


**Health and Safety**  
**Electrical Appliances Testing and Inspection**
**Policy**

The University of Auckland provides for specific safe operating practices for the safety testing and inspection of portable electrical appliances in accordance with AS/NZS 3760:2001. A general Safety Guideline on Electricity for all University staff can be found in Appendix 3.

The University of Auckland requires all electrical appliances to be inspected and tested immediately after construction, repair or modification or where there is reason to suspect the equipment is faulty or damaged but cannot be confirmed by visual inspection.

**Procedure**
**Coverage**

All electrical appliances in use in departments, laboratories, workshops and offices owned or administered by the University of Auckland except for fixed wiring installations e.g. light fittings, air conditioning units, etc.

**Responsibility**

Primary responsibility for ensuring the safety testing of electrical appliances, in accordance with electrical regulations and AS/NZS 3760:2001 is with the Vice Chancellor. The Vice Chancellor has delegated this responsibility through the Dean / Director / Librarian to the Head of Department / Manager.

Annual testing programme will be reported, by the department, as part of the annual hazard review process due to be completed by 31 March each year.

There are important legal responsibilities for the University and its staff in relation to electrical safety. Legal risks for the University and its staff are mitigated by compliance with this policy. Where a staff member takes all reasonable steps to conduct testing in accordance with this policy and guideline, and where there is an injury or potential serious harm incident, the University will provide all reasonable legal and other support for the staff member.

**Testing**

All electrical appliances in the University of Auckland must be inspected and tested prior to commissioning and at regular intervals during its service life to check that no degradation has occurred to its electrical safety since manufacture. Equipment that has a current electrical safety certificate need not be tested. All other appliances are to be tested at prescribed intervals.

Conducting Tests

“Approved Competent Persons” include those with registration and current practising licenses as Electrical Service Technicians, Electricians, and other staff trained to conduct testing. (Refer to section on Training). Specific Testing Guidelines are set out in Appendix 4.

“Approved Competent Persons” shall perform electrical safety testing.

In addition all staff should visually check electrical appliances used in their work areas on an ongoing basis. In particular, staff in laboratories should visually check all equipment in use prior to all sessions for any faults or apparent degradation of insulation or conductors. Typical visual faults are: cord cracks, burns to insulation, insecure sheath grip of cord at plug or appliance, loose screws in plug(s), bent electrodes on plugs and inadequate ‘Intrusion Protection’ of an instrument or that its case is not securely attached (eg. missing screws) etc.

Non-compliant equipment

Electrical appliances which fails to comply with the standard when tested shall be withdrawn from service immediately, labelled with a warning against further use and arrangements made for by an authorised repair agent or service personnel or for disposal or destruction.

### Frequency

In accordance with the AS/NZ Standard 3760:2001 the University of Auckland requires testing and inspection of electrical appliances in workshops and laboratories to be conducted at the frequency specified in Table 2, AS/NZS 3760: 2001. This table is to be interpreted in accordance with Appendix 1. Table 2 is reproduced in Appendix 2.

An annual review of usage of appliances should be conducted to establish the testing cycle for electrical appliances in use in the following year. This review should be reported as part of the annual hazard review process.

In order to meet these requirements departments should initially prioritise the electrical equipment to be tested based on the frequency of use and level of risk, as follows:

- The first priority should be to test and inspect all electrical appliances in regular use in workshops and laboratories on an annual basis.
- Secondly, electrical appliances, which are used occasionally and are low risk may be prioritised to be tested in the next 1-2 years.
- For rarely used appliances in office environments, testing should be carried out at least 5 yearly.

### Documentation/Records

The minimum requirement is for the following information to be recorded on the label attached to the appliance:

1. The date of testing
2. Person performing the test

To assist with managing regular testing of equipment the University has an optional annual colour coding system that may be used to enable a quick, visual reference for staff. Coloured pens may be used on the tag as follows:

- Test 6 monthly – red
- Test annually – green
- Test biannually – blue
- Test 5 yearly - yellow

A quick and easy, cost effective method to use for documentation is the Electrical Safety Certificate system which is provided by the Electrical Workers Registration Board at P.O. Box 10-156 Wellington. This system enables the person conducting the testing to retain a record of the test on the butt of the certificate book for future reference and a certificate of testing to be fixed to the equipment. The registration board retains a record of the certificate book issued for ease of tracking.

