



Guidance Note GS 23
from the
Health and Safety
Executive

Electrical safety in schools (Electricity at Work Regulations 1989)

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These guidance notes are published under five subject headings: Medical, Environmental Hygiene, Chemical Safety, Plant and Machinery and General.

INTRODUCTION

1 This guidance note was originally issued in September 1983. It has been revised in the light of subsequent experience, taking into account the requirements of the Electricity At Work Regulations 1989 which 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 subjected. 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

*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.

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 modified or '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. Modifications should be made only by a competent person working to manufacturers' instructions. 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 person.

12 All portable electrical apparatus should be routinely inspected and tested. It is recommended that a register be kept, eg 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 (eg 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.

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 treated 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 II (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 used in conjunction with properly maintained mains voltage equipment are generally 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 personnel 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*. Isolating transformers should comply with the requirements of BS 3535:1987¹⁴, *Specification for safety isolating transformers for industrial and domestic purposes*.

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 backup 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 V 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 in the live pole. This implies the use of non-standard plugs and sockets 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 12 000 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, eg 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.

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 lead/acid 12-V 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, eg 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 if 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 the electrical 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 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 equipment 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 (eg 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 testing*⁷ (see also paragraph 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.

REFERENCES

- 1 Institution of Electrical Engineers *Regulations for Electrical Installations (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 nd.
- 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 (electric 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.

16 Health and Safety Executive. Memorandum of guidance on the Electricity at Work Regulations 1989 HS(R)25 HMSO ISBN 0 11 883963 2.

British Standards are available from:
BSI Sales Department
Linford Wood
Milton Keynes
MK14 6LE

FURTHER INFORMATION

This guidance note is produced by the Health and Safety Executive. Further information about this or any other HSE publications can be obtained from the following public enquiry points:

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or from any HSE area office.

APPENDIX

Listed below are typical routine electrical checks for portable 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. Non-electrical checks are outside the scope of this guidance note.

Equipment:

Make:

Serial No:

<i>Item</i>	<i>Test</i>	<i>Pass condition</i>
1 mains lead	(a) visual inspection	two layers of insulation no damage
	(b) mains plug	correctly connected cable clamp gripped to sheath correct fuse fitted
2 either: mains lead or instrument connector (if lead detachable)	(a) visual inspection of instrument male connector	IEC 320 type or equivalent (BS 4491, CEE22)
	(b) attempt to open socket without tool	unopenable
	(c) attempt to pull socket cable from female connector	no movement
	(d) polarity of 3-pin units	as per BS 4491
or: grommet/clamp	(a) inspection of grommet	cable insulation protected
	(b) sharp pull on cable	no appreciable movement
	(c) rotation of cable	no rotation
3 mains on/off switch	(a) visual inspection	correct operation no damage
either 4 and 5 or 6 and 7		
4 conducting case	(a) visual inspection: (if marked <input type="checkbox"/> treat as item 5) earth tester which will check resistance and pass a current of at least twice the fuse rating	earth resistance 0.1 Ω or ohms or earth resistance 0.5 Ω or ohms for loads fused at 3 A or less
	(b) high voltage insulation 500 V ac minimum test	no fault indicated after 5 seconds
5 insulating case	visual inspection	maker's double insulation mark visible <input type="checkbox"/> case undamaged - if in doubt test using portable Appliance Tester

<i>Item</i>	<i>Test</i>	<i>Pass condition</i>
6 accessible fuse holders	visual inspection	no damage removal of carrier does not permit live part to be touched
7 exposed output connections	(a) visual inspection	no voltage greater than 50 V
	(b) for outputs greater than 50 V*	short-circuit less than 5 mA or short-circuit current greater than 5 mA and labelled 'unsuitable for use by children'.

* ie live at more than 50 V when in use.

NOTE: at least 25% of all double insulated equipment should be tested each year ie all equipment is tested at least once every 4 years.

Overall result (Delete as necessary)

passed

Unit is

failed

Signed: Date:

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