



BBC Studioworks

Electrical Safety Policy

Health and safety policy



Table of Contents

1. ORGANISATION FOR ELECTRICAL SAFETY	2
2. ELECTRICAL SAFETY INFORMATION, INSTRUCTION AND TRAINING – REQUIREMENTS	6
3. SELECTION, USE AND MAINTENANCE OF ELECTRICAL EQUIPMENT.....	8
4. WORKING SPACE, ACCESS AND LIGHTING FOR WORK WITH ELECTRICAL EQUIPMENT	11
5. WORK ON OR NEAR EXPOSED ELECTRICAL CONDUCTORS MADE 'DEAD'	14
6. SAFE DESIGN AND INSTALLATION OF ELECTRICAL EQUIPMENT	15

1. Organisation for electrical safety

So far as they relate to matters within their control and as is necessary to prevent injury arising when working on or near electrical equipment, managers must have arrangements in place which ensure that electrical safety responsibilities within their workforce are clearly defined and documented.

Those divisions/departments which carry out any work directly on or with electrical systems, installations or equipment, as opposed to those who only consume or use electrical power, should have in place an appropriate structure of appointments such that the requirements given by this document can be met. This will include, for example, identifying and appointing a suitable person or persons to be responsible for:

- managing electrical safety in the workplace
- implementing day to day electrical safety rules (i.e. the Authorised Person)
- providing, assessing and keeping of electrical safety risk assessments
- assessing and issuing permits to work and authorities to work live
- verifying the electrical competence of persons, both staff and contractors, working in the area
- managing electrical inspection and testing regimes, and the keeping of records
- managing / supervising specific electrical tasks
- specifying, selecting and purchasing of electrical plant and equipment
- maintaining or repairing electrical plant or equipment

It is important that those who need to, for safety reasons, are aware of and understand not only the extent of their own electrical safety duties and responsibilities, but also those of others who have been appointed to manage or supervise work for the area, production or operation. Details of posts and responsibilities held should be recorded in departmental safety documentation and communicated to all whom it may affect. For some responsibilities, inclusion in job specifications may be appropriate e.g. Managers, Authorised Persons.

Identifying and recording “who is responsible to whom and for what” is particularly important in shared workplaces, where there may, by necessity, be a division of responsibilities between different Studioworks departments, or between the BBC Studioworks and a partner/contractor. Where such division of responsibilities occur, each are to nominate a representative (i.e. an Authorised Person) to ensure co-operation and co-ordination of respective activities in order to prevent danger. Each appointment and demarcation of responsibility should be precisely identified and recorded in writing, possibly accompanied by an annotated circuit diagram. Where possible, demarcation should be at a cable termination of a switch or circuit breaker.



Where the BBC Studioworks has control of the danger

BBC Studioworks has provided this framework of requirements and guidance to help meet its duties under the HSWA to provide a safe place of work and a safe working environment. The Authorised Person is the BBC Studioworks agent responsible for ensuring that all parties for which they are responsible are aware of, and have given their intention to comply with, the requirements given by these documents.

Where the BBC Studioworks provides an electricity supply to another consumer

Where this supply is provided on a temporary basis, it is to include a means of isolation which is under the control of the BBC Studioworks. The supply terminals of the temporary system are to be at the outgoing terminals of a switch/isolator, circuit breaker or other clearly identified terminal. BBC Studioworks are to be responsible for the control of the system up to, and including, these supply terminals; whilst the consumer is to be responsible for the connections to the terminals and for the remainder of the downstream system.

Where this supply is to be provided on a permanent (or semi-permanent) basis, the Authorised Person, on behalf of BBC Studioworks, is to satisfy themselves that the installation complies with the Electricity Supply Regulations, and all other appropriate regulations, before allowing connecting of the installation to the BBC Studioworks system. BBC Studioworks are to be responsible for the supply cable, the disconnecting/isolating device, any metering equipment and the conductors up to the supply terminals. BBC Studioworks are not to be responsible for the installation downstream of the supply terminals.

