

**LEAFLET 12****SAFETY WHEN WORKING WITH ELECTRICITY AND ELECTRICAL EQUIPMENT****CONTENTS****Para**

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**Annex**

- A Guidance for Line Managers.

**LEAFLET FOR LINE MANAGERS****REGULATIONS**

- 1 The following regulations apply:
  - 1.1 Health and Safety at Work etc. Act 1974 (HSAWA)
  - 1.2 Management of Health and Safety at Work Regulations 1999 (MHSWR)
  - 1.3 Electricity at Work Regulations 1989 (EAWR)
  - 1.4 Provision and Use of Work Equipment Regulations 1998 (PUWER)
  - 1.5 Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)
  - 1.6 Low Voltage Equipment (Safety) Regulations 1989 (LVESR)
  - 1.7 Supply of Machinery (Safety) Regulations 1992 (SMSR)

**DEFINITIONS****Battery**

- 2 For the purposes of clarity within this document, the term battery shall be used to mean any cell or battery.

**Electrical installation**

3 This is the system by which electricity is transmitted around establishments and buildings. It includes, power sources, cabling, ducts and trunking, distribution boards and control panels.

**Electrical equipment**

4 Anything used to generate, provide, transmit, convert, conduct, distribute, control, store, measure or use electrical energy.

**Fixed electrical equipment**

5 Any piece of equipment requiring an electrical power supply, which is fixed to a support or otherwise secured in a specific location.

**Portable electrical equipment**

6 Any piece of equipment which can be moved while in operation, or which can be easily moved from one place to another while connected or unconnected to the supply. This means any moveable equipment with a flexible cable connection, the method of connection of that cable being either a plug and socket or a fixed connection point.

**DUTIES****General**

7 Line managers are to ensure that all persons are protected from the hazards associated with the use of electrical equipment within their workplace. The main hazards are electrocution, electrical burns, fire and explosion. Other possible hazards, such as electromagnetic radiation, are dealt with in a separate leaflet.

**Head of Establishment / Commanding Officer**

8 Care of the electrical installation is the duty of the head of establishment/commanding officer. (This does not apply where the MOD is a lodger unit or has no direct control of the electrical installation of the establishment/building)

9 The head of establishment/commanding officer shall ensure that:

9.1 Electrical installations are tested, maintained, repaired and modified in accordance with Defence Estates safety rules and procedures (SRPs) and suitable maintenance records kept.

9.2 Suitable means shall be available for cutting off the supply of electrical energy from, and the isolation of, any electrical equipment. This requires the ability to identify circuits. Where appropriate, record drawings showing the electrical systems on an establishment shall be maintained. Circuits shall be correctly labelled and clearly identified (This does not apply where the MOD is a lodger unit and has no direct control of the electrical installation of the establishment/building).

9.3 A competent person is appointed to maintain the electrical installation in accordance with regulatory requirements and Defence Estates safety rules and procedures (SRPs)

9.4 Set policy for the use of personal electrical appliances on their establishment. Where the use of personal items is allowed anywhere on an establishment, a specific risk assessment must be carried out and suitable and sufficient control measures put in place to control their use.

9.5 A procedure is in place to report to the HSE as a requirement of RIDDOR certain accidents and incidents that occur in connection with the use of electrical energy.

**Project Managers / Equipment Managers / Support Authorities**

10 Within military equipment there is often the requirement for electrical systems. The variation in voltages and frequencies used and the operational requirements of military equipment makes this a complex subject.

11 It shall be the duty of the person responsible for the equipment at any given point in its life cycle to ensure that:

11.1 The electrical systems are compliant where practicable with current legislation and MOD policy, and that it will remain safe for all its intended and foreseeable uses throughout its life cycle.

11.2 All information required to use, maintain, test and repair electrical systems is made available to those requiring access to such information.

**Line Managers**

12 Line managers shall ensure that:

12.1 The electrical installation within their area appears in good order.

12.2 No work is carried out to the electrical installation without the consent of the appropriate authority.

12.3 No work is carried out on live electrical systems or equipment unless it is unreasonable for the system to be made "dead" to perform the work.

