

Supplement to the Electricity at Work Policy

Appendix I: DBC Estate

Address	Dutyholder	Group Manager of Service Responsible	Contractor engaged to undertake works	Location of Records
The Forum Marlowes, Hemel HP1 1DN	Dacorum Borough Council			

This appendix to be completed as part of the health & safety workstream on dutyholders

Appendix II – Requirements of specific regulations

Electrical Installation Condition Survey Defects Codes

Code 1 (C1) observation means 'Danger present. Risk of injury. Immediate remedial action required.' It is an immediate threat and should be rectified or made safe as soon as possible. An example of a C1 defect would be accessible live conductors due to damage, poorly modified enclosures or removed maintenance panels. Incorrect polarity would also attract a code C1 as it may allow conductive parts, not normally expected to be live, to become live.

The presence of a code C1 warrants immediate action to be taken which would be to inform the duty holder or responsible person for the installation immediately, both verbally and in writing, of the risk of injury that exists.

A **Code 2 (C2)** is a potentially dangerous defect, these might be things that don't pose an immediate threat but are likely to become a danger in the future. A C2 is described as 'Potentially dangerous - urgent remedial action required.'

The phrase "potentially dangerous", in the C2 code is designed to point towards a risk of injury from contact with live parts after a sequence of events. A sequence of events could mean that an individual may gain access to live parts through a day to day task that would not be expected to give access to live parts.

Code 3 (C3) is described as 'Improvement recommended.' This means it does not comply with the regulations but isn't actually dangerous. A code C3 should imply that the installation is not necessarily dangerous but it may not comply with the current version of the regulations or for example, may have damaged fittings that do not have exposed live parts. A code C3, in itself, should not warrant an overall unsatisfactory report.

An observation code **FI** is described as 'Further investigation required without delay.' This means that the electrical contractor has observed something whilst carrying out the testing for instance emergency lights seem very dim. This might not have been covered in the report so they have noted it separately as code FI.

Key Regulations

Regulation 4

- 1) All **systems** shall at all times be of such construction as to prevent, so far as is reasonably practicable, **danger**.
- 2) As may be necessary to prevent **danger**, **all systems** shall be maintained so as to prevent, so far as is reasonably practicable, such **danger**.
- 3) 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**.
- 4) Any equipment provided under these Regulations for the purpose of protecting persons at work on or near **electrical equipment** shall be suitable for the use for which it is provided, be maintained in a condition suitable for that use, and be properly used.

The safety of a system depends upon the proper selection of all the electrical equipment in the system and the proper consideration of the inter-relationship between the individual items of equipment. For example, electrical protection against overloads and earth faults etc may need to be provided in one part of a system to protect another, possibly remote, part of the system.

Inspection and, where necessary, testing of equipment is an essential part of any preventive maintenance programme. Records can aid demonstration of compliance and allow useful analysis of equipment condition. Maintenance records (including test results), preferably kept throughout the working life of an electrical system, will allow the condition of the equipment and the effectiveness of maintenance policies to be monitored. Without effective monitoring, dutyholders cannot be certain that the requirement for maintenance has been complied with.

Regulation 4(3) requires that work activities of any sort, whether directly or indirectly associated with an electrical system, must be carried out in a way which, as far as is reasonably practicable, does not give rise to danger.

Regulation 6 – Adverse environments

This regulation requires that where *Electrical equipment which may reasonably foreseeably be exposed to –*

- a) *mechanical damage;*
- b) *the effects of the weather, natural hazards, temperature or pressure;*
- c) *the effects of wet, dirty, dusty or corrosive conditions; or*
- d) *any flammable or explosive substance, including dusts, vapours or gases, shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, **danger** arising from such exposure.*

The regulation draws attention to the kinds of adverse conditions where danger could arise if equipment is not constructed and protected to withstand such exposure.

Electrical equipment must be suitable for the environment and conditions of use to which it may reasonably foreseeably be exposed so that danger which may arise from such exposure will be prevented so far as is reasonably practicable.