If at any time the installations or systems being supplied are known to be unsafe or likely to cause interference to the BBC Studioworks system, the Authorised Person should, taking all due safety considerations and with the full knowledge of the consumer, isolate the supply. This isolation should remain in place until all defects are remedied to the satisfaction of the Authorised Person

Competency

Personal competence is a critical factor in being able to work safely with electrical systems, installations or equipment. No one should be put at risk, or put others at risk, due to a lack of skills, knowledge and experience. In relation to a particular task or job, deciding if someone has an appropriate level of competence will require consideration of whether they have adequate:

- technical knowledge of electricity
- experience of the electrical task or job
- understanding and practical experience of the system or equipment to be worked on
- awareness of the limitations of their own experience and knowledge
- understanding of the hazards which may arise and the precautions necessary
- ability to recognise at all times whether it is safe to continue
- understanding of relevant current best practice

In law, it is for the employer to judge the level of competence required to carry out a particular job or task and to ensure that no person is called upon to carry out work for which they do not have the required competence. Competency standards should be set for each job or post requiring work with electrical systems or installations. Those who appoint against these standards need to ensure that there

is a formal appointment, verification and recording process in place, as well as a subsequent and ongoing assessment and training process to ensure competence levels remain adequate.

Evidence of competence might include for example:

- experience in the job, or a related job
- formal academic qualification
- formal practical qualifications (e.g. NVQs)
- certificated in-house short courses with examination
- records kept of supervisory checks on the understanding of, and adherence to, safe working practice

The concept of competence is wider ranging than 'qualified'. For example, a person required to carry out routine testing of portable appliances (PAT) might not have electrical qualifications although, with suitable training, they could be considered competent to carry out the task correctly and safely. In contrast, a Chartered Electrical Engineer might not be competent to work on high voltage switchgear unless he or she had received appropriate instruction and training specific to it.

Assessing competence

Assessing competence requirements in relation to the technical and practical safety demands of a job/task is a manager's responsibility. If the job/task involves working with electricity or electrical systems, both the worker and the manager/supervisor need to have determined, in relation to that job/task:

- the extent of responsibilities to be held with regard to electrical safety
- the degree of control the worker has to exercise over any danger
- whether the worker has the necessary knowledge and experience to carry out the tasks safely.

Responsibilities to be considered include whether they will be required to:

- manage / supervise others, including contractors, to undertake electrical tasks safely
- advise others on aspects of electrical safety
- purchase electrical equipment for use by others
- carry out electrical installation work
- carry out maintenance or repair work on electrical equipment or systems
- carry out electrical commissioning, inspection or testing
- plan and draft electrical safety rules and procedures
- check compliance with safety standards, rules and procedures

If at any time you have concerns about your own, or other peoples, ability to work safely with electrical systems or installations, you should discuss them with your manager or supervisor before either undertaking the task or allowing the task to be undertaken.

The effectiveness of arrangements in ensuring compliance with the Electricity at Work Regulations and with the BBC Studioworks electrical safety requirements is regularly assessed through appropriate monitoring and auditing, with adequate records kept where electrical systems, installations or equipment, or parts thereof, are handed over to or managed by persons not under their direct control,



for example, another BBC Studioworks department or to a maintenance partner or contractor, the division of responsibilities between the parties is understood and agreed by both parties and, where necessary for safety reasons, is clearly indicated on an annotated circuit diagram or plan, signed by both parties.

In many situations, the authority and control of electrical equipment and systems is exercised on behalf of the BBC Studioworks by another organisation, either a partner or a contractor. Provided that the Studioworks has exercised all due diligence in respect of the safe and proper handover of any respective electrical systems, installations or equipment, the responsibility and authority for the control of danger passes to that Partner or contractor. Where BBC Studioworks appoints a partner or contractor, the conditions of contract should specify either:

- that the contractor shall comply with the Studioworks Requirements and Guidance, or
- the contractor will provide and work to written requirements (rules) and procedures which are at least as rigorous as those of BBC Studioworks.

For the latter to be acceptable, the contractor's or partner's rules/requirements should be assessed and approved as suitable by BBC Studioworks' appropriate Authorised Person before their work can commence.

Where Studioworks appoints a partner/contractor for new work which has yet to be handed back to the studios, the partner/contractor retains control of the danger and is to comply with all relevant statutory provisions and conditions of contract until such time as the project/installation is handed back to BBC Studioworks. Where the partner/contractor is responsible for only part of a system or installation, the exact extent of the responsibilities held between the parties should be agreed beforehand and written records kept.

If BBC Studioworks has to undertake any work or test that involves the switch or circuit breaker at the position of the demarcation or otherwise may affect the system or circuit under the control of the contractor/partner, then Studioworks will ensure a permit to work or other appropriate document from the contractor/partner is in place prior to carrying out such work. Where it is known that Studioworks is to accept control of the danger, an Authorised Person must be nominated to ensure Studioworks rules and procedures are adhered to. This person must communicate and co-operate with the contractor's nominated person in order to familiarise themselves with the system or installation for which responsibility is to be taken.

