

In-Service Inspection and Testing of Electrical Equipment

by Paul Bicheno

In-service inspection and testing of electrical equipment, commonly known as 'Portable Appliance Testing', is a vital part of making sure that the various types of electrical equipment within a work environment are maintained in a safe condition. Many questions are put to the IET on this subject so this article looks at discussing some of these, including legislation related to in-service inspection and testing, training required to carry out formal inspection and testing, test equipment and implementation of an inspection and testing programme.

What is the Legislation for in-service inspection and testing of electrical equipment?

In-service inspection and testing is not a specific legal requirement. Regulation 4(2) of the Electricity at Work Regulations 1989 states 'As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far is as reasonably practicable, such danger'. Electrical equipment forms part of an electrical system and as such would need to be maintained in some way to ensure safety. However, it is recognised that regular in-service inspection and testing of electrical equipment is required to maintain equipment and thus comply with this regulation. Anyone who inspects and tests an electrical equipment system must be competent to undertake such work as they control that part of the electrical system while carrying out the maintenance activity.

The Provision and Use of Work Equipment Regulations 1998 requires work equipment to be constructed in such a way that it is suitable for the purpose for which it is to be used. Regulation 4(1) states: 'Every employer shall ensure that work equipment is so constructed or adapted as to be suitable for the purpose for which it is used or provided'. Regulation 5(1) is specifically related to

maintenance and states: 'Every employer shall ensure that work equipment is maintained in an efficient state, in efficient working order and good repair'. In this regulation 'efficient' means the condition of the equipment in relation to health and safety. Therefore, in-service inspecting and testing of electrical equipment should be included within the maintenance regime for a work environment.

What training is required to carry out in-service inspection and testing?

Regulation 16 of the Electricity at Work Regulations requires persons to be competent to prevent danger and injury. Therefore persons performing inspection and testing of electrical equipment should be trained to do so in order to make sure of their own safety and the safety of others. The training should cover all the appropriate technical knowledge required to perform the activity including the understanding of the results generated.

There are specific training courses related to in-service inspection and testing of electrical equipment available from a number of electrotechnical training providers, which are typically one day courses. City and Guilds has a formal qualification in this subject, namely the Level 3 Certificate for the Code of Practice for In-Service Inspection and Testing of Electrical Equipment (2377). This has two specific qualifications. The first is the Level 3 Certificate in Management of Electrical Equipment Maintenance. As the title implies this qualification is aimed at managers and administrators of work places that need to implement an inspection and

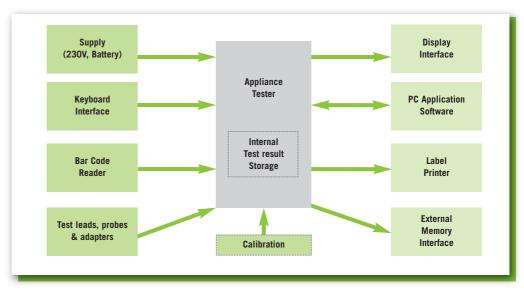


Fig. 1 Block diagram of typical appliance tester interfaces

testing regime. This would equally apply to organisations providing maintenance and testing services. The second is the *Level 3 Certificate for the Inspection and Testing of Electrical Equipment*. This qualification is aimed at persons undertaking and recording the inspecting and testing of electrical equipment.

Some training providers offer courses that lead to gaining the City and Guilds qualifications. Others offer courses that are aligned to the IET Code of Practice for Inservice Inspection and Testing but are not a formal qualification. As a minimum a course syllabus should be confirmed that it aligns to the Code of Practice. When choosing a training course it is worth considering that the electrical industry recognises the formal City and Guilds qualifications e.g. 2382 for requirements for electrical installations BS 7671 and 2391 certificate in inspecting, testing and certification of electrical installations as part of the evidence for competency. Therefore it would seem logical to choose a course that leads to gaining the appropriate 2377 qualification. It is also worth

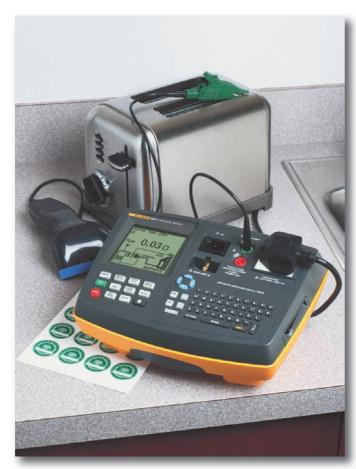
checking the types of appliance test equipment a training provider would use during a course to align with what an organisation already uses or intends to use, so that the training directly relates to what will be used in practice. Some training providers offer customized courses in this respect.