12.4 Where live working is to be undertaken the necessary precautions required by the Safe System of Work (which may include a Permit to Work) and first aid support is available, and followed.

12.5 All tools to be used for live working are insulated appropriate for the task and voltage, and are serviceable.

12.6 Any electrical equipment, to be connected to the electrical installation is compatible with the electrical supply voltage and current, is suitable for the environment in which it is placed and is appropriate for the task for which it is to be used. If any doubt exists seek advice from a competent person.

12.7 All electrical equipment is maintained in accordance with regulations, MOD specific requirements and manufacturers recommendations and that inspection, test, repair or routine maintenance is carried out only by a person competent to do so.

12.8 The rules and procedures required for the safe use of the electrical equipment are brought to the attention of the contractor or visitor, where electrical equipment is brought onto their establishment by the contractors or visitors for the purpose of their work. Monitor, as far as is reasonably practicable, that the procedures are adhered to.

12.9 Personal electrical equipment is not used on site by staff without permission from the appropriate authority and that if personal electrical equipment is permitted; it is controlled in accordance with site procedures.

12.10 All staff receive suitable and sufficient information, training (induction and refresher) and supervision in order for them to comply with the requirements of this guidance leaflet.

**All MOD staff**

13 All staff shall check that the electrical installation appears in good order, and report any suspected faults with electrical equipment to an appropriate authority

14 All staff shall ensure that:

14.1 Electrical equipment provided for use at work is not misused or interfered with in any way

14.2 That portable electrical equipment are compatible with the electrical supply voltage and current, is suitable for the environment in which it is placed and is appropriate for the task for which it is to be used.

14.3 Battery powered equipment is suitable for the working environment in which it to be taken and is in good order and to report any suspected faults.

14.4 They do not bring onto site any personal electrical equipment without the permission of an appropriate authority. Where personal electrical equipment is permitted all staff shall obey any specific requirements relating to the use of personal electrical equipment.

## **RECORDS AND THEIR RETENTION**

15 Line managers will retain the completed risk assessments and details of any actions and their outcomes for the period of its validity, or in accordance with any local instruction.

16 Line managers must be able to demonstrate that all portable electrical equipment is subject to regular inspection and maintenance. The most effective way to do this is to maintain a register of all portable electrical appliances, labelling all equipment with a unique ID number and details of the date of next inspection/test.

17 It is recommended that a maintenance log be kept for high-risk equipment. A detailed maintenance log can provide information for future planning of maintenance activities and inform maintenance personnel and others of previous action taken.

18 Records of the serviceability inspections of tools used on live working should be kept until the next inspection report is available or the tool is replaced.

## **ASSOCIATED DOCUMENTS**

19 Related leaflets and topics

- Leaflet - The Purchase and Safe Use of Work Equipment
- Leaflet - Safety in the use of Electromagnetic Radiation
- Leaflet - Permit to Work

**LEAFLET 12 ANNEX A****SAFETY WHEN WORKING WITH ELECTRICITY AND ELECTRICAL EQUIPMENT****CONTENTS****Para**

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- 1 Inspection and testing of portable electrical appliances.

**GUIDANCE FOR LINE MANAGERS****DANGERS OF ELECTRICITY**

1 Electrical energy is encountered in many forms within the workplace, from small batteries in electronic systems, through power distribution systems at extra low voltage (ELV), low voltage (LV), high voltage (HV) and up to static electricity and lightning. Variations in the voltage, current and the frequency of the electricity affects the way in which the electrical energy will act, but basically there are common dangers associated with all the different forms of electricity.

2 Risk of electrical burns and electrocution are the dangers dealt with within these guidance notes. A person forming a path for an electrical current to flow will suffer an electrical shock or burn. The degree of severity being dependent on the nature of the electricity, the duration of the contact, the amount of current which flows and the route it takes as it passes through the body.

3 The table below shows approximate figures for current flow and the effects on the human body. However the variation in human physiology means these values can vary significantly and it may only require a few milli-amps to cause cardiac arrest.

