



Policy and Plans for Utilisation, Maintenance and Testing of Fixed and Portable Electrical Equipment at Didcot Railway Centre

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**GREAT WESTERN SOCIETY
ELECTRICAL POLICY DOCUMENT**

DIDCOT RAILWAY CENTRE

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FOREWORD

1. Although electricity causes relatively few occupational accidents, those that do occur are responsible for a high proportion of deaths. Electrical faults are also the second most frequent cause of fires in industry and commerce in the United Kingdom. The majority of electrical accidents involve equipment that has become defective due to insulation failure, inadequate earthing, incorrect over-current protection (fuses, breakers, etc.) or faulty wiring. These pose a threat to personal safety causing electric shock, burns, explosions and fires.

2. The Electricity at Work Regulations 1989, came into force in all places of work on 1 April 1990. They provide general rules on insulation, cutting off supply, and maintenance of electrical systems, but they do not specify insulation materials nor the design of switches and isolators. Nor do they (contrary to what seems to be a widely held misconception) specify the nature and frequency of maintenance and testing other than to require that maintenance must be such as to prevent danger.

3. The purpose of this Policy Document is to advise all who use or work with electricity on practical ways and means of avoiding electrical danger and of complying with the Regulations. The Code is subsidiary to, and forms part of, the Society's Safety Management System.

4. The many and varied uses to which electricity is put in the Railway Centre as elsewhere are such that no single document can cover all aspects. Lists of further publications covering specific electrical safety topics are appended.

5. Certain parts of the Electricity at Work Regulations have been widely misinterpreted to imply that all existing electrical systems, plant and equipment, are rendered obsolete and must be replaced, regardless of cost, as soon as possible. This is most definitely not the case. The following is abstracted from the Health and Safety Executive's Memorandum of Guidance on the Electricity at Work Regulations 1989 (ISBN 0 7176 1602 9):

"Where electrical equipment pre-dates the Regulations this does not of itself mean that the continued use of the equipment would be in contravention of the Regulations. For example, much of the equipment to which the Regulations apply may have been made to a standard, such as a British Standard, which has since been modified or superseded. It is likely to be reasonably practicable to replace it with equipment made to a more recent standard when, but only when, it becomes unsafe or falls due for replacement for other than safety reasons, whichever occurs sooner. Equally, fixed installations to which the IEE Wiring Regulations are relevant may have been installed in accordance with an earlier edition, now superseded but then current; that in itself, does not mean that the installation does not comply with the current Regulations."

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1 INTRODUCTION

1.1 Electricity is widely used throughout the Railway Centre, and in normal circumstances no hazards should arise. Neglect and misuse of electricity can, however, result in electric shock to individuals, or in overheating, leading to fire.

1.2 This Policy Document details how the Society should assess and implement these arrangements. It forms part of the general Society policy on safety and its status is that of good practice that must either be followed or be replaced by equivalent good practice. The Policy, or relevant sections (whichever is appropriate) is incorporated into the Society's Safety Management System.

The nature of electricity is such that no Policy or Code of Practice can hope to cover every conceivable aspect of its use. Guidance on specific aspects of electrical safety can be found in relevant British Standards, official publications by the Health and Safety Executive, professional bodies such as the Institute of Engineering and Technology and many other sources.

It is of critical importance, however, that those engaged in work with electricity to any degree should have the necessary level of competence to carry out their work safely. It is also important to bear in mind that ensuring the competence of those working with electricity is a statutory requirement, failure to observe which is a serious offence, carrying with it heavy penalties. The following is extracted from the Health & Safety Executive's official guidance on the Electricity at Work Regulations.

Only those who have both the knowledge and experience to make the right judgements and decisions and the necessary skill and ability to carry them into effect should undertake work subject to this Code. A little knowledge is often sufficient to make electrical equipment function but a much higher level of knowledge and experience is usually needed to ensure safety.

Special note:

The terms 'Facility Manager' and 'Project Manager' are used throughout the code. The Facility Manager is responsible to the Society Health and Safety Manager for ensuring that the Facility, any activity in the Facility and any equipment used in the Facility complies with all safety requirements. Similarly, the Project Manager is responsible for the activities and equipment involved in the project for which they are responsible.

1.3 This Code is intended for Facilities with no staff (with the exception of those suitably qualified and experienced members of the Site Electrical Team) approved for the construction, repair and maintenance of equipment and fixed installation and who use only commercially produced equipment.