### Test Equipment

Tests shall be done using a P.A.T (portable appliance tester) or appropriate testing equipment in accordance with the AS/NZS 3760. The P.A.T. should be routinely calibrated i.e. 6 monthly and to be maintained accurate to 5%. Larger departments are expected to purchase and maintain this equipment. Smaller departments may seek to use larger department's equipment.

Further details regarding specific testing requirements and practical guidelines refer to Appendix 2.

### Training

"Approved Competent Persons" will be trained to standards set by the Health and Safety Office of Human Resources. These standards will cover:

- the operation of this policy and its procedures
- the ASNZ3760/2002 Standard
- the testing of the diverse range and use of electrical and electronic equipment in the University.

The University will provide annual electrical testing and inspection workshops through CPD for those staff involved in electrical appliance testing.

In addition other laboratory and workshop staff will be offered the opportunity annually to attend a basic electrical safety awareness and familiarisation session.

Approved

Vice Chancellor

## Appendix 1: Interpretation of Table 2 of AS/NZ 3760:2001 ("In-Service Testing and Inspection of Electrical Equipment")

### Definitions of terms used in this appendix:

"Appliance" *shall* mean 'Low Voltage' electrical equipment and high-current Extra Low Voltage (ELV) electrical equipment powered from mains 230AC volts connected by flex-wire cord, as defined by the Electrical Regulations 2003, their subsidiary Regulations and Standards.

"*Shall*" means mandatory.

"*May*" means optional.

"*Environment*" refers to the situation and conditions within the immediate area (generally at least 1.8m) of which an appliance (including its power cord) is located. This applies to the 'environment' external to, and within an appliance.

"*Hostile environment*" includes an environment in which heat, shock, vibration (movement, flexing), moisture (ice, fluids, condensation), pressure (inc. crushing forces), or abnormal levels of dust is present.

"*Abuse*" shall be its plain English meaning.

"*Loaned*" shall be given a broad interpretation.

### Category 1:

(6-monthly frequency of testing for Class-1 equipment; 1-yr for Class-2.)

This category shall exclude –

- a) "University Workshops", unless circumstances c), d), or e) exist.
- b) 'Loaned' appliances ( added class to category 5).

Category 1 shall include-

- c) any appliance which is used in a severe 'hostile' environment or is exposed to multiple 'hostile' environment factors or is open to abuse
- d) any appliance which is subjected to a high frequency of use
- e) portable appliances (i.e. under 18kgs, such as electric drills and saws), cord extension sets, and electric portable outlet devices (EPODs) which are operated in *different* environments.

(Note: Portable appliances, including extension cords and EPODs, which are not used in *different* environments are normally tested under other categories.)

### Category 2:

(1-year frequency of testing)

The term "Educational Establishments" will *not* be applied to the University of Auckland where conditions of this Appendix are complied with. Accordingly, re-scheduling (exemption<sup>1</sup>) and amended categories 2, 3, 4, & 5, of this appendix may be adopted. Otherwise all parts of AS/NZ 3760:2001 shall apply in full.

Electrical appliances used in laboratory environments (undergraduate and research), University workshops and kitchens, are generally included in this category.

Extra attention should be given to insulation, electrical leakage, corrosion, and earth-bonding, in appliances containing heat or moisture. These appliances have self-made internal environments which can be defined as 'hostile' and should therefore be tested annually, at least, or more frequently (Cat-1) if subjected to more severe or multiple 'hostile' environmental factors.

