# Preventative role of PAT testing

*By J Wallace, Seaward Group*

*There is an onus on the duty holder to ensure that equipment in the workplace is maintained to prevent danger. It is this obligation that introduces an implied requirement to perform periodic inspection and testing because without such actions, the duty holder will be unable to establish the potential dangers posed by faulty or unsafe appliances.*

The recommendation of the recent Löfstedt Review that the health and safety executive further clarifies the requirement for portable appliance testing (PAT) promises to bring some much needed clarity to a situation that has long been the subject of debate and discussion.

In particular, any moves to encourage a sensible and common sense approach to PAT should also help to improve professional standards in the industry for the benefit of all involved in maintaining a safe working environment. The periodic testing of portable electric appliances has been performed in the UK for over three decades and within certain sectors it was common practice before the introduction of the Electricity at Work Regulations 1989.

The Electricity at Work Regulations 1989 sets out to raise the standards of safety within industry and commerce, but nowhere in the documentation is there a specific requirement for the testing of portable appliances. There is, however, an onus on the duty holder to ensure that equipment in the workplace is maintained to prevent danger. It is this obligation that introduces an implied requirement to perform periodic inspection and testing because without such actions, the duty holder will be unable to establish the potential dangers posed by faulty or unsafe appliances.

## Existing guidance and practices

To clarify the issue of in-service periodic inspection and testing of electrical appliances, both the Health and Safety Executive and the IET (formerly IEE) have produced guidance documents, based on the advice and experience provided by experts in the various sectors.

Using a process of risk assessment, a duty holder is able to refer to these guidance documents to determine whether inspection and testing is appropriate and, if so, how often this should be taken.

This rationale is generally regarded as sound and realistic by the majority. However, there are some situations where misinformation and an over-zealous interpretation of the requirements have led to claims of over compliance.

## Who performs PAT?

An analysis of the data associated with the purchase of PAT instrumentation shows that the type of users is broken down into two groups. Around 45% of users are individual organisations or companies who perform their own in-house testing and 55% are electrical contractors and specialist PAT companies providing a test service on a sub-contract basis. Further investigation of the differences in testing regimes between different types of user, shows that organisations that perform their own tests tend to integrate portable appliance inspection and testing into broader health and safety and asset management policies.

## Rates of test failure

The extent of portable appliance test failure is illustrated by an industry analysis of 80 000 portable appliance inspection and test reports that have been performed by both in-house test engineers and contract test companies across a wide range of industry sectors.

Detailed analysis of 43 000 records from organisations in different sectors showed an average electrical appliance failure rate of 1,7% - indicating that the presence of over 1 300 potentially dangerous appliances in the full sample would not have been discovered if inspection and testing had not been carried out.

| Office | Total Tests | Total Fails | % Fails |
|---|---|---|---|
| Housing Association | 4 356 | 31 | 0.71 |
| Local Authority A | 8 713 | 41 | 0.47 |
| Solicitors | 752 | 8 | 1.06 |
| Local Authority B | 2 450 | 36 | 1.46 |
| | **16 271** | **116** | **0,71%** |

| Industrial | Total Tests | Total Fails | % Fails |
|---|---|---|---|
| Process Industry A | 1 539 | 167 | 10,85 |
| Car Manufacturer | 1 018 | 10 | 0,98 |
| Engineering Company A | 158 | 38 | 24,05 |
| Factory Workshop | 295 | 7 | 2,37 |
| | **3 010** | **222** | **7,4%** |

| Education | Total Tests | Total Fails | % Fails |
|---|---|---|---|
| University A | 9 039 | 296 | 3,27 |
| Further Ed College | 1 829 | 40 | 2,19 |
| University B | 3 305 | 22 | 0,66 |
| University C | 9 965 | 51 | 0,51 |
| | **24 138** | **409** | **1,7%** |

*Table 1: Within different sectors the results also confirmed the presence of different levels of risk associated with the type of equipment being used, their patterns of use and the working environment (actual company and organisation names have been withheld).*

These results (see *Table 1*) not only demonstrate the value of the inspection and test process but also confirm that the general advice and guidance provided by the IEE Code of Practice is an appropriate and realistic approach to this subject.

## Nature of faults

Examination of the reasons for test failure show that there was a high proportion which failed visual inspection due to defects in the cable, appliance enclosure or the mains plug.

However, approximately a third of those items which failed had defective protective conductors or insulation and these faults could only be detected by carrying out specialist electrical testing or checking using an appropriate test instrument.

## Initial and repeat inspections

The nature of portable appliance inspection and testing regimes means that the number of failed appliances recorded is always likely to be higher during an initial test programme – simply because items may have been in use for an extended period before testing has been introduced.

