suitably insulated) unless it is unreasonable for it to be dead. If it is unreasonable to work dead, e.g. because diagnostic testing is being carried out, a risk assessment must first be carried out to see if it is reasonable to work near or on it whilst live and that suitable precautions, including the use of suitably insulated tools and personal protective equipment where necessary, can be taken to prevent injury. Work on or near live conductors should rarely be permitted (Reg. 14).

Working Space and Access

For the purpose of preventing injury adequate working space and access should be provided (Reg. 15). Where there are dangerous exposed live conductors within reach the working space should be enough to allow persons to pull back away from the conductors without hazard and pass one another with ease. A typical example would be an intake cupboard, which re-enforces the need not to use these spaces for storage.

Lighting Work Areas

Adequate lighting must be provided at all electrical equipment (Reg. 15). This duty is strict unlike some of the others. This is particularly so in the case of electrical equipment where unwanted contact is likely to produce more severe injuries than with most other equipment. Thus, if a light bulb failed in such an area and the employer had a reasonably efficient system of reporting defects in lighting arrangements, they would still be in breach of statutory duty if an accident occurred.

COMPETENT PERSONS TO PREVENT DANGER AND INJURY

Whatever work is carried out requires a sufficiently competent person for the task. Electrical work can be as simple as changing a fuse or a light bulb, which require very little knowledge and can be carried out by most persons after very little training, or complex, such as testing and interpreting the results, where a far greater understanding is necessary.

Competence is related to knowledge, experience and training. Regulations often refer to 'competent persons', without (normally) defining the term - though the previous Electricity Regulations went some way towards this by defining an 'authorised person'. The Regulations require that 'no person be engaged in any work activity where technical knowledge/experience is necessary unless either he possess such knowledge/experience; or he is under appropriate supervision (Reg. 16). This Regulation also encompasses the possibility of 'lone worker' situations.

It is the manager's responsibility to ensure that the level of competence is appropriate; it may be necessary to seek the guidance of a qualified electrician to assist in determining this and the Housing Property Services DLO can provide this service.

INSPECTION AND MAINTENANCE

All systems must be maintained so as to prevent risk of injury (Reg. 4). A regular inspection programme of equipment is an essential part of any maintenance programme.

The law does not specify how often routine inspection and preventative maintenance should be carried out. The obligation to maintain only arises if danger, i.e. risk of injury, would otherwise result.

The manager of an employee using electrical equipment has the responsibility for ensuring that their working conditions and systems are safe. However, although not recommended as it may cause confusion if not properly managed, in some locations the line manager may not hold the necessary budget and have been allocated the duty to arrange for inspection and testing of portable electrical equipment and to maintain the records.

Whether or not it is the line manager, the frequency of inspection and testing of items listed on their inventory is at the discretion of the duty holder. Where they are not the same person, the duty holder must make arrangements for inspection and testing in consultation with the operational manager(s); in such cases, any query by a manager should initially be referred to the relevant duty holder.

FREQUENCY OF INSPECTION AND TESTING

Fixed installations

Fixed installations should normally be inspected at least once a year but the depth and frequency should be determined by such factors as the type of installation, its use and operation, the frequency of maintenance and the environment. It may be appropriate for the installation to be fully tested at not less than five year intervals (see "TESTING" below).

All wiring work in and about buildings must be carried out to conform to The Institution of Electrical Engineers for Electrical Installations (the IEE) Wiring Regulations also now in BS 7671 which is a recognised Code of Practice. Contractors must be approved by the National Inspection Council for Electrical Installations Contracting (NICEIC), the Electrical Contractors Association (ECA) or other recognised accredited organisation.

Portable equipment

Portable equipment (essentially anything with a plug on it) should be inspected and tested on a sufficiently regular basis based on experience and having regard to e.g. its condition, type, use and manufacturers guidance. Each item must be labelled with its own unique identification number and so must any detachable supply lead.

The maintenance programmes must include user checks not requiring a record, formal visual inspections (without a test), and combined inspection and testing as is considered appropriate. Further information regarding these maintenance tasks is given below. The law does not specify how often these should be carried out to prevent danger as it is individual to the piece of equipment and circumstances of use.

