

Portable Appliance testing (PAT)



Information sheet

Portable Appliance Testing (PAT's):

Basic Testing Procedures

General:

All items should be tested in isolation. That is: Any equipment interconnected by means of mains or data cables will first have these interconnections removed (this includes the disconnection of "networked" equipment from the network cabling system). If necessary, operations must be requested to "shutdown" systems prior to testing.

The portable appliance tester must be plugged into a 13A socket outlet and the correct date set by following the prompts on the display panel and using the appropriate keys.

The appliance and site codes should be entered for each test.

NOTE: Hard wired equipment should be disconnected from the associated outlet, having first isolated the mains supply at a suitable point. Testing should take place with a the "SAFE BLOC (type)" wire to plug top adapter.

1) EARTH BOND IMPEDANCE TEST - For CLASS 1 appliances the 8 Amp earth bond terminal on the tester will be utilized for appliances fused up to 3 Amps and the 25 Amp terminal for appliances fused between 5 and 13 Amps.

The earth impedance limit should be set according to the size and length of the connecting flexible cord. Typical nominal resistance's values are given in Appendix 3.

NOTE: The British Standards for most IT. Equipment specify an earth bond impedance of 0.1 Ohms. This figure does NOT include the additional impedance/resistance of a flexible cord and plug top. Generally speaking a reading of 0.25 Ohms or less can be considered within acceptable limits for equipment using a 2 metre length cord with 0.5 square millimetres or greater conductors.

A tests engineer should take sufficient care when connecting the earth clip to CLASS 1 appliances to ensure that proper contact is made and thereby reduce the possibility of incorrectly failing an appliance (earth connections can be looked for with a simple Ohm Meter prior to testing with a PAT). Prior to failing any items as a result of an abnormally high earth impedance, the test engineer should first check that all associated equipment has been disconnected (thus removing potential parallel earth paths) and that the Test clip is securely attached to the item in question. It is recommended that this test be repeated at least three times to eliminate such problems.

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2) INSULATION RESISTANCE TEST - Unless the equipment manufacturer/supplier specifies otherwise, insulation resistance testing (at 500V dc) will take place with the appliance mains switch in the "OFF" position. This is due to the fact that the majority of IT. Equipment power supplies utilize filters and protective devices. These are generally rated at 240 Volts, or just above, and tend to be connected across Live and Neutral and earth. Thus a standard PAT insulation test would greatly over stress these components and would in fact reduce the longevity and safety of the appliance. It may, in some cases, be possible to remove these "sensitive" components prior to testing, but generally speaking this is considered impracticable.

3) LOAD TEST - A load test should be carried out to protect the test engineer from possible hazards produced by a very low impedance being present between Live and Neutral during the OPERATION TEST. The test should be performed with the equipment turned "ON", and failure will halt further testing.

4) OPERATION TEST - An operation test should be performed to ensure that the equipment under test does NOT draw excessive current (the results obtained will not differ significantly from the manufacturer specification). Abnormally low currents will indicate open circuits or ruptured fuses which will need to be reported/repared.

5) EARTH LEAKAGE TEST - This test should take place to measure the total current from Live and/or Neutral to earth under operating conditions. A result of not greater than 3.5 mA will be recorded.

NB: Certain noise suppression components may give rise to a failure result. The equipment manufacturer/supplier should be consulted where there is any doubt

Failures:

For any equipment failing Electrical Safety tests, a procedure should have be previously discussed with the test engineer as to the action required of making safe any equipment. Should it be decided to remove any equipment from service, the flexible cord will be turned around the plug and secured with a nylon cable tie in such a manner so that the plug top cannot be inserted into a socket outlet. A "FAILED - DO NOT USE" label should be affixed in a prominent position on the equipment and the Premises Manager and Network Services Department notified immediately. A "FAIL" status will be entered against the item on the Equipment Register. A list of all FAILED items should be presented to the facilities manager.

On Site Repairs:

Where a plug tops, fuses or flexible cords are replaced/repared, the appropriate entry should be made on the equipment register. The repairs will be carried out prior to electrical safety testing unless other irreparable defects are apparent which would cause the appliance to fail.

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Downloading Results and Preparing Reports:

Results should be down loaded following the set procedures and all entries will be checked for their integrity.

Current results will be checked against previous years results where applicable. Where significant deterioration is apparent the facilities manager should be informed, in writing, via the final report.

Upon completion of the testing phase, final printed versions of the equipment register and all test results and notes will be presented to the Facilities Manager (in the form of a report) which should be kept on site for presentation to Local Authority Inspectors.

Specialist advice should be obtained before taking or refraining from taking, action based on comments contained in this note which is only intended as a briefing note.

