

# Appliance Checking

*versus*

# Appliance Cheating



An Introduction to AS/NZS3760 as your  
Appliance Testing Standard

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While every effort has been made to ensure the accuracy of the information included in this book the publisher accepts no responsibility for any error or omission.

# TESTING AND TAGGING - THE THEORY

## ✓ Who is Competent and Responsible to Test?

This booklet has been written to help organisations and individuals needing to comply with AS/NZS3760. The following insert from the Foreword of AS/NZS3760:2010 shows the importance of testing:

*“In-service testing is a necessary part of any safety program to help ensure the safety of persons using electrical equipment in the workplace. This Standard specifies in-service safety inspection and testing protocols and criteria that satisfy these obligations, and provides a cost-effective approach to safety without jeopardizing personnel safety or involving excessive equipment downtime.*

*The philosophy of the document is to provide an inspection and testing regime capable of implementation with only simple instrumentation, and performed by a person not necessarily having formal qualifications or registration, but who has the necessary practical and theoretical skills, acquired through training, qualification, experience or a combination of these, to correctly undertake the tasks prescribed by this Standard.”*

As can be seen from the Foreword, this routine testing can be performed quickly and by non-electrically qualified people. For both Australia and New Zealand a **‘competent person’** is all that is required to enable testing to commence. Many people see testing and tagging as a “growth industry” but it was never intended to be so. It was introduced with the primary goal of ensuring electrical safety in the workplace.

The following excerpt from AS/NZS3760:2010 makes it clear that this Standard was written to be used by a competent person and to allow a competent person to undertake testing as required by the Standard.

#### **AS/NZS3760:2010 1.4.4 - Competent Person**

##### **NOTE**

- (1) *A competent person is not required to be a registered or licensed electrical practitioner. Requirements for registration vary between jurisdictions.*
- (2) *Competency levels may need to be updated following technological advances in both the testing instrumentation available and the equipment being examined"*

It should be noted that merely holding an electrical qualification does not necessarily make someone competent to test in accordance with the Standard. The Standard puts accountability on to the **'responsible person'** to ensure that people doing the testing are competent to do so as can be seen in the excerpt below:

#### **AS/NZS3760:2010 1.4.19 - Responsible person**

*The responsible person shall be considered as:*

- (a) *The owner of the premises; or*
- (b) *The owner of the electrical equipment; or*
- (c) *A person who has a legal responsibility for the safety of electrical equipment within the scope of this Standard. Guidelines to assist a responsible person to assess the knowledge of a competent person are set out in Appendix B.*

*Also under the NZ Health & Safety in Employment Act 1992 (section 13(b)) all employees must be **adequately trained** in the safe use of all Personal Protective Equipment and appliances and equipment that they may be required to use or handle.*

It is common practice for test and tag companies to put down in-house testing (testing of equipment owned by a company or organisation by themselves). This is usually done through scare tactics, i.e. if you do in-house testing using a competent person you are liable. They often do not point out that **if they do not test and tag correctly you will also be held responsible.**

They will likely point out that they hold Public Liability insurance, however, be aware that this does not guarantee immunity from prosecution.

It is our belief that the inspection and testing of electrical equipment and installations (buildings) is necessary and the majority of this testing can be performed by competent people. This said we also recognise that training will often be required and that according to NOTE 2 1.4.4 of AS/NZS3760:2010, the **competency definition** in the Standard, competency levels will need to vary depending on what the competent person is allowed to do. This is an important concept and needs to be clearly understood. For example, the licences issued by

**SCHEDULE 1**  
For Attendance Certificate No: M0001-24(1)

**Ben Morgan**

After completing training on 4 September 2012 for Testing and Inspection of electrical equipment was considered competent to undertake TESTING of 230 volt portable equipment whilst remaining in the employment of:

**Metrotest.Com Ltd**

I understand the need to judge my own competency in any given test situation.

I will not undertake the testing of Isolating Transformers or items I am not familiar with.

**\*Attendance Certificate No. M0001-24(1) is valid until 03.09.2013 and is only valid whilst the above named person is using the Metrel AlphaPAT Portable Appliance Tester**

I understand and accept the conditions set out in this Schedule 1.