In order for the maintenance of any individual piece of equipment to be related to the risk, the inspecting and testing frequency and who should carry these out must be based on accurate information of the present condition of the equipment and previous records. This means that testing information should be provided to managers where they are not the duty holder; conversely, it is most important that information regarding the physical condition and use is provided by managers to duty holders.

Testing once a year regardless of the risk does not meet the legal requirement. Testing too frequently is costly and unnecessary. On the other hand a frequently used kettle may need, for example, formal visual inspections every few months and testing annually. The appropriate frequencies should be determined by the manager carrying out a risk assessment, recording it in writing if significant. This must have regard both to the use and the previous test history. If the insulation on any piece of equipment begins to break down then this may mean more frequent testing is necessary and the DLO will be able to make recommendations regarding this.

As they make the necessary arrangements, ultimately the frequencies of inspection and testing are at the discretion of the duty holders. The intervals mainly depend on the type of equipment, the work environment and how often it is moved.

The intervals between checks, inspections and tests must be kept under review, particularly until patterns of failure/damage, if any, are determined. After the first few inspections/tests consideration can be given to increasing the intervals or if necessary reducing them.

The most expensive part of the maintenance arrangements are combined inspection and testing. To ensure that much time and effort is not unnecessarily expended in having unrealistically short periods between examinations, suggested starting points for combined inspection and testing intervals in low risk environments such as offices are shown in the table below.

INSPECTION OF PORTABLE EQUIPMENT

Inspection, depending on what is appropriate at the time for the individual piece of equipment, does not necessarily have to be carried out by a highly-trained person. Many of the common faults that occur may be detected visually or by simply removing a plug top. Different levels of competence are required for different tasks. It is the manager's responsibility to ensure that the level of competence is appropriate; it may be necessary to seek the guidance of a qualified electrician to assist in determining this and the Housing Property Services DLO can provide this service.

User Checks

User checks are the responsibility of operational managers. These are informal checks by staff who should periodically be reminded that they should report any defects observed. Cables and leads of moveable equipment, e.g. kettles, are most at risk from damage in use. If a fault is suspected then the item should be unplugged before examination.

User checks are not necessary for static equipment e.g. desktop computers, photocopiers etc. Visible coloured wires that have pulled out of cord grips, signs of overheating, taped joints and damage to casings or loose screws account for the majority of defects and can be spotted by a user.

If it is considered that there is a fault then the piece of equipment must be unplugged and conspicuously labelled to prevent it being used until it has been examined and any necessary repairs carried out by a competent person and then, if necessary, tested. The DLO are able to undertake this work.

Formal Visual Inspections

Formal visual inspections are for operational managers to arrange. Most people can carry them out after brief training. These are formal checks for obvious defects at predetermined intervals by a nominated person. It involves, for example, removing the covers of plugs, checks on fuses, security of cord grips and cable's termination and looking for signs of overheating damage.

If a fuse requires renewing, this should not be done unless it is certain that the reason for the fault has been determined and any fault cleared. Replacing a fuse with one of the correct rating is important. Although the equipment may be labelled with the correct size of fuse to be used, in other cases the replacing a fuse requires a certain level of competence. It should not be assumed that the size of fuse present is necessarily correct.

A formal visual inspection does not usually require a qualified electrician. There may be exceptions depending upon the equipment type and use, who is available and what is found. The DLO are able to provide a comprehensive service and may be used if there is no one capable or resources are not available in the work environment.

Combined Inspection and Testing of Portable Equipment

It is not always possible to identify electrical faults by visual inspection alone and it is sometimes necessary to carry out Portable Appliance Testing (PAT). The DLO are able to offer this service. Further information regarding testing is given below.

TESTING

Fixed Installations

When a system is first wired up, the electricity supply authorities require a 'Certificate of Compliance' before it can be connected to the mains supply. This is a certificate issued by an independent qualified electrician stating that certain tests have been carried out and that the system is in a fit state to be connected.

A copy of this certificate should be attached to the Register/Inventory (see "Documentation" below) and available on site. If one is not already available consult the Chief Building Surveyor in the Planning and Transportation Department at Time Square.

After this initial certification the fixed wiring should need comparatively little attention. Re-testing at least every 5 years should suffice, unless there are circumstances shown by assessment to demand otherwise. Again, copies of the test certificates should be attached to the Register/Inventory.

