ZURICH
Resilience Solutions

Risk Insight: Electrical Installations and Equipment

Overview

Electrical fires continue to be one of the most common causes of fire in the UK. Common causes of electrical fires include misuse of electrical equipment, gradually occurring faults such as loose connections leading to overheating, overloading, wear and tear, deterioration of insulation materials and damage to cabling.

The good news is that a robust electrical inspection, testing, and maintenance programme can substantially reduce the risk of these fires occurring. Using our insights from electrical fires we have created this Risk Insight to help inform your electrical maintenance programme, with the aim of improving business resilience and reducing the fire risk.

Recent fire statistics[1] show that there were 20,445 primary fires[2] with the cause attributed to electrical distribution or equipment. As well as the minimum legal requirements to make sure that the electrical installation is safe, there are important considerations to minimise both the life safety and business risks that could arise from an electrical fire.

Electrical Maintenance Checklist

Ahead of the general guidance, we have put together the following questions to check against your current electrical maintenance procedures.

	Question	Answer	Comment
1	Do you ensure work is completed by a competent person in compliance with relevant legislation[3]?	Yes / No ☐ ☐	
2	Do you have a clear audit and decision trail for all the remedial actions identified by your fixed wiring inspection and additional visual inspections?	Yes / No ☐ ☐	
3	Have you discussed with your electrician any areas that were not inspected or tested as part of the fixed electrical installation reporting?	Yes / No ☐ ☐	
4	Is there a clear procedure for reporting and dealing with electrical defects that may be discovered in between more formal inspections?	Yes / No ☐ ☐	
5	Do you have an asset register of all electrical equipment to ensure that aging electrical equipment is replaced in accordance with the manufacturer's guidelines?	Yes / No ☐ ☐	
6	Have you considered the use of thermographic cameras to inspect electrical equipment? This is highly recommended for existing and also new equipment once live.	Yes / No ☐ ☐	
7	Have you provided training to relevant staff regarding your electrical installation, electrical equipment and hazards present at your premises including the action to take in the event of an electrical fire?	Yes / No ☐ ☐	
8	Do you have a risk based portable appliance testing regime in line with the guidelines in the Health and Safety Executive "Maintaining portable electrical equipment" document HSG107?	Yes / No ☐ ☐	
9	Have you checked that electrical cupboards and charging areas are kept clear of combustible materials?	Yes / No ☐ ☐	
10	Are your electrical cupboards and plantrooms correctly fire stopped using approved products installed by competent contractors?	Yes / No ☐ ☐	

[3] Examples of legislation include:
The Electricity at Work Regulations 1989
Electricity at Work Regulations (Northern Ireland) 1991
The provision and Use of Work Equipment Regulations 1998
Requirements for Electrical Installations IET Wiring Regulations BS7671:2018+A2:2022
alongside the IET Guidance Note 3 Inspection & Testing and the IET On-Site Guide
Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002

General Guidance

This guidance is designed to provide useful insights and discussion points to review against your own electrical maintenance programme. The aim is to help minimise the risk of electrical fire and increase your organisational resilience.

Maintenance

To ensure compliance with the Institution of Engineering and Technology (IET) wiring regulations, an Electrical Installation Condition Report (EICR) is needed. One important point is to discuss any limitations of the testing with your electrical contractor such as areas that were not accessible or parts of the system that could not be switched off. Whilst it has been rare, there have been electrical fires due to areas not inspected at all as they were not easily accessible.

Table 3.3 of IET Guidance Note 3 provides details on the range of samples for inspection purposes. Again, it is important to confirm in the Limitations section of the EICR report that these exceptions are not increasing the risk of fire. For example, 100% of the main switchgear, circuit breakers and distribution boards should be tested. Final circuit accessories may be less than 100% although it is advised that 100% of accessible sockets are inspected.

For larger premises a rolling programme of inspections is often selected so that only a percentage of the installation is inspected each year. In these cases, if a large number of defects are identified, be prepared to increase the programme based on the output of the initial test results.

If a large number of Code 1 and Code 2 defects are identified it is considered necessary to consider whether there are any underlying issues. For example, are there reasons such as the system is aging or showing signs of increased deterioration that justify further interventions?

The EICR will note any issues with the system and observations are defined by their risk level:

Code 1
Danger present and risk of injury. Immediate remedial action required.

Code 2
Potentially dangerous. Urgent remedial action required.

Code 3
Improvement recommended.

FI
Further investigation required without delay.