Signature.....  
Name

M O GOLDTHORPE for  
**METROTEST**  
ELECTRICAL SAFETY

Metrotest will always have restrictions on them defining what the licence holder can do (Fig. 1).

A person is either competent or not competent to do a given task and this is regardless of who pays them to do it. Furthermore using an electrical company or a Test'n'Tag company does not guarantee the competency of the testing personnel.

## ✈ The Standard – AS/NZS 3760

The Standard, AS/NZS 3760, is a 'living document' which is frequently revised to ensure that it keeps up with current electrical safety testing practices,

requirements, new technologies, and demands. It was initially drafted in 1990 as AS 3760. It was revised and adopted by New Zealand in 1996 and renamed AS/NZS 3760. This Standard underwent revision and amendment in 2000, 2001, 2003, and 2010 to keep it relevant to current technology and health and safety policies. AS/NZS 3760:2010 is the most extensively revised version to date. The key changes to the Standard from previous versions are as follows:

- ✦ Table 4 has been reviewed to align with the Electricity (Safety) Regulations 2010.
- ✦ Changes to the definition for ‘**responsible person**’.
- ✦ New information to test three phase residual current devices (RCDs) and electrical equipment has been added to improve user safety.
- ✦ The requirement for the retest date as well as the test date to appear on the test label (tag) as well as the words AS/NZS3760.

Other Standards, such as AS/NZS 3012 (Electrical Installations-Construction and demolition sites) etc., may also be appropriate in specific industries. However, it is AS/NZS 3760 which provides greatest general information on testing and this Standard is frequently referred to in regards to testing by a number of other Standards.

## ✦ Health and Safety Act

In New Zealand, the Health and Safety in Employment Act 1992 Section 2 part 6 states the following:

*Every employer shall take all practicable steps to ensure the safety of employees while at work; and in particular shall take all practicable steps to:*

- (a) Provide and maintain for employees a safe working*

- environment; and,*
- (b) Provide and maintain for employees a safe working environment; and,*
  - (c) Ensure that plant used by any employee at work is so arranged, designed, made, and maintained that it is safe for the employee to use.*

## ✈ Keeping Records

While there is no legal requirement to keep written records, the Department of Labour recommends that records are kept as they help to show how the business is managing Health and Safety. Some test and tag companies may suggest that records are not required and can be detrimental to safety. We completely disagree with this position. While keeping records is currently optional, they are very useful in keeping track of individual items and the history of their electrical test values. While some companies may argue that it will cost you more to keep records this shouldn't be the case. Metrotest and other legitimate operators know that customers can be supplied full records at no additional cost if the testing company is using suitable test equipment. Sadly, often the real reason behind the dissuasion of record keeping is that it reduces the accountability for the test company. It is impossible to audit results when there are no records!

There are two ways a testing company can provide records of the testing carried out to a client:

### 1. **Manual Entry**

If the test equipment being used has **NO** internal memory and then the operator manually records results in a logbook and then types all the testing details, including results (usually just a pass or fail) into an Excel spreadsheet.

**This system is very vulnerable to abuse.**



## 2. Downloaded Results

If the test equipment being used has on-board memory, details of the test carried out including date, time, test results with numerical values, together with other optional information such as appliance ID number are automatically saved. These values are then downloaded into a computer programme which collates the information to produce reports. As the date, results, and other test data fields cannot be altered in either the tester or the programme this system Using downloaded results ensure proven via an outside auditor at a

Report Of Passed And Failed Applications For Sales and Leasing									
Application Description	Application #	Test Date	City	Unit	Application Status	Leasing Status	Test Unit	Sub-Link Unit	Flag Unit
UNION - WORKBOOK									
UNION	384	03/10/10	PA	0.1	0.12 P	0.0			
UNION	385	03/10/10	PA	0.5	0.07 P	0.0	0.021	-0.019 P	
UNION	386	03/10/10	PA	0.5	0.07 P	0.0	0.024	-0.019 P	
UNION	387	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	388	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	389	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	390	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	391	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	392	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	393	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	394	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	395	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	396	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	397	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	398	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	399	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	400	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	401	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	402	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	403	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	404	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	405	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	406	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	407	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	408	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	409	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	410	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	411	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	412	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	413	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	414	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	415	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	416	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	417	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	418	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	419	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	420	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	421	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	422	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	423	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	
UNION	424	03/10/10	PA	0.5	0.07 P	0.0	0.0	0.0	

Printed: 03/10/2010

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Total Applications: 52

A report created from downloaded testing results.

tester or the programme this system is very difficult to manipulate. Using downloaded results ensures the validity of the tests can be proven via an outside auditor at any time.