1.4 The electrification structures and cabling of the Network Rail System pose an obvious danger, and are not covered in this document, but it must be pointed out that no one should go near a structure or have an item long enough to touch the wires and additionally that no one should be outside of our fence line unless they have a NR PTS which already has 25kV electrification as part of its training.

All other issues around safety of the 25kV system are dealt with within the DRC Operating and General Regulations Manual.

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2 INSTALLATIONS WITHIN AND AROUND BUILDINGS

2.1 Work to install, modify or maintain the fixed installations at Didcot Railway Centre should only be undertaken by suitably qualified and experienced persons. This will generally be taken as having served an electrical apprenticeship, or other equivalent training, followed by experience in an industrial environment.

2.2 Installations are to comply with the current edition of the IET Wiring Regulations, published as BS7671.

The nature of the Didcot Railway Centre site is generally considered a harsh environment for electrical equipment. Accordingly, the majority of the electrical installations will need to be fit for an industrial environment, utilising steel wire armoured cabling or within a suitably robust conduit and trunking wiring system. The preference, within buildings, is for a steel trunking and conduit installation, with the main runs adequately sized to provide scope for any future alterations and extensions.

Cabling between buildings will generally be PVC insulated and sheathed steel wire armoured cables, run where possible through the duct network. Where multiple cables are run (e.g. up a wall to gain access to a building) a support system of galvanised steel supporting a galvanised steel cable tray is to be utilised to keep the cabling neat.

2.3 The industrial nature of the DRC site makes the use of reduced low voltage (110v) hand tools desirable. Accordingly, workshops and other areas where work is carried out should be equipped with adequate numbers of 110v socket outlets (BS EN IEC 60309-1 earth position 4h, coloured yellow, supplied from a suitable centre tapped transformer).

It is acknowledged that there will be situations requiring 230v and 400v supplies, generally as supplies to accommodation vehicles or larger portable equipment such as welders. These will be catered for by the provision of limited numbers of suitably rated BS EN IEC 60309-1 socket outlets with earth position 6h and coloured blue for 230v and red for 400v supplies. A neutral conductor should be provided to all 400v outlets even if the initial requirement does not need it. The outlet should also include a 30mA RCD to provide RCD protection at the point of use.

2.4 Control gear circuits associated with 400/415V 3-phase equipment should be operated at a maximum of 110V AC from an isolating transformer with one side of the winding earthed.

2.5 Lighting, both internal and external, should utilise low energy (e.g. LED) sources. Period appearance luminaires are available for use in heritage areas. Emergency lighting to cover escape to an external location is to be provided within and in the immediate vicinity of all buildings.

2.6 In order to provide compatibility, the preferred distribution boards are the Schneider Electric MCB range.

2.7 All new installations, and major extensions will need to be tested in accordance with Chapter 64 of the IET Regulations. Copies of the test results are to be forwarded to the Site Electrical Department for retention.

2.8 All fixed installations are to be subject to periodic inspections and testing as outlined in Chapter 65 of the IET Regulations. It is recommended that this be a rolling program visiting each installation at least every 8 years. Records will again be held by the Site Electrical Department.

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3 INSTALLATIONS WITHIN ROLLING STOCK OR OTHER VEHICLES

3.1 There are a number of railway vehicles and storage containers in use on the Didcot Railway Centre site that contain electrical equipment.

Heritage rolling stock typically makes use of a 24v DC system supplied by batteries mounted in boxes attached to the underframes of the vehicle. In addition to the risks associated with the batteries, it is worth noting that some of the cabling associated with these installations may be carrying much higher currents than may be expected. It is therefore important that all connections are securely made in order to reduce the risk of overheating through working loose.

3.2 Various other vehicles and containers have been adapted from their original use to create accommodation and storage functions. As these are moved relatively infrequently, there is often a requirement to provide a 'shore' electrical supply to the vehicle/container.

The main guidance on these installations comes from Section 721 of the IET Regulations, covering installations in caravans and motor caravans. The main points to consider here in adapting the application to railway usage involve the provision of a bonding conductor to the chassis/underframe (or in the case of a container, the main steel framework) and the provision of an accessible external connector to BS EN IEC 60309-1. This must be arranged with the pin portion of the connector on the container/vehicle and the socket tubes on the floating connector. This is to ensure that shunters/slingers can easily and safely disconnect the power supply from the vehicle/container.

The supply point is to include a 30mA RCD, and the flexible cable is to include an earthed steel sheath or braid. (Olflex SY cable or similar).

