Electrical Isolation

Identify the circuit or equipment to be worked on or near and the work that needs to be done

34 These tasks should be carried out before the work starts. Factors that may affect the safe system of work should also be taken into account. In many cases, actual physical identification will be necessary and this may be aided by the use of appropriate drawings, diagrams and other written information. The features of equipment mentioned in paragraphs 8–17 should be taken into account.

Plan the work

35 Many electrical accidents are due to a failure to plan ahead. Planning should consider the management, supervision, implementation and completion of the work, and should lead to a formal system of work based on information in the safety rules and a task-specific risk assessment. In some instances, the planning requirements of the Construction (Design and Management) Regulations[19] will apply. You should consider the following:

- the work to be done;
- the hazards of the system or equipment to be worked on and the risks associated with the work;
- the people doing the work, their competence and the level of supervision necessary;
- the precautions to be taken and the system of work to be employed;
- the possibility that the nature of the work may change, eg a testing job may turn into fault finding.

36 There must be adequate information available about the electrical system and the work to be done. In the case of a newly constructed electrical system (or newly installed equipment), there should be drawings and schedules relating to the design and these should have been updated, if necessary, by the people carrying out the installation.

37 Records in the form of drawings and/or schedules should be kept for all but the most basic of installations. In the case of old installations where records may be poor, you should attempt to improve the records, eg by a combination of surveying, testing and labelling. However, when checking records before working on an installation it is unwise to rely solely on one source of information, eg a label. Labels should be securely fixed to equipment to clearly identify their function.

38 Electrical accidents often occur during fault-finding after a plant breakdown when pressure to repair the equipment results in risks being taken. To anticipate this, you should plan and establish safe fault-finding procedures to be implemented during breakdown maintenance.

Specify level of supervision and whether accompaniment is necessary

39 The planning process will have indicated the level of supervision required. An important factor to consider is the amount of training and experience workers have had to do the specific jobs – the less experienced or knowledgeable the worker is, including the level of familiarity with the system to be worked on, the greater will be the need for supervision. There will also be a greater need for supervision when working live. The need for accompaniment is also greater for live work, although it may still be necessary for some cases of working dead, especially if there are adjacent live parts. The accompanying person should be trained to recognise danger to switch off and if necessary to give assistance in the event of an emergency.

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Select and instruct competent workers

40 Training as part of making a person competent is very important. Even the most highly qualified and capable people may not be competent to carry out specific types of work without suitable training. Competent workers will be self-disciplined and aware that reckless behaviour with electricity can lead to injury and death.

41 Those in control of the work should:

- assess the degree of competence of individual workers against the **specific** type of work to be done;
- provide clear instructions, information and adequate training for employees on: the risks they may face;
- the measures in place to control the risks, emphasising the safe system of work to be used;
- how to follow emergency procedures;
- arrange for those being trained or those newly trained to be accompanied and supervised.

Ensure correct working methods

42 Managers and supervisors should ensure that workers understand the correct working methods, related to the specific work in hand. People doing the work should be aware of the limitations of that work and the constraints as to how they carry out the work. This includes recognising when it is unsafe to continue with the work and knowing how to deal with any contingencies that may arise.

Provide and ensure use of appropriate protective equipment

43 Managers, supervisors and workers have a responsibility to provide the protective equipment identified in the task-specific risk assessment and make sure that it is:

- suitable for the use for which it is provided;
- maintained in a condition suitable for that use; and
- used properly.

Provide information, tools and instruments and ensure workers are fully instructed

44 The workers must be supplied with and use correct and appropriate information, such as electrical drawings, tools, instruments

Make arrangements for management checks and supervision of work

45 Employers and workers must comply with the EAW Regulations in so far as they relate to matters within their control. You should check that workers are following the rules and correct procedures. Sometimes, some or all of these checks may be delegated to the supervisor of the work. Even in organisations with effective written safety rules and safe systems of work, regular and systematic management checks of the work are necessary. This is particularly important if the work is being done in the field, on another occupier's premises, or by peripatetic workers

Paragraphs 57–58 Apply circuit main earth(s) where necessary **regulation 13**

Paragraph 59 Take precautions against adjacent live parts where necessary **regulations 14, 15**

Paragraph 60, 69–82 Issue permit-to-work where necessary **regulation 13**

Paragraphs 57–58 Apply local earth(s) where necessary **regulation 13 DEAD WORKING, ie SAFE**

Paragraphs 48–51 Cut off supply, isolate and secure isolation **regulation 12**

Paragraph 52 Retain keys. Post 'caution' and 'danger' notices **regulations 12, 13**

Paragraph 47 Identify the circuit or equipment to be worked on **regulation 4**

Paragraphs 53–56 Prove circuit or equipment dead **regulation 13**

Working Dead

46 While it is not always possible to follow a set procedure rigidly in every situation, the sequence illustrated in Figure 4 is recommended as a guide.

