

Guide To PAT Testing

Below is a guide to Portable Appliance Testing as laid out in the Code of Practice for In-Service Inspection and Testing of Electrical Equipment compiled by the Institute of Electrical Engineers.

Portable Appliance Testing has been developed as a convenient and complete method of testing electrical appliances to ensure that they are safe and with the correct maintenance schedule and test results ensures you to comply with your legal obligations.

PAT testing is often seen as a process of "going through the motions" for some companies and often many companies fail to have it carried out at all.

As a company we have tested many thousands of appliances and often attend premises to find appliances in dangerous conditions. The risks to employees, employers and businesses is very real, not only from the risk of electrical shock but also the risk of fire caused by faulty appliances. How many times do you read in the newspaper that a life has been lost or a home or business has been destroyed and that the cause was an electrical fault ?

PAT testing is an important part of any health & safety policy. Although there is no direct law at present stating that Portable Appliance Testing must be carried out you have a legal obligation under the following regulations to ensure that your electrical equipment is safe.

Legal Requirements

There are four main regulations which cover health and safety law

The Health & Safety at Work Act 1974 puts the duty of care upon both the employer and the employee to ensure the safety of all persons using the work place.

The Management of Health & Safety at Work Regulations 1999 state:

"Every employer shall make suitable and sufficient assessment of:
the risks to the health and safety of his employees to which they are exposed whilst at work"
and
to ensure the health and safety of persons not in his employment arising out of or in connection with the conduct by him or his undertaking."

The Provision and Use of Work Equipment Regulations 1998 state:

"Every employer shall ensure that work equipment is so constructed or adapted as to be suitable for which it is provided."

PUWER 1998 covers most risks that can result from using work equipment. With respect to risks from electricity, compliance with the Electricity at Work Regulations 1989 is likely to achieve compliance with the PUWER 1998.

PUWER 1998 only applies to work equipment used by employees at work. This includes all work equipment connected to a source of electrical energy. PUWER does not apply to fixed installations in a building such as the building internal wiring. The electrical safety of which is dealt with by the Electricity at Work Regulations.

The Electricity at Work Regulations 1989 state:

"As may be necessary to prevent danger, all (electrical) systems shall be maintained so as to prevent, so far as reasonably practicable, such danger."

"System' means an electrical system in which all the electrical equipment is, or may be, electrically connected to a common source of electrical energy and includes such source and such equipment"

"Electrical Equipment' includes anything used, intended to be used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy."

Who should carry out the Testing?

The IEE Code of Practice states, those carrying out the inspection and testing must be competent to undertake the inspection and, where appropriate, testing of electrical equipment and appliances having due regard of their own safety and that of others.

The tester must have an understanding of the modes of electrical, mechanical or thermal damage to electrical equipment and appliances and their flexes which may be encountered in any environment.

Training must include the identification of equipment and appliance types to determine the test procedures and be able to recommend the frequency of inspection and testing. Persons testing must be familiar with the test equipment used and in particular their limitations and restrictions so as to achieve repeatable results without damaging the appliance through testing.

Types of Equipment

Although the term used for testing is portable appliance testing it is not only your "portable" appliances which are required to be tested as laid out in the code of practice.

The reason why PAT testing is carried out is to reduce the risk of danger from electrical shock and fire caused by faulty appliances.

After all you have the same risk of receiving an electrical shock from a piece of equipment that is movable or static as you have a piece of portable equipment.

The IEE Code of Practice gives guidance on the various equipment types. They then use this guide to suggest how often you should re-inspect equipment according to the type of business they are operating within.

Portable appliance

An appliance of less than 18kg in mass that is intended to be moved whilst in operation or an appliance which can easily be moved from one place to another, e.g. vacuum cleaner, toaster, food mixer, etc.

Movable equipment

This equipment is either:

18 kg or less in mass and not fixed,

or

Equipment with wheels, castors or other means to facilitate movement by the operator as required to perform its intended use.

Hand Held equipment or appliances

This is portable equipment intended to be held in the hand during normal use, e.g. hair dryer soldering iron.

Stationary equipment or appliances

This equipment has a mass exceeding 18kg and is not provided with a carrying handle, e.g. refrigerator, washing machines.

Fixed Equipment or appliances

This equipment or an appliance which is fastened to a support or otherwise secured in a specific location many of these appliances are mainly fed from a hard wired cable directly into a fused spur unit, e.g. bathroom hand driers etc.

Information technology equipment

Information technology equipment includes electrical business equipment such as computers and mains powered telecommunications equipment, and other electronic equipment, such as printers, photocopiers, fax machines and monitors but to name a few.

Frequency of Testing

The Code of practice suggests testing frequencies based upon both the type of equipment, the class of equipment and the location or type of business in which the equipment is used. They have based their frequencies upon factors such as:-

Environment - If equipment is installed in an environment where it may suffer damage such as on a construction site then the frequencies of testing would be more often than in an office for example where equipment is not subjected to the elements.