What PAT tester functionality and accessories are available?

Figure 1 shows a block diagram of the typical appliance tester interfaces. Manufacturers typically produce a range of appliance tester products that have various levels of interfaces and functionality aimed at small to large volume testing. The standard related to this test equipment is BS EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use. The appliance test units can be powered via a 230 V supply or a battery pack and so can be a desktop unit or hand held unit. The units have a keyboard interface for entering appliance details along with specific buttons for selecting the various test functions. There are various display

options from alphanumeric to graphical displays. The units with graphical displays include useful graphical help for the various tests. Units also now have various sizes of onboard memory to enable storage of a number of appliance details and associated test results. Bar code readers are available as an input device. This enables the user to read an associated appliance label that has details of the appliance. This means the user does not have to manually enter details again where it is included in a continuous testing regime.

The bar code labels can be generated via a dedicated label printer used as an output device. The printed labels would have an appliance number and bar code that includes the relevant appliance details. There are also various other types of appliance labels available. There are simple combinations of write-on pass and fail adhesive labels, plugtop specific labels, cable lead labels and equipment tags. Also, some of these include the provision of laminates to protect the label information. There are also appliance register sheets and appliance certificate of inspection and



test sheet sets that can be used for manual recording. There are a number of leads and adapters available to enable an array of appliances to be tested including 13A BS 1363 plug to IEC socket, extension lead and various 13A BS 1363 plug to industrial type sockets. Some units include an external memory interface where data can be copied to a memory device for copying to a central data system. There is also powerful PC application software packages specifically designed to interface with the test units. These offer the functionality to store appliance details and tests results, customer details and equipment registers, issue testing certificates and management of the testing schedules. PDA versions are also available. Manufacturers also normally offer a calibration service for the appliance test unit.

The testing units have a number of test functions including the following;

- Earth continuity testing (class I)
- Insulation testing
- Functional testing Load/leakage or touch current testing
- Built in fuse check

Some units include functionality to enable a test to run continuously to enable the user to check various parts of the appliance like flexing a lead throughout its length rather than just a one shot test. This is also useful when conducting a current or load test on an appliance that has a long start up period e.g. some information technology equipment.

Test units also have functionality for carrying out testing in a manual or automatic mode. Manual test mode is where a particular test is initiated by the user as a one shot test. Automatic mode is where the user selects a predefined test routine, typically for class I or II type appliances. Prompts are included at appropriate points in the sequence. These are useful for semi-skilled type users as they provide the various prompts on the unit display interface.

Implementing in-service inspection and testing An inspection and testing

regime should include a process that comprises user checks, formal visual inspection and formal inspection and testing of the electrical equipment. Depending on the type of organisation this regime can be implemented as an ongoing maintenance program or at a point prior to the change of ownership of electrical equipment. The regime can be implemented by using an internal organization resource or utilising an external organisation that offers an inspection and testing service. The regime will need to include the use of the appropriate testing equipment, trained personnel and a system to formally record inspection and testing. The record keeping system should include an equipment register, equipment formal inspection and test records, equipment labelling, faulty equipment register, equipment repair register and test instrument records. Labelling of equipment should be used to indicate that it requires routine inspection and testing along with the safety status. This should also include information to ascertain when it is next due for testing. It is also important to label equipment that has been deemed faulty so that it is

clear that it should not be used.

Although the Electricity at Work Regulations 1989 does not have a specific requirement to keep records, the HSE Memorandum of guidance (HSR25) advises that records of maintenance, including the test results should be kept throughout the life of an electrical system. This serves two purposes. The first enables the duty holder to show that electrical equipment has been maintained and also enables the effectiveness of the maintenance regime to be monitored. The records could also be used to make further judgements on whether the intervals between inspection and testing can be altered.