Fixed Wiring Test Procedures

Visual Inspection:

- (i) Joints and Connections It is not practicable to inspect every joint and termination in an electrical installation. Nevertheless a sample inspection should be made. An inspection should be made of all accessible part of the electrical installation e.g. switchgear, distribution boards, and a sample of luminaire points and socket-outlets to ensure that all terminal connections of the conductors are properly installed and secured. Any signs of overheating and conductors, terminations or equipment should be thoroughly investigated and included in the Report.

Switching Devices:

It is recommended that a random sample of a minimum of 10 per cent of all switching devices is given a thorough internal visual inspection of accessible parts to assess their electrical and mechanical conditions.

Protective Devices:

The presence, accessibility, marking and condition of devices for electrical protection, isolation and switching should be verified. It should be established that each circuit is adequately protected with the correct type, size and rating of fuse or circuit-breaker. The suitability of each protective and monitoring device and its overload setting should be checked.

Conductors:

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The means of identification of each conductor, including protective conductors, should be verified. The deterioration of, or damage to, conductors and their insulation, and their protective coverings, if any, should be noted.

Marking and Labelling:

The labelling of each circuit should be verified. Notices or labels are required at the following points and equipment within an installation :

- (i) at the origin of every installation
- (ii) where different voltages are present
- (iii) earthing and bonding connections
- (iv) Residual Current Devices (r.c.d.'s)

Continuity of Protective Conductors and Earthed Equipotential Bonding :

If any electrical installation can be isolated from the supply it is permissible to disconnect the protective and equipotential conductors from the main earthing terminal in order to verify their continuity. The sequence of operation needed for initial testing can be carried out safely on an existing installation if it is isolated from the supply. Where an electrical installation cannot be isolated from the supply the protective equipotential conductors must NOT be disconnected as, under fault conditions, the exposed and extraneous-conductive-parts could be raised to a dangerous level above earth potential.

The 'combined' integrity of the conductors shall be established by continuity/earth fault loop impedance tests. The former to establish continuity of conductors and the latter to establish and confirm an appropriate disconnection time in the event of an earth fault.

Polarity:

Test shall be made to verify that:-

- (i) the polarity is correct at the meter and consumer unit/distribution board
- (ii) single-pole control and protective devices are connected in the phase conductor only
- (iii) conductors are correctly connected to socket-outlets and other accessories/equipment
- (iv) centre-contact bayonet and Edison-type screw lamp-holders have their outer or screwed contacts connected to the earthed neutral conductor
- (v) all multi-pole devices are correctly installed

Earth Fault Loop Impedance:

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Where protective measures are used which require a knowledge of earth fault loop impedance, the relevant impedance shall be measured, or determined by an equally effective method.

Earth fault loop impedance tests are carried out at the locations indicated below:-

- (i) at the origin of each installation and at each Distribution Board
- (ii) fixed equipment and socket-outlets
- (iii) 10 per cent (on a random basis) of all luminaires, with a minimum of one luminaire, preferably the further one from the consumer units, for each circuit of any building
- (iv) at any location which may be exposed to exceptional damage or deterioration or represent a special hazard at the furthest point of every radial circuit

Where the installation incorporates an R.C.D., the value of earth fault loop impedance obtained in the test should be related to the nominal residual operating device.

Insulation Resistance:

Insulation resistance tests should be made on a dead circuit and any electronic equipment which might be damaged by application of the test voltage must be disconnected or isolated. The insulation resistance should be measured between each live conductor and earth and should not be less than 0.5 megohm. Where practicable the tests are applied to the whole of the installation with all fuse links in place and all switches closed. Alternatively, the installation may be tested in parts.

Operation of Devices for Isolation and Switching:

Where means are provided in accordance with the requirements of the Regulations for isolation and switching, a 10 per cent sample shall be operated to verify their effectiveness and checked to ensure adequate and correct labelling.

Operation of Residual Current Devices to B 4293:

Where protection is provided by an R.C.D., the effective operation of each R.C.D. shall be verified by a test simulating an appropriate fault condition independent of any test facility incorporated in the device, followed by operation of the integral test device. The nominal rated tripping current for protection of a socket-outlet for use with equipment outdoors or physically installed outside the general installation equipotential zone must not exceed 30 mAmp (0.03 amp).

In certain situations such as high risk areas, 10 mAmp RCD's may be appropriate for the particular installation.

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Testing Frequency

Notes:

1. Particular attention must be taken to comply with S1 1988 No. 1057. The Electricity Supply Regulations 1988 (as amended).
2. S1 1989 No. 635. The Electricity at Work Regulations 1989. (Regulations 4 & Memorandum).
3. BS 5266
5. Other intervals and recommended for testing operation of batteries and generators.
6. BS 5839
7. Local Authority Conditions of Licence.

<i>Type of installation</i>	<i>Maximum Period Inspections</i>
General	
Domestic	10 years
Commercial	5 years
Educational establishments	5 years
Hospitals	5 years
Industrial	3 years

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