DOCUMENT NO: **ES-E-01**

SAFETY

INTRODUCTION

The Statutory requirements relating to electrical inspection and testing activities is the *Electricity at Work Regulations 1989 (EAWR)*.

Regulation 4(3) requires that every work activity on or near to an electrical system "*shall be carried out in such a manner as not to give rise, so far as is reasonably practicable, to danger.*"
Regulation 14 places a strict prohibition on working on or near exposed live conductors unless:

- **it is unreasonable in all circumstances for it to be dead; and**
- **it is reasonable in all circumstances for the work to take place on or near the live conductor; and**
- **Suitable precautions, including the provision of suitable protective equipment where necessary, have been taken to prevent injury.**

The Management of Health and Safety at Work Regulations 1999 **require that a suitable and sufficient risk assessment is made.**

CONTENTS

SAFETY

RISK ASSESSMENT

Generic risk assessments are available to all Engineer Surveyors through the Allianz Engineering document delivery portal. All persons should ensure familiarity with these assessments relative to their intended activity and apply the requirements more specifically referring to the specified control measures. These should be used in conjunction with site and activity specific risk assessments. If there is any doubt as to how to control risks, the intended activity should be ceased and further advices sought.

The assessments are intended to identify hazards and associated risks normally found on sites where inspection & testing is being carried out. The Engineer Surveyor may, in consultation with the site operator identify other risks which may be specific to the site. This may require completion and adherence to client Permit to Work or Safe Systems of Work as so provided by the client. In such cases the risk assessments applicable to conducting electrical inspections and testing should be extended to incorporate the additional information.

To achieve a safe working environment and to establish safe systems of work the results of site risk assessments will help identify the steps that need to be taken to achieve this. Hazards associated with the inspection & test of electrical systems are wide ranging and some key examples are listed in the sections to follow.

Safe systems of work that include ***specific to task*** risk assessments for conducting the inspection and test of electrical installations are provided within the supporting document **ES-E-03-01-TG-04**, with additional guidance provided in document; ES-01-07-01-01.

If at any time the Engineer Surveyor or Client has any concerns that safety will be compromised then activities should cease and the issues be discussed by all parties concerned to achieve an agreeable and safe way forward.

(Accurate feedback from the identified experiences or circumstances should be sent to the inspecting Engineer Surveyor's Line Manager & Engineering Standards to evaluate such situations and to review current procedures as necessary.)

SAFETY

HAZARDS

The following table contains some examples of site and job specific hazards encountered by the Engineer Surveyor whilst conducting inspection & tests and should be taken into account when formulating risk assessments and safe systems of work:

Mechanical Hazards	Crushing/Impact Shearing/Cutting Entanglement/Drawing In/Trapping Vehicular Movements Unguarded Moving Parts Handling/Transmission systems
Automatic/Computer Controlled Equipment	Unexpected start-up of plant & systems
Stored Energy Hazards	Suspended Loads/Counterweights Spring Loads (Tension/Compression) Pressurised Systems
High Pressure Fluid Ejection Hazards	Compressed Air/Pneumatic Systems Steam Systems Water Systems Hydraulic Systems
Slip, Trip, and Fall Hazards	Over Reaching Working at Height Uneven Floors/Spillages Obstacles/Poor Access Poor Lighting
Electrical Hazards	Incorrect isolations Overhead Conductors/Transmission Lines Exposed Live Parts Incorrect Equipment In Ex areas Static Electricity Asbestos PCB's (Polychlorinated Biphenyls)
Fire or Explosion Hazards	Equipment Failure Chemical Reactions Temperature Control Failure/Cooling System Failure Combustible Materials Oxidising Substances
Thermal Hazards (Risk of Burns/Scalds/sears and frostbite)	Defective equipment Steam Refrigerant Friction High/Variable Operating Temperature of Equipment
Noise Hazards	Removal of Acoustic Enclosures to facilitate inspections Defective Plant High Noise Areas

SAFETY

Vibration Hazards	Defective Plant High Vibration Processes
Radiation Hazards (Ionising and non-ionising)	X Rays Alpha Radiation Beta Radiation Ultraviolet Infrared Laser Microwave Radio Waves
Process & Material Hazards	Falling/Ejected/Exhausted Materials Material Failures Power System Failures (Electrical, Hydraulic, Pneumatic, Steam, Pressure) Hazardous Substances (Asphyxiants, Oxygen Depletion, Pathogenic, Toxic, Irritant/Corrosive, Infectious, Allergenic, and Sensitising. Asbestos
Ergonomic Hazards	Poor Design/Location/Identification Inadequate Lighting/access Poor Operational Direction & Controls

Each hazard identified during the course of an Engineer Surveyor's activities must be duly assessed whereby suitable and sufficient Control Measures shall be applied in order to mitigate risk.