Vehicles containing sleeping accommodation will require emergency lighting and a functioning automatic fire alarm system.

3.3 These installations should be tested and inspected at least every 3 years, with the test results retained by the Site Electrical Department.

4 PORTABLE EQUIPMENT

4.1 GENERAL SPECIFICATIONS

Didcot Railway Centre is a harsh environment for electrical equipment.

The conditions experienced during restoration or maintenance of locomotives and rolling stock are not far removed from those of a construction site. Accordingly, the Society policy is to eliminate, as far as is practicable, the use of 230/240V equipment outside of the office, catering, shop and museum areas. New installations will incorporate RCD protection on all 230/240V socket outlet circuits.

Hand tools should operate at 110V from a centre tapped earth supply, giving a maximum of 65V to earth. The standard connector to be a BS EN IEC 60309-1 16A 2P & E plug or socket with earth position 4h.

Handlamps used in boilers, tanks or other metallic vessels should be supplied from a 25V centre tapped earth supply.

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Alternatively, battery operated hand tools or lamps may be used, with the recharging of the battery taking place in a ventilated indoor area (eg Mess Room, Catering Building).

The use of Step-up transformers to obtain 240V from a 110V input is deprecated and should only be used under controlled conditions and fitted with primary and secondary overload protection and the output connector must be further protected by a 30mA Residual Current Device. Departments making use of such devices shall eliminate their use when equipment is replaced by purchasing equipment designed to operate on 110V supply.

Welding machines and other similar equipment may require the use of more power than can be supplied by the 110V distribution system, and equipment requiring more than 2kW should be ordered for operation on 400/415V supply. The purchaser must liaise with the Electrical Department for provision of a suitable RCD protected supply, which will terminate on a suitably rated BS EN IEC 60309-1 3P N & E socket with earth position 6h. The cabling to the machine, or any extension lead, is to be of the type incorporating an earthed steel braid in addition to the circuit live and protective conductors (Olflex 'SY' cable or similar)

230/240V supplies will be afforded to accommodation vehicles, as these move relatively infrequently, but the supply will be afforded via a suitably rated RCD protected socket. Supply leads to these vehicles are to be of a type incorporating an earthed steel braid in addition to the circuit live and protective conductors (Olflex 'SY' cable or similar), and the connection to the vehicle must be made via a suitably rated connector (on the cable) and a fixed plug (on the vehicle), to allow for safe and easy disconnection by the Shunters.

4.2 RESIDUAL CURRENT DEVICES (RCDs) FOR EARTH LEAKAGE PROTECTION

Residual current devices (previously ELCBs/RCCBs) monitor the current in the live and neutral conductors: any imbalance will cause the device to trip.

RCDs can be installed in an electrical circuit as a protective device, which will rapidly disconnect the mains supply if a fault current is detected. The magnitude of the fault current allowed is preset and in circumstances where shock to persons is anticipated this should be between 10mA and 30mA and trip the supply within 30mS. This limits the energy, which may be passed through the body. RCDs for protection against fire may have a preset sensitivity of up to 100mA. RCDs will not protect a person touching both live and neutral conductors.

The IET Regulations state that all installations outside the equipotential zone, i.e. external/outdoor from the main installation should be protected by RCDs. The Regulations make it clear, however, that reliance on this form of protection is not acceptable as the sole or main means of protecting persons from electric shock. RCDs may only be used as a useful backup to primary safeguards such as insulation, enclosure, low voltage etc.

4.3 ELECTRIC SPACE HEATERS

Privately-owned heaters may not be used in the Railway Centre. If under special circumstances the Society considers it necessary to provide a heater, the Facility Manager will ensure that it is checked regularly.

The use of radiant electric fires is specifically prohibited. Their unauthorised use in the past has been the cause of a number of accidents including life-threatening fires.

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4.4 COMMERCIAL ELECTRICAL EQUIPMENT

- 1.1 This applies to Facilities with no staff approved for the construction, repair and maintenance of equipment and fixed installation and who use only commercially produced equipment.
- 1.2 Where standard commercial equipment is in use the correct fuse/overcurrent device should be fitted. Contact with live parts must be prevented by enclosure, isolation or by some other effective means.
- 1.3 The equipment should be visually checked before being put into use to ensure initial safe condition.