### Rescheduling of some appliances

Testing of some appliances may be rescheduled to a 2 year test period only provided they are lower risk electrical appliances which:

- are not in a hostile environment
- do not contain heating elements
- are used in a safe clean & stable 'environment'

and written consent given by the overseeing person responsible (i.e. Head of Department or Line Manager), which specifies:

- details of the re-scheduled equipment or occupied space
- justification of the re-scheduled (provided by an Electrical Service Technician or a qualified Electrical Engineer)
- dates of re-scheduling
- date for review

**Category 3:**

(1-yr test frequency)

Applies to electrical appliances in offices or environments which are subjected to a "hostile environment".

Note: This category (1-yr test) shall not include office appliances which are subject to more harsh conditions as described in Category-1 b), c), d), or e).

Lower risk appliances in Category 3 be re-scheduled to a 2-yearly frequency of testing provided the appliance meet the requirements for requirements for rescheduled equipment as per Category 2 and the same documentation requirements are met.

**Category 4:**

(5-yr test frequency)

Appliances in offices (as per Table-2) which cannot be defined in other categories.

This includes equipment operated in safe stable non-hostile environments, where power cords wires are seldom flexed.

**Category 5:**

(Hire equipment - to be tested monthly or before each loan)

Shall additionally include loaned electrical appliances.

## Appendix 2: Table 2 of AS/NZ 3760:2001

**TABLE 2**  
**TESTING AND INSPECTION INTERVALS FOR ELECTRICAL EQUIPMENT**  
**(CAUTION: This page must be read in conjunction with the Standard as a whole, and particularly Clause 2.1)**

Type of environment and/or equipment  (a)	Interval between inspection and tests						Cord extension sets and EPODs  (h)
	Class of Equipment		Residual Current Devices (RCDs)				
	Class I (protectively earthed) (b)	Class II (double insulated) (c)	Push-button test by user		Operating time RCD tester		
			Portable (d)	Fixed (e)	Portable (f)	Fixed (g)	
1 Factories, workshops, places of work or repair manufacturing, assembly, maintenance or fabrication	6 months	12 months	Daily, or before every use, whichever is the longer	6 months	12 months	12 months	6 months
2 Laboratories, health care and educational establishments, tea rooms and office kitchens	12 months	12 months	3 months, or before every use, whichever is the longer	6 months	2 years	2 years	12 months
3 Office environment: Where the equipment or supply flexible cord is subject to flexing in normal use OR is open to abuse OR is in a hostile environment	12 months	12 months	3 months	6 months	2 years	2 years	12 months
4 Office environment: Where the equipment or supply cord is NOT subject to flexing in normal use AND is NOT open to abuse and is NOT in a hostile environment	5 years	5 years	3 months	6 months	2 years	2 years	5 years

Type of environment and/or equipment  (a)	Interval between inspection and tests						Cord extension sets and EPODs  (h)
	Class of Equipment		Residual Current Devices (RCDs)				
	Class I (protectively earthed)  (b)	Class II (double insulated)  (c)	Push-button test by user		Operating time RCD tester		
			Portable  (d)	Fixed  (e)	Portable  (f)	Fixed  (g)	
5 Hire equipment (note 3)	Inspect before each hire.  Test monthly	Inspect before each hire.  Test monthly	Prior to each hire.  Test monthly	NA	Prior to each hire.  Test monthly	NA	Inspect before each hire.  Test monthly
6 Repaired/serviced/second hand equipment	After repair or service which could affect electrical safety, or on re-introduction to service						
7 Equipment used for commercial cleaning	6 months	12 months	3 months	NA	2 years	NA	12 months
8 Residential type areas: Residential institutions, hotels, boarding houses, hospitals, accommodation houses, motels, hostels and the like	2 years	2 years	6 months	6 months	2 years	2 years	2 years

## NOTES:

- 1 Multiple environments may exist in any location e.g.: An 'office' classification and a 'laboratory' classification may exist within a 'factory' establishment.
- 2 Regulatory Authorities, other Standards, workplace safety requirements or manufacturers' instructions may specify intervals appropriate to particular industries or specific types of equipment.
- 3 RCDs in transportable equipment shall be regarded as portable RCDs.
- 4 The following Standards refer only to the inspection and testing method of Clause 2.3 of this Standard, but not the intervals of testing in Table 2 above. Refer to the appropriate standard for specific test intervals:
  - AS 3001 Electrical installations – Movable premises (including caravans) and their installations
  - AS 3002 Electrical installations – Shows and carnivals
  - AS/NZS 3003 Electrical installations – Patient treatment areas of hospitals and medical and dental practices
  - AS 3004 Electrical installations – Marinas and pleasure craft at low voltage
  - AS/NZS 3012 Electrical installations – Construction and demolition sites
  - AS/NZS 4249 Electrical safety practices – Film, video and television sites

