

**GUIDANCE NOTES ON
ELECTRICITY
AT WORK**

**The Highland Council, Corporate Services,
*Health and Safety Team***

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1 Introduction

- 1.1 Each year about 1000 accidents at work involving electric shock or burns are reported to the Health & Safety Executive, around 30 of which are fatal. Even non-fatal shocks can cause severe and permanent injury. Other dangers associated with the use of electricity include the risk of fire and/or explosion. The following guidance has therefore been produced to assist in controlling the risks associated with the use of electricity at work.

2 Legal Requirements

- 2.1 The Health & Safety at Work etc Act 1974 places a general duty on employers to ensure the health, safety and welfare of employees and others affected by their work activities. This duty extends to the provision and maintenance of safe plant, systems of work, workplace and working environment.
- 2.2 The Electricity at Work Regulations 1989 require employers to assess the risks associated with work activities involving electricity. There is also a requirement that electrical equipment be properly constructed, installed, maintained and suitable for the environment in which it is used. If necessary, suitable protective equipment must be supplied in good condition. Employers must also ensure that work activities including maintenance are carried out safely, with special arrangements for live working if it cannot be avoided. Any persons carrying out electrical work must be competent for the tasks which are assigned to them.

3 Electrical Hazards

- 3.1 ***Electric Shock***

The human body responds in several ways to electrical current flowing through it, one of which is electric shock. When a shock is received, the current may take multiple paths through the body with variable intensity. The passage of the current may cause muscular contractions, respiratory failure, fibrillation of the heart, cardiac arrest or internal burns, any of which may prove fatal. Electric shock occurs when the body makes contact with a live electrical conductor and the susceptibility is increased if the person is in good electrical contact with the earth, ie in damp conditions. The public electricity supply voltage of 230 volts 50 hertz ac is potentially fatal and the most dangerous situation is where contact is made with conductors by each hand. In this situation the current flow is “hand to hand” across the heart region.

3.2 *Electric Burn*

Electric burns are due to the effect caused by the passage of electric current through the body tissues. They are commonly associated with electric shock and often occur in and on the skin layers at the point of the electrical contact. Electric burns are usually painful and very slow to heal, with permanent scarring being common.

3.3 *Fires of Electrical Origin*

Fire may be started by electricity in a number of ways. The principal mechanisms are:-

- a) overheating of cables and electrical equipment due to overloading of conductors
- b) leakage current due to poor or inadequate insulation
- c) overheating of flammable materials placed too close to electrical equipment which is otherwise operating normally; and
- d) the ignition of flammable materials by arcing or sparking of electrical equipment

3.4 *Arcing*

Arcing can occur when the energy available at a piece of electrical equipment is sufficient to maintain a conductive path through the air or insulation between two conductors (one of which may be the human body). Arcing generates ultra violet radiation which causes damage to the skin similar to the effect of severe sunburn. Molten particles from the arc itself can penetrate, burn and lodge in the flesh in addition to any radiated heat damage.

3.5 *Explosion*

Switchgear, motors and power cables are liable to explode if they are subjected to excessive currents, or if they suffer prolonged internal arcing faults. Electricity may also be the source of ignition of flammable vapours, gasses, liquids and dusts, either through arcing, sparking of high surface temperatures of equipment.

4 *Safe Working Practices*

4.1 **As the safety of domestic appliances cannot be ensured, it will not normally be permissible for staff to bring portable electrical appliances (ie kettles, heaters etc) into the workplace.**

4.2 *There may be some exceptions to the above, but only where:-*

- a) Property and Architectural Services have been consulted about the suitability of the appliance and its potential electrical consumption.
- b) The situation has been authorised by the Manager responsible for the premises or staff member concerned.
- c) The appliance has been checked and tested by a competent person (see Section 5.10) and included on the regular inspection and testing schedule.

4.3 **Service Directors, Area Managers and Area Service Managers** should ensure that the following HSE guidance is complied with throughout the range of Highland Council Services and premises. They should also ensure that the guidance is brought to the attention of all staff, and in particular those with a responsibility for ordering electrical appliances within premises.