Portable Appliances

When an appliance is purchased, or first brought onto the premises, it should have already undergone tests for being suitable for the purpose it was made. That these tests have been carried out will be indicated by their being marked in some way. The BSI 'kite' and BEAB approval marks are well known examples. So long as the equipment is to be used for the job it was designed it is necessary to do very little initially. A user check will normally suffice.

Local managers/governing bodies will need to appoint a competent person to be responsible for the maintenance of a Register/Inventory of portable electrical appliances (those with a plug on the end including leads). This responsibility will include ensuring all new equipment is:

- individually marked;
- entered into the Register/Inventory;
- assessed as to test interval; and
- regularly tested thereafter.

Electrical appliances are divided into two categories based upon the principal methods of protection used. They are:

- (a) Class 1 or earthed appliances - these have any exposed metal surfaces 'bonded' to the supply earth. These appliances will have an earth lead fitted.
- (b) Class II or double insulated appliances - these rely on two layers of insulation to protect the user. That is any metalwork that the user may touch, which might potentially

become live is completely separated from any dangerous voltages by two distinct layers of insulating material. These appliances do not have an earth lead fitted.

The broad strategy of testing programmes falls into three areas:

1. regular visual inspection;
2. regular essential tests (earth bond and insulation); and
3. optional tests, such as the flash, load and earth leakage tests.

The frequency of 1 and 2, and the advisability of carrying out tests in 3 will have to be determined by assessment on first testing and/or following a change in circumstances. It should be noted that some appliances, such as microwave ovens, fume cupboards etc. require Regular, non electrical testing or calibration.

The person doing the testing of portable electrical appliances need not be an electrical engineer nor an electrician. However, they must be trained for the work they are to undertake, competent to carry out the tests, able to interpret the results and have the authority to take any action indicated by those results. They must also accept responsibility for their actions in liaison with their manager. Basically there are two levels of competency:

1. Where a person who is not skilled in electrical work routinely follows an appropriate test procedure and uses a simple "pass/fail" type of portable appliance tester (PAT), where no interpretation of readings is necessary.
2. Where a skilled electrician, who is competent due to technical knowledge and experience, uses an instrument which gives readings requiring interpretation.

Appendix 1 gives typical routine electrical and mechanical checks for portable appliances and apparatus to be carried out by a competent person. The checklist is intended as a guide; certain apparatus may need different or additional inspections and tests.

Assessment

Suggested, initial testing frequencies based on HSE guidance are shown in the table below but must relate to the individual circumstances of use. Following initial testing, assessing the necessary frequencies must relate to experience and records of the:

- i) physical condition of the equipment
- ii) conditions of use
- iii) manufacturers guidance
- iv) previous inspection dates and results
- v) test results and who carried them out
- vi) safety consequences of faults or damage

Whereas a portable electric drill may need to be tested every 3 months or so, official guidance suggests that a computer sitting on a desk all of the time may not need testing at all. However, it is recommended that all items of electrical equipment should be tested at least every 4 years.

Advice should be sought from a competent person to draw up the testing programme based on risk. This should take account of the following suggested starting points for test frequencies other than in schools (see Appendix 2 for specific guidance for schools) and following the first test as shown in the following table:

	Heavy use and/or regular movement	Normal use	Occasional use and/or static equipment
Class 1 hand held appliances (such as kettles, some floor cleaners etc.)	3 months	6 months	1 year
Class 1 moveable equipment (such as heaters, fans, etc.)	6 months	1 year	2 years
Class 1 stationary appliances (such as hot-plates, domestic equipment etc.)	1 year	2 years	4 years
Class 11 appliances	Official guidance suggests that testing is not normally necessary but it is recommended that at least 25% is tested each year so that all are tested at least once every 4 years		
Cables, leads & plugs	1 year	2 years	4 years
Exceptions:	Where Class 1 computer equipment is not moved it can be treated as for Class 11. Television sets should be treated as Class 1 moveable or stationary appliances depending on the type and use.		

DOCUMENTATION

Register/Inventory Sheets

These should be used to record a list of all portable electrical equipment that is brought onto the premises for use. A sample sheet is given at Appendix 3.

A Register/Inventory of all portable apparatus should indicate how often each item must be subject to a detailed examination and tested, as appropriate, by a competent person. Each item, including each individually detachable flexible cable, must be suitably labelled with its unique reference number and there must be a job card or logbook which contains recorded details of inspection, testing and maintenance carried out and by whom.