2. Electrical safety information, instruction and training – Requirements

So far as they relate to matters within their control and as is necessary to prevent injury arising when working on or near electrical equipment, managers **must** have arrangements in place which ensure that:

- they provide and maintain local electrical safety rules and procedures which neither conflict with, nor set lower standards of safety than, those provided within Corporate Requirements and Guidance
- they provide and maintain documented safe systems of work – **See Electrical Safety Health & Safety Arrangements**
- they provide suitable and sufficient risk assessments for those activities and operations not already adequately controlled through a documented safe system of work

The Electricity at Work Regulations 1989 (Reg. 4(3)) require that “every work activity, including operation, use and maintenance of a system and work near a system, shall be carried out in such a manner as not to give rise, so far as is reasonably practicable, to danger”. In addition, the Management of Health & Safety at Work Regulations 1999 (Reg. 3) require a suitable and sufficient risk assessment to be made where any significant risk to health and safety is identified. To be suitable and sufficient, the assessment need determine:

- **hazards** - their nature and extent, including if things were to go wrong, and not only considering the effects of contact with electricity itself but including other associated hazards created by, for example, lighting failure, equipment failure, etc.
- **severity of harm** - what could happen if things were to go wrong, how serious could it be
- **likelihood of harm being realised** - given existing precautions, how likely is it that people could still be hurt
- **who affected** - need to consider anyone who could foreseeably be affected, not only those working directly with the electrical system / circuit
- **existing precautions** - the adequacy or otherwise of all existing precautions should be considered, including personal competency levels, integrity / condition of system, available information and instructions, etc.
- **assessment of risk** - degree of risk present from each hazard dependent upon all of the factors identified above and should be used to identify the,
- **further precautions required** - the improvements or alternative measures required to reduce any significant risks to an acceptable level.

The assessment should cover risks to the health and safety of:

- those persons working directly on or with electrical systems and or equipment
- any other persons who could come into contact with electricity or be affected by other hazards arising from electrical systems, installations or equipment when being energised or de-energised, whether planned or not.

Once the assessment has been completed, there should be arrangements in place to ensure that any additional precautionary measures are implemented and that the findings are communicated to those who may need to know about them. Significant findings need to be recorded and reviewed and amended as necessary.

Management of shared workplaces

Whenever the workplace is shared, either between different BBC Studioworks departments, or between the BBC Studioworks and a contractor, Partner or tenant, there is a significant potential for safety conflicts to occur. This is particularly relevant to electrical systems where, for example, inadvertent re-connection of supplies or inadequately connected equipment can present unseen dangers to those who may be unaware or unfamiliar with the hazards present. In order to prevent such safety conflicts arising, each employer should take steps to ensure that they:

- co-operate with one another e.g. by adhering to instructions issued in the interests of their safety
- co-ordinate their activities with one another e.g. by carrying out certain tasks at the most opportune times, such as testing and inspections in studios when they are not being used
- inform one another of the risks to their health and safety associated with their activities and the precautions they need to take.

In practical terms, such co-operation, co-ordination and communication will include consideration of the activities of such persons as:

- contract cleaners and security staff and others who may visit the workplace out of normal work hours and who may have little electrical safety knowledge
- contract maintenance or installation workers, who although possessing electrical safety knowledge, may be infrequent visitors to the area and be unaware of local hazards and local safety rules. Such persons may also bring or create new hazards in the workplace.
- Tenants at the studios, either long or short term and unfamiliar with systems and/or safety rules and local hazards.
- emergency services or other unplanned visitors who may need to be made aware of particular hazards

Depending upon circumstances, the exchange of information can be verbal or written. For the occasional visiting contractor (e.g. someone refitting floor tiles whilst local staff are present) a verbal caution of what can or can't be touched or used will normally suffice. For more involved situations (e.g. an electrical contractor carrying out extensive installation or repair work in an operational area), more comprehensive and detailed exchange of information would be required, most likely to be in written format and given well before work commences such that risk assessments can be amended accordingly.

Information, instruction, training and supervision needs will vary greatly depending upon the nature of the tasks to be undertaken and the competence of the individuals involved. All persons should receive sufficient information and instruction to enable them to work safely, but those who are not competent to carry out a particular task or job safely, will also require an appropriate level of supervision i.e. from someone who has the required level of competence and knowledge of the task or job. Suitable training programs should be in place in order to improve competence levels and thus minimise supervisory requirements.