Occasionally the Engineer Surveyor may identify a potential hazard which may not be of a direct consequence to himself in the normal course of his work, but may become a hazard to others on site. In the cases, legislation places a duty of care on all persons at work and the Engineer Surveyor must accurately report details of the potential hazard to a responsible person on site. (**ES-01-08-06** details that Client Communication Records should be employed for this task.)

SAFETY

GENERAL SAFETY

The following sections relate to general safety aspects to be aware of during the inspection and test of electrical fixed wiring. It should not be considered as an exhaustive listing but as a guide to some of the most common issues experienced during this activity.

- ## Competence

Allianz Engineering complies with the standards for Engineer Surveyor competency set by **UKAS** through their relevant RG document series and applied in accordance with the SS01 **SAFed** standard. The following criteria are used in assessing the competence of electrical Engineer Surveyors:

- Knowledge of electricity;
- Experience of electrical work;
- Understanding of the different types of installation to be worked on and practical experience of that work.
- Understanding of the hazards which can arise before conducting and during the work and the safe systems of work to be applied.
- Ability to recognise at all times whether it is safe to continue with the working activity.

The complexity of the work activity will normally be within the capability of all Engineer Surveyors authorised to undertake the particular type of work in conjunction with additional knowledge provided by site personnel.

When accompanied by others, (Trainee Engineer Surveyors, UKAS representatives or any other person) the competent Engineer Surveyor shall assess every accompanying person, before the activity starts, to ensure competency is established to undertake the work that is to be completed. **Competency shall not be assumed**

(*Trainee Engineer Surveyors knowledge of electrical systems and safety procedures would have been determined at the interview stage. The site assessment is intended to establish details of competency for specific activities at sites during the training period.)*

No person shall undertake any work activity where technical knowledge or experience is needed to prevent electrical danger or injury, unless that person has such technical knowledge or experience, or is under such supervision as is necessary for the work undertaken.

- ## Duties

The responsibilities placed upon persons for the safety of those engaged in a work activity and those who are or may be affected by the work activity shall be in accordance with National Legislation (e.g. Health & Safety at Work Act, Electricity at Work Regulations, etc.)

The client's designated responsible person (Duty Holder or Appointed Person for example) has a duty to all personnel involved in a work activity on, with, or near an electrical system for which they are responsible, to instruct them in the safety requirements, safety rules and company instructions applicable to their work (where two or more installations come together it is essential that formal arrangements are in place for all parties).

Often the Engineer Surveyor will be the most experienced and knowledgeable person at the site in regard to electrical systems and during the work activity will be the nominated person in control of the installation. A proactive role shall therefore be taken in helping the client discharge their duties. This will normally take the form of asking the clients nominated person if there are rules of working, if there are any peculiar circumstances existing at the site which may be affected by the intended activities and generally looking at the work place whilst familiarising with the installation prior to the inspection and test.

Before any work activity is started and during that work activity, the Engineer Surveyor in control of the inspection and test shall ensure that all-relevant requirements, rules and instructions are complied with.

The Engineer Surveyor in control of the work activity shall instruct all persons engaged upon the work activities of all dangers that are not immediately apparent to them and to ensure access is adequately controlled when equipment is being subjected to inspection or testing.

Where the work activity is subdivided e.g. complex installations, it may be necessary to nominate a person to be responsible for the safety of each subdivision but all to remain under the responsibility of one co-ordinating person. The use of Permit to work schemes or other procedures for safe working should be employed in these cases.