**Table 1 Current Flow and the effects on the human body**

<b>Effect on Human Body</b>	<b>Approximate current flow</b>
Perception of current flow	1 milli-amp
Muscular contractions occur	15 milli-amps
Respiratory failure	50 milli-amps
Fibrillation	80 milli-amps
Cardiac arrest	100 milli-amps
Current which is likely to flow when a person comes into contact with a standard mains supply	110 milli-amps

*\*The human body having a resistance of approximately 2000 Ohms under normal circumstances*

4 Consider this against the fact that a 100 Watt light bulb uses 0.5 Amps (500 milli-amps) and a power drill approximately 13 Amps (13,000 milli-amps).

5 Susceptibility to electric shock is increased if a person is in good electrical contact with earth. This should be taken into account when using electricity in damp/wet conditions or in conducting locations such as inside a metal tank.

6 Electrical burns are caused by the heating effect caused by a passage of an electric current through the body, and are different from burns due to fire, arcing or explosion. They are often found at the point of contact with the electrical conductor which gave rise to the electric shock, but because electrical current can damage tissue beneath the skin, electric burns are usually very painful and heal very slowly.

7 Fire and explosion are the result of unplanned and uncontrolled discharges of electrical energy. The energy that is released over a short period of time when a large current flows causes the conducting path and surrounding areas to heat up which could result in either a fire or explosion. A significant percentage of fires on the MOD estate are either started by electrical faults or the misuse of electricity.

8 Fires may be started by:

8.1 Overheating of electrical systems due to overloading of conductors,

8.2 Failure of electrical equipment,

8.3 Leakage of electrical current due to poor, inadequate or faulty insulation,

8.4 Overheating of materials placed too close to electrical equipment which is otherwise operating normally,

8.5 Ignition of materials in the vicinity of electrical equipment caused by arcing or sparking of the electrical equipment during failure.

9 Electrical explosions are caused by the catastrophic failure of electrical equipment where a significant fault current occurs. Fault currents can be in the range of 16,000 Amps (16,000,000 milli-amps).

## **PROTECTIVE DEVICES**

### **Fuse**

10 These come in a variety of types and sizes and are specifically designed to protect the electrical system, **NOT THE USER**, from overloads and short circuits from the position of the fuse onwards. They are better at operating under short circuit conditions than a circuit breaker but poorer at operating under overload currents. Fuses are a single operation device.

**Circuit breaker**

11 These come in a variety of types and sizes are specifically designed to protect the electrical system, **NOT THE USER**, from overloads and short circuits from the position of the circuit breaker onwards. They are better at operating under overload conditions than fuses, but poorer at operating under short circuit conditions. Circuit breakers are a multiple operation device, but they will deteriorate in performance over time/use.

**Residual current device (RCD)**

12 These are used as a method of personnel protection against electric shock. However they should not be relied on as the sole means of protection. They operate at a rated current of 30 milli-amps. RCDs are a multiple operation device, but they will deteriorate in performance over time/use, therefore RCDs shall be subjected to a regular testing regime.

**COMPETENCY (TRAINING AND INFORMATION)**

13 Everybody has electricity at home. In the domestic environment people have changed light-bulbs, fitted plugs, repaired car stereos and changed the memory cards in their computer.

**NOTE**

This does not make them competent to do so in the workplace.

14 Line managers must ensure that where there is a risk of injury or possibility of an incident staff receive suitable levels of training and information. This could include correct use, care and maintenance, fault identification and for how not to (or where not to) use portable electrical appliances.

15 The sort of training that should be considered includes, but should not be limited to:

15.1 General safety induction training

15.2 Training on particular pieces of electrical equipment

15.3 Training on working in high risk areas

15.4 Training on specific tasks on an electrical installation

15.5 Regular refresher training.

15.6 If it is necessary for a person to carry out works on electrical equipment then it should be identified within person's terms of reference and appropriate training given.

15.7 Specialised installations and equipment

16 There are electrical systems within the MOD, which operate at unusual voltages and/or frequencies (i.e. not 415V or 220V 50 Hz). The nature and use of the electrical system may give rise to particular safety issues (for example electromagnetic radiation).

17 There is insufficient space within this document to deal effectively with all combinations of voltages and frequencies. The basic principles for safe operation and maintenance still apply, risk assessment procedures shall be carried out, and suitable control measures put in place.