## Appendix 3: Electricity - Safety Guideline

# Safety Guideline



## Electricity

### Faults and repairs

1. All electrical repair work (including fitting and rewiring plugs, and the replacement of fixed wiring fuses) is to be performed by electrically certified technicians.
2. All electrical appliances that fail electrical safety tests will be taken out of service or rendered inoperable until the appliance is repaired by an electrically certified technician
3. Report any faulty equipment immediately to your supervisor or manager. Outside of normal hours and where prompt attention is needed ring the University Security Desk, ext 85000. Your concern will be relayed to Property Services who are on call.
4. Switch off the faulty equipment and remove it from service, or leave a warning notice if it is likely to be a hazard to other workers.
5. Faults in fixed wiring are to be reported to Property Services.

### Safe working practices

1. Do not interfere with or alter the fixed electrical supply to an office, laboratory or workshop. This includes the opening of fuse boxes.
2. Do not use electrical equipment that has frayed or exposed leads or faulty or damaged plugs.
3. Protect electrical leads from mechanical, chemical, or heat damage.
4. When an item of equipment is situated at a distance from a power point, the electrical lead should not run along the floor. If necessary, place hooks along the wall to raise the lead above the floor.
5. Do not use extension cords as a substitute for fixed wiring. Additional power outlets can be requested from Property Services.
6. When power boxes are used that enable a number of appliances to be run from one power outlet, care must be taken to ensure that the circuit is not overloaded. Where possible, use power boxes with circuit breakers attached. However it is better to once again request more permanent power outlets.
7. Keep clothes, paper and other flammable materials well clear of heaters and other equipment producing heat as a function of their operation.
8. Keep all objects and dust away from air vents required by equipment for cooling to reduce the risk of fire. Liquid spills should be immediately removed as these can cause electrical short circuits that may lead to metal cases becoming 'live' or to fire.
9. Do not attempt construction of electrical equipment or carry out alterations or repairs to it unless you are appropriately licensed and hold a current practicing certificate.
10. Do not open covers on any equipment that leaves potentially 'live' circuits exposed.
11. In wet or damp conditions a residual current device should be used. Protective rubber gloves and boots should be worn.
12. Display warning notices in places where specific dangers are present - high voltage, high power transmitters, lasers, unearthed equipment, etc.
13. Turn off and preferably unplug all electrical apparatus that is not in use.
14. Any electrical equipment left operating and unattended should have the control switch clearly marked and instructions for switching off in the case of emergency posted in a prominent position
15. Do not use three-phase outlets for single-phase equipment.

## Equipment Inspection and Testing

1. The AS/NZS 3760/2001 standard provides for the inspection and testing of electrical equipment connected to the mains by flexible leads. An "Approved Competent Person", who does not necessarily need to be electrically qualified, may carry out inspection and testing.
  - a) The inspection involves:
    - i) A check that the equipment is free from obvious external damage.
    - ii) A visual check for damage to accessories, connectors, plugs or outlet sockets.
    - iii) A check that the inner conductors of flexible leads are not visible and that unprotected conductors or insulation tape are not in evidence.
    - iv) A check of the security and alignment of any control knobs.
    - v) A check that covers and guards etc are properly secured in place.
    - vi) A check that mechanical safety devices are in good working order and that ventilation inlets and exhausts are not obstructed.
    - vii) A check that any controls and alarms are in good working order.
  - b) The testing involves:
    - i) An earth test to ensure that there is less than 1ohm resistance between exposed metal parts and earth.
    - ii) An insulation test to ensure that there is more than 1M ohm resistance between phase and neutral and earth.
2. All laboratory and workshop equipment must be inspected and tested annually.
3. Office equipment, where the leads are not flexed in everyday use, must be inspected and tested every 5 years.
4. Departments must maintain a register of electrical equipment, especially laboratory and workshop equipment, which records date of purchase and dates of inspections and testing.
5. Because the inspection and testing to the standard does not involve the removal of covers and an internal inspection, safety hazards may exist in older equipment due to ageing of insulation and loosening of connections, especially where heat and vibration are present.
6. A special inspection schedule should be established for equipment greater than 10 years old.
7. Equipment on the schedule should be inspected inside and out by a registered electrical technician at appropriate intervals. Property Services or external firms (eg equipment suppliers) may be contracted to undertake inspections if internal resources are insufficient.
8. Hazards identified common to particular pieces of equipment should be advised to the H&S Advisor who will maintain a clearing house for this information.
9. External providers of electrical equipment (eg photocopiers) should provide a certificate of electrical safety when they service the equipment.