The Engineer Surveyor shall be sure that the client's responsible person is aware that electrical power interruptions will occur throughout the test period that may disrupt normal production routines. Hazards occurring from a loss of power e.g. machinery stopping, affects upon lighting levels, safety systems, and information/data security etc. must be taken into consideration and assessed before any isolation takes place.

The operator of the site has a duty to have sufficient number of persons provided with training and information so that they are able to give appropriate first aid treatment for electric shock and/or burns. The Engineer Surveyor must be aware of the first aid arrangements at the site and comply with the requirements of those arrangements.

- ## Work Activity & Area

When working on any site the content of the following publications regarding 'Lone Working' should always be considered and applied where necessary;

i) INDG73 HSE Guidance on Working Alone
ii) OHS 6.1.2-01 G-10

The "Extent" or area for inspection & test should be fully agreed with the person responsible for the electrical system. The Engineer Surveyor shall ensure that sufficient knowledge of the system (or part of) is obtained to undertake the work in a safe manner.
The use of site layouts, installation drawings and diagrams, supported by circuit details acquired from previous reports will greatly assist to provide key knowledge however in the absence of such information the Engineer Surveyor shall conduct a familiarisation exercise with the site and electrical system by "walking the job" with a person familiar with its operation. During such familiarisation activities the Engineer Surveyor shall make a note of distribution equipment locations, points of isolation, and other work being undertaken on or near to the electrical system and any reliance of machinery or processes on maintaining power supplies.

Test methodology should take into account sensitive devices installed into circuits (e.g. Residual Current Devices) which may be inadvertently "tripped" during testing activities resulting in loss of illumination or essential supplies to key equipment.

The work activity areas should have suitable precautions in place to prevent injury from other sources of danger or other systems such as mechanical and pressure systems, and safeguards against exposure to toxic hazards as detailed in the previous 'HAZARDS' section.
Objects which impede access and/or flammable materials shall not be placed adjacent to or placed in/on access walkways and routes to and from electrical switching equipment or operational control gear. In addition, flammable materials shall be kept away from electric arc sources.

If the above are not being complied with, the Engineer Surveyor shall assess the situation with regard to personal and work area safety when undertaking the work activity.
Where during the work activity an immediate danger is found to be present at the location or within the electrical system then immediate action will be necessary before continuing with the work activity. It is not sufficient just to record the fault for inclusion in written reports. The person responsible for the safety of the installation for the client shall be made aware that the danger exists and agreement shall be made with this person as to the appropriate action to be taken, to immediately remove the danger. (ES-01-08-02 details that Emergency Reports should be employed to supplement these situations)

- ## Tools, Equipment & Devices

For 'Live Testing' all tools, equipment and devices shall comply with the relevant European, National, or International safety Standards relating to insulation properties. Issued test equipment shall be compliant with; BS EN 61010 & BS EN 61557 and should be used in conjunction with GS38 requirements relating to test leads.

'Dead Testing' does not require explicit application of the standards specified for live testing but all items shall be suitable for the intended activity, where effective control measures shall be employed to ensure these items are not used for any live testing activity.

All test equipment used will be calibrated prior to being put into service by a UKAS accredited laboratory where values are traceable to National Standards supported by periodic measurement, proving and examination checks conducted by the Engineer Surveyor as detailed in ES-E-06-01.

Test equipment for use by Electrical Engineers Surveyors is detailed in ES-E-06 and shall be used in accordance with the instruction or guidance as provided by the manufacturer or supplier and in conjunction with Allianz safe systems of work.

Tools, equipment and devices shall be maintained in a condition suitable for use (voltage rated insulation where required) and shall be properly stored and protected to prevent damage when not in use. (Maintained in a condition suitable for use means, satisfactory visual and operational checks prior to use which includes any provided attachments, test leads & probes.)

Full operational checks of test equipment should be conducted prior to use if the meter has been returned from the test laboratory after calibration/repair or if a replacement meter has been issued.

Equipment includes personal protective equipment and issued hazard notification signage. During work activities, signs provided by Allianz Engineering shall be displayed to draw attention to potential hazards that may be present. These should be maintained in a good and legible condition.