**WORKING ON ELECTRICAL INSTALLATIONS AND ELECTRICAL EQUIPMENT**

18 The electricity at work regulations require that any work carried out on an electrical installation or item of electrical equipment should be undertaken with the installation/equipment **DEAD**.

**NOTE**

DEAD means completely isolated and disconnected from all sources of electricity, including any charged capacitors, such that unintentional reconnection cannot be achieved.

19 The electricity at work regulations are quite specific about this matter. No person shall work near or on any live conductor where danger may arise unless:

19.1 It is unreasonable in all the circumstances for it to be dead; and

19.2 It is reasonable in all the circumstances for them to have to work on or near it whilst it is live; and

19.3 Suitable precautions have been taken to prevent injury.

**LIVE WORKING**

20 This section applies to all electrical installations regardless of voltage, or power source

21 If it is not reasonable, taking into account all the circumstances of the task, to undertake the work with the installation/equipment DEAD, then there is a need for a formal risk assessment of the work to be carried out and suitable precautions taken to prevent injury.

22 If live working is unavoidable a safe system of work shall be put in place.

23 Any person required to work on a live system must have technical knowledge and experience appropriate to the nature of the work to be carried out and must be competent.

24 Persons working on live systems must be supplied with the appropriate tools to reduce risk of electrocution. If permanent issue these tools must be subject to regular inspection to ensure serviceability.

25 The MOD has produced a significant amount of documentation covering the processes involved working with live electrical systems. Referencing of the relevant publications shall be carried out as part of any safe system of work.

**ALTERNATE ENERGY SOURCES (BATTERIES, CAPACITORS, GENERATORS ETC.)**

26 Care should be taken when working on or near installations and/or equipment utilising alternate energy sources as disconnecting the mains supply may not necessarily render the system safe. Knowledge of the specific power source and the system are important.

27 Small batteries can be more than capable of producing enough electrical current to start a fire and a larger battery backup and power systems are more than capable of delivering a fatal shock current.

28 Capacitors are capable of acquiring and retaining a charge following disconnection from a power supply. They can acquire and retain enough electrical energy over a period of time to pose a serious electrical shock hazard.

29 Generators can start automatically in the event of a mains failure. Switching off a system could effectively simulate a mains failure causing a generator to start up and re-energise that system.

**MAINTENANCE OF OFFICE EQUIPMENT**

30 Simple maintenance (changing cartridges, dealing with paper jams) of general office equipment such as photocopiers, computers, printers can generally be carried out by office staff with the minimum of supervision and training.



31 Equipment manufacturers have a duty to ensure that persons are protected from the dangerous parts of equipment by guards (which includes casings) and interlocks. Any access to a piece of equipment, which requires the use of tools (including a screwdriver), shall only be undertaken by a competent person.

### **CONSTRUCTION OF ELECTRICAL EQUIPMENT**

32 Electrical equipment is manufactured specifically to operate safely in certain environments and under different conditions, including variations in temperature, humidity, adverse weather conditions, flammable atmospheres, continuous running, constant starting and stopping, subjected to high impact etc.

33 Care shall be taken when selecting electrical equipment to ensure that it is not adversely affected by the environment into which it is to be taken, and the task which it is required to perform. Manufacturers and suppliers will be able to provide appropriate information on the construction of equipment and its limitations.

### **ELECTRICAL GOODS INTENDED FOR THE DOMESTIC MARKET**

34 Some domestic electrical equipment is not suitable for business/industrial use and may be manufactured and/or tested to a different and lower standard to a similar looking business/industrial use item. There is often a very good reason why a domestic product is significantly cheaper than its industrial equivalent (see above). When purchasing electrical equipment it is important to ascertain its suitability for use in the workplace environment. If in doubt a competent person must be consulted.

### **PORTABLE APPLIANCE TESTING**

35 See Annex A, Appendix 1 for details of Portable Appliance Testing

### **NON MOD EQUIPMENT**

36 Contractors and visitors may bring onto site electrical equipment for use in the workplace. The person bringing equipment onto an establishment is responsible for ensuring that it is compliant with regulatory and MOD requirements. MOD staff responsible for contractors and visitors coming onto an MOD establishment shall ensure that they provide all necessary information and appropriate training in relation to specific MOD safety requirements.