Users - if the users report damage as and when it becomes evident, hazards will be avoided. Conversely, if equipment is likely to receive unreported abuse, more frequent inspection and testing is required

Equipment construction - the safety of a Class 1 appliance is dependant upon a connection with earth of the electrical installation. If the flexible cable is damaged the connection with earth can be lost. Safety of Class 2 equipment is not dependent upon the fixed electrical installation as Class 2 equipment does not require an earth connection for the purpose of appliance safety.

The equipment type - appliances which are hand held are more likely to be damaged than fixed appliances. If they are Class 1 the risk of danger is increased, as the safety is dependant upon the continuity of the protective conductor from the plug to the appliance.

Testing Procedure

In-Service testing involves
Preliminary visual inspection
Earth continuity tests (for Class 1 equipment)
Insulation testing (Which may sometimes be substituted by touch current measurement)
Functional checks.

Electrical testing should be performed by a person who is competent in the safe use of the test equipment and who is able to interpret the test results obtained.

Visual Inspections

Formal visual inspections should only be carried out by persons competent to do so. The results of the inspection must be recorded.

The following must be considered when carrying out the inspection

Suitability of the equipment for the use and environment

The equipment should be assessed for its suitability for the environment or the nature of the work being undertaken. When the work environment is harsh or hazardous particular care needs to be taken when selecting the equipment and assessing the frequency of inspection and testing.

Good Housekeeping

A check should be made to ensure the equipment is installed and is being operated in accordance with the manufacturers instructions. Notwithstanding the manufacturers instructions, the following are examples of items which should be checked:

- (a) Cables located so as to prevent damage occurring.
- (b) Means of disconnection/isolation readily accessible
- (c) Adequate ventilation and cooling and that ventilation points are not obstructed.
- (d) Cups, plants and work material are placed correctly to prevent spillage
- (e) Equipment so positioned as to avoid strain on the cables or cords.
- (f) Equipment is being operated with the covers in place and any doors are closed
- (g) No Indiscriminate use of multi-way adaptors and trailing socket outlets.
- (h) No unprotected cables run under carpets

Disconnection of equipment

The means of isolation from the electricity supply must be readily accessible to the user, i.e. in normal circumstances it must be possible to reach the plug and socket without to much difficulty.

The condition of the equipment

Before inspecting equipment the users should be asked if they are aware of any faults and if the equipment works correctly.

The following items need to be inspected:

- (a) The flexible cable
- (b) The socket outlet (if known), or flex outlet
- (c) The appliance - does it work and is it free from cracks or damage
- (d) The plug

Some of the following checks may not be possible for equipment fitted with a non-rewirable plug

Plug Top Checks

- (a) Check detachable power cords to Class 1 equipment incorporates an earth cable
- (b) Check for signs of overheating
- (c) Internal inspection; cord anchorage, wired correctly, connections are tight
- (d) If non-rewirable plug; cord anchorage
- (e) Correct size fuse is fitted with British Standard or ASTA markings
- (f) Plug cover properly fitted
- (g) Check the flexible cable connections and anchorage at the equipment, if practical

Testing Procedure

The electrical testing procedure should only ever take place after an appliance has successfully passed the visual inspection. All automatic Portable appliance testing equipment follows this procedure.

Earth bond continuity tests
Insulation resistance testing
Functional checks

Earth Bond Test (Class 1 equipment only):

Readings should be less than $0.1+R$ Ohms (where R is the resistance of the cable)

Tested at a current of 1.5 times the rating of the fuse and no greater than 25A for a period of between 5 and 20 seconds or with a short-circuit test current within the range 20mA to 200mA.

Insulation Resistance Test (may be substituted for the Touch current method)

The applied test voltage recommended is 500 Vdc

Class 1 heating equipment greater than 3kW 0.3M Ohms

Class 1 All other equipment 1M Ohms

Class 2 Equipment 2M Ohms

Class 3 Equipment 250k Ohms

Touch current method

Class 1 Handheld Appliances 0.75mA

Other Class 1 Appliances 3.5mA

Class 2 Appliances 0.25mA

Optional Tests:

More advanced tester will carry out load/run tests and also download test results to a PC

Operation / Load test The appliance is powered from the 240 v ac supply and a power consumption reading is taken from the appliance this is usually displayed in Watts or VA (Volt Amperes) and should be compared to the wattage rating stated upon the appliance label.

Flash Test

The flash test is no longer a requirement and is only recommended to be carried out upon repair of an appliance i.e. power tools.

Record Keeping

Records of tests along with test results should be kept throughout the working life of an appliance. Without such records duty holders cannot be certain that the inspection and testing has actually been carried out. If an unfortunate incident should occur then records of test results could prove that you had done all "as far as is reasonably practical" in preventing danger.

Records should include:

A register of all Equipment

A record of formal visual inspections and tests

A repair register

A register of faulty equipment

Labeling

On successful completion of tests an label should be attached to the appliance indicating:

Appliance Number

Whether the unit has passed or failed

Test Date

Next test due date

Testers identity