4.4 *Work Safely*

Make sure that people who are working with electricity are competent to do the job. Even simple tasks such as wiring a plug can lead to danger - ensure that people know what they are doing before they start.

Check that:-

- suspect or faulty equipment is taken out of use labelled “DO NOT USE’ and kept secure until examined by a competent person;
- where possible, tools and power socket-outlets are switched off before plugging in or unplugging;
- equipment is switched off and/or unplugged before cleaning or making adjustments.

More complicated tasks, such as equipment repairs or alteration to an electrical installation should only be tackled by people with a knowledge of the risks and the precautions needed.

Electricians and electrical contractors must only be appointed from the Approved list of Electrical Contractors maintained by Property and Architectural Services. This will ensure that all work is carried out to the current IEE Regs standard and that safe working practices (ie permits to work) are adopted.

Work on or near exposed live parts of equipment must not take place unless it is absolutely unavoidable and suitable precautions have been taken to prevent injury, both to the workers and to anyone else who may be in the area.

4.5 *Ensure that the electrical installation is safe*

- install new electrical systems to a suitable standard, (eg BS7671 “Requirements for electrical installations”) and then maintain them in a safe condition;
- existing installations should be properly maintained;
- provide enough socket-outlets - overloading socket-outlets by using adaptors can cause fires;

4.6 *Provide safe and suitable equipment*

- choose equipment that is suitable for its working environment;
- electrical risks can sometimes be eliminated by using air, hydraulic or hand powered tools. These are especially useful in harsh conditions: ie heavy traffic routes or damp environments.
- ensure that equipment is safe when supplied and then maintain it in a safe condition;
- provide an accessible and clearly identified switch near each fixed machine to cut off power in an emergency;
- for portable equipment, use socket-outlets which are close by so that equipment can be easily disconnected in an emergency;
- the ends of flexible cables should always have the outer sheath of the cable firmly clamped to stop the wires (particularly the earth) pulling out of the terminals;
- replace damaged sections of cable completely;
- use proper connectors or cable couplers to join lengths of cable. Do not use strip connector blocks covered in insulating tape;
- some types of equipment are double insulated. These are often marked with a 'double-square' symbol. The supply leads have only two wires - live (brown) and neutral (blue). Make sure they are properly connected if the plug is not a moulded-on type;
- protect lightbulbs and other equipment which could easily be damaged in use. There is a risk of electric shock if they are broken;

- electrical equipment used in flammable/explosive atmospheres should be designed to stop it from causing ignition. You may need specialist advice.

4.7 *Reduce the voltage*

One of the best ways of reducing the risk of injury when using electrical equipment is to limit the supply voltage to the lowest needed to get the job done, such as:-

- temporary lighting can be run at lower voltages, eg 12, 25, 50 or 110 volts;
- where electrically powered tools are used, battery operated are safest;
- portable tools are readily available which are designed to be run from a 110 volts centre-tapped-to-earth supply.

4.8 *Provide a safety device*

If equipment operating at 230 volts or higher is used, an RCD (residual current device) can provide additional safety. An RCD is a device which detects some, but not all, faults in the electrical system and rapidly switches off the supply. The best place for an RCD is built into the main switchboard or the socket-outlet, as this means that the supply cables are permanently protected. If this is not possible a plug incorporating an RCD, or a plug-in RCD adaptor, can also provide additional safety.

RCDs for protecting people have a rated tripping current (sensitivity) of not more than 30 milliamps (mA). Remember:

- an RCD is a valuable safety device, never bypass it;
- if the RCD trips, it is a sign there is a fault. Check the system before using it again;
- if the RCD trips frequently and no fault can be found in the system, consult the manufacturer of the RCD;
- the RCD has a test button to check that its mechanism is free and functioning. Use this regularly.

4.9 *Carry out preventative maintenance*

All electrical equipment and installations should be maintained to prevent danger. It is strongly recommended that this includes an appropriate system of visual inspection and, where necessary, testing. By concentrating on a simple, inexpensive system of looking for visible signs of damage or faults, most of the electrical risks can be controlled. This will need to be backed up by testing as necessary.