The legislation does not set statutory periods for formal visual inspection and testing. However, the IET Code of Practice and HSE publications include guidance for recommended initial intervals related to user checks, formal visual inspection and combined inspection and testing for different types of electrical equipment in different environments. These should not be interpreted as what the law requires but as a recommended starting point.

The appliance test unit itself should also be included within a maintenance program to make sure that the results produced remain within specification, e.g. via an in-house or external calibration service.

Within a business or organisation there should be regular team meetings that includes health and safety matters like electrical safety. This can be used for managers to brief employees on electrical safety matters and just as importantly for employees to highlight any electrical safety issues that can then be passed to appropriate safety

department, engineering department or management to deal with. Users should be briefed on the use of electrical equipment. This should include checking that the electrical equipment safety status is clearly identified via a label and to carry out basic user checks prior to use. The second point is important since although equipment could be labelled correctly as safe, it could have been done some time ago so the user should not just rely on the label.

Bigger organisations have the benefit that various groups of job functions are available to implement an efficient system. For example, with the advent of numerous items of IT equipment, an IT department can have personnel trained to carry out the initial checks as they would normally be carrying out other activities on the

equipment before being put into use. Subsequent checks could then be carried out by engineering departments. In addition many organisations implement multi-skilled training programmes where non electrical personnel are also formerly trained to carry out the inspection and testing, thus increasing the level of maintenance.

It is worth highlighting that domestic premises have many items of electrical equipment that other than when new, are not subjected to ongoing inspection and testing. Therefore an inspection and testing regime could be implemented that would aid making the home safer. There are organisations that offer inspection and testing services for electrical equipment in both business and landlord premises that could easily offer the same service for domestic premises. These

companies also offer microwave oven leakage testing which could also be included.

Additional information

The IET publish the Code of Practice for In-Service Inspection and Testing of Electrical Equipment (3rd edition). This can be obtained from IET publishing (http://www.theiet.org/publishi ng/books/wir-reg/cop.cfm). The model forms for in-service inspection and testing included within this publication are available to download from the IET website via the following link www.theiet.org/publishing/ wiring-regulations/forms. They are included within the document 'BS 7671:2008 forms' that can be downloaded from this page.

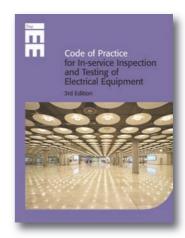
The Health and Safety
Executive publish guidance
related to in service inspection
and testing of electrical
equipment obtainable
from HSE books
(www.hsebooks.co.uk) as
follows:

Maintaining portable and transportable electrical equipment (HSG107) Maintaining portable electrical equipment in offices and other low-risk environments (INDG236)

Maintaining portable electrical equipment in hotels and tourist accommodation (INDG237)

Also Memorandum of guidance on the Electricity at Work Regulations 1989 (HSR25)

The IET offers the following two courses relating to In-service inspection and testing of electrical equipment; Certificate of Competence Management of Electrical Equipment Maintenance (City and Guilds 2377-100)



Certificate of Competence for the Inspection and Testing of Electrical Equipment (City and Guilds 2377-200) Further information on these courses can be obtained via the IET courses unit, telephone 01438 767289 (www.theiet.org/careers/ courses/electrical/index.cfm)

Specific information on the City and Guilds 2377 qualification can be obtained from their website www.cityandguilds.com.

The following list details of some equipment manufacturers of portable appliance test equipment:

Fluke (UK) Ltd

www.fluke.co.uk

(Robin Electronics

www.robinelectronics.co.uk)

Kewtech

www.kewtechcorp.com

Martindale Electric

www.martindale-electric.co.uk

Megger

www.megger.com/uk

Metrel

www.metrel.si

Seaward

www.seaward.co.uk

(Clare www.clare.co.uk)

Transmille

www.transmille.co.uk

The following link can be used to find companies that offer in-service inspection and testing, training and equipment: www.patdirectory.org.uk ■