We believe that the recording of results is very important not only for your records, but also for your Health & Safety obligations.

## ⚡ Obtaining a Copy of AS/NZS 3760

It can be helpful to have a copy of the Standard to refer to when making decisions concerning testing and tagging. Copies of the Standard are available for purchase in hardcopy and PDF form from Standards New Zealand and Standards Australia.

## Standards New Zealand

- ✎ [www.standards.co.nz](http://www.standards.co.nz)
- ✎ E-mail: [enquiries@standards.co.nz](mailto:enquiries@standards.co.nz)
- ✎ Phone : 0800 782 632
- ✎ Fax: 04 498 5994
- ✎ Mail: Private Bag 2439, Wellington 6140, **New Zealand**



## Standards Australia

- ✎ [www.standards.org.au](http://www.standards.org.au)
- ✎ E-mail: [sales@saiglobal.com](mailto:sales@saiglobal.com)
- ✎ Phone : 02 8206 6010
- ✎ Fax: 02 8206 6020
- ✎ Mail: SAI Global Information Services, GPO Box 5420, Sydney NSW 2001, **Australia**



# TESTING AND TAGGING - THE OPTIONS

## ✚ Testing – What are the Options

If you are going to implement the testing and tagging of appliances in your business or organisation there are two options to choose from: in-house testing and out-sourced testing.

### 1. In-house Testing

This involves purchasing or hiring the required testing equipment and employing a member of your own staff to undertake the testing.

If you choose to test in-house you will need to:

- ✚ Allocate the necessary time for testing to be done.
- ✚ Ensure testing staff have the necessary skills or obtain training as described under the Health & Safety in Employment Act 1992 (section 13(b)) and Standard AS/NZ S3760:2010 1.4.19
- ✚ Have or obtain suitable testing equipment. For large scale testing you will likely need to allocate at least \$5000 for test equipment and accessories including software/scanners and a label printer.

In-house testing is not, as some people may lead you to believe, a second rate option. Performing in-house testing often tends to 'breed' electrical safety due to the fact that existing staff are taking responsibility for their work places' on- going electrical safety.

### 2. Out-sourced Testing

This involves contracting an electrician or 'Test and Tag' company to test your appliances for you. Though it would seem like the easiest and safest option, it

still does come with risks which need to be carefully considered.

### ✍ **Testing by an Electrician**

Getting an electrician to do your testing does not guarantee testing is performed correctly. We have seen many electricians incorrectly testing. This is not particularly surprising considering that the majority of electricians or registered electrical inspectors often have had very little to do with appliances. On the other hand, electricians are less likely to cheat by just tagging items without testing due to the fact that if caught they would risk discipline from the Electrical Workers Registration Board (NZ) putting their licence and livelihood on the line.

### ✍ **Testing by a 'Test and Tag' Company**

Contracting a 'Test and Tag' company for your appliance testing is usually viewed as the best and most practical option. In theory, it makes sense to use a company who specialize in appliance testing and tagging and may be members of an association of professional appliance testers. While there are many good testing and tagging companies there are some who cut corners **by tagging appliances** without actually testing them. Tagging without testing has become a widespread problem in the UK and unfortunately is becoming much more frequent in both Australia and New Zealand

As well as being fraudulent and negligent, 'tagging' without testing does not ensure electrical safety. In this situation the testing company and the contracting organisation would both be liable if something goes wrong.

With electrical safety on the line, one might wonder why a test and tag company would cheat like this. Simply put, the main motivation is **GREED!**

With the growing emphasis on health and safety in the workplace, some people have seen the test and tag industry as a cash cow. These 'cowboys' of the industry often have no electrical training and use bare minimum, basic test equipment which allows them to cheat. They may supply results in hard or soft copy which look very professional, but usually the results have been manually entered into a spreadsheet. This means it is possible, in the worst case scenario, that no actual testing has been performed. If they are found to have passed an unsafe appliance they can simply say that it was OK when they tagged it!