Allianz Engineering employees shall wear suitable close fitting clothing, normally it will be the PPE issued to the Engineer Surveyor. Protective footwear is also issued and these should be worn at all times whilst engaged in work activities.
Special consideration shall be given to any jewellery worn by the Engineer Surveyor and the items shall be removed if they present an unnecessary increase in risk. (It should be noted that metals used in jewellery items are highly conductive to electricity.)

Suitable Eye Protection, Ear Protection and Hand protection should be employed where required and site PPE requirements and signage should always be observed.

ELECTRICAL SAFETY

The following sections relate to electrical safety aspects to be aware of during the inspection and test of electrical fixed wiring. It should not be considered as an exhaustive listing but as a guide to some of the most common issues experienced during this activity.

- ## Electrical Isolation

Electrical isolation is the procedure of which the objective is to ensure that the electrical supply is disconnected and remains disconnected for reasons of safety. The process of isolation can be broken down into a number of steps as necessary for the particular circumstances. Reference should be made to the requirements of HSR25 (EAWR guidance) & HSG85 (EAWR Safe Working Practices) but as a minimum, the following safe working procedure shall be adopted by the Engineer Surveyor, (always with the clients knowledge) to ensure conductors are dead for work.

- Remove the electrical load if practicable and always, if the switching device is not rated for load breaking.
- Open the means of disconnection and secure in the open position with a lock or other suitable means.
- If means of disconnection is unsuitable for locking in the open position then other methods shall be used to ensure the supply is not restored until safe to do so. This may involve;
  - The removal of fuses or links, and their retention by the person doing the work activity, and/or
  - Isolation 'upstream' of the installation where work is to be conducted
- Notices shall be fixed at the point of isolation declaring that work is being undertaken on the system and that power shall not be restored.
- Prove the correct operation of an authorised voltage test instrument, against a known source.
- With the same voltage test instrument, test the circuit(s) to be worked on to verify that no dangerous voltage is present.
- Prove the voltage test instrument again against the known source to check that it was functioning correctly when the circuits are tested for the presence of a voltage.

If any risk assessment for an isolation procedure includes the need for Earthing or Short-circuiting equipment or devices to be used (which includes switching items of switch gear into earth positions) then this procedure must always be carried out by the client's appointed person(s)

In all cases the Engineer Surveyor shall ensure that the earthing and short-circuiting equipment or devices and cables or connectors for bonding used for this purpose are suitable and adequately rated. The Engineer Surveyor shall also ensure that suitable precautions are taken by the client or his representative to ensure that the method of earthing employed remains fully secure during the time the work is in progress.

- **Protection Against Contact With Live Parts**

If there are parts of an electrical installation in the vicinity of the work location that cannot be made dead, then special additional precautions are necessary and shall be applied before work starts. The special precautions might include the use of temporary screens, barriers, or insulating covers. Each of these devices shall be suitable for the electrical and mechanical stresses to which they may be subjected.

If the above measures cannot be carried out then protection shall be provided by maintaining a safe distance not less than the sum of D_L+ D_v where;
D_L is the distance defining the outer limit of the live working zone, and
D_v is the distance defining the outer limit of the vicinity zone) plus the ergonomic component of the distance. This is only to be used for voltages less than 1000volts, resulting in;
0mm + 500mm + 200mm = **700mm**.

The Engineer Surveyor shall make a judgement of safe working for the specific area in which the issue of having to work near live conductors is experienced, taking into account the particular circumstances of the intended inspection and/or testing activity.

Working on or near live conductors shall not be considered as a normal working arrangement and shall only be undertaken having full regard for Regulation 14 and associated guidance in the Memorandum of guidance on the Electricity at Work Regulations 1989 (HSR 25).
For example;
If the conductors are positioned at the top of an enclosure and the Engineer Surveyor is working below them the probability of accidental contact is reduced because the risk of slipping onto them is small. If however they were at the base of the enclosure the probability of accidental contact would be higher.

When working near live conductors the Engineer Surveyor shall ensure that a stable location is provided which presents a hands-free situation. There should also be an adequate level of lighting, working space and protection from ‘External Influences’.