Clearly the rate of test failures is likely to decline during subsequent reviews, as more potentially defective equipment is routinely identified and rectified.

This is best illustrated by recent sequences of tests undertaken by trading standards officers in a programme funded by the Electrical Safety Council. In this programme the average proportion of defects discovered during 'first-time' appliance testing of a range of electrical equipment was 12%.

## Consequences of electrical faults

There is considerable evidence that faulty electrical appliances continue to pose a real threat to people and property.

In the opening remarks on electrical safety included in the Löfstedt Review, reference is made to the 1 000 workplace accidents and 30 fatalities involving electric shock and burns that are reported to the Health and Safety Executive each year.

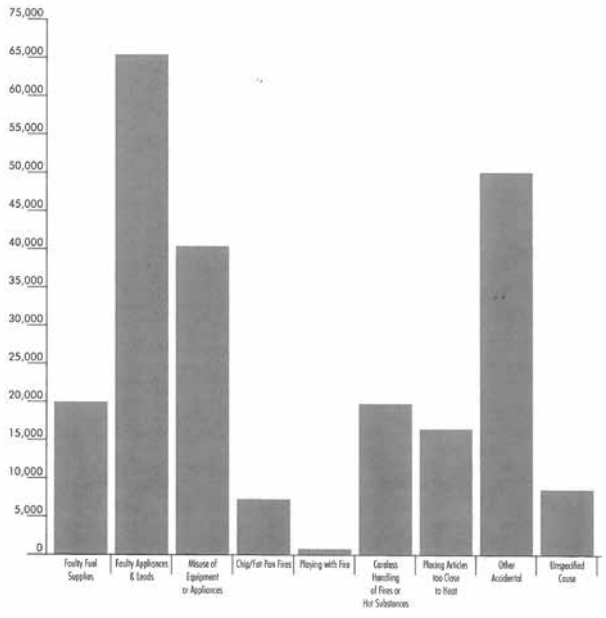


*Figure 1: Causes of accidental fires in buildings other than dwellings from 1999/2000 to 2010/11. Courtesy: Fire Statistics, Great Britain).*

Abbreviations

ESC – Electricity Safety Council
FPA – Fire Protection Association
HSE – Health & Safety Executive
PAT – Portable Appliance Testing
WHS – Work, Health & Safety

However electric shock and electrocution represent only part of the problem associated with faulty electrical items and full consideration also needs to be made of the contributory role of faulty electrical appliances in property fires which are also a major cause of deaths, injuries and considerable costs to businesses.

In particular, successive annual Fire Statistics show that faulty appliances and leads continue to pose the single most common problem as the main cause of accidental fires in other buildings (non dwellings).

In 2011 faulty appliances and leads were the cause of 25% of all accidental fires in non-residential buildings.

Between 2000 and 2011 (excluding 2010 for which no breakdown is available), each year faulty appliances and leads were identified as the cause of between 25% and 32% of accidental fires in non dwelling type buildings.

According to statistics collated by the Fire Protection Association (FPA), between 2000 and 2005, in 346 reported fires that were electrical in origin in business premises, the reported losses totalled over £178 M, with an average loss per incident of over £51 000.

## Individual experiences

Other evidence demonstrating the dangers and hazards associated with the use of unsafe electrical appliances featured strongly at the Electrical Safety Council's 2013 Product Safety Conference, where a number of organisations reported on their own experiences.

Individual presentations included the following facts:

- London Fire Brigade reported 891 fires caused by large domestic appliances in the period 2008 - 2011.
- Statistics from Essex Fire and Rescue showed that from 2006 - 2008 there were 438 primary fires as a result of faulty electrical appliances, causing 75 casualties.
- An appliance testing programme carried out by the trading standards office of Suffolk County Council revealed that 26% of electrical items tested were non-compliant and 45% were unsafe.
- A safety campaign carried out by Essex trading standards officers revealed that 5,8% of the electrical items tested were found to be faulty. It estimated that if all the faults had led to fires, the total costs could have been as high as £88 M.
- As part of a fire safety campaign run by Bolsover District Council, 120 electrical appliances were tested and 47 faulty items had to be replaced.

## Counterfeit electrical goods

Portable appliance inspection and testing is also one of the main ways in which dangerous counterfeit electrical equipment is identified.

BEAMA6 recently summarised the problems related to the infiltration of traditional supply chains by counterfeit electrical equipment that had not been subject to normal compliance testing and certification.

Approximately £30 M of counterfeit electrical products entered the United Kingdom market in 2010. Counterfeit electrical products include everything from domestic appliances to cables and leads, lighting

products, power tools and wiring accessories. 12,9 million counterfeit products have been seized and destroyed in the last 10 years.