General Guidance

It should also be noted that some Code 3 items may have a significant fire implication despite the Code 3 rating. A common example would be missing or inappropriate fire stopping in electrical cupboards. Missing fire stopping can significantly increase the risk of fire and smoke spread. An important point here is that there should be a clear audit and decision trail for each observation and the action that has been taken.

A point that is occasionally overlooked is that the building will contain other fixed electrical equipment that is not included within the fixed wiring test. Building and facility managers should be aware of what is and isn't included in the fixed wiring test and ensure there are comprehensive maintenance plans in place. This should include an asset register of equipment with details of when the equipment will need replacing in accordance with the manufacturer's guidelines. Guidance is provided on this in the IET publication In-service Inspection and Testing of Electrical Equipment.

An example is Power Factor Correction (PFC) equipment which is installed to increase energy efficiency and therefore reduce electrical costs. However, such equipment has been known to cause fires. PFC units are often found in a wide range of properties where equipment is typically located on a 3-phase supply.

The capacitors used in PFC systems have a limited lifespan which can be significantly reduced if they are exposed to increased ambient temperatures. Failure of such units can be rapid and therefore they should be installed in fire rated compartments ideally separated from the other incoming electrical switchgear. Additional maintenance such as thermographic or ultrasound inspection by a competent electrical engineer can help early identification of defects, but it's key to replace such equipment prior to the manufacturer's recommended replacement time being reached for the ambient conditions present or if there are any signs of deterioration.

If your building contains combustible building materials or hidden voids it is considered good practice to ensure that electrical contractors, or any other contractors that may work in your building, understand the construction of the area that they are working in.

Contractors, or in-house maintenance colleagues, who compromise the integrity of fire stopping will significantly increase the risk of fire and smoke spread should an electrical fire occur. Contractors should therefore follow agreed standards in respect of fire stopping and it is considered good practice to request photographic evidence after the work has been completed. Fire stopping is often a weak link especially when it comes to the inappropriate use of fire rated foam[8].

It is critical that expanding fire rated foams are only used in accordance with the fire test used for the product. Typically such foams can only be used to fill small holes (5mm to 30mm wide) in a fire rated compartment wall. Under no circumstances should such foam be used to fill large holes as such foams are actually combustible products.

The frequency of the inspections should be based on a risk assessment for the actual building and hazards present. There are however, standard inspection frequencies provided in the IET Guidance Note 3, Table 3.2, for example:

- **Leisure facilities yearly**
- **Industrial every 3 years**
- **Offices every 5 years**
- **Commercial every 5 years**
- **Educational every 5 years**

Competent Electrician

All work involving the installation, modification, testing and inspection should be carried out by a competent person who has sufficient technical knowledge and experience appropriate to the type of installation[9].

In the United Kingdom, electrical contractors should be approved by the National Inspection Council for Electrical Installation Contracting (NICEIC)[10], the Electrical Contractor's Association (ECA)[11], a member of the Safety Assessment Federation (SAFed)[12] or SELECT (the Electrical Contractor's Association of Scotland)[13].

For residential EICR reports a NAPIT registered electrician can also be used[14]. If your own electrical engineering staff are used, they should be suitably qualified, for example a Joint Industry Board graded electrician, Level 3 qualification, or equivalent.

Inspection Checks

In addition to the formal programme of periodic inspection and testing, a programme of routine visual inspections of your electrical installations and equipment should be taking place in accordance with IET Guidelines. These checks should include:

- Checking that actions from the EICR report have been completed
- Visual inspections to look for any signs of overheating, damage or wear for example
- That electrical equipment, such as electrical switchgear panels, electrical cupboards, battery charging areas, light fittings or luminaires, are kept clear of combustible materials.

Thermographic Inspections

Thermal imaging cameras are considered to be an extremely effective tool at minimising one of the most common causes of fires in electrical installations, namely overheating caused by loose electrical connections. Loose electrical connections generate heat via the increased electrical resistance and this will show up as a 'hot spot' on a thermal camera image.

In the early stages these hot spots will be invisible to the naked eye. However, these hot spots over time increase the resistance of the connection which leads to further heating. This cycle can continue for some time until sufficient heat is generated to ignite combustible materials in the electrical panel.

Thermographic cameras can easily detect hot spots in electrical boards and connections. In the event that a fault is found, all that the electrician needs to do is either tighten the connection or replace the component.

Regular use of these inexpensive cameras by a competent operative is an excellent method of early identification of developing faults, as part of a preventative maintenance programme. This will help reduce downtime and improve the efficiency of your electrical and mechanical maintenance programmes.

