Portable Appliance Testing

Why do we PAT test?

We all use a large variety of electrical equipment each day. If all this equipment was used in accordance with the manufacturer's guidelines, it would most likely to be safe during its working life. However, this is not always the case. A lot of equipment is not treated as the manufacturer intended; rough handling, poorly trailing mains leads and often used in the wrong environment. These are just some of the common reasons why electrical equipment fails early on in its life.

Due to these facts, we need to implement a preventative maintenance programme. We need to prevent injury from faulty equipment, whether it is by electrical shock, by mechanical injury or even fire. To reduce the chance of problems arising from faulty equipment, we need to:

- Regularly check equipment for electrical or mechanical faults
- Review intervals between inspection and test
- Promote good record keeping
- Ensure equipment is suitable for the environment it is being used in
- Encourage users to visually check equipment and report faults.

The Electricity at Work Regulations (EAWR) does not require inspection and testing and they do not specifically mention portable appliances. However it does state that all electrical systems need to be maintained to prevent injury and danger. In summary, as danger is defined as "risk of injury", if there is the slightest of faults with the equipment that could have been prevented with regular maintenance, you could find yourself in serious trouble.

There are two main lines of defence in the safe use of electricity:

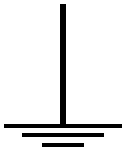
Insulation – Providing adequate isolation from live electrical parts so the user does not come into direct contact with them, preventing electrical shock. Insulation should have very high resistance.

Earthing – If the outer casing of electrical equipment is made from a conductive material, it is usual practice that it would be bonded to earth. The purpose of this is that under fault conditions, a large current would flow to earth via the casing and the circuit protective device (CPC) tripping/ blowing the protective device.

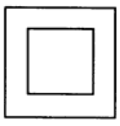
Appliance Classification

The class that the appliance is put in can identify the line of safety used.

Class I: Any exposed metalwork is 'bonded' to the supply earth. An earth symbol can often be marked on a Class I appliance. Examples of Class I appliances are fridges, toasters and kettles.



Class II: These rely on two lots of insulation to protect the user. That is, any metalwork that the user may touch, which may potentially become live, is separated from any dangerous voltages by two distinct layers of insulating material. These appliances do not have an earth lead fitted. Examples of Class II appliances would be lawn mowers, hedge trimmers and table lamps. Below is the symbol that should be displayed on Class II appliances.



Some appliances use a combination of these two methods, often called **ClassI/ClassII** appliances.

Essential tests that should be carried out when testing portable appliances are:

- Visual Inspection
- Earth Bond Test (Class I appliances only)
- Insulation Test

VISUAL INSPECTION

This test is the most important test. Statistics have shown that it reveals approximately 90% of faults on portable appliances. Visual inspections can be carried out on three different occasions:

- User Checks – visual checks carried out by user. Records are only kept if faults are found.
- Formal Visual Inspections – carried out by a competent person. All results are logged.
- Combined Inspection and Testing – carried out by a competent person. All results are logged.

EARTH BOND TEST

To ensure any exposed metalwork on the appliance is securely connected to earth. During the test, a high current (typically 25A) is passed through a circuit comprising the appliance earth conductor of the supply lead, the exposed metalwork and the tester bond lead. If the connections are good, the resistance of the circuit will be low.

INSULATION TEST

To ensure that a breakdown of the insulation cannot occur between any live parts within the appliance and parts of the casing that the user may touch. The appliance tester must be capable of performing a 500V d.c test across load resistances of 2MOhm and greater, otherwise the test is invalid. This test can be performed as many times as you like without causing undue stressing to the appliance under test.

There are some optional tests, which may be performed once the essential tests have been completed. These tests are not always available as standard on all PAT testers.

Flash – not to be routinely carried out and should only be performed by fully trained personnel, due to high voltages used. Flash testing can stress the appliance therefore if performed regularly; flash testing could deteriorate the insulation. Flash testing would typically be used when an appliance has been completely overhauled or at manufacture.

Load and Operation – can be useful for routine testing. The portable appliance tester will run the appliance for a pre-determined amount of time. During this time, it will typically carry out two tests:

- **Load –** During the test, the tester will check the rating (in VA) of the appliance. This can be a useful early indicator of mechanical wear, such as worn bearings.
- **Touch Current Test (earth leakage) –** very good substitute if there is any doubt whether an insulation test can be applied. The test compares how much current is flowing in the live wire against what is flowing in the neutral. Any difference must be leakage to earth; regardless of what path it takes.

Testing should be systematically documented with all the results recorded. Whether this is by test sheets or software packages. Each appliance should be clearly labelled with the next test date being displayed to ensure testing is done at the due time.

Below is a table showing the portable appliance testers Megger have to offer.

	PAT 32	PAT4DV	PAT4DVF
Functions			
Fuse check	■	■	■
Circuit test	■	■	■
Insulation	■	■	■
120V appliances		■	■
230V appliances	■	■	■
Extension lead test adaptor	option	option	option
Earth continuity	■	■	■
10A Earth bond	■	■	■
25A Earth bond	■	■	■
Operation test		■	■
Lead test		■	■
Flash test			■
Earth leakage		■	■
Test sockets BS1362/BS4343 (UK)	■	■	■
Features			
Automatic operation		■	■
Client/Location/Results database		■	■
RS232 download		■	■
Printer port		■	■
Full keyboard		■	■
Digital display	■	■	■
Backlight		■	■
Bar code reader		option	option
Results printer		option	option