Whilst not all tasks/jobs will by necessity require the worker to be examined or to hold certain qualifications, it would nevertheless be prudent to ensure some process is in place for recording the validation of knowledge and understanding through the provision of information, instruction and training. This could be as simple as a log which verifies that such training has been given and that they have subsequently demonstrated their ability to carry out the task safely.

Provision of information and instructions

For each work activity, arrangements should be in place to ensure employees, and where necessary others, are made aware of and understand in good time the following information in relation to working safely with electrical systems, installations and equipment:

- **risk assessments** - which identify nature of hazards present and the precautionary measures required to avoid injury or accident e.g. use of protective equipment (e.g. insulated tools, screens, etc.)
- **safe systems of work** - which provide structured information and instructions on how tasks are to be carried out safely e.g. how and when disconnection of electrical supplies is required
- **local rules and procedures** - which set out the circumstances and standards under which work with electrical systems is to occur with Divisions / departments e.g. how and when authority to work live is to be obtained
- **Corporate requirements and guidance** - which provide Corporate safety standards, instructions and guidance which all persons should work to
- **legislation and training documents** - relevant requirements and guidance in relation to the avoidance of danger
- **task / job specifications** - which clearly describe the duties and responsibilities of staff for ensuring the safety of themselves and others.

Provision of training and supervision

Where appropriate, Managers and Supervisors should have in place the following arrangements, including the means by which these are to be given to employees and, where necessary, others:

- **job specific safety training** - given in a structured way, including tool box talks, by competent persons and prior to the work being undertaken
- **refresher training** - content and frequency of which to be determined by needs of the individual
- **monitoring** - verification that the training given is appropriate to the task and is achieving the level of competence required
- **record keeping** - records should be kept of all training, assessments and monitoring undertaken
- **supervision** - criteria by which supervision is given should be based on risks to health and safety associated with the task / job.

3. Selection, use and maintenance of electrical equipment

So far as they relate to matters within their control and as is necessary to prevent injury arising when working on or near electrical equipment, managers **must** have arrangements in place which ensure that;

- electrical equipment is suitably selected, having due regard to its purpose, location and expected conditions of use

In this requirement, “suitably” means suitable in any respect in which it is reasonably foreseeable that it will affect personal health or safety. Appropriate selection of suitable equipment can, in itself, reduce or eliminate risks, whether this is during normal use or during non-routine activities such as maintenance. Unless such risks are minimal, suitability of equipment for a particular task should be determined through a risk assessment process which addresses the:

- initial integrity of the equipment
- location and circumstances of expected use
- purpose for which it will be used.

The intention is to select equipment which is of appropriate design, construction or adaptation in relation to the work required of it and under the conditions in which it will be used. In most cases, this will mean following the manufacturer's instructions and specifications on use. However, care should be taken when selecting equipment designed for domestic purposes, as they are often not strong enough to withstand the more arduous conditions of use in the workplace. Those procuring and assessing the suitability of equipment should first make sure they understand both how and where the equipment will be used and what effect use in the workplace may have on it. Electrical equipment used in broadcasting environments is often exposed to adverse or hazardous conditions (e.g. outdoors, in public areas, underwater, at altitude, regularly transported, etc) where danger could arise if they are not constructed or protected to withstand such exposure.

The Index of Protection (IP) provides a reference rating system for the conditions to which electrical equipment may be exposed and remain safe to use [this system is recognised in most European countries and is set out in BS EN 60529: 1992 - Degrees of Protection provided by enclosures (IP Code)]. The most commonly used ratings are those for exposure to rain / water and exposure to solid objects / particles. Further IP ratings include exposure to pressurised, flammable, high temperature, etc. environments. All equipment should be used in accordance with manufacturer's guidelines and / or the findings of relevant risk assessments or local instructions. Any identified defects should be reported to line managers and steps taken to withdraw the equipment from service for repairs / replacement as soon as is necessary to prevent danger.

Electrical equipment must always be used or operated in a safe manner, commensurate with its intended purpose. Suitable precautions are taken to ensure that electrical equipment is maintained in a safe condition, including:

- visually inspected before use
- subjected to a suitable regime of maintenance, including being inspected, and where appropriate tested, by competent persons at regular intervals
- the provision and management of a system which ensures that faulty equipment is removed from service, reported and, where necessary, decommissioned in order to prevent persons being exposed to danger from electricity

All equipment should be maintained in an efficient state, in efficient working order and in good repair. It is important that equipment is adequately maintained so that its performance does not deteriorate to the extent that it puts people at risk. The extent and complexity of maintenance will vary enormously from one type of equipment to another. Equipment may need to be checked frequently to ensure that safety related features are functioning correctly. Faults which affect production are normally apparent within a short time, but faults in standby safety critical systems may remain undetected, and thus dangerous, for prolonged periods unless they are regularly checked / tested. The frequency of checks / maintenance required is dependent on the equipment itself and the risk involved. Whilst the manufacturer's guidelines would be adequate in most cases, this may not be true where the equipment is used in particularly arduous conditions where component or circuit failures could be considered more likely.