Regulation 7 – Insulation, protection and placing of conductors

All conductors in a system which may give rise to danger shall either –

*a) be suitably covered with insulating material and as necessary protected so as to prevent, so far as is reasonably practicable, **danger**; or*

*b) have such precautions taken in respect of them (including, where appropriate, their being suitably placed) as will prevent, so far as is reasonably practicable, **danger**.*

Regulation 7(a) states that conductors must be insulated. Suitable insulation of the conductors in an electrical system is, in the majority of cases, the primary and necessary safeguard to prevent danger from electric shock, either between live conductors or between a live conductor and earth.

Regulation 7(b) permits the alternative of having such precautions taken in respect of the conductors. These precautions may include the suitable placing of conductors. They may comprise of strictly controlled working practices reinforced by measures such as written instructions, training and warning notices etc. The precautions must prevent danger so far as is reasonably practicable.

Regulation 8 Earthing or other suitable precautions

Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeably become charged as a result of either the use of a system, or a fault in a system, becomes so charged; and, for the purposes of ensuring compliance with this regulation, a conductor shall be regarded as earthed when it is connected to the general mass of earth by conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth.

This regulation applies to any conductor (other than circuit conductors), including the conductive parts of equipment, such as outer metallic casings, which can be touched and, though not live, may become live under fault conditions.

Techniques employed for achieving the above include:

- (a) double insulation;
- (b) earthing;
- (c) connection to a common voltage reference point on the system;
- (d) equipotential bonding;
- (e) use of safe voltages;
- (f) earth-free, non-conducting environments;
- (g) current/energy limitation;
- (h) separated or isolated systems.

The principle of '**double insulation**' is that the live conductors of the electrical equipment are covered by two discrete layers or components of insulation, each of which would adequately insulate the conductor but which together ensure an improbability of danger arising from insulation failure. This arrangement avoids the need for any external metalwork of the equipment to be connected to a protective conductor or to earth.

For portable equipment and equipment used externally the preference is to have double insulated equipment.

The use of a residual current device (RCD) designed to operate rapidly at small leakage currents (typically not exceeding 30 mA), although these devices do not eliminate the risk of electric shock. RCDs **should not be considered as the sole means** of protection but as an additional protective measure. They should be operated regularly using the test trip button. This test trip procedure is important in maintaining the effectiveness of most types of RCD. If single insulated equipment is used externally then it **must** be used in conjunction with a RCD and pre-user checks.

Regulation 10 Connections

The regulation requires that 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 the connections must be suitable, having regard to the conditions of use including likely fault conditions.

Plug and socket connections and their use must be arranged so that accidental contact with live conductors at dangerous voltages is prevented. This should be achieved by selection of appropriate equipment but may involve some degree of operator skill and/or training, depending on the circumstances.

Regulation 11 Means for protecting from excess of current

Efficient means, suitably located, shall be provided for protecting from excess of current every part of a **system** as may be necessary to prevent **danger**.

It is recognised that faults and overloads may occur on electrical systems. The regulation requires that systems and parts of systems be protected against the effects of short circuits and overloads if these would result in currents which would otherwise result in danger.

The means of protection is likely to be in the form of fuses or circuit breakers controlled by relays etc, or it may be provided by some other means capable of interrupting the current or reducing it to a safe value.

Regulation 12 Means for cutting off the supply and for isolation

Regulations 12(1) requires:

*where necessary to prevent **danger**, suitable means (including, where appropriate, methods of identifying circuits) shall be available for –*

- a) cutting off the supply of electrical energy to any **electrical equipment**; and*
- b) the isolation of any **electrical equipment**.*

*“isolation” means the disconnection and separation of the **electrical equipment** from every source of electrical energy in such a way that this disconnection and separation is secure.*

12(1)(b) requires that there will be available suitable means of ensuring that the supply will remain switched off and inadvertent reconnection prevented. This is isolation. This will require the use of lock off devices where the key is held by the person undertaking the work on that circuit. On older systems this may require the removal of the trip device, or fuse to ensure that the circuit cannot be made live. The isolator switches/trip device/fuse remains in the possession of the person undertaking the work on the circuit at all times. The circuit should be tested to confirm it is not live prior to undertaking any work on the circuit.