Test Results Sheet

One of these should be made out for each appliance. They can be kept at the location of the appliance or together in a ring binder at a central location. A sample sheet is given at Appendix 4.

Certificate of Compliance - (see "Fixed Installations" above).

Test certificates - (see "Fixed Installations" above).

These documents should be maintained, preferably at a central location on site, for the lifetime of the appliance or installation.

PRIVATELY OWNED EQUIPMENT

The use of mains operated privately owned electrical equipment should normally be prohibited. However, if in exceptional circumstances permission is given the item must be tested before being put into use and if to remain in the workplace for any period of time it must be included in the maintenance arrangements. When persons are permitted to work from home then all electrical equipment they use comes within the requirements of the Regulations.

The decision on the use of equipment not owned by the Authority will need to be made by the local manager in consultation with staff, following advice from a competent person and in liaison with the building manager. If such equipment is permitted it becomes part of the electrical equipment of the workplace. Therefore, it will need to be included on the inventory for testing and in this case initially tested before use. In the event of test failure the equipment should, like any other, not be put into service until repaired and re-tested. The cost of testing may, at the manager's discretion, be recovered from the owners/users.

IMPLICATIONS FOR MANAGERS

Electrical work must only be undertaken by a person who is both competent (see above) for the task and authorised by the manager. It depends upon the degree of risk and the consequences of a wrong action.

As the representative of the employer the local manager/head teacher etc. will be responsible for ensuring that the Regulations are implemented and that their requirements are carried out. The work, including the management of records, etc., however, may be carried out by other persons, e.g. contractors etc.

The inspection and testing of portable electric appliances and the maintenance of records may be carried out by a member of the manager's own staff, providing that whoever does the work is recognisable as a 'competent person' as described in the Regulations. HSE guidance is that qualified electricians are not necessarily required for inspection and/or testing provided that the person that carries this out has the necessary knowledge/experience/training to carry out the task. Repairs, however, are likely to need a suitably qualified person.

It is the manager's responsibility to ensure that the level of competence is appropriate; it may be necessary to seek the guidance of a qualified electrician to assist in determining this and the Housing Property Services DLO can provide this service.

Employees carrying out any electrical work must have appropriate technical knowledge, be suitably trained and experienced and their duties and responsibilities should be defined in writing. Inherent in Regulation 11 of the Management of Health and Safety at Work Regulations 1992 is a requirement to provide employees with information and training on the correct and safe usage of electrical equipment.

SPECIAL NOTE FOR EDUCATION PREMISES

In order to discharge its responsibilities and comply with the Regulations, schools will need to ensure that the person appointed to carry out testing is competent and suitably qualified. In addition, your attention is brought to HSE Guidance Note GS23, Electrical Safety In Schools, reproduced as Appendix 2.

FURTHER INFORMATION

HS(G)85 Electricity at Work – Safe Working Practice

Section 3(6): Electricity at Work

HS(R)25 Memorandum of guidance on the Electricity at Work Regulations 1989.
ISBN 0 11 883963 2.

GS 23 (rev) Electrical Safety in Schools. 1990. ISBN 0 11 885426 7

GS 27 Protection against electric shock. 1984. ISBN 0 11 883583 1

PM 32 (rev) The Safe Use of Portable Electrical Apparatus. 1990. ISBN 0 11 885590

PM 38 Selection and use of electrical handlamps. 1992. ISBN 0 11 8863606

Maintaining portable electrical equipment in offices and other low-risk environments. 1994 ISBN
O 7176 0719 4

A Practical Guide to the Electricity at Work Regulations. P C Buck and E Hooper,
Paramount/IOSH 1990. ISBN 0 947665 14 5

TESTS FOR PORTABLE APPLIANCES

Listed below are typical routine electrical and mechanical checks for portable appliances and apparatus to be carried out by a suitably competent person.

Note: This checklist is intended as a guide; certain apparatus may need different or additional inspections and tests.

Item		Test	Pass condition
1.	Mains lead	(a) Visual inspection (b) Mains plug	Two layers of insulation. No damage. Correctly connected. Cable clamp gripped to sheath. Correct fuse fitted.
2.	Either mains lead or instrument connector (if lead is detachable) or: Grommet or clamp	(a) Visual inspection of panel male connector. (b) Attempt to open socket without tool. (c) Attempt to pull cable from female connector. (d) Polarity of 3 pin units. (a) Inspection of grommet (b) Sharp pull on cable. (c) Rotation of cable.	IEC 320 type or equivalent (BS 4491, CEE 22) Unopenable No movement As 4491 Cable insulation protected. No applicable movement. No rotation.
3.	Mains on and off switch, correct operation.	Visual inspection.	No damage.