Where lack of testing/maintenance could cause the equipment or protection devices to fail in a dangerous way, a formal system of planned preventative maintenance (PPM) may be necessary in order to prevent the failures occurring or to minimise their frequency to an acceptable level. A PPM regime may constitute written instructions for the inspection, testing and, perhaps more importantly, the periodic replacement or refurbishing of components or equipment before they reach the end of their useful life. These instructions should be based on the manufacturer's recommendations, as well as experience from previous service histories and condition monitoring.

The proper functioning of electrical equipment also depends upon the integrity of the supply installation. Whilst many systems are designed to fail to safety following power loss, in other systems or situations, sudden loss or return of power, can give rise to danger. Regimes to verify and maintain the safety integrity of an installation will depend upon the nature and complexity of the installation, the safety systems in use, and the usage to which they are normally subject. An assessment of risk should consider such factors, together with the likelihood of failure and potential consequences.

Responsibility for the regular inspection, test or maintenance of some parts of an installation will often be held at local level (e.g. testing of workshop RCDs). Part of these responsibilities include the need to have and use a defect / fault management and reporting system, with everyone aware of their responsibility to report any defects or deficiencies they find in the condition or use of systems and installations. This reporting system should be supported by arrangements which prevent or minimise the risks to health and safety which might thereby arise (e.g. removal from service, isolation, etc.).

Checklist (maintenance and testing):

Managers responsible for electrical equipment in the workplace should ensure that:

- all electrical tools and equipment are regularly inspected/tested/maintained to ensure that they remain fully serviceable and safe in use
- the regularity of all inspections/testing/maintenance are commensurate with the frequency and conditions of use of the equipment
- all inspections/tests/maintenance are carried out by competent personnel, working in accordance with specified procedures and using appropriate testing equipment
- where necessary, appropriate records are kept of all inspections/testing/maintenance
- up to date records are kept which demonstrate the measures taken to ensure that electrical equipment is maintained in a safe condition

The requirement for the keeping of records for testing/checking/maintenance activities on electrical equipment should be determined from:

- legislative requirements
- the risks to health and safety associated with that equipment
- the risks to health and safety which could arise should records not be kept
- the practicalities of making a record.

For example, written records are required for the testing of portable appliances but not for each external visual inspection carried out by the user before use. Where specific guidance is not available, the need for record keeping should be stipulated through a risk assessment process. Where they are required, logs and records should give sufficient information to provide an accurate and up to date history of the service life of that equipment to aid future planning and purchasing decisions. In some

situations, e.g. some wiring installations / alterations, adequate labelling of the cables, updated as necessary, may be all that is necessary.

4. Working space, access and lighting for work with electrical equipment

So far as they relate to matters within their control and as is necessary to prevent injury arising when working on or near electrical equipment, managers **must** have arrangements in place which ensure that:

- adequate working space, means of access and lighting are provided to all electrical equipment upon which, or near which, work is to be carried out

So far as is reasonably practicable, there should be provided adequate space, access and lighting wherever persons are required to work on, at, or near electrical systems, installations or equipment. These requirements are not restricted to those circumstances where live conductors are exposed but apply wherever work is being done in circumstances which may give rise to danger from electricity. Whilst these requirements only strictly apply when work is being done, they should also be similarly considered in relation to other foreseeable tasks, for example, cutting off power supplies in an emergency situation.

Working space and access

Where there are exposed live conductors within reach of the work, the surrounding space should:

- allow persons to pull back away from the conductors safely; and
- where required, allow persons to pass one another safely.

Lighting

For task definition, colour rendering and other reasons, adequate natural light is always preferable to artificial light, but where the work has to be carried out under artificial light, it is preferable that this is from a permanent and properly designed installation. Lighting levels which are adequate for general workplaces are unlikely to be sufficient for work on electrical apparatus and the lighting sources may need to provide illumination in both vertical and horizontal planes. Where necessary, portable lamps or torches may have to be used, but whatever the means of lighting, the level of illumination should be adequate to enable injury to be prevented.