## Equipment fuse replacement

Unplug equipment from the mains before replacing blown fuses in equipment. Ensure that the replacement fuse cartridge is of the correct physical size and electrical rating. It is best to consult technical staff to find the cause for the blown fuse before replacement. Always consult if in doubt.

## Imported equipment

Equipment made outside New Zealand may have wire colours and voltage settings that are different from NZ standards. It is advisable to have new imported apparatus checked by an electrically certified technician. Plugs may only be fitted or rewired by an electrically certified technician.



## Appendix 4: Safe Operating Practices

### P.A.T (portable appliance tester)

A PAT is usually required to perform:

1. Earth-bonding measurements between the appliance case (and any exposed metal parts) with respect to the earth pin of the appliance's power plug. This test may have a current available of 25 Amps supplied at a potential 6 volts AC. maximum.
2. Insulation leakage tests for Class-1 electrical appliances are required to be done at 500 volts DC, or 1500 volts DC for Class-2 electrical appliances (as in double insulated).
3. Power measurement (not mandatory), however electrical equipment is required to display its power consumption. Testing for excessive power consumption can alert service personnel to the malfunctioning of an appliance.
4. Data-logging of the test ( is not mandatory for PAT's but can be useful for future reference)

### Testing Electrical Appliances

General information:

Class-1 appliances i.e. low voltage equipment which is supplied from 50 volts AC or 120 volts DC; up to 1000 volts AC or 1500 volts DC, which is safety earth bonded. (For full definition see AS/NZ Standards)

Earth bond resistance; 1 ohm maximum should be measured between the appliance body or exposed metal case and the earth-pin of the supply cord's plug.

Insulation resistance; 1 Meg-ohm minimum (except for metal-sheathed mineral - filled heating elements, 0.01 Meg-ohms minimum, measured by applying 500 volts DC at the cord plug between the earth pin and the active (phase) pin with neutral combined.

*Caution:*

Ensure that the power switch on the appliance is in the 'ON' position so that in the event of a DPST switch being fitted, the neutral line (as in USA-made equipment) is not disconnected from the active parts of the circuits, otherwise testing for insulation leakage resistance of all active parts may not be achieved.

Class-2 appliances i.e. low voltage as above, except that these are not earth-bonded. They are generally wired with 2-wire flex (e.g. domestic vacuum cleaners) This class of appliance is defined as "double-insulated" meaning that any exposed metal (labels, etc) is doubly insulated from active conductors. A Class-2 appliance label should display the identifying square symbol within a square. Insulation test voltage = 1500 volts DC.

### Heating Devices

(Note: It is strongly recommended that these are re-tested every 12 months.)

Heating devices require special attention due to their tendency for;

1. Breakdown of insulation and electrical leakage
2. Corrosion, including oxidation and failure of electrical terminations
3. Higher currents, requiring closer attention to sound connections and conductors.

*Note:*

Metal cased heating elements containing mineral insulations commonly show high leakage after periods of non-use. It may be useful to heat these for a short time before testing. The Standard now allows for 0.01 Meg-ohm on these types of heating elements. However, their cases must be well earth-bonded refer to AS/NZS 3760:2001; 2.3.3.2.(d).