### **PERSONAL ELECTRICAL EQUIPMENT**

37 The head of an establishment/commanding officer shall establish a policy on the use of personal items of electrical equipment. It is not sufficient to allow persons to bring onto MOD property any items of electrical equipment 'at their own risk'. A dangerous piece of equipment may electrocute any person (not just the owner) and a fire or explosion caused by a fault will also have consequences which affect others.

38 The use of personal items of electrical equipment in the workplace should be discouraged, as their suitability for use and standard of inspection, maintenance and repair cannot be easily guaranteed.

39 There are areas such as accommodation areas for service personnel where it is impossible to instigate a full inspection and testing regime. A risk assessment must be carried out and suitable and sufficient control measures put in place.

40 Possible control measures may include:

- 40.1 Permission required for items of electrical equipment
- 40.2 Visual checks made of equipment on a regular basis
- 40.3 Removal of unsafe equipment

**EXTENSION LEADS/ADAPTER PLUGS**

- 41 Extension leads are used where there is a need to increase the number of socket outlets and/or provide an electrical supply to an area away from the electrical installation. They should be looked upon only as a temporary measure shall only be used where there is a short term need. Their use shall be discouraged. In the long term, the modification of the electrical installation shall be undertaken.
- 42 Extension leads are portable electrical appliances and shall be inspected and tested accordingly.
- 43 Extension leads shall be fully uncoiled for use
- 44 The use of two or more extension leads connected to each other to increase the number of socket outlets or the length of cable run is prohibited.
- 45 The use of the multi-way adapter plug blocks (the small square blocks that allow more than one 13 amp plug to be plugged into a single socket outlet) is prohibited.

**HAZARDOUS AREAS**

- 46 Certain areas have restrictions on access and/or the type of electrical equipment that can be operated within them, due to fire/explosion risks and/or risks to personnel safety.
- 47 These areas include:
- 47.1 Explosive stores and explosive process buildings
  - 47.2 Areas used to store fuels oils and lubricants
  - 47.3 Paint shops
  - 47.4 GRP/composite material workshops
  - 47.5 Vehicle workshops
  - 47.6 Electrical substations and switch-rooms
  - 47.7 Areas where conductive or anti-static regimes are in operation
  - 47.8 Areas where there is high humidity/dampness
  - 47.9 Workshops
  - 47.10 Construction sites

48 No electrical equipment shall be taken into these areas or any other hazardous area unless it is suitable for use within that area and suitable for the task to be carried out within that area.

49 If in doubt about use of electricity or electrical equipment in any work area or environment, line managers should always seek specialist advice as to the restrictions, which may apply.

**BATTERY CHARGING AREAS**

50 Battery charging can give rise to an increase in the possibility of fire and/or explosion, and therefore additional control measures must be introduced in order to address this risk. The Crown Fire Standards provide details of specific requirements for battery charging facilities and the appropriate fire safety authority must be consulted as to the specific precautions that are required.

**LEAFLET 12 ANNEX A APPENDIX 1****INSPECTION AND TESTING OF PORTABLE ELECTRICAL APPLIANCES****CONTENTS****Para**

- 1 User checks
- 2 Visual inspection
- 4 Testing by a competent person
- 8 Periodicity
- 10 Equipment register
- 15 Labelling
- 16 Suggested initial inspection/testing intervals for office type environments

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**USER CHECKS**

1 Before using an item of electrical equipment the operator should critically look for damage to the outside of the equipment and any connecting cables and plugs/socket. Any defects should be reported to their line manager. If equipment is suspect it must not be connected to the electrical supply and not used until repaired/inspected/tested, as appropriate, by a competent person.

**VISUAL INSPECTION**

2 This does not have to be undertaken by an electrician. Visual inspections can be carried out by any sensible member of staff provided they have been given appropriate training and have acquired sufficient experience.