Thermographic imaging works best when the electrical system is under load as this is when the hot spots will be detected. When commissioning a thermographic inspection, however, there are three typical levels. The most effective is considered to be when the electrical system is under load and the covers have been removed. Inspections can also be completed using residual heat with the equipment not operating during the scan or, and this is the least effective, with the covers still in place.

Thermographic inspections are intended to complement and support the normal fixed wiring inspections and must not be used in isolation.

Portable Appliances

The common issues found with portable appliances are damaged cabling, overloading of extension cables, 'daisy-chaining' of extension cables and use of less appropriate forms of temporary heating.

The use of portable appliances such as electric convector heaters or flame based heaters should be avoided. If heaters are essential then oil filled radiators or wall mounted radiant heaters may be used. Trailing electrical leads are susceptible to mechanical damage, which may cause them to short circuit, and result in overheating and ignition. The use of trailing leads should ideally be avoided, but if this is essential, they should be subject to regular inspection. The use of multi point adapters and extension leads should be avoided with additional fixed sockets being installed as required.

It is suggested to implement a risk assessment based portable appliance testing (PAT) regime in line with the guidelines in the Health and Safety Executive "Maintaining portable electrical equipment" document HSG 107[15]. Things to include in your risk assessment when considering need and frequency of PAT regime are:

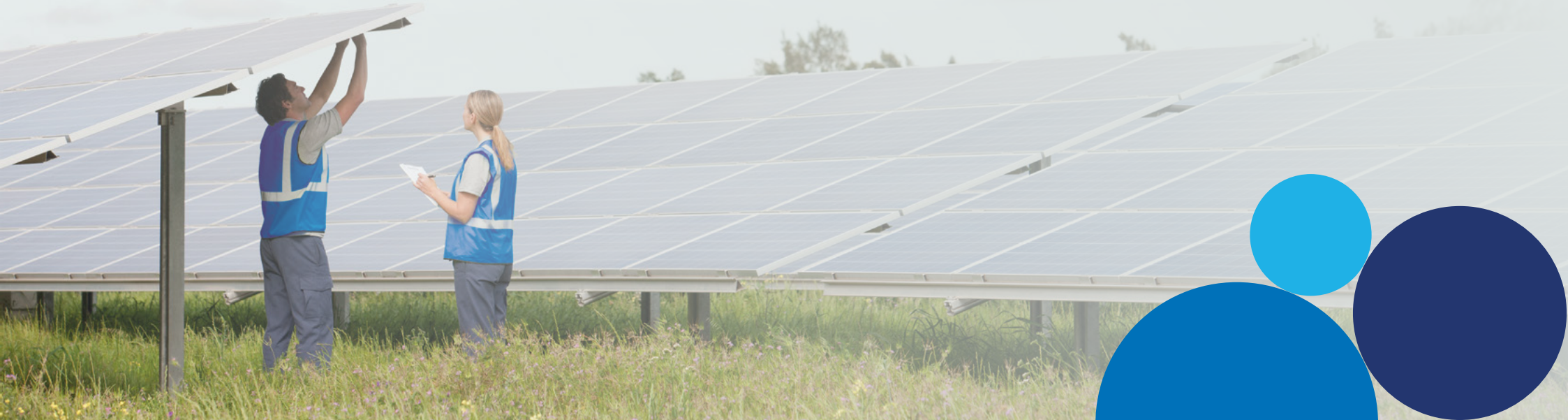
- Type of equipment
- Whether hand-held
- Manufacturer's recommendations
- Integrity and soundness of equipment
- Age of equipment
- Working environment of use or likelihood of mechanical damage
- Frequency of use
- Foreseeable misuse
- Effects of modifications or repairs
- Analysis of previous maintenance records (formal visual, combined inspection and testing)

Photovoltaic (Solar) Panels

It is important that Photovoltaic (PV) systems meet current design, installation and maintenance standards to ensure that the potential for unexpected events, which can result in significant losses, is controlled and the risks associated with these systems are eliminated, controlled or mitigated as far as is reasonably practicable.

Please see our Zurich guidance document[16] that addresses the design, installation and maintenance aspects of roof mounted PV systems.