BE VERY CAREFUL if choosing to use a Test and Tag company. You need to be testing for safety not compliance. Not all Test and Tag companies operate as described above, There are some excellent companies who strive to carry out a high standard of testing for the safety of their clients. When contracting a company be sure to do your research thoroughly so you are confident that the people you are entrusting with your electrical safety have your electrical safety, and not your wallet, in mind.

## ✂ **How to Choose a Test and Tag Company**

Below are some very important questions which should be considered before contracting a Test and Tag company.

### **1. What qualifications does the founder/principal have?**

In New Zealand you can check if a person is a registered or licenced Electrical worker or have been in the past though Electrical Workers Registration Board. This can be done for free on their website, [www.ewrb.govt.nz](http://www.ewrb.govt.nz); or by calling them on 0800 661 000. In Australia,

registration and licencing can be checked though the State Regulator. If they do not have any electrical qualifications entitling them to registration this could be an indication they are in it for the love of money rather than electrical safety. Nearly every week we get calls from non-electrically qualified people thinking about getting into testing and tagging stating, “I think we could make a lot of money”.

## **2. How long has the company been operating?**

Companies that have been around for 10 or more years should have built up a substantial reputation in the market place making it relatively easy to check their qualifications and references. Newer companies will be harder to find information on though they may still be highly competent. Be wary if they are unwilling to supply references from current or previous clients.

## **3. What training have their technicians had?**

A company may still be quite legitimate even if their technicians have not had much electrical training. In order to test equipment in accordance with AS/NZS 3760 a person needs only be “competent”. You will need to decide if they are truly competent based on the training the company provides their technicians.

## **4. What test equipment or PAT (Portable Appliance Tester) do they use?**

You may want to reconsider if the company you are researching only uses basic PATs such as the Seaward PAC 3760, Aegis Patrol, or similar. These types of testers are very inexpensive to purchase and are generally classified as appliance checkers as they only give results as a pass or fail (no readings) and do not store the test results with a ‘real time clock’. If someone wants to falsify results then these manual instruments make it very easy to do so. Usually people using these testers will still supply you

manually inputted electronic records. **These records may look very professional but there is no way to confirm their validity.**



*Seaward PAC 3760*



*Aegis Patrol Pro*

The instruments themselves are not at fault and some legitimate companies may be using them. However, they do allow those wanting to cheat to easily do so. Your best option, if you want to avoid the risk of being caught out, is to ensure that the testing company uses a tester which tests the appliance and automatically stores the test results including values and prints a traceable tag at the time of the testing.

Your company logo and choice of details are stored in the printer memory, and will print out on each tag

Individual Asset/Appliance number (listed is asset Number 123) for tracking of assets and appliance testing history

Barcode generated from test code and asset number

3 DIGIT TEST CODE NUMBER  
i.e. 001 equals a visual only test carried out by the tester – Provides EASY external auditing of testing done.

Date the test was carried out

TEST STATUS

Retest Date– time selected in months and printed off in date format

The person who carried out the testing

AS/NZS3760 TEST TAG

**Electrical Safety TESTING & INSTRUMENTS**

**METROTEST**  
ELECTRICAL SAFETY TESTING

Tel: Au 1800 789 973  
NZ 0800 638 768

----- CENTRE CABLE HERE -----

Appliance: 001123

TEST DATE: 12/04/2012    RETEST DATE: 12/04/2013

USER: JMM

TEST STATUS: PASS

*Features of a Metrotest SupaPAT Test Tag*

In our opinion the best, least cheatable, systems are in order of preference:

- ✦ Metrotest SupaPATs. This is a very secure system. Test parameters are not adjustable by the user.
- ✦ Seaward ProTag System using the Supernova /EuropaPlus
- ✦ Ethos 9500 ProTag System



**Metrotest SupaPAT**

These three systems have onboard memory, record test values as well as pass/fail results, and are fully downloadable to recordkeeping software.