Certain tests will have to be carried out with the supply voltage present, e.g. measuring voltage, prospective fault current, and earth fault loop impedance, so particular care should be taken under these circumstances. The Engineer Surveyor shall take appropriate precautions to prevent accidents. Such as ensuring that test instruments and test leads are suitable and properly used; that the equipment to be worked upon is safe for the intended tests i.e. all live parts are protected to a minimum level of IP2X and that the working environment does not present additional dangers (Reference to HSE guidance GS38 should be applied.)

- ### Aged Electrical Equipment (Ageing Plant)

Some older equipment that is still in use, including open-type switchboards and fuse boards used by electricity distributors and in industrial premises such as steelworks for example, is not designed or constructed to prevent people touching live conductors and suffering injuries from shock or burns. In these cases, the user must have sufficient knowledge and experience to recognise the danger and avoid it. This type of equipment should be located in a secure room or area, with access available only to those who have specific authority and are competent to prevent danger. Even then, you will need to further protect this type of open, uninsulated equipment to prevent accidental contact with live parts when competent persons are working near it.

Other types of old building materials or electrical equipment may present other hazards to health e.g. Asbestos & PCB's (Polychlorinated Biphenyls)

Asbestos was widely used in buildings for lagging and insulation, fire retardant ducts for cable runs and can still be found. When conducted site specific hazards for compiling risk assessments then reference to site registers should be carried out.

If during the work activity suspected Asbestos is encountered within equipment (e.g.arc suppression material in fuse holders) then the following procedure should be adopted;

- Do not disturb or remove any suspected Asbestos material used in Arc shields or fuse holders. If fuse holders are known beforehand to contain asbestos materials then do not remove the fuse carrier and report as an **operational** limitation.
- If the presence of Asbestos material is not established and the fuse carrier is removed revealing suspected Asbestos material then do not remove or disturb it and immediately replace the fuse carrier.
- In all cases report the presence of the suspected Asbestos to the client's representative.

PCB's (Polychlorinated Biphenyls) was widely used prior to 1977 as insulation and coolant oil in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. Equipment containing PCB's should be clearly labelled but sometimes may be described by specific material names instead which include: *Abestol, Aroclor, Askarel, Chlophen, Chlorextol, DK, EEC-18, Fenclor, Inerteen, Kennechlor, No-Flamol, Phenoclor, Pyralene, Pyranol, Saf-T-Kuhl, Solvol, and Non-Flammable Liquid.*
In normal operation the PCB material is entirely enclosed however due to the age of the equipment small amounts may leak out of the enclosures which may present a risk considering skin exposure. If equipment is suspected as containing PCB's or leakage is observed then it should not be touched without prior assessment and control measures being put into place and it should be reported to the client's representative.

- **Hazardous Areas & DSEAR (Dangerous Substances & Explosive Atmospheres Regulations)**

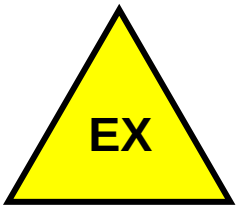
Overall, **DSEAR** clarifies the existing requirements to manage fire and explosion risks which are set out in the **Management of Health and Safety at Work Regulations 1999 (Management Regulations),** and is a set of Regulations concerned with the protection against risks from fire, explosion and similar events arising from dangerous substances used or present in the workplace. The regulations have been fully in force since June 2006.

The Regulations give a detailed definition of a *'dangerous substance'*, which you should refer to for more information, but it includes any substance or preparation, which because of its properties or the way it is used could cause harm to people from fires and explosions. Dangerous substances include: Petrol; liquefied petroleum gas (LPG); paints; varnishes; solvents; and dusts which when mixed with air could cause an explosive atmosphere, for example, dusts from milling and sanding operations. Dangerous substances can be found, in varying quantities in most workplaces.

An explosive atmosphere is an accumulation of gas, mist, dust or vapour, mixed with air, which has the potential to catch fire or explode. An explosive atmosphere does not always result in an explosion, but if ignited the flames would rapidly propagate and if this occurs in a confined space (e.g. in plant or equipment) the rapid spread of the flames or rise in pressure could also cause an explosion.

Regulation 7 (Places where explosive atmospheres may occur) requires the client to classify those areas in which a dangerous substance may exist. The classification of those areas (or ZONES) will depend upon the extent, frequency and duration of any occurrence of an explosive atmosphere.