Item		Test	Pass condition
4.	Conducting case	(a) Visual inspection: (if marked as double insulated treat as item 5. (b) Earth tester which will check resistance and pass a current of at least twice the fuse rating. (c) High voltage insulation 500v ac minimum test.	Earth resistance 0.1 Ohms. or Earth resistance 0.5 Ohms for loads fused at 3 A or less. No fault indicated after 5 seconds.
5.	Insulating case	Visual inspection.	Maker's double insulation mark visible. Case undamaged - if in doubt test using portable appliance tester.
6.	Accessible fuse holders	Visual inspection.	No damage. Removal of carrier does not permit live part to be touched.
7.	Exposed outlet connections.	(a) Visible inspection. (b) For outlets greater than 50v*, test short circuit current	No voltage greater than 50v. Short circuit less than 5mA. or Short circuit greater than 5mA and labelled 'unsuitable for children'.

* Live at more than 50 volts in use.

Note: At least 25% of all double insulated equipment should be tested each year, i.e. all equipment is tested at least every 4 years.

HSE GUIDANCE NOTE GS23

ELECTRICAL SAFETY FOR SCHOOLS

INTRODUCTION

1. This guidance note takes into account the requirements of the Electricity at Work Regulations 1989 that apply directly to schools. Adoption of the preventative maintenance recommendations in this guidance note will help ensure that the requirements of the Regulations are met. The Regulations and the accompanying memorandum of guidance are available from HMSO.
2. This Guidance Note deals with the safety precautions necessary in respect of the danger of electric shock or burn to pupils in primary and secondary schools. For more advanced students using specialised apparatus other provisions may be appropriate; these are outside the scope of this document. Extra precautions may be necessary for special schools or other places where children with handicaps or behavioural problems are taught.

GENERAL APPROACH

Electrical installations

3. The Institution of Electrical Engineers publishes a Code of Practice known as the Regulations for Electrical Installations (commonly called the IEE Wiring Regulations)¹.
4. Fixed electrical installations which have been installed in accordance with the present or earlier editions of the IEE Regulations for Electrical Installations should be safe for general purposes provided that they have been adequately maintained. It is recommended that management ensure that electrical installations are inspected and tested by a competent person* AT LEAST every 5 years (3 years in the case of agricultural/horticultural installations). Experience may show that fixed installations in some schools are subject to damage and abuse; this also applies to some installations in temporary (portacabin) classrooms. In such cases more frequent inspection and testing will be necessary. Guidance on inspection and testing may be found in the IEE Regulations for Electrical Installations. A test certificate should be prepared showing the date and results of the inspection and test. A copy of the certificate should be kept at the school.
5. All electrical equipment, including socket outlets and other fittings such as lights, radiant heaters, etc., should be chosen bearing in mind the use and abuse to which it may be subject. This advice applies to alterations, even of a minor nature. Items which are close to where pupils sit are likely to be meddled with and should be selected and located with this in mind.
6. The IEE Regulations for Electrical Installations cover all electrical installations including temporary systems (for example stage lighting and its control gear etc.). The Regulations recommend that such temporary installations be tested and inspected initially and at least every 3 months thereafter.
7. Experience has shown that the fixed electrical installation associated with stages/theatre halls in schools may be altered, modified, extended or otherwise changed, often by people with limited electrical knowledge and competence. For instance, during 1989 a Local Education Authority (LEA) and a teacher were both prosecuted because of unsafe

electrical wiring. The work had been undertaken by a 16-year old pupil but had not been checked. Any such changes should only be made with the consent and approval of a competent person who is in overall control of the installation. It is strongly recommended that these changes are inspected and tested before being energised and that these fixed installations are inspected and tested annually (see paragraph 4).