## **5. How frequently is their test equipment calibrated?**

Test equipment is designed to test and give a reading (or value) and as such these readings need to be accurate. This is why it is necessary to regularly check to see if the instrument is reading correctly and recalibrate as necessary. Most manufacturers recommend 6-12 monthly calibration checks. Ask to see the paperwork of when the test equipment (PAT) was last calibrated.

## **6. Will it cost me more to use a testing company that uses the more expensive downloadable test equipment?**

*As using downloadable testers usually speeds up the testing process they are usually just as cost efficient to use as less expensive testing equipment. Therefore, there would not usually be any increased cost passed onto you as the client.*



The above questions are probably the most useful for determining the quality of work you can expect from a Test and Tag company. Before you make a final decision there are some other practical questions you should consider:

- i) What is the cost per hour or cost per test?
- ii) What does the price include? (i.e. tags, site fee etc.)
- iii) Does the company hold public liability insurance? How much?
- iv) How are results recorded? (i.e. manual entering into a spreadsheet or real time test results downloaded from a PAT Tester.)
- v) How will records be managed and accessed?
- vi) What type of testing reports and data can be produced?
- vii) Does the company hold health & safety accreditation?

# TESTING AND TAGGING - THE PROCEDURE

## ✈ Testing of a Typical Class I Appliance

Firstly a **visual check** will be performed to decide whether the appliance is visually safe, if not visually safe then **NO** testing should be performed and the appliance should be withdrawn from service and labelled 'DANGER DO NOT USE' or similar.



If the appliance is safe, then the Class, Class I or Class II, needs to be determined before testing can commence.



If the appliance is a Class I appliance, the first test performed will be an **earth bond test**. For both countries, the maximum protective earth resistance allowed is 1 Ohm. The Standard suggests that ideally this should be under 0.5 Ohm as faults will increase the resistance. The length and diameter of the supply lead will also have an effect on the resistance. The test current most likely to be used on this type of appliance would be 10 or 25 Amps. The 10/25 Amps flows through the protective earth circuit and the resistance between the earth pin and the metal case is measured. For the appliance to pass the resistance needs to be under 1 Ohm - it is likely to be under 0.2 Ohm.



*Typical Class I Appliances*

Providing the earth test passes then a **500V DC insulation resistance test** is performed. The 500 volts is applied between the phase and neutral pins of the appliance plug bonded together and the earth pin, all switches need to be in the 'on' position. The minimum insulation resistance allowable is 1 MegOhm (1,000,000

Ohms), the higher this figure is the better. The 500 Volt insulation resistance test is a very good test providing all the switches can have their contacts closed without powering the appliance. If this is not possible then the Standard requires that a **powered leakage test** be performed at the normal operating voltage of the appliance under test.

Therefore, if we do not do the 500 volt insulation resistance test we must perform a leakage test. The maximum allowable leakage for any Class I appliance is 5 milliamps. The switches must be 'on' for this test and therefore the appliance needs to be secured as it will operate.

Once the tests are completed the tagging and record keeping process then begins.

**NOTE** an earth bonding test must always be performed before any other test on Class I appliances—THIS IS FOR SAFETY REASONS.

## ⚡ Testing of a Typical Class II Appliance

Firstly a visual check will be performed to decide whether the appliance is visually safe, if not visually safe then **NO** testing should be performed and the appliance should be withdrawn from service and labelled 'DANGER DO NOT USE' or similar.

If the appliance is safe, the Class needs to be determined and then the tests performed.

No earth test is performed on a class II appliance so the first and only test may be the **500V DC insulation resistance test**. For this test the 500 volts is applied between the phase and neutral pins of the appliance



*Typical Class II Appliances*

plug bonded together and the case of the appliance, all switches need to be in the 'on' position. The minimum insulation resistance allowable is 1 Meg Ohm (1,000,000 Ohms).

As detailed above, if a switching device cannot be closed without the appliance being powered then a **leakage current test** needs to be performed. The maximum leakage for Class II is 1 milliamp.

Once the tests are completed the tagging and record keeping process then begins.

## ⚡ Testing of 3 Phase Appliances

3 Phase appliances tend to be big, use more electricity and will normally be Class I. Because they use more electricity than single phase appliances they usually have a switching device that cannot be switched to the 'on' position without powering the equipment. Therefore to test in accordance with AS/NZS3760, the 3 phase appliance will normally require a powered up



leakage test to be performed instead of the 500V insulation resistance test. 3 Phase testing is no more complex than the testing of single phase equipment, but better test equipment is required and it takes considerably longer to complete the testing.