Since artificial lighting is almost certain to be electrical, it may be lost in the event of an electrical fault needing attention to the electrical system. Additional emergency lighting may be needed in such cases and, whilst lighting from UPS systems may be appropriate for some installations, emergency handlamps and torches might be adequate provided they give sufficient illumination to prevent danger. Further information on lighting levels is available in the HSE publication HS(G)38 - Lighting at Work.

Electrical conductors at voltages nominally above 50 V r.m.s. or 120 V d.c. should be enclosed or positioned in such a way that inadvertent access is not possible; conductors below these voltages should be so protected where additional hazards are present (e.g. within a tank or pit or in the presence of moisture). Conductors of high current in d.c. circuits (i.e. those having a very low internal resistance such as a battery supply) and at lower voltages must also be enclosed.

UPS

Particular care should be taken when working on systems where there is automatic provision of a second source of supply should the mains fail; so-called uninterrupted or uninterruptible power supplies (UPS). Detailed knowledge of such supplies is essential before work on the systems or circuits they serve is carried out as an output will continue to be present when the mains output is removed; the UPS, or any automatically switched standby supply, should be checked first to ensure it is fully isolated. Where standby mains systems are installed, check that provision has been made for:

- full disconnection of loads from all sources of supply including stand-by or bypass supplies
- full labelling of the switching arrangements, including input, output and bypass
- clear indication that loads are fed from a UPS or automatic standby supply, both at the area isolator and at the loads themselves.

Interlocks

Safety interlocks are provided to protect both personnel and equipment. When access is made into enclosures protected by interlocks, it is necessary to be aware of any conditions which might have rendered normally 'dead' conductors 'live'. Safety interlocks should not be defeated or by-passed in any way except with authorisation from the respective Authorised Person (having satisfied themselves that an alternative safe system of work is in place), that notices warning of the modification are suitably posted and that the interlock is restored to normal service on completion of the work. These safety requirements apply even if the interlock needs to be defeated on a regular basis. An interlock may only be permanently modified, by-passed or removed on the written authority of the Authorised Person for the area, with the record of such kept at the workplace.

Soldering irons, test equipment etc.

Wherever practicable, only soldering irons which operate at extra low voltage (i.e. below 50 V a.c. or 120 V d.c.) should be used. All test probes and trimming tools used on live equipment must be properly insulated and should be long enough to ensure that the user's hand remains clear of live conductors. The length of exposed metal on probes should be at a minimum; probes which have the bare metal covered by sliding a sleeve are preferable. Where checking for d.c. with a multi-meter or similar instrument, the probes and their leads should be of different colours.

The condition of all soldering and test equipment, including their associated mains leads, should be checked at appropriate and regular intervals and maintained in good condition. A record should be kept of the results of these checks. Defective equipment which might introduce a hazard should be removed from service and either disposed of or clearly labelled as defective and not returned to service until the fault has been rectified.

Enclosure labelling

Those doors, covers or panels which provide protection from exposed or potentially exposed dangerous conductors and which can be removed without the need for a tool or key, are provided with a suitable sign warning of the danger within and indicating the maximum voltage that may be present, such covers should be labelled:

'DANGEROUS VOLTAGE ENCLOSED' in black letters on a yellow background, with the voltage rating and accompanied by the standard electrical pictogram (see *The Health and Safety (Signs and Signals) Regulations 1996*). In addition to BBC Studioworks owned and maintained equipment, this also applies to hired equipment where BBC Studioworks are responsible for its maintenance.

Where live conductors may frequently be exposed in the course of work, a suitable notice must be prominently displayed on all entrance doors stating the nature of the danger e.g. -

'DANGEROUS VOLTAGES EXPOSED : UNAUTHORISED ENTRY PROHIBITED' together with the appropriate pictogram and voltage rating.

In other areas, whenever live conductors are temporarily exposed and left unattended in the course of installation, modification, maintenance or testing, a suitable temporary notice must be prominently displayed on all apparatus stating, for example:

'DANGEROUS VOLTAGES EXPOSED'

or,

'CAUTION: THIS PLANT IS UNDER TEST AND MAY BE DANGEROUS' again, together with the appropriate pictogram and voltage rating. All covers, whatever the voltage concerned, must be securely replaced after any work requiring their removal has been completed.