Identification

47 Adequate information should be supplied to identify equipment correctly (see paragraph 36). For most circuits and equipment correct labelling is important, but it should never be assumed that labelling is correct and that work can be started without having first proved that the equipment or circuit is dead. In some special cases, eg underground cables, cable-locating techniques using specialised instruments may be necessary and it may also be necessary to identify the cable both before and after switching operations and cable spiking.

Disconnection

48 Disconnect the equipment from every source of electrical energy before working on, or near, any part which has been live or is likely to be live. On equipment that is capable of storing charge, such as capacitors and high-voltage cables, ensure that any stored charge has been safely discharged.

Secure isolation

49 For adequate isolation, the disconnecting device should have an isolating gap sufficient for the voltage levels present or likely to occur. Make sure that any switch disconnector or other means of disconnection is secure. Switches, including circuit breakers, should be locked in the OFF position preferably using a 'safety' lock, ie a lock or padlock having a unique key or combination. Lockout devices that can be attached to the actuators of circuit breakers are available and should be used where appropriate. All keys should be retained in a secure place. If a plug has been withdrawn, make sure that it cannot be reconnected to the electrical supply while work is taking place on the circuits or apparatus – the use of proprietary lock-out devices for this purpose is encouraged.

50 If a fuse is removed, make sure that it or a similar one cannot be reinserted by taking it away or by locking the box or enclosure until work is completed. Some manufacturers produce lockable insulating blanks that you can insert in an empty fuseway. These prevent inadvertent fitting of a fuse while the associated circuit is being worked on.

51 If you rely on locking off where a number of people are working, the use of a multiple locking hasp attachment, lock-out box or key-safe may be appropriate to ensure that all the locks have to be removed before the equipment can be re-energised. Everyone involved in the work should apply a lock to the multiple locking hasp and keep personal possession of the key.

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Post notices

52 You should put a notice or label at the place of disconnection so everyone else knows that work is being done. For example, a 'caution' notice can be used to indicate that someone is working on the apparatus and may be injured if it is re-energised, and 'danger' notices attached to live equipment adjacent to the place of work will indicate that the apparatus is still energised. Notices or labels should be easily understood by anyone in the area. You should remove labels or notices when they no longer apply so that the system does not fall into disrepute. It is often useful for the 'caution' and 'danger' notices to have a space for the name of the person responsible for the work and for the date.

Proving Dead

53 Having isolated the circuit or equipment, and before working on it, check that the parts to be worked on or near really are dead, even if the isolation has been achieved automatically through an interlocking system. If it is a three-phase system or equipment with more than one supply, prove that all supply conductors are dead.

54 The instrument to do this should be properly constructed to protect against electric shock and designed to prevent short circuits occurring during use. For low voltages, proprietary voltage detectors such as two-pole voltage detectors, test lamps, or voltmeters with insulated probes and fused leads can be used (see HSE Guidance Note GS38). The use of multimeters, which can be set to the wrong function, is not recommended for proving dead on low-voltage systems, neither is the use of non-contact devices such as 'volt sticks' (note: in coal mines the use of appropriately certified non-contact devices is permitted).

55 It will be necessary to test the instrument before and after use. This may be done by means of a proving unit with a low power output. If live circuits are used to prove instruments, adequate precautions against electric shock and short circuits should be taken (see paragraphs 25–32). Training in the correct use of voltage detectors is essential to avoid risk in the event of unexpected use on a live conductor. All instruments used for checking circuits should be maintained and inspected frequently (note: in coal mines appropriately, certified non-contact devices must be tested daily before they are taken underground).

56 Where underground cables cannot be positively identified and proved dead at the point of work, it may be necessary to spike the cable using a properly designed, cartridge-operated spiking gun.

Earthing

57 The risk to people if the above precautions fail can be minimised by securely earthing all the conductors using properly designed earthing devices or earthing leads, usually applied to all points where the circuit or equipment is isolated from the supply. Additional local earths at the point of work may also be necessary if this is remote from the point of isolation, but these should be applied only after proving dead at the point of work. This procedure is essential for high-voltage apparatus and stored energy equipment (eg capacitors). The earthing conductors and their connections should be suitable for the energy that may flow in the event of a failure of the above precautions.

58 Earthing low-voltage equipment is desirable if there is a risk of re-energisation, eg from a generator under someone else's control. In other low-voltage equipment, however, it may be physically impractical to apply earths, or the risk of short circuit from introducing an earth near adjacent live parts may outweigh the benefit of earthing the apparatus being worked on.

Adjacent parts

59 When the circuit or equipment to be worked on has been made dead or where the work is non-electrical, you must still protect against danger from inadvertent contact with other live parts nearby. This should preferably be done by erecting physical barriers and/or the use of temporary insulation and posting 'danger' notices. The requirements regarding adequate working space, access and lighting must also be met.