Regulation 13 Precautions for work on equipment made dead

*Adequate precautions shall be taken to prevent **electrical equipment**, which has been made dead in order to prevent **danger** while work is carried out on or near that equipment, from becoming electrically charged during that work if **danger** may thereby arise.*

The regulation may apply during any work, be it electrical or non-electrical. The regulation requires adequate precautions to be taken to prevent the electrical equipment that has been made dead from becoming electrically charged, from whatever source, if this charging would give rise to danger.

The precautions must be effective in preventing the electrical equipment from becoming charged in any way which would give rise to danger.

In the first place, the procedures for making the equipment dead will probably involve use of the means required by regulation 12(1)(a) for cutting off the supply of electrical energy. Isolation of the electrical equipment will be necessary and the means required by regulation 12(1)(b) will facilitate this. Ideally, a means of locking off an isolator can be used. Where such facilities are not available, the removal of fuses or links and their being held in safe keeping can provide a secure arrangement if proper control procedures are used.

Regulation 14 Work on or near live conductors

*No person shall be engaged in any work activity on or so near any live **conductor** (other than one suitably covered with insulating material so as to prevent **danger**) that **danger** may arise unless –*

- a) it is unreasonable in **all** the circumstances for it to be dead; and*

- b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and*
- c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent **injury**.*

Testing to establish whether electrical conductors are live or dead **MUST** always be done on the assumption that they may be live and, therefore, it should be assumed that this regulation is applicable until such time as the conductors have been proved dead.

Although live testing may be justifiable it does not follow that there will necessarily be justification for subsequent repair work to be carried out live. The risk assessment must provide a detailed reasoning why working live is being undertaken.

If danger may otherwise arise it is always preferable that work on or near electrical equipment should be carried out when that equipment is dead.

The design of electrical equipment and of the installation should eliminate the need for live work which puts people at risk of injury. This can often be done by careful thought at the design stage of installations. Where situations arise and identifies such systems remedial work should be carried out so that in the future the circuit/conductor (or part therefore) can be isolated.

Live work includes live testing, for example the use of a potential indicator on mains power and control logic circuits.

The factors which should be considered in deciding whether it was justifiable for work to proceed with the conductors live should include the following:

- a) It is not practicable to carry out the work with the conductors dead, eg where for the purposes of testing it is necessary for the conductors to be live.
- b) To make the conductors dead will create other hazards, such as to other users of the system, or for continuously operating process plants etc.
- c) The need to comply with other statutory requirements.
- d) The level of risk involved in working live and the effectiveness of the precautions available set against the economic need to perform that work.

The above must be justified in the risk assessment and must be notified to the person issuing the permit to work prior to commencing works.

The need to be near uninsulated live conductors

The precautions necessary to comply with regulation 14(c) should be commensurate with the risk. The system of work must:

- a) allow only people who are competent to do so to work on or near exposed, live conductors; *and*
- b) indicate within what limits the work is to be attempted; *and*
- c) indicate what levels of competence apply to each category of such work; *and*
- d) incorporate procedures under which the person attempting the work will report back if the limits specified in the system are likely to be exceeded.

This must be detailed in the risk assessment and method statement. In addition to consider placing notices or placards giving details of emergency resuscitation procedures in the event of electric shock at those locations where people may be at greater risk of electric shock.

Regulation 16 Persons to be competent to prevent danger and injury

*No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent **danger** or, where appropriate, **injury**, unless he possesses such knowledge or experience, or is under such degree of supervision as may be appropriate having regard to the nature of the work.*

Regulation 29 states:

*“it shall be a defence for any person to prove that he took **all** reasonable steps **and** exercised **all due diligence** to avoid the commission of that offence”.*

Regulation 29 applies only in criminal proceedings. It provides a defence for a dutyholder who can establish that they took all reasonable steps and exercised all due diligence to avoid committing an offence under regulations 4(4), 5, 8, 9, 10, 11, 12, 13, 14, 15 or 16.