When left unattended, measures are taken to deny access to unauthorised persons to all rooms, boards, panels or other enclosures housing electrical equipment which may give rise to danger, with any keys or access codes held only by authorised persons

Unauthorised access to potential areas of electrical danger needs to be controlled. Entrances to normally unoccupied rooms or enclosures dedicated to containing, for example, a main intake switchboard, central battery system, remotely controlled plant or generating set, should be closed and locked when such equipment is left unattended. For temporary system installations (e.g. OB's, locations), the relevant Authorised Person should determine the level of access control measures required through a risk assessment process. All rooms, enclosures or areas where there is residual electrical danger to unauthorised persons should be suitably identified by warning signs / notices.

When occupied, the doors and gates of non-interlocked rooms, enclosures or cubicles in which people work with electrical equipment are only fastened in such a way that they can be easily and immediately opened from either side

All danger areas should be provided with adequate means of access and egress such that, in the event of an emergency, occupants can evacuate quickly and safely or assistance can be quickly given. Whilst people are working in these areas, access doors or gates should not be locked or otherwise impeded; if, for safety reasons, further access restrictions are required, appropriate warning signs should be used and / or an Accompanying Person posted at the entrance. The door or gate of any room, enclosure or cubicle containing live technical equipment or dedicated to switchgear is kept free of all obstructions. Apart from a limited number of items such as special tools and spare fuses, no other materials, tools or apparatus of any sort should be left in rooms or enclosures dedicated to housing switchgear or behind open type switchboards.

Unimpeded access is maintained at all times to isolators, switches and switchboards situated in areas which are not dedicated to housing switchgear.

Where switching / isolating arrangements are not located in dedicated enclosures, for example on workshop benches, clear access to them should be maintained at all times. In an emergency, unimpeded access to such switchgear / isolating mechanisms may be paramount in preventing injury.

5. Work on or near exposed electrical conductors made 'dead'

So far as they relate to matters within their control and as is necessary to prevent injury arising when working on or near electrical equipment, managers **must** have arrangements in place which ensure that:

- work on or near live conductors is avoided wherever practical and is not undertaken at voltages greater than 1000 V r.m.s. or 1500 V d.c. between conductors, or 600 V r.m.s. or 900 V d.c. between conductors and Earth
- where work is carried out on electrical equipment made 'dead', adequate precautions are taken to ensure that the equipment cannot be inadvertently re-energised whilst the danger from electricity remains

Most work on electrical systems or equipment can and should be carried out with the electrical supply disconnected. It is important to take steps to ensure that this supply is not inadvertently re-energised (i.e. switched "ON") during the work. If the point of isolation is not within sight and directly under the control of the person carrying out the work, additional precautions may need to be taken, for example, by arranging for a second person to control access to the isolating device, fixing appropriate locks or notices to the isolator.

Where used, such notices should inform and not challenge e.g.

"DANGER - Work in progress: Do not switch on"

rather than:

"Do not touch"

The difference between 'cutting off' of the electrical supply and its 'isolation' is that true isolation is secure and thus cannot be re-energised inadvertently. True isolation can be achieved by locking the isolator in the "OFF" position, either with an integral lock or using a padlock, and with the key kept in a secure location; access to this key should be controlled through a permit to work or similar record system issued by the Authorised Person. Where appropriate for safety reasons, the Authorised Person should effect all isolations, prove the system to be worked on as 'dead' and secure the lock / padlock.

Wherever practicable, reliance should not be placed on 'ON/OFF' switches alone to disconnect equipment. Where there is no provision for locking off, the equipment should either be unplugged and / or the fuses removed. If these measures are impractical, and the switch is to be relied upon to effect isolation of the supply, the integrity of the switch should be verified using an appropriate tester, which should itself be properly tested before relying upon it. In all cases, the equipment should be regarded as live until the integrity of the switch has been proven.

Particular care should be taken before working on equipment supplied by dual power supplies (e.g. UPS). These have automatic switching to maintain supplies and each supply should be securely isolated and proven 'dead' before work on the systems should begin.

Safe System for Working Dead

Before carrying out any work on 'dead' electrical systems, installations or equipment, a safe system of work should be in place which ensures, as appropriate, that:

- suitable and sufficient precautions are in place, as identified by the risk assessment
- the extent of the circuit, system or equipment to be worked on is correctly identified
- the supply is cut off, isolated and the isolation made secure
- any residual charges are discharged and local earths applied as necessary
- the circuit / system / equipment is proven dead
- precautions are taken to prevent accidental contact with any adjacent live parts.