The Zone classification will also define the requirements for the selection and installation of equipment and protective systems so as to prevent sources of ignition. Any area classified as Hazardous shall be suitably marked at all entry points with the following symbol.

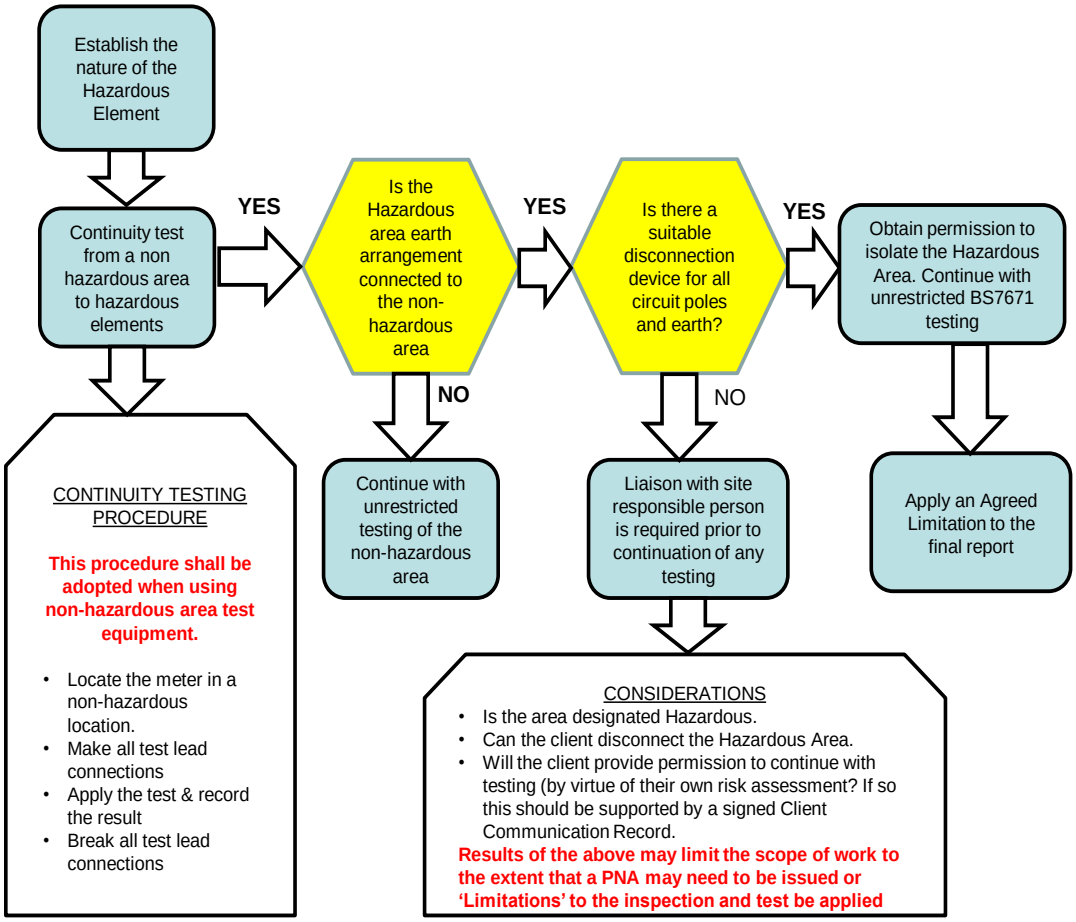


Hazardous Area inspections must only be carried out by Engineer Surveyors who have received specific instruction, training and authorisation.

SAFETY

If during any activity of site familiarisation for the inspection & test of low voltage fixed wiring installations the EX symbol is observed or an area of the installation has been assessed to be Hazardous (e.g. LPG installation), then reference to the requirements of **ES-E-03-01 (Low Voltage Electrical Fixed Wiring)** indicates that these areas are exempt from the current scope of work.

To maintain electrical safety in locations where hazardous areas are present, specific assessments must be carried out to ensure that electrical testing in non-hazardous areas does not present danger to the explosive atmosphere that may be present. The following logic chart should be used when confronted with a hazardous area when conducting the BS7671 thorough inspection & test.



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