Apparatus

8. Most of the electrical equipment used in schools will be of normal domestic or commercial pattern. Modern apparatus designed to comply with the Low Voltage Electrical Equipment (Safety) Regulations 1989² should be safe in normal use. Apparatus complying with the Electrical Equipment (Safety) Regulations 1975³, which have now been revoked by the 1989 Regulations, may continue to be used and should be safe in normal use when properly maintained.
9. Schools are recommended to prepare an inventory of all electrical apparatus used in the school. This may be taken room by room or department by department or by some other similar means of identification. When the inventory is prepared and during subsequent updating, a competent person should examine the apparatus so that obsolete, redundant or defective apparatus can be removed from service or store and be properly repaired or disposed of.
10. Some electrical apparatus for special purposes may not have been constructed to modern safety standards. For example, some pottery kilns may have exposed electrical elements which are live at mains voltage and can be touched. Similarly radiant heaters of older designs may be inadequately guarded to prevent shock, burn or fire. Such equipment need not necessarily be brought up to more modern standards published since the equipment was manufactured, but it must be made safe, for example by guarding and/or interlocking etc., as appropriate, to prevent access to the conductors when they are live. Guidance may be found in BS 5304:1988⁴, Code of practice for safety of machinery.
11. Particular care is needed with 'home made' equipment whether for general use or for use in science laboratories. During 1989, for instance, a student received a 240-V ac shock while connecting a video lead to a television because of the holes drilled into the television casing by the technician when mounting the set on a stand. All home-made apparatus should be robustly constructed and properly protected to prevent electric shocks. The design of such equipment is important; it should be inspected and tested before use by a competent, suitably qualified person.
12. All portable electrical apparatus should be routinely inspected and tested. It is recommended that a register be kept, e.g. a log book or record card system, and that each item of portable apparatus for use at more than 50 V be given an identification. Each school term (preferably before term starts) all such apparatus should be visually inspected and any defects rectified. Experience may dictate that some apparatus in some schools will need more frequent inspection. It is strongly recommended that when new or replacement equipment is purchased (e.g. hand lamps, soldering irons) consideration should be given to equipment operating at voltages of 50 V ac or less.
13. All Class I (earthed) hand-held portable electrical equipment such as drills, saws, irons, hand lamps etc. should be subject to a detailed inspection and test (see Appendix) by a competent person, who should record the results in the register, at least every 12 months. The earth connections should be examined and tested. Earth continuity tests should be made using proprietary test equipment at not less than twice the current rating of the fuse protecting the equipment.

Section 3(6): Electricity at Work

14. All Class II (double insulated) hand held portable electrical equipment should be visually inspected for damage or defect by the teacher before use. This equipment should be subject to a detailed inspection and test (see Appendix) based upon experience and the usage of the equipment (see paragraph 12).
15. Portable apparatus test units are available and can be used for these tests.
16. For all other items of equipment, such as bench-mounted heaters, centrifuges, instruments, microscopes etc., not hand-held, the following should be observed.
17. Audio-visual and other equipment with exposed metalwork which can be touched should be tested as Class I (earthed) equipment and the metalwork earthed unless the manufacturer specifically claims that the apparatus is double insulated (Class II). The earth continuity test should not be less rigorous than that described in paragraph 13.
18. It is important that external metalwork of Class 2 (double insulated) apparatus is not earthed. Portable apparatus test units are available and can be used to test such equipment.
19. Where it is necessary to connect together equipment of Class I and Class II construction, it is essential that proper provision is made to ensure the efficient and effective connection of the Class I equipment to earth.
20. Where computers, television sets and other monitors are connected in networks, the filter network currents within the individual items of equipment may summate to potentially dangerous levels. Danger may arise if there are defects in the protective (earth) conductor system. In all such cases the advice of the manufacturers of the equipment should be sought and followed.
21. Flexible cables should be selected, maintained and used so that there is adequate protection against foreseeable mechanical damage.