3 A visual inspection shall be conducted with the equipment DEAD, and shall ensure that

- 3.1 There is no damage e.g., cuts and abrasions (apart from light scuffing) to any cable covering,
- 3.2 There is no damage to any plug e.g. the casing is not cracked or pins are bent or misaligned,
- 3.3 There are no non standard joints including taped joints in any cable,
- 3.4 The outer covering (sheath) of the cable is securely gripped where it enters the plug or the equipment, and that the coloured insulation of the internal wires are not showing,
- 3.5 The equipment shows no sign of having been used in an environment where it is not suitable,
- 3.6 There is no damage to the outer cover of the equipment, e.g. obvious loose parts, screws missing or cracks in the casing,
- 3.7 There are no signs of overheating (burn marks or staining),
- 3.8 The equipment is labelled as being within its current test date.

**TESTING BY A COMPETENT PERSON**

- 4 Electrical testing should be undertaken by a competent person with knowledge, experience and training in testing electrical equipment.
- 5 In addition to the visual inspections required in the previous section, Double insulated electrical equipment shall undergo periodic visual inspection by a competent person.
- 6 Single insulated (earthed) equipment shall be subject to a periodic electrical test and visual inspection as appropriate.
- 7 Equipment leads that can be totally disconnected from equipment and supply shall be subjected to periodic test and visual inspection

**PERIODICITY**

- 8 A table showing the frequency of testing is shown at the end of this appendix
- 9 The frequency of inspection and testing depends on the equipment type, its usage and the operating environment. Where the inspection/testing regime is picking up a number of faults then consideration shall be given to increasing the frequency of inspection and testing.

**EQUIPMENT REGISTER**

- 10 Line managers must be able to prove that all portable electrical equipment is subject to regular inspection, testing and maintenance. The most effective way to do this is to maintain a register of all portable electrical appliances, labelling all equipment with a unique ID number and details of the date of next inspection/test.
- 11 The register shall be used to assist the person who conducts the tests to determine the quantity and location of the items. The register shall be kept up to date and retained in an appropriate location
- 12 The minimum requirements for an equipment register should include
- 12.1 The description of the piece of equipment,
  - 12.2 An asset number or equipment serial number (unique identifier),
  - 12.3 Location of the equipment or equipment keeper (person responsible for its whereabouts),
  - 12.4 Frequency of visual inspection/testing,
  - 12.5 Date of next inspection/test,
  - 12.6 Details of any inspection/test failures.
- 13 The reasons for keeping details of inspection/test failures is so that any trends may be spotted and inspection frequencies either increased or decreased.
- 14 Equipment should be brought into the testing/inspection regime from first issue. It should be inspected, tested if necessary and labelled before being put into use for the first time.

**LABELLING**

- 15 A visible label should be affixed to each item of electrical equipment that passes the test/inspection. The label shall display the date when the next test/inspection is due.

**SUGGESTED INITIAL INSPECTION/TESTING INTERVALS FOR OFFICE TYPE ENVIRONMENTS**

16 The table shows the suggested initial inspection/testing intervals for office environments.

**Table 1 Initial inspection/testing intervals**

<b>Equipment</b>	<b>User checks</b>	<b>Visual Inspection</b>	<b>Inspection Testing</b>
Battery operated (less than 20V)	No	No	No
Extra Low Voltage (less than 50V) e.g. telephone equipment, low voltage desk lights	No	No	No
Information Technology: Computers VDU screens	No	Yes 2-4 years	No if Double insulated Otherwise up to 5 years
Photocopiers, fax machines NOT hand held and rarely moved	No	Yes 2-4 years	No if Double insulated Otherwise up to 5 years
Double insulated equipment. NOT hand held and moved occasionally, e.g. fans, table lamps and slide projectors	No	Yes 2-4 years	No
Double insulated equipment: HAND HELD e.g. some floor cleaners and some power drills	Yes	Yes 6 months to 1 year	No
Earthed equipment (Class I): e.g. Electric kettles and some floor cleaners	Yes	Yes 6 months to 1 year	Yes 1-2 years
Cables (leads) and plugs connected to the above and extension leads	Yes	Yes 6 months to 4 years depending on the type of equipment it is connected to	Yes 1 to 5 years depending on the type of equipment and the working environment

17 In other working environments the periodicity shall be set by a risk assessment process and a similar table produced as part of a safe system of work. User checks shall always be carried out.