Quarries National Joint Advisory Committee (QNJAC)

Plant Information Sheet 1

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The Management of Electrical Safety in Quarries, Associated Plant and Equipment

REMEMBER

Electricity can kill!

This information sheet has been developed by the Quarries National Joint Advisory Committee (QNJAC) to help quarry operators, contractors, managers and others make health and safety improvements in the quarry industry. This guidance may go further than the minimum you need to do to comply with the law.

1. INTRODUCTION.

The use of electricity in quarries, associated plant and equipment has been regulated since 1938, in the intervening time the safety climate has greatly changed. The introduction of the Health and Safety at Work Etc. Act 1974, Quarries Regulations 1999 and a raft of subordinate legislation has removed the prescriptive requirements of the early Regulations and replaced them with modern regulations requiring that health and safety be properly and effectively managed.

Electricity regulations generally deal with the safety of electrical equipment and electrical work practices so as to prevent electrical danger, i.e. shock, burn and explosion. The Quarries Regulations 1999 requires all health and safety to be properly managed and the management arrangements to be included in the health and safety document. This guidance has to encompass both requirements and aims to give quarry operators, electrical staff and contractor's information on the topics to be included in the health and safety document.

In addition to electrical dangers arising from electric shock or burns, electrical equipment plays an important part in the integrity or safety of machinery, for example emergency stopping systems and guard interlocking for machinery, access arrangements for robotic enclosures etc. and where non electrical risks can occur from the failure of electrical equipment. These systems, which deal with non-electrical risks, are also be covered by this guidance.

In parallel with the modernisation of health and safety legislation, British, European and International standards and codes of practice such as BS7671 have developed to standardise the construction, installation, maintenance and safe operation of electrical equipment and work practices to ensure compliance with the electrical safety regulations and the standards for inspection and testing of electrical equipment and systems.

This guidance covers the generalities of the Management System for Electrical Installations at quarries, associated non quarry sites and mobile equipment. The requirements are to be included in the health and safety document. It therefore details the requirements such as the management structure, authorisation and competence of staff, risk assessments etc. as well as electrical requirements detailing the construction and installation of electrical equipment, safe use of equipment and inspection, testing and maintenance of equipment, safety rules, procedures and safety systems for machinery etc.

Where words/phrases such as 'advised,' 'recommended,' and 'may be fitted' are used in this guidance they are not mandatory. However, where alternatives are used, care must be taken to ensure compliance.

2. SCOPE.

This guidance applies in quarries to.

- All electrical systems and equipment.
- Associated plant and non quarry sites.
- Mobile equipment.
- All equipment used by and all work activities undertaken by staff and contractors on or near electrical equipment.

This guidance does not cover the electrical components on wheeled or tracked mobile plant where the sole source of the electrical supply is from batteries rated up to 120V DC.

3. RELEVANT LEGISLATION and STANDARDS.