### Electrical Portable Outlet Devices (EPOD)

EPODS must be tested as a Class-1 appliance. Multi-way Outlet Blocks refer AS/NZS 3760:2001; Appendix B3.3 and Figure B3. Multi-outlet devices should only be used when they have overload protection. It is preferable that types with individual switches are used as extra partial protection against back-feeding inductive loads into other sensitive electronic equipment.

*Caution:*

There is concern regarding the use of inexpensive imported EPODS with soft-brass earth-rails. Their earth connections have frequently been found to be open circuit after only one use. Any equipment that develops high leakage while operating from one of these poor quality EPODS could become potentially dangerous.

## Flexible Extension Cord Sets

These must be periodically inspected and tested as Class-1 appliances, as follows:

1. Annually if rarely moved, or 3-4 monthly (or more often) if frequently moved
2. For correct polarity of connection between its ends
3. To ensure the size of wire conductors are adequate for the maximum current loads for which it will be used
4. For maximum permitted voltage drop of 7% under full load (refer Electrical Regulations for Electrical Wiring Tables)

*Note:*

Extension sets should never be used coiled up or on a reel, except for very light duty (low current applications).

## Isolations Transformers

Refer AS/NZS 3760:2001 2.3.3.3.

The advised minimum insulation value of 1 M-ohm is in practice exceptionally low for an Isolation Transformer. It is recommended that if such a low value is discovered, the device should be more carefully checked.

## Residual Current Devices (RCD's)

Refer AS/NZS 3760:2001 2.3.3.4 & Table 1 and Table-2.

RCD's must be tested every time before use by pressing the test button on the unit to ensure that power is instantly disconnected in the event of leakage current being present. The routine tests in Table-2 require specialised equipment.

## Two Phase Equipment

Refer to three-phase equipment

As of 8/2002 these new "N" pattern plugs (PDL 964) are being used to connect Electric cooker 'ranges'. They may be wired to either 4 or 6mm-squared conductor wires, depending on the current loads.

Special caution is needed when servicing two-phase equipment. Treat as for three-phase.

## Three Phase Equipment (3-Q)

An increasing amount of 3-Q equipment is being installed in the University. Most of this equipment is supplied from heavy-duty 4-core flex cable (and sometimes five-core), usually fitted with one of several types of PDL Series-56 connectors.

*Caution:*

Service personnel should be wary of 3-Q breakers and single-phase operated 3-Q switches. Circuits will remain alive if one (or more!) switch contactors fail to disengage (weld). In single-phase operated controllers, 230 volt relay energiser circuits may remain alive inside equipment even though its three-phase breaker is released 'open'.

To perform electrical safety check on 3-Q equipment, either a special adaptor is required or a hand-operated 500 volts DC Megger Tester. This document does not provide sufficient information for testing or servicing 3-Q equipment. Electrical Safety Technicians should refer to Electrical Regulations and the relevant Standards for more information. If at all in doubt about your ability, call for assistance from an experienced technician or an electrician.

## Fixed Wired Equipment

Electrical Safety Technicians are generally not able (nor permitted) to perform electrical safety tests on the supply side of fixed-wired equipment. However, an earth approximation test is possible between a nearby 10 Amp-230 volt mains outlet from which your P.A.T is one pole and the PAT's earth test probe placed on the equipment's earthed frame is the other pole. This measures the equipment's fixed-wiring, via the building's earth wire system. Typical earth (loop resistance) values of 3-ohms can be expected. This earth 'loop' value indicates that the resistance will be sufficiently low enough to carry fault currents and that in the event of major insulation breakdown the overload devices will operate. Be wary of three-phase overload devices as not all phases will necessarily isolate in event of an overload condition. This is not a certifiable test and is not normally done. This type of test may also be used if it is suspected that a 10 Amp outlet's earth is faulty, i.e. by testing between two 10 Amp outlets. Earth loop testing can upset earth-current sensing RCCB's. If unsure, ask for qualified advice or assistance.