SCIENCE LABORATORIES AND OTHER PRACTICAL AREAS

22. Standard socket outlets suitably positioned and use in conjunction with properly maintained mains voltage equipment are quite acceptable for use in school laboratories. The positions chosen for socket outlets should however be such as to minimise penetration by water. If the situation is excessively damp or if, for example, washdown facilities are required, special socket outlets may be required.
23. For installations where water outlets are in close proximity to electrical socket outlets the provision of a high standard of electrical protection is important. Users of relocatable laboratory service systems should take care that sinks are not moved so close to electrical outlets that safety is impaired.
24. A higher standard of electrical protection can be achieved through the use of residual current devices (RCDs), isolating transformers, or earth free areas.
25. Where RCDs are provided for personal protection, the rated trip current should not exceed 30 mA and the RCD should comply with the requirements of BS 4293:1983¹³, Specification for residual current operated circuit breakers. Isolation transformers should comply with the requirements of BS 3535:1987¹⁴, Specification for safety isolating transformers for industrial and domestic purposes. (See note 1)
26. The provision of RCDs, also known as current operated earth leakage circuit breakers, is referred to in the IEE Regulations for Electrical Installations. RCDs may be used to

provide additional back-up protection against fire and shock. If RCDs are used they should be tested frequently by means of the test button on the unit. If the RCD fails to trip when the test button is pressed, the system should not be used until it has been inspected and tested by a competent electrician. When the installation is routinely tested (see paragraph 4) the tripping current and timing of RCDs should be checked.

27. Where electrically operated hand-held portable equipment is used outdoors, the source of supply should be controlled by an RCD (see paragraph 24). 110-V centre-tapped earthed systems should be used, in conjunction with appropriate equipment wherever possible¹⁰.
28. Where 1:1 isolating transformers are used to provide a supply which is not referenced to earth, a frequent maintenance procedure including tests should be established to ensure that no earth fault exists on the unearthed system.
29. Earthing the centre tapping of the secondary winding of a 1:1 isolating transformer supplied from the mains does not give a safe system; 120 volts to earth can still be lethal. Such supplies need to be fused in both poles and if fused plugs are used THESE SHOULD NOT be of the domestic type (to BS 1363) which has a fuse only on the live pole. This implies the use of non-standard plugs with the resulting problem of flexibility of use in other parts of the school. Double pole switches will also be necessary. The centre tapped to earth system may be combined with the use of an RCD if desired, in which case paragraph 14 also applies.
30. If a 1:1 transformer is fitted with a centre tapping with a high impedance connection to earth this must be associated with sensitive earth leakage detection. The impedance must be not less than 12000 ohms and the nominal tripping current of the earth leakage device not more than 5 mA. Standard plugs and sockets may be used with this system.
31. Plugs and sockets should be chosen to prevent accidental or inadvertent connection to the wrong supply, e.g. it should not be possible to plug 110-V apparatus into a 240-V socket outlet.
32. Where 240-V ac electrically operated equipment is used outdoors, appropriate plugs and sockets complying with BS 4343 should be used. IT SHOULD BE NOTED that standard 13-A plugs and sockets are not proof against the ingress of moisture/water/dirt. (See note 2).

LIVE WORKING

33. Where there is a possibility of a person, pupil or otherwise, coming into contact with live conductors at voltages above 25 V or where large short-circuit currents could flow, for example from led/acid 12V batteries or similar, in experiments, the teachers and technicians involved should be electrically competent. This competence will necessitate technical knowledge or experience including:
 - (a) adequate knowledge of electricity;
 - (b) adequate experience of electrical work;
 - (c) adequate understanding of the system to be worked on and practical experience of that class of system;
 - (d) an understanding of the hazards which may arise and the precautions which need to be taken;
 - (e) ability to recognise at all times whether it is safe for work to continue.

34. Pupils in schools must not be allowed to be exposed to dangerous voltages above 25 V (see paragraph 35). Advice on any special electrical facilities, e.g. for evening classes, visiting musicians etc. is outside the scope of this guidance note. Such facilities which might be a danger to school pupils should be removed before school begins or kept in a part of the building to which pupils do not have access.
35. Where setting up a project, experiment etc. is part of the learning process and there is any possibility that the child might come into contact with parts live at more than 25 V, special precautions must be taken, unless the apparatus is incapable of inflicting a dangerous electric shock. Such experiments and practical exercises must be checked for potential hazards and supported by written instructions which draw attention to the possible risks and the precautions to be taken.
36. Before any electricity supply is connected the teacher should be satisfied that the equipment has been set up so that there will be no danger when the supply is connected (see paragraph 33). Connection to the supply should be made only by the teacher using plug and socket, a fused safe-block or similar connector with double pole switch or a switch-fuse with the operating handle interlocked with the cover and all live terminals shrouded to prevent accidental contact.
37. Experiments and exercises of this type should be devised so that the student is not required to change connections in the course of the exercise. Interconnecting leads having plugs with retractable shrouds are now available; they should be used where the voltage exceeds 50-V. If a fault occurs the experiment or exercise should be completely isolated from all supplies before the fault is investigated.
38. Teachers and technicians who construct, assemble, modify or maintain equipment should do so in such a way that neither they nor the pupils are put at risk (see paragraph 26). If it is necessary for such teachers and technicians to work on apparatus where parts live at more than 50 V are exposed (e.g. for fault finding or calibration) this should be done in an area set apart, where a second competent person is present to render assistance in the event of an emergency such as electric shock. General advice on precautions on electrical testing is contained in booklet HS(G) 13 Safety in electrical testing⁷ (see also para. 11).
39. Some further useful advice and guidance may be found in Safety recommendations for off-the-job training in electrical skills available free from the Manpower Services Commission, Moorfoot, Sheffield, S1 4PQ.