It is for this reason that DBC must be satisfied that contractors/subcontractors working on electrical systems on DBC controlled premises are competent and undertake their working practices having regard to the Electricity at Work Regulations 1989.

Appendix III – Ingress Protection Rating

IP Ratings - what they mean.

First Digit (intrusion protection)

1. No special protection
2. Protection from a large part of the body such as a hand (but no protection from deliberate access); from solid objects greater than 50mm in diameter.
3. Protection against fingers or other object not greater than 80mm in length and 12mm in diameter.
4. Protection from entry by tools, wires etc, with a diameter of 2.5 mm or more.
5. Protection against solid bodies larger than 1mm (eg fine tools/small etc).
6. Protected against dust that may harm equipment.
7. Totally dust tight.

Second Digit (moisture protection)

1. No protection.
2. Protection against condensation
3. Protection against water droplets deflected up to 15° from vertical
4. Protected against spray up to 60° from vertical.
5. Protected against water spray from all directions.
6. Protection against low pressure water jets (all directions)
7. Protection against strong water jets and waves.
8. Protected against temporary immersion.
9. Protected against prolonged effects of immersion under pressure.

Appendix IV - Useful definitions and further reading

'Electrical equipment' as defined in the Regulations includes every type of electrical equipment from, for example, a high-voltage transmission overhead line to a battery-powered hand lamp. There are no voltage limits in the Regulations; the criteria are whether danger (as defined) may arise.

Regulation 2 defines a conductor as 'a conductor of electrical energy'. This means any material which is capable of conducting electricity (electricity is synonymous with electrical energy) and therefore includes both metals and all other conducting materials. The definition is not limited to conductors intended to carry current and so includes, for example, metal structures, salt water, ionised gases and conducting particles.

The Regulations use the two defined terms, 'danger' and 'injury'. 'Danger' is defined as 'risk of *injury*'. 'Injury' is defined in terms of certain classes of potential harm to people. Where the term 'prevent danger' is used it should therefore be read as 'prevent the risk of *injury*'.

Injury

The purpose of the Regulations is to prevent death or personal injury to any person from electrical causes in connection with work activities.

'Injury' means death or injury to any person from:

- a) electric shock;
- b) electric burn;
- c) fires of electrical origin;
- d) electric arcing;
- e) explosions initiated or caused by electricity.

Electric shock

The human body responds in several ways to electrical current flowing through it. The sensation of shock is only one such effect and this can be extremely painful. When a shock is received, the electric current may take multiple paths through the body and its intensity at any one point is difficult or impossible to predict. The passage of electric current may cause muscular contractions, respiratory failure, fibrillation

Dead (as used in regulations 13 and 14)

The term 'dead' is not defined in the Regulations so it takes its ordinary meaning. Thus, in the context of the Regulations, for a conductor to be 'dead' means that it is neither 'live' nor 'charged'.

Sources of useful guidance

1. *Electricity at work: Safe working practices* HSG85 (Third edition) HSE Books 2013 www.hse.gov.uk/pubns/books/hsg85.htm
2. *Dangerous substances and explosive atmospheres: Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance* L138 (Second edition) HSE Books 2013 www.hse.gov.uk/pubns/books/l138.htm
3. *Maintaining portable electric equipment in low-risk environments* Leaflet INDG236(rev3) HSE Books 2013 www.hse.gov.uk/pubns/indg236.htm
4. *Avoiding danger from underground services* HSG47 (Third edition) HSE Books 2013 www.hse.gov.uk/pubns/books/hsg47.htm
5. *Avoiding danger from overhead power lines* General Guidance Note GS6 (Fourth edition) HSE 2013 www.hse.gov.uk/pubns/gs6.htm
6. *Working safely near overhead electricity power lines* AIS8(rev3) HSE Books 2012 www.hse.gov.uk/pubns/ais8.htm