4.4.1 ELECTRICAL EQUIPMENT CONSTRUCTED ON SITE/NEW EQUIPMENT

- 4.4.1.1 Any brand-new item of portable electrical equipment should be registered with the electrical department so it can be added to the database. Any new installation and second-hand equipment to be used on site must be inspected and registered by the electrical department. This will include a portable appliance test or installation tests as appropriate to register the items on the database.
- 4.4.1.2 Motor driven equipment is to be checked for compliance with Regulations 422.3.7 (Prevention of overheating) and 463.3 (Prevention of automatic restarting) of BS7671 (IET Wiring Regulations), as well as a visual inspection of guarding of mechanical parts.

4.5 CHECKS BEFORE USE

- 4.5.1 Manufacturers of any electrical equipment have a legal obligation to ensure that it is safe when properly used. Provided that the correct fuse has been fitted, commercial equipment should be safe without modification. However, instructions given by the manufacturer should be brought to the attention of all users.
- 4.5.2 When older equipment is brought into use, arrangements must be made to ensure that it conforms to current safety standards, and that its condition is such that the original built-in safety has not been degraded by wear or misuse.
- 4.5.3 It is the Facility or Project Manager's responsibility to ensure that all electrical equipment is PAT tested, is in date and safe to use. In case of doubt, reference should be made to a competent person.
- 4.5.4 230/240V Equipment to be used out of doors should be fitted with suitable weatherproof connectors (eg BS EN IEC 60309-1) and only connected to an outlet protected by a residual current device (RCD) to provide optimum protection. In such cases, advice is available from the Electrical Department. It should be noted, however, that the use of RCDs cannot be regarded as replacing primary safety features (enclosure, insulation, etc.).
- 4.5.5 Particular attention is drawn to the high standards of maintenance needed in respect of 'hard use' electrical appliances. Visual checks of plugs, power cables, connections (at plug and appliance ends) should be frequently carried out and users instructed as to action to be taken if and when unsafe conditions are identified. The term 'hard use'

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includes all hand tools, *and associated extension leads*, and may also include the following:

Electric Drills, Grinders etc
Vacuum cleaners
Floor scrubbers/polishers
Horticultural/gardening equipment
Mains powered radios/tape players and any other AV equipment
Floor/desk/table/inspection lamps
Portable kitchen appliances
Welding Rod Ovens/Quivers
Soldering irons

and most other equipment which is frequently moved about, plugged and unplugged, or which is subject to added stresses from handling, wet, heat or corrosion.

4.6 MAINTENANCE

- 4.6.1 It is the Facility or Project Manager's responsibility to ensure that electrical equipment used in the Facility is maintained in a safe condition and that the condition of all appliances is kept under review so as to prevent danger.
- 4.6.2 The most important arrangement to be made is a visual check of the condition of the connecting cables and of the plug. The connecting cable must be undamaged and securely fastened both at the appliance end and at the plug ends. The plug must be undamaged and must not rattle, which may indicate loose terminals and potential danger. Check for visual evidence (blackening, scorching, etc.) of arcing or overheating. Any apparent defect must be investigated and remedial action taken.
- 4.6.3 A full electrical test must be undertaken from time to time. The frequency of tests depends on the amount, type and conditions of use. A good guide is contained in the HSE leaflet, Maintaining Portable Electrical Equipment. Testing and records of the test should be arranged by Facility or Project Managers in conjunction with the Electrical Department, who will keep records of tests and arrange for a label to be securely attached to the equipment so that the test history can be checked. A copy of test records is to be kept by the Railway Centre Manager (These records are normally held by the Site Electrical Department on behalf of the Manager). Such tests should also form part of any repair procedures. (It should be noted that many service contracts will be concerned only with the correct functioning of the equipment and not with its electrical safety).

4.7 SUMMARY

- 4.7.1 Users should be instructed in the safe methods of use of electrical equipment and should be warned of the hazards of using unsafe equipment.
- 4.7.2 They should be made aware of the need to make frequent visual checks of the condition of cables and plugs.
- 4.7.3 Facility and Project Managers should ensure that electrical equipment is safe to use when installed and remains so by regular checking and maintenance at appropriate intervals. Facility and Project Managers may choose to sub-contract such maintenance but it remains their responsibility to initiate and monitor any arrangement, including ensuring the handover of any records for retention by the Society.

APPENDIX

Maintaining Portable Electrical Equipment HSE Publication HSG 107
Currently 3rd Edition, ISBN 978 0 7176 6606 5, published by HSE 2013, price £15. Also
available free on the internet at <http://www.hse.gov.uk/pubns/priced/hsg107.pdf>