It is recommended that fixed installations are inspected and tested periodically by a competent person, ie the fixed wiring in a building checked by an electrician every 5 years.

The frequency of inspections and any necessary testing will depend on the type of equipment, how often it is used, and the environment in which it is used. Records of the results of inspection and testing can be useful in assessing the effectiveness of the system.

Equipment users can help by reporting any damage or defects they find.

4.10 *Underground power cables*

Always assume cables will be present when digging in the street, pavement or near buildings. Use up-to-date service plans, cable avoidance tools and safe digging practice to avoid danger. Service plans should be available from regional electricity companies. Any excavation within a public road should only be carried out by an operator trained in accordance with the New Roads and Street Works Act standard.

4.11 *Overhead power lines*

When working near overhead lines, it may be possible to have them switched off if the owners are given enough notice. If this cannot be done, consult the owners about the safe working distance from the cables. Remember that electricity can flash over from overhead lines even though plant and equipment do not touch them. Over half of the fatal electrical accidents each year are caused by contact with overhead lines. More detailed guidance on avoidance of danger from overhead electric lines is available from HSE.

4.12 *Electrified railways and tramways*

If working near electrified railways or tramways, consult the line or track operating company. Remember that some railways and tramways use electrified rails rather than overhead cables.

5 ***THE MAINTENANCE AND TESTING OF PORTABLE ELECTRICAL EQUIPMENT***

- 5.1 One of the main duties under the Electricity at Work Regulations is to ensure that all electrical systems are *maintained* to prevent, so far as is reasonably practicable, danger. It is from this requirement that the responsibility to check portable equipment derives.

5.2 The Regulations do not specify electrical testing at all, let alone the frequency of such tests. However formal guidance has been produced by the Health & Safety Executive that describes a regime for the maintenance of portable electrical apparatus involving various levels of checks, inspections and tests. The following information is therefore based on this document.

5.3 *Controlling the Risk*

- i) Nearly a quarter of all reportable electrical accidents involve portable equipment. The majority of these accidents result in shock; others result in fires. A major cause of such accidents is failure to maintain the equipment.
- ii) The degree of risk in any particular situation will be influenced by a number of factors:-
 - a) the *use* of equipment
 - b) the *construction* of the equipment
 - c) *where* the equipment is being used
 - d) the effectiveness of *maintenance*

5.4 *The use of the equipment*

- i) The reason for distinguishing between portable and fixed equipment is that the electrical connections to portable equipment (eg the plug and flexible cable and its terminations) are more likely to be damaged or subject to wear. The fixed installation is usually provided with a significant degree of protection against damage by the fabric of the building or fixed enclosure.
- ii) Equipment which is handled when switched on will present a greater degree of risk because the person holding it can receive an electric shock if a fault develops.

5.5 *The construction of the equipment*

- i) For safety reasons, some electrical equipment relies on the metallic (exposed conducting) parts of the equipment being effectively earthed (Class 1 type). If this earth connection is lost there is a possibility of the exterior of the equipment becoming live with a potentially fatal result. Anyone touching live metal will be in contact with electricity.
- ii) Another design of electrical equipment (Class II) (which includes double insulated equipment) is constructed with high integrity insulation and does not have or need an earth connection in order to maintain safety.

5.6 *Where the equipment is being used*

- i) The risk of receiving an electric shock will be greater when the user is standing on a good conductor, such as the ground outside, a concrete floor or scaffolding, rather than if standing on a wooden floor or dry carpet and not in contact with earthed metal work.

5.7 *The effectiveness of maintenance*

- i) Maintenance is a general term that in practice will include visual inspection, testing, repair and replacement. Maintenance will determine whether equipment is fully serviceable or whether remedial action is necessary.
- ii) Routine inspection, and appropriate testing where necessary, will be part of any overall strategy for ensuring that work equipment is maintained in a safe condition.