6. Safe design and installation of electrical equipment

So far as they relate to matters within their control and as is necessary to prevent injury arising when working on or near electrical equipment, managers **must** have arrangements in place which ensure that:

- electrical equipment is of sufficient strength and capability and constructed to defined and appropriate safety / technical standards, having regard to its intended purpose, location or expected conditions of use

The Authorised Person responsible for the provision and/ or putting into use of any electrical system or installation for the first time should satisfy themselves that:

- the design has been carried out by people competent to do so
- all items comprising the installation are specified to a recognised standard; for example, individual items of equipment should be checked for conformity marks (e.g. CE or BS EN), all new fixed installations should comply with appropriate regulations (e.g. BS 7671), etc.
- the installation has been appropriately inspected, commissioned or tested prior to handover for use and that this has been verified by certificate or other written record; for example, portable appliance test records, fixed wiring installation certificate, etc.
- all items comprising the installation have been suitably selected to take account of the environment and conditions of their intended use
- all component parts have, where necessary for safety reasons, been adequately and clearly labelled for unambiguous circuit identification purposes
- accurate circuit diagrams or plans of the installation have been provided and kept, and arrangements are in place to update them should subsequent modifications occur
- all electrical systems are periodically inspected and tested and appropriate records kept, with the records readily available to those who need to consult them.

Responsibilities

Most power installation or repair work will be carried out by specialist contractors. Whilst they have responsibilities to carry out this work in accordance with legislation and other standards specified in their contract/job specification, ultimate responsibility for the condition and suitability of the installation or system rests with those who appoint and manage them, whether they are employees of BBC Studioworks or a Partner to the BBC Studioworks. Managers/Authorised Persons, should put in place or comply with such arrangements as are necessary (e.g. contractor approval, design review, site inspections, project handover, documentation review, etc.) to satisfy themselves that they are discharging their responsibilities appropriately in this regard.

Probably the most fundamental measure that can be taken to protect against the dangers of electricity is insulation. It is usually the first line of defence against electric shock and is also instrumental in decreasing the hazards associated with the other dangers of electricity. In deciding if the standard of protection afforded is adequate, two aspects to insulation need to be considered:

- it must be effective over the range of voltages, including any foreseeable fault voltages, that it is being used to insulate
- it must be able to remain effective under its intended conditions of use.

In practical terms, this will mean consideration of the following factors which could potentially affect the integrity of the insulation:

- mechanical damage including impact, flexion, abrasion
- environmental (e.g. water, wind, pressure, temperature)
- corrosive conditions
- fire
- proximity of other conductors (together with their current loads, voltage gradients between them and any frequency implications).
- all conductors, other than circuit conductors, which may become electrically charged through a fault or for some other reason, are suitably earthed or similarly protected
- precautions are in place to ensure circuit conductors referenced to earth cannot subsequently achieve significantly different potentials
- every joint and connection is mechanically and electrically suitable for use

All connections in circuit and protective conductors, including connections to terminals, plugs and sockets, and any other means of joining or connecting conductors, should be suitable for the purposes for which they are used. This requirement applies equally to temporary and permanent connections. The insulation and conductance of these connections, as well as their mechanical protection and strength, should be suitable and fit for purpose, including under likely fault conditions and subject to any specific maintenance requirements identified by regulation, manufacturer's literature or local BBC Studioworks standards.

Joints and connections in protective conductors should be made at least as carefully as those in circuit conductors and they should be of sufficient strength and conductance to allow for the passage of fault

currents. Such connections may need to be treated so as to prevent corrosion. It is recommended that combinations of metals liable to produce damaging electrolytic action be avoided.

Plug and socket connections should not expose persons to accidental contact with conductors at dangerous voltages. This should be achieved by selection of appropriate equipment, but may also involve some degree of operator skill and/or training, depending upon the circumstances. Where a plug and socket type connector conveys a protective conductor together with the circuit conductors, the protective conductor should be the first to be made and the last to be separated; equipment designed to appropriate standards will meet this safety requirement.

Where the plug and socket connections are not adequately rated to withstand the maximum possible load current, effective arrangements should be in place to prevent the making or breaking of the connection under these conditions, for example, by using a means of mechanical interlocking linked to the power control switch. Special attention should be given to joints and connections in cables and equipment which may be handled regularly, for example flexible cables for portable equipment. Plugs and sockets for such equipment should be constructed in accordance with appropriate standards and arranged that, where necessary, insertion of the plug automatically ensures the earthing of any metal casing of Class I equipment.

The handover of any newly installed or significantly modified electrical systems are supported by up to date and sufficiently detailed information, including certificates, circuit diagrams and/or plans, and where appropriate, design philosophy.