There are very few portable appliance testers that we are aware of that can test 3 phase appliances for a leakage test and provide on board automatic results storage. Metrotest can provide you with a list of testers which are suitable for testing 3 phase appliances

You will need to check with your testing company and with the Regulator in your State or country regarding who may perform 3 phase testing. In New Zealand, a competent person may test 3 phase appliances, but this is not the

case in Australia as each State has developed their own regulations.

## ⚡ Testing of RCDs



*Portable RCD*

A residual current device (RCD) is designed to constantly monitor the power flowing in the phase and neutral conductors. If there becomes a difference and that difference is enough, then the RCD must disconnect the circuit it supplies within 40 milliseconds or 300 milliseconds if it is designed as a personal protection RCD.

RCDs are required to be tested in two ways. Firstly with a push button self test and secondly with an RCD tester which measures the disconnect time normally called “trip time”.

AS/NZS3760, which generally addresses requirements for portable appliances, presently also outlines testing criteria for both portable and **fixed** installed RCDs.



*Fixed RCD*

# TESTING AND TAGGING - THE PRACTICE

## ✚ Electrical Classes of Appliances

In Australia and New Zealand the only two classes of appliance we need to be concerned with are:

- ✚ Class I equipment (earthed equipment)
- ✚ Class II equipment (double insulated equipment)

The Standard AS/NZS3760 has the following definitions for these classes:

### 1.4.2 Class I equipment (basic insulated, protectively earthed equipment)

*Equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution, in that conductive accessible parts are connected to the protective earthing conductor in the fixed wiring of the installation in such a way that those accessible parts cannot become live in the event of a failure of the basic insulation.*

*NOTE 1 Class I equipment may have parts with double insulation or parts operating at extra-low voltage.*


*NOTE 2 This provision includes a protective earthing conductor as part of the flexible cord or cable for equipment intended for use with a flexible cord or cable*

### 1.4.3 Class II equipment (double insulated equipment)

*Equipment in which protection against electric shock does not rely on basic insulation only, but in which an extra layer of insulation (called “supplementary insulation”) is provided to give double insulation, there being no provision for protective earthing or reliance upon installation conditions. This equipment is generally manufactured with a non-conductive*



*Double insulated markings as found on a Class II appliance*

*(insulated) enclosure, and is marked either with the words 'DOUBLE INSULATED' or with the symbol  to allow easy identification.*

*NOTE 1 Class II equipment may also be manufactured with metal enclosures which are double insulated from live parts.*

*NOTE 2 Class II equipment may be provided with an earth connection for purposes other than safety, this earth connection is referred to as a functional earth (FE). Functionally earthed parts are double insulated from live parts.*

## ⚡ Visual Inspection

The visual inspection plays a very large role in ensuring the safety of appliances. It is important to note that a visually unsafe appliance may, in many situations, pass all tests performed by individual test instruments or PATs (portable appliance testers). This does not mean that the test equipment used to test the appliance is unreliable, but merely that the test equipment does not have eyes!

The environment that the equipment is used in will often dictate the type of damage that will be found and also what other equipment is used around it, e.g. a welder, angle grinder and extension lead are often used together and angle grinders grind or scuff leads easily when put down whilst still rotating. Hence, both the angle grinder and the extension lead could easily receive damage. A welder produces sparks and hot metal which



*Exposed cables on a drill press*

can damage cases or leads easily in a workshop, but an extension lead in an office environment is more likely to be damaged by a chair or door.

Ownership of the equipment along with skill levels of operators will also dictate the likelihood of damage, along with other things like

transportation and storage e.g. a hired appliance that frequently moves and is portable, is likely to sustain far more damage than an 'owned' and infrequently moved appliance.

The physical visual inspection should always commence only when the appliance has been isolated from its' power supply. The inspection should start at the plug end (not the cord connector end if it is an extension lead). This guarantees that the appliance is disconnected (isolated).