Cost effective maintenance of portable electric equipment can be achieved by a combination of actions applied at three levels:

- **user checks**
- **formal visual inspection by persons appointed to do this**
- **combined inspection and tests by a competent person or by a contractor**

5.8 *User Checks (Visual)*

- i) Any person using equipment should be encouraged to look at it critically and, **visually check** for signs that it is not in sound condition. For example:
 - a) damage apart from light scuffing to the cable sheath
 - b) Damage to the plug, for example the casing is cracking or the pins are bent
 - c) inadequate joints, including taped joints in the cable
 - d) the outer sheath of the cable is not effectively secured where it enters the plug of the equipment. (Obvious evidence would be if the coloured insulation of the internal cable cores were showing)
 - e) the equipment has been subjected to conditions for which it is not suitable, eg it is wet or excessively contaminated
 - f) damage to the external casing of the equipment or there are some loose parts or screws
 - g) evidence of overheating (burn marks or discoloration)
- ii) These checks also apply to extension leads and associated plugs and sockets
- iii) Any faults should be reported and the equipment taken out of use immediately.
- iv) Effective steps should be taken to ensure that the equipment is not used again until properly repaired (eg the defective equipment should be labelled as faulty and its associated plug removed). A suggested user checklist is given in Appendix 1.
- v) **Service Directors and Area Service Managers should ensure that all staff are aware of the requirements for visual inspections and the checklist pro-forma**

5.9 *Formal Visual Inspections*

The most important component of a maintenance regime is usually the formal visual inspection carried out routinely by a **competent person**. The majority of potentially dangerous faults can be picked up by such inspection and the maintenance regime should include this component. To control the risks and monitor the user checks, a competent person should carry out regular inspections which include visual checks similar to the user checks above, but undertaken in a more formal and systematic manner. Additional checks could include:-

- removal of the plug cover and a check made that a fuse is being used (eg it is a fuse and not a piece of wire, a nail etc)
 - the cord grip is effective
 - the cable terminations are secure and correct, including an earth where appropriate
 - there is no sign of internal damage, overheating or ingress of liquid or foreign matter.
- ii) The formal visual inspection should not include taking the equipment apart.
- iii) The **competent person** can be a member of staff who has sufficient information and knowledge on what to look for and what is acceptable, eg how to wire a plug correctly.
- iv) **Service Directors, Area Managers and Area Service Managers** should therefore determine the numbers of competent persons required to effectively carry out formal visual inspections in all premises for which they have a responsibility. Appropriate information will be given to ensure that all persons designated with the task of carrying out visual inspections are competent to do so. (See Section 6) A suggested checklist for such inspections is included in Appendix 2.
- v) The inspections should be carried out at regular intervals. The period between inspections can vary considerably depending on the type of equipment, the conditions of use and on the environment. For example, equipment used on a construction site will need much more frequent inspection (maybe once every 1 to 3 months) compared to equipment used in an office. In all cases, however, the period between inspections should be reviewed in the light of experience.

The pattern of faults found can be used by management to indicate whether:-

- the right equipment is being selected for the job
- further protection may be necessary in a harsh environment
- the equipment is being misused

5.10 *Combined Inspections and Tests*

- i) The user and formal visual *checks* and *inspections* outlined above will, if carried out properly, reveal most (but not all) potentially dangerous faults. **Testing**, together with a thorough visual inspection can detect less obvious faults such as loss of earth integrity, deterioration of insulation or contamination of internal and external surfaces. Occasions when testing is likely to be justified are:
- wherever there is reason to suppose the equipment may be defective, (and this cannot be confirmed by visual inspection)
 - after any repair, modification or similar work
 - at periods appropriate to the equipment, the manner and frequency of use and the environment.

- ii) The inspection carried out in conjunction with testing should usually include:

- checking of correct polarity
- checking of correct fusing
- checking of effective termination of cables and cores
- checking of the suitability of the equipment for its environment

Such *combined inspection and testing* should be carried out by someone with a wider degree of competence than that required for inspection alone. For this reason arrangements will be made for the testing of all portable electrical appliances within the Highland Council premises by persons with the appropriate level of competence.

