

Portable Appliance Testing
An Introduction



Introduction

The subject itself is quite complicated, while the regulations give scope for the Inspector to adopt inspection and recording methods to suit their situation.

This document has been written to help the uninitiated grapple with the underlying principles. It does not pretend to be a comprehensive instruction manual, and further research must be undertaken if you are planning to begin your own testing programme. The regulations require that tests should be undertaken by a 'competent person'. Training courses are widely available to provide the knowledge necessary to undertake all but the most complicated testing.

The testing procedures involve the use of voltages and currents that have the potential to cause harm to the Inspector. It is important to ensure that the equipment under test should not be touched during the testing process.

Do not conduct any PAT tests unless you have been trained. There are hazards as mentioned above, and without proper training you cannot be sure that your test results are valid.

What is a Portable Appliance?

Generally, portable appliances can be thought of as electrical goods that can be plugged into a power socket. This includes such items as FAX machines, toasters, drills etc. Testing incorporates 110 volt and 415 volt (3 phase) appliances, not just mains powered equipment (240 volt).

When is testing required?

Testing is a requirement whenever:

- Employees use electrical appliances
- Customers (ie non-employees) use electrical appliances
- When electrical goods are re-sold or hired
- When appliances have been repaired

What has to be done?

Under the Electricity at Work Regulations 1989 in particular, and other Health & Safety requirements, it is generally agreed that a planned regime of testing is the only way to show that a proper 'duty of care' has been taken to protect users from electrical shock and the hazard of fire.

Unless the equipment is to be tested every time it is to be used, you will need to keep records to show when testing has been carried out, test results and who did the testing.

Equipment that has passed its testing should be marked on the outside to show the date when re-testing is due. The equipment should not be used after this date. Showing the test date will have little value to the average user who will not have the knowledge to decide if the equipment is safe to use or needs to be tested before use.

Test intervals are determined by considering the nature of use, frequency of use and working environment. Equipment used in an office where it is not moved eg a FAX machine will not require testing as often as the kitchen kettle, which in turn may not require testing as often as an extension cable that is being used outdoors on a building site.

A principle of electrical safety is that there should be 2 levels of protection. Earth + insulation (an earthed appliance) are known as Class 1 appliances. Class 2 appliances are protected using insulation + insulation (a double insulated appliance).

Nearly all of the equipment we meet falls into either Class 1 or Class 2. We will concentrate on these here, but seek specialist advice if you feel that you have equipment that falls outside these classes.

All test equipment should be calibrated at intervals determined by the Test House. Without using calibrated test equipment the tests are all but meaningless. It is easiest to conduct the tests using equipment especially designed for such testing, but separate items of equipment can be used where the Inspector has sufficient knowledge.

Many PAT testers are designed to store and then download the test results to a PC, although manual testers can be used where results are recorded by the Inspector.

TESTING PROCEDURES

Before undertaking any electrical tests you should always conduct a visual inspection, looking for damage exposing live parts, missing insulation, damage to the earth conductor, loose cable grips, checking for correctly rated fuses etc. Only when you feel that the equipment has passed all visual checks should you move on to conduct the appropriate electrical tests. Please remember to switch on the item before conducting further tests.

Where possible, always use an RCD (Residual Current Device), with a trip value of no greater than 30mA, in the supply to the test equipment. This precaution should prevent any shocks sustained by the Inspector from proving fatal.

Class 1 Protection

This is the class of protection we meet most frequently. There are 2 tests that must be carried out, once a careful visual inspection has been conducted, and the equipment has been deemed fit for electrical testing.

EARTH BOND TEST

Must be completed with a successful test result before commencing the Insulation Test.

A substantial current is passed down the earth conductor, to the external metalwork and returns via the probe or crocodile clip which is connected to the test equipment. The value of the resistance is shown on the tester. When selecting a test point on the case, bear in mind that many decorative finishes are also poor conductors.

We are looking for a low value ($<0.1\Omega$). In the case of a failure, the earth return should present a lower resistance path to earth than that offered by the human body.

Where long cables are being tested, the Inspector will need to make an adjustment to the value returned by the test to allow for the resistance in the cable itself, before they can be sure that the nett resistance value is low enough to be considered safe. How this adjustment is calculated is outside the scope of this document.

A high test current is used so that should an earth conductor be too flimsy to provide protection under fault conditions, it will fail (melt) under test. This will allow the fault to be remedied before re-testing, and its eventual return to service.

Do not touch the equipment while conducting the test.

INSULATION TEST

A test voltage is applied, usually 500V DC, between the Earth conductor and Live & Neutral linked together.

We are looking for a high value ($>1M\Omega$), and results showing infinity (∞) are common.

Do not touch the equipment while conducting the test.

Class 2 Protection

How do you recognise Class 2 equipment? It should be marked with the symbol below.



The double box - symbolising the 2 levels of insulation - should be found on the outside of the equipment.

There is just one test that must be carried out, once a careful visual inspection has been conducted, and the equipment has been deemed fit for electrical testing.

INSULATION TEST

A test voltage is applied, usually 500V DC, between the Live & Neutral conductors linked together and the tip of a test probe. This probe is moved over the exterior of the case, paying particular attention to any openings for cooling etc.

We are looking for a high resistance value, and results showing infinity (∞) are common.

Do not touch the equipment while conducting the test.

There are other tests that may be undertaken at this stage. Often the choice of these extra tests is governed by the PAT tester in use.

FLASH TEST

This test should only be used where absolutely necessary, and by an Inspector who fully understands all the factors. This test is similar to the Insulation Test (for Class 1 and Class 2) but uses a much higher voltage. It can damage insulation on some equipment, and equipment using sensitive electronics, as in computer controlled devices, can suffer catastrophic failures.

Do not touch the equipment while conducting the test.

OPERATION

By checking that the equipment works, you can be sure that it was switched on when conducting the earlier tests.

Monitoring the current draw can be particularly useful to check that lanterns are using lamps of the anticipated rating.

This test has the added advantage of preventing a non-working item being returned to service!

Do not touch the equipment while conducting the test.

Re-tests

Equipment should not be used once it has passed the “DO NOT USE” date marked on the outside. You need to develop a procedure for identifying such items so that they can be tested before next use. It is perfectly acceptable to have items ‘out of date’ and untested if they are not being used. Once they need to be used, however, they need to be tested.

Repair work that affects the power or protection arrangements eg dismantling part of a case on a Class 1 item, will require testing before use.

Record Keeping

If you are using a PAT Tester that is designed to interface with a PC, the format of record storage and printouts will have been determined for you.

You will need to make your own arrangements if you are using a manual tester. Below are samples of the results tables you could use for Class 1 and Class 2 tests. The forms should also include details of the equipment and a means of identifying each item.

Identification can be achieved by using the manufacturer’s serial number or a labeling system of your own devising.

Test Date	Visual Inspection	Earth Bond mΩ	Insulation MΩ	Operation	Tested By
07/08/2001	✓	80	2.5	✓	Patrick Testa

Table 1 Sample Class 1 results table

Test Date	Visual Inspection	Insulation MΩ	Operation	Tested By
01/09/2001	✓	∞	✓	Patrick Testa

Table 2 Sample Class 2 results table



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