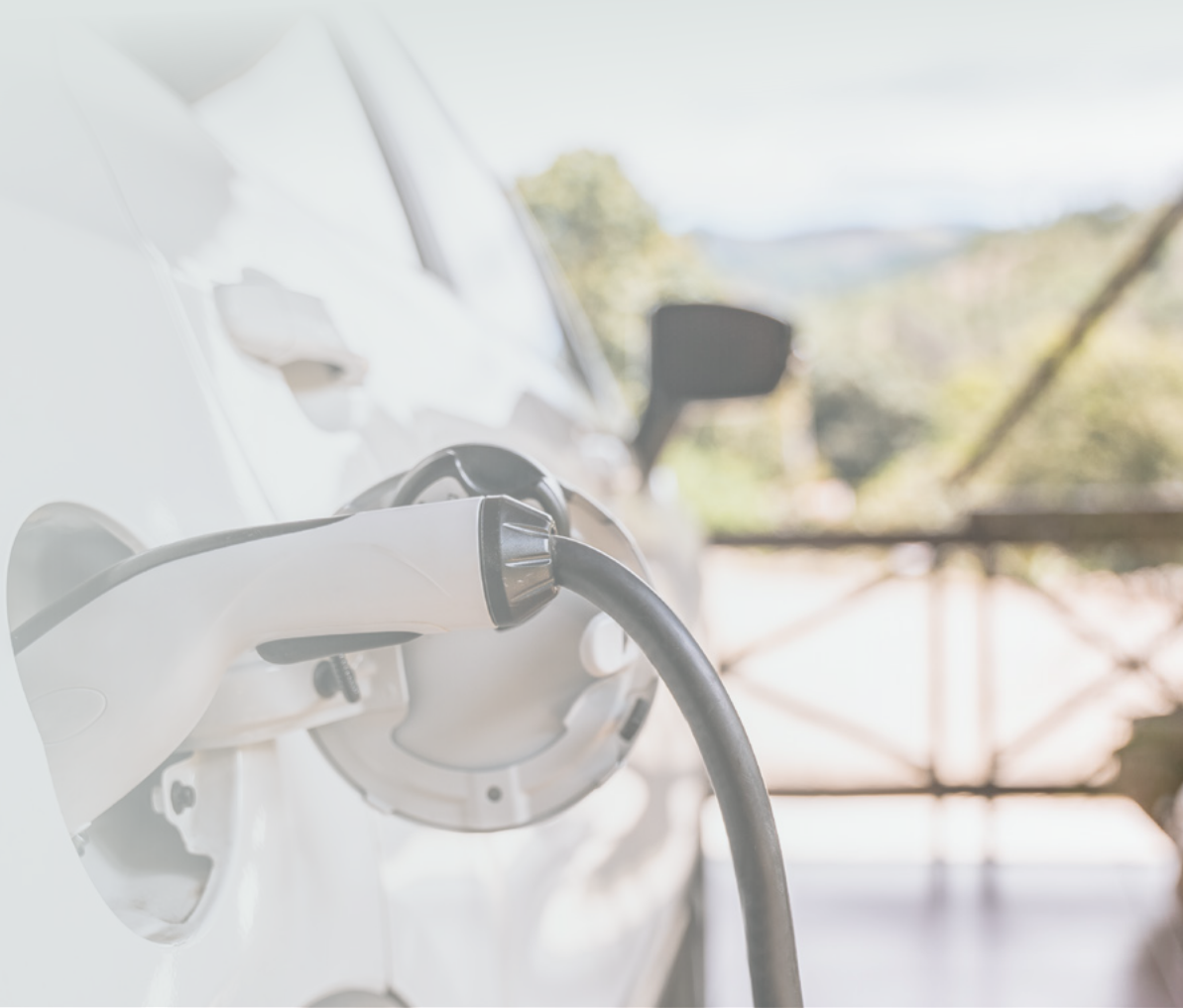
Please note that the electrical installation associated with the PV system must also be inspected and tested. This will require an electrician that is competent in both Alternating Current (AC) and Direct Current (DC) systems.



Electric Vehicle Chargers

There are a number of factors that should be considered prior to and following the installation of electric vehicle charging units at your premises, to ensure that the associated hazards are adequately managed.

Please see our Zurich document[17] that provides guidance for these types of installation.



Summary

Electrical faults continue to be a significant cause of fires and it is important that suitable precautions are taken to minimise the fire risks. This guidance document is not intended to be a definitive list of precautions, but it aims to strengthen your electrical management programmes based on our experience of electrical fire losses.

Please note that for particularly hazardous or harsh environments where electrical appliances and installations are used, such as where flammable atmospheres or explosive dusts are present, additional guidance will apply that has not been covered within this guide.

Zurich Resilience Solutions

For further information about any of the topics mentioned in this guidance, or to discuss a specific electrical installation project, please speak to your local Zurich contact, or email Zurich Resilience Solutions at zrs.property.uk@uk.zurich.com.

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2. **Primary fires are those that meet at least one of the following criteria - occurred in a (non-derelict) building or outdoor structure or involved a fatality, casualty or rescue or were attended by five or more pumping appliances.**
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