## Cost of PAT

There is a great deal of recorded evidence that illustrates that electrical inspection and testing has identified many situations where defective equipment could have caused electrocution or fire. In the vast number of cases, the cost of taking a reasonable approach to inspection and testing can be considerably lower than that associated with other forms of assessing health and safety risks – and certainly lower than the likely financial cost of any personal injury or fire damage to premises that can result from faulty appliances remaining undetected.

For example, a basic test instrument, with a training video and test record book, can be purchased for a few hundred pounds. Such a system should have a life of up to 10 years. A small organisation with 100 appliances should be able to perform the inspection and testing in less than a day each year. In such an example the company will therefore have a minimal cost associated with this aspect of its electrical health and safety policy.

With larger organisations the cost will be proportional to size and type of industry. However there are excellent test products, software and accessories available which can greatly reduce the time associated with the inspection and testing process.

## Achieving compliance

In reality, a duty holder can demonstrate compliance with the regulations by a variety of means, of which inspection and testing is one, and it is up to the duty holder to determine how this can best be achieved in relation to the risk posed in their own particular environment.

In doing so, adequate electrical safety measures can be - and in many cases are already being - maintained without the imposition of an overly excessive test regime.

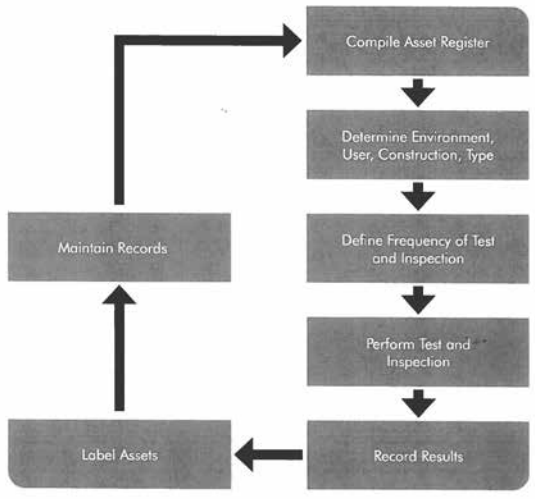


*Figure 2: Demonstrating compliance.*

The existing regulations and guidance notes have proved themselves as the basis of successful preventative maintenance programmes, although it is also clear that there are undoubtedly situations where there has been over zealous implementation of the inspection and test regime.

In an attempt to address this concern, two guidance booklets have been produced from within the PAT industry to help put the subject of inspection and test into perspective and to help duty holders act in a reasonable and practical manner. 'A responsible PAT testing business builder' is aimed at the PAT testing contractor and 'a common sense approach to electrical safety' is intended for use by in-house health and safety professionals.

## Conclusion

There is indisputable evidence that the periodic in-service inspection and testing of portable electrical equipment saves lives and prevents fires that may otherwise have caused injuries, loss of life and serious damage to work premises. In this respect the Electricity at Work Regulations 1989, HSE Memorandum of Guidance and the IEE Code of Practice provide sound advice based on industry experience and quantifiable evidence. The process of electrical inspection and testing has therefore made a significant contribution to improving and maintaining safety in the workplace, although it is clear that there is a continuing need to both educate the contractors who provide this service and better inform those organisations who carry out inspection and testing on their own behalf.

Clearly a problem rests with the actions of unethical contractors and in this respect the industry needs to consider how higher levels of responsibility and professionalism among PAT contractors can be encouraged. This is an area where a number of the electrical trade organisations could play a significant role in helping to raise standards within the industry. The clarification on PAT recommended by the Löfstedt Review is therefore very welcome and should help to encourage a better and more widespread understanding of this vitally important area of health and safety.

## Bibliography


[1] Löfstedt Review. 2011. Reclaiming health and safety for all.

[2] Electricity at Work Regulations. 1989. Health and Safety Executive/ Local Authorities Enforcement Liaison Committee (HELA).

[3] Market figures derived from analysis of Seaward Group customer database.

[4] Analysis of test records supplied by Hawkesworth Appliance Testing and from instruments returned to Seaward for calibration and repair.

[5] ESC Product Safety Conference, October 2011. Fire Statistics, Great Britain, from 2010-2011.

[6] RiskFix Newsletter. 2011. Risk Management.

[7] ESC Product Safety Conference. 2011. BEAMA Anti Counterfeit Presentation.



Jim Wallace is associate director of the Seaward Group, where he heads up the company's product development and new technology programmes. He has been with Seaward for approximately 15 years, during which, as engineering manager and product and technology manager, he was instrumental in the development and introduction of a range of advanced test instruments. Jim is also chairman of the Gambica Electrical Test Instruments Group and an active member of several IEC standard working groups. Enquiries: Email jimw@seaward.co.uk.

About the author