The lead between the plug and the appliance body should always be carefully checked for damage as majority of faults will be found in this area. The body of the appliance and the plug should also be examined for signs of damage or wear which could compromise the electrical safety of the item. It is called a **visual inspection** but in some cases it will also include tapping, pulling, twisting, smelling and feeling.

The visual inspection process involves using commonsense; unfortunately commonsense does not appear to be so common anymore! However, the more inspection and testing that is performed by an individual the easier it becomes to locate visual faults. Due to the nature of individual designs there may be consistent faults that are found throughout an appliance type and also some common faults that are unique to a particular make and model. As an individual undertaking testing becomes more familiar the appliances specific to their industry they will know to look for these faults during the visual inspection.



*Visual damage to an extension lead*

The visual inspection process is likely, in some testing environments, to locate 90% plus of faults in equipment. Some could argue, "why bother to test then?", but it needs to be understood that **the hidden faults which can only be found with a testing instrument are potentially more dangerous BECAUSE they are**



**hidden.**

Visual inspection is a very important part of the overall testing process. It encompasses everything that can be done to check an appliance for breaches in its electrical safety without testing equipment, but by itself is insufficient to determine electrical safety.

## **Earth Bond Test**

This test is sometimes referred to as the earth continuity test. However we are not just interested in continuity, but rather whether the earth conductor is of a low resistance and capable of transporting high fault current back to ground.

It needs to be clearly understood that the protective earth conductor is the main safety feature in the design of a Class I appliance, apart from its basic insulation. The protective earth conductor is designed to transport any electricity that leaks into the case of a Class I appliance back to the ground away from the body or case of the appliance and prevent anyone from receiving an electric shock or being electrocuted. A single strand of earth wire would have continuity but would act like a fuse wire if a high fault current flowed through as may happen in a real life situation. This is why the emphasis of the test is not continuity, but the ability of the earth conductor to take the electricity back to the ground. Electricity will normally take the easiest (lowest resistance) path back to the ground so a low resistance earth conductor is very desirable. Protective devices such as circuit breakers/fuses will also operate faster if the protective earth path is of a low resistance.

Ideally for non-IT appliances the test current used to test the protective earthing conductor and measure resistance should be 10 or 25 Amps. This relatively high test current is designed to simulate a fault current; the result being that you know, in a real life situation, death by electrocution is unlikely

as a result of the protective earth conductor's failure.

When testing some items, such as IT equipment, a soft earth test of 100/200mA may be more suitable than the standard 10/25A test. The most suitable PAT for all round testing will include the ability to test at 100/200mA as well as at at least 10 Amps.

## ⚡ Insulation Resistance Test

Good insulation resistance is required on all appliances and even more so on Class II (double insulated) appliances as they do not have an earth conductor to transfer any electricity leaking into the case to ground. Single phase appliances normally operate at around 240Volts. To be sure the insulation is not breaking down, i.e. letting electricity leak out, we normally test the insulation resistance at 500Volts, which is approximately twice an appliance's normal operating voltage. The test is designed to stress the insulation and show up any weakness where electricity could escape.

When testing for insulation resistance, all switches should be in the 'on' position. If switches are not in the 'on' position the test results may be meaningless. If switches cannot be switched on without powering the appliance then AS/NZS3760:2010 requires a leakage test to be performed.

## ⚡ Differential Leakage Test

10 years ago there was no requirement for this test on any appliance but now, for those wishing to comply with AS/NZS3760:2010, this test is mandatory where the appliance under test cannot be switched on without applying power.

All good PAT testers should be able to perform this test on single phase appliances easily; however, there are very few capable of testing for leakage in 3 phase appliances. See the section on 3 Phase testing for further information.

The desired outcome of the test is to show if leakage is getting into the case of the appliance—effectively, whether the insulation is breaking down. If it is then it will allow electricity to come in contact with the user. A differential leakage test involves making a comparison of the currents flowing in the phase and neutral conductors, which in a healthy appliance should be identical. Any imbalance suggests the difference is flowing to or could flow to earth either through the earth conductor or via an alternative path. The maximum allowable leakage for Class I is 5 milliamps and the maximum allowable leakage for Class II is 1 milliamp. The reason for the higher allowance on Class I is that Class I appliances must have a protective earth.