*Note: For the purposes of this guidance note, a competent person is a person who possesses sufficient technical knowledge, experience and skills to be able to carry out the specific task and prevent danger or injury arising during the course of the work, or as a result of the work.

Note (1) The approved standard for all new or refurbished premises within Bracknell Forest Borough Council is the installation of a 10mA RCD within science laboratories, for the protection of pupils and staff.

Note (2) The within Bracknell forest Borough Council standard is that where a socket is installed primarily for the use of portable equipment outdoors, it will be protected by a 30mA RCD.

REFERENCES

1. Institution of Electrical Engineers Regulations for electrical installation (IEE Wiring Regulations) 15th ed. 1981 ISBN 0 85 296235 5, with separate 1983 amendments.
2. The Low Voltage Electrical Equipment (Safety) Regulations 1989 (SI 1989/728) HMSO ISBN 0 11 096728 3.
3. Electrical Equipment (Safety) Regulations 1975 (SI 1975/1366) HMSO ISBN 0 11 051366 5
Electrical Equipment (Safety)(Amendment) Regulations 1976 (SI 1976/1208) HMSO ISBN 0 11 061208 6.
4. BS 5304:1988 Code of practice for safety of machinery.
5. Health and Safety Executive Protection against electric shock
Guidance note GS 27 1984 HMSO ISBN 0 11 883583 1.
6. Radio Electrical and Television Retailers Safety in electrical testing: recommendations for electrical safety in television, radio and audio equipment testing and servicing (RETRA) Ltd.
7. Health and Safety Executive Electrical testing HS(G) 13 1980 HMSO ISBN 0 11 883253 0.
8. DES Safety series booklets. Published by Department of Education and Science, available through HMSO.
9. BS 4163:1984 Code of practice for health and safety in workshops of schools and similar establishments.
10. Health and Safety Executive The safe use of portable electrical apparatus (electrical safety) Guidance note PM 32 1983 HMSO ISBN 0 11 883563 7.
11. Health and Safety Executive Selection and use of electrical handlamps
Guidance note PM 38 1984 HMSO ISBN 0 11 883582 3.
12. Health and Safety Executive Electrical installations in motor vehicle repair premises
Guidance note PM 37 1984 HMSO ISBN 0 11 883569 6.
13. BS 4293:1983 Specification for residual current operated circuit breakers.
14. BS 3535:1987 Specification for safety isolating transformers for industrial and domestic purposes.
15. The Electricity at Work Regulations 1989 (SI 1989/635) HMSO ISBN 0 11 096635 X.

BRACKNELL FOREST BOROUGH COUNCIL

EQUIPMENT REGISTER

Site:

All equipment should be entered onto this sheet and an initial assessment of test frequency made prior to use. Enter the frequency of testing in weeks or years e.g. 1y or 26 wks. Serial number is optional.

Individual equipment number	Description	Location	Serial Number	Date brought into use	Assessed frequency of testing	Date of disposal

BRACKNELL FOREST BOROUGH COUNCIL

PORTABLE ELECTRICAL APPLIANCE TEST RECORD

Appliance No:

Site:

Location:

Description of appliance: Class: 1 or 2

Serial No: Date Purchased: Test frequency:

Supplier:

Please indicate the type of test carried out

Test Dates		Essential Tests			Optional Tests			Results		
Due	Done	Earth Bond	Insulation	Flash	Earth Leakage	Load	Other (specify)	Pass	Fail	Initials