5.11 *Arrangements for Portable Appliance Testing*

- i) Service Directors must ensure that arrangements have been made for the inspection and testing of all portable appliances in all locations throughout the Highland Council Area.
- ii) It is anticipated that contractual arrangements will be drawn up in the near future regarding the provision of a Council wide electrical appliance testing service. Information will be circulated once the process has been completed. In the meantime arrangements should be made to have the testing carried out by one of the following:
 - a) Commercial Operations, Cleaning Services, - Contact Crawford Gray, Seafield Road, Inverness, Tel: (01463) 715087
 - b) Zurich Municipal - Contact the Insurance Section of Finance Services, Headquarters, Tel: (01463) 702414
 - c) Any electrical contractor on the Highland Council approved list - Contact Energy Services section of Property & Architects at Kinmylies, Inverness, Tel: (01463) 703503

5.12 *Arrangements for testing/Computer Equipment*

- i) The contract arrangements with ICL include a requirement that ICL arrange for the inspection and testing of all equipment ***supplied by them*** to a standard which complies with the Electricity at Work Regulations.
- ii) It is important therefore that when drawing up an inventory of electrical equipment to be tested in accordance with para 5.11 that any computer equipment not supplied by ICL be added to the list.
- iii) ***Each Service*** should make reference to its own IS customer representative to determine which equipment ICL may be responsible for.

5.13 *Maintenance and test records*

- i) Although there is no requirement in the Regulations to keep maintenance logs for electrical equipment, a suitable log is useful as a management tool for monitoring and reviewing the effectiveness of the maintenance scheme and can demonstrate that a scheme exists. It can also be used as an inventory and a check on the use of unauthorised equipment (eg domestic kettles or electric heaters brought to work by employees and improperly made-up equipment).
- ii) The contractor responsible for portable appliance testing will be required to maintain up to date records of all equipment tested. It is important however that an inventory of electrical equipment is maintained within each of the Council premises together with details of visual checks carried out.

6 ***INFORMATION TO ACCOMPANY FORMAL VISUAL INSPECTIONS***

- 6.1 It is not expected that the level of knowledge required to carry out formal visual inspections (see 5.9) would require specific training.
- 6.2 Persons selected to carry out such inspections should therefore feel competent to correctly wire a plug with reference to information supplied by the Health and Safety Team.
- 6.3 Management should therefore contact the Health and Safety Team at Dochfour Drive, (Tel:01463-703095) with the names of persons selected to carry out the inspections and request instructional and information material to be supplied to them.
- 6.4 If a person feels that even with the information supplied that they are not capable of fulfilling the role then they should notify their line manager. In such circumstances the line manager should then seek an alternative person to carry out the role.

7 **MANAGEMENT CHECKLIST**

- 7.1 The following checklist forms a summary of the guidance and highlights the key points that managers should address.

- 7.2 Inform staff that the policy and guidance on Electrical Safety exists and discuss its contents and implementation at staff meetings or team briefings etc to ensure that:-
- a) User checks are carried out (See 5.8)
 - b) Safe working practices are adopted (See 4)
 - c) Domestic appliances are not brought into the workplace (See 4.1)
 - d) Faulty equipment is taken out of use
 - e) Only competent persons attempt to repair or maintain electrical equipment
- 7.3 Ensure that sufficient numbers of staff are selected to carry out formal visual inspections (See 5.9) and notify the Health and Safety Team. (See 6.3)
- 7.4 Ensure that an inventory of all portable electrical equipment is available on the premises and that arrangements have been made for regular testing. (See 5.10)
- 7.5 Establish a monitoring programme to ensure that implementation of the above is effective.

8 MONITORING

- 8.1 Service Directors should ensure that the implementation arrangements for this policy and guidance are incorporated into their Service Health and Safety Policies. Monitoring of arrangements at Area level can be discussed at Service Management Team meetings.
- 8.2 Area Service Managers should make arrangements to ensure that the implementation of this policy and guidance can be monitored in all premises where they have Area staff based. This could be achieved by requiring regular reports from competent persons appointed to carry out formal visual inspections. (See 5.9)
- 8.3 Area Managers should monitor the implementation of this policy and guidance by requiring progress reports to be submitted from each Service at Area Management Team meetings.