**For safety reasons an earth test must always be done on a Class I appliance before doing a differential leakage test.**

## ✈ Polarity Test

All extension leads need to be wired correctly. People are generally not surprised when a lead with a rewireable plug is found to be incorrectly wired. However most people are surprised to learn that every year thousands of factory leads are produced with the phase and neutral conductors transposed (incorrect polarity).

With the above in mind, it is a good idea to do a polarity test on all rewireable leads and all long moulded (factory made) extension leads. This test does not add a lot of time to the testing process.

It is perhaps an unnecessary test on moulded computer leads and does make

computer testing more complicated and time consuming. Given the low risk to electrical safety it is not normally performed in this situation.

## ⚡ Testing of New Equipment

In New Zealand, new equipment used in workplaces (excluding shop stock) must be inspected and tested in accordance with AS/NZS 3760 prior to being put into service. In Australia, new equipment may be used without any testing being performed but must be fitted with a 'new to service' tag. This ensures that new equipment is eventually tested in accordance with the timeframe for environment of use.



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## ⚡ Frequency of Testing

Table 4 of AS/NZS 3760 has suggested time frames for testing and the criteria for making decisions on testing frequency. Table 4 is included for reference on the following pages but it should only be read and applied in conjunction with AS/NZS 3760, particularly Section 2.1. If you don't have a copy of the Standard information on how to purchase one can be found on page 6 of this booklet.

TABLE 4

Indicative testing and inspection intervals for electrical equipment

CAUTION: This page must be read in conjunction with AS/NZS 3760 as a whole, and particularly 2.1

Type of environment and/or equipment	Interval between inspection and tests				
	Equipment including Class I equipment, Class II equipment, cord sets, cord extension sets and EPODs	Residual current devices (RCDs)			Operating time and push-button test
		Push-button test - by user			
(a)	(b)	Portable (c)	Fixed (d)	Portable (e)	Fixed (f)
1 Factories, workshops, places of manufacture, assembly, maintenance or fabrication	6 months	Daily, or before every use, whichever is the longer	6 months	12 months	12 months
2 Environment were the equipment or <b>supply</b> flexible <b>cord</b> is subject to flexing in normal use OR is open to abuse OR is in a <b>hostile environment</b>	12 months	3 months	6 months	12 months	12 months
3 Environment were the equipment or <b>supply cord</b> is NOT subject to flexing in normal use and si NOT open to abuse and is NOT in a <b>hostile environment</b>	5 years	3 months	6 months	2 years	2 years

Type of environment and/or equipment	Interval between inspection and tests					
	Equipment including Class I equipment, Class II equipment, cord sets, cord extension sets and EPODs	Residual current devices (RCDs)				Operating time and push-button test
		Push-button test - by user				
(a)	(b)	Portable (c)	Fixed (d)	Portable (e)	Fixed (f)	
4 Residential type areas of: hotels, residential institutions, motels, boarding houses, halls, hostels, accommodation houses, and the like	2 years	6 months	6 months	2 years	2 years	
5 Equipment used for commercial cleaning	6 months	Daily, or before every use, whichever is the longer	N/A	6 months	N/A	
6 Hire equipment: Inspection Test and tag	Prior to hire 3 months	Including push-button test by hirer prior to hire N/A		N/A	N/A	12 months
7 Repaired, serviced and second-hand equipment	After repair or service which could affect electrical safety, or on reintroduction to service, refer to AS/NZS 5762					

## ✦ Further Help

Have you got more questions regarding testing and tagging of your appliances?

We can show you:

- ✦ How to set up servers and IT equipment so they do not need shutting down for testing.
- ✦ How to minimise testing without increasing risks.
- ✦ How to choose the best testing equipment for your specific industry.
- ✦ How to interpret and understand the Standard AS/NZS 3760. With a representative from Metrotest on the AS/NZS 3760 committee for over 10 years we have an intimate working knowledge of this Standard.

We are also happy to share our knowledge and experience of testing in many different environments.

You can call us with any queries or concerns on:

**(NZ) 0800 638 768**

or

**(AUS) 1800 789 973**

E-mail us at:

**[help@metrotest.com](mailto:help@metrotest.com)**

Or find us online at:

**[www.metrotest.com](http://www.metrotest.com)**