8.4 Members of the Health & Safety Team will monitor the implementation as part of the programme of audits and inspections of Council premises.

ELECTRICITY AT WORK

USER CHECKLIST

Name of person carrying out the check _____

Service _____ Location _____

Appliance _____ Serial No _____

- | 1 | <u>Condition of the Appliance</u> | Yes | No |
|----------|--|--------------------------|--------------------------|
| | a) Are any parts missing? | <input type="checkbox"/> | <input type="checkbox"/> |
| | b) Is there obvious damage to the casing? | <input type="checkbox"/> | <input type="checkbox"/> |
| | c) When in use does it appear faulty? | | |
| 2 | <u>Condition of the Cable</u> | | |
| | a) Are there any cuts, kinks, taped joints, fraying and/or burn marks? | <input type="checkbox"/> | <input type="checkbox"/> |
| | b) Can coloured inner cores be seen anywhere along its length? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3 | <u>Condition of the Plug</u> | | |
| | a) Is the plug cracked, discoloured or otherwise damaged? | <input type="checkbox"/> | <input type="checkbox"/> |
| | b) Is the cable loose, ie not secured by cable grip? | <input type="checkbox"/> | <input type="checkbox"/> |
| 4 | <u>Condition of Isolation Switch or Socket</u> | | |
| | a) Is the wall socket loose or not securely fixed to the wall? | <input type="checkbox"/> | <input type="checkbox"/> |
| | b) Is the wall socket cracked, discoloured or otherwise damaged? | <input type="checkbox"/> | <input type="checkbox"/> |

If the answer to any of the above is Yes then the appliance must be taken out of use and the fault reported without delay to the person's Supervisor/Line Manager

Appendix 2

ELECTRICITY AT WORK

FORMAL VISUAL INSPECTION CHECKLIST

Name of person carrying out
Check _____

Service _____ Location _____

Appliance _____ Serial No _____

On Inventory - Yes/No

- | | <u>Yes</u> | <u>No</u> |
|--|--------------------------|--------------------------|
| 1 <u>The Plug</u> | | |
| a) Is the wrong type of fuse fitted? | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Are cable terminations loose or incorrectly made? | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Is the cable loose/not secured by the cord grip? | <input type="checkbox"/> | <input type="checkbox"/> |
| d) Are there signs of overheating? | <input type="checkbox"/> | <input type="checkbox"/> |
| e) Are pins bent, corroded or otherwise damaged? | <input type="checkbox"/> | <input type="checkbox"/> |
| f) Is the casing of the plug damaged? | <input type="checkbox"/> | <input type="checkbox"/> |
| 2 <u>The Isolation Switch or Socket</u> | | |
| a) Is the wall socket loose or not securely fixed to the wall? | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Is the switch difficult to operate? | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Does the socket show signs of overheating? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3 <u>The Cable</u> | | |
| a) Are there any cuts, kinks, taped joints, fraying and/or burn marks? | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Can coloured inner cores be seen anywhere along its length? | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Is it loose or ill-fitting at the point of connection with the appliance? | <input type="checkbox"/> | <input type="checkbox"/> |
| 4 <u>The Appliance</u> | | |

- | | | |
|--|--------------------------|--------------------------|
| a) Are there any parts cracked, missing, dented or showing signs of overheating? | <input type="checkbox"/> | <input type="checkbox"/> |
| | YES | NO |
| b) Are there any insecure parts or loose screws etc? | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Has it been subject to conditons for which it is not suited eg wet or contaminated? | <input type="checkbox"/> | <input type="checkbox"/> |

5) **The Environment**

- | | | |
|---|--------------------------|--------------------------|
| a) Are any parts cracked, missing dented or showing signs of overheating? | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Is the equipment going to be used in a wet or dusty environment? | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Should an RCD circuit breaker be used? | <input type="checkbox"/> | <input type="checkbox"/> |

If YES has been ticked in relation to the above questions then please note action taken (ie Appliance taken out of use, trailing cables re-routed, or RCD fitted etc)

<p><u>ACTION TAKEN</u></p>

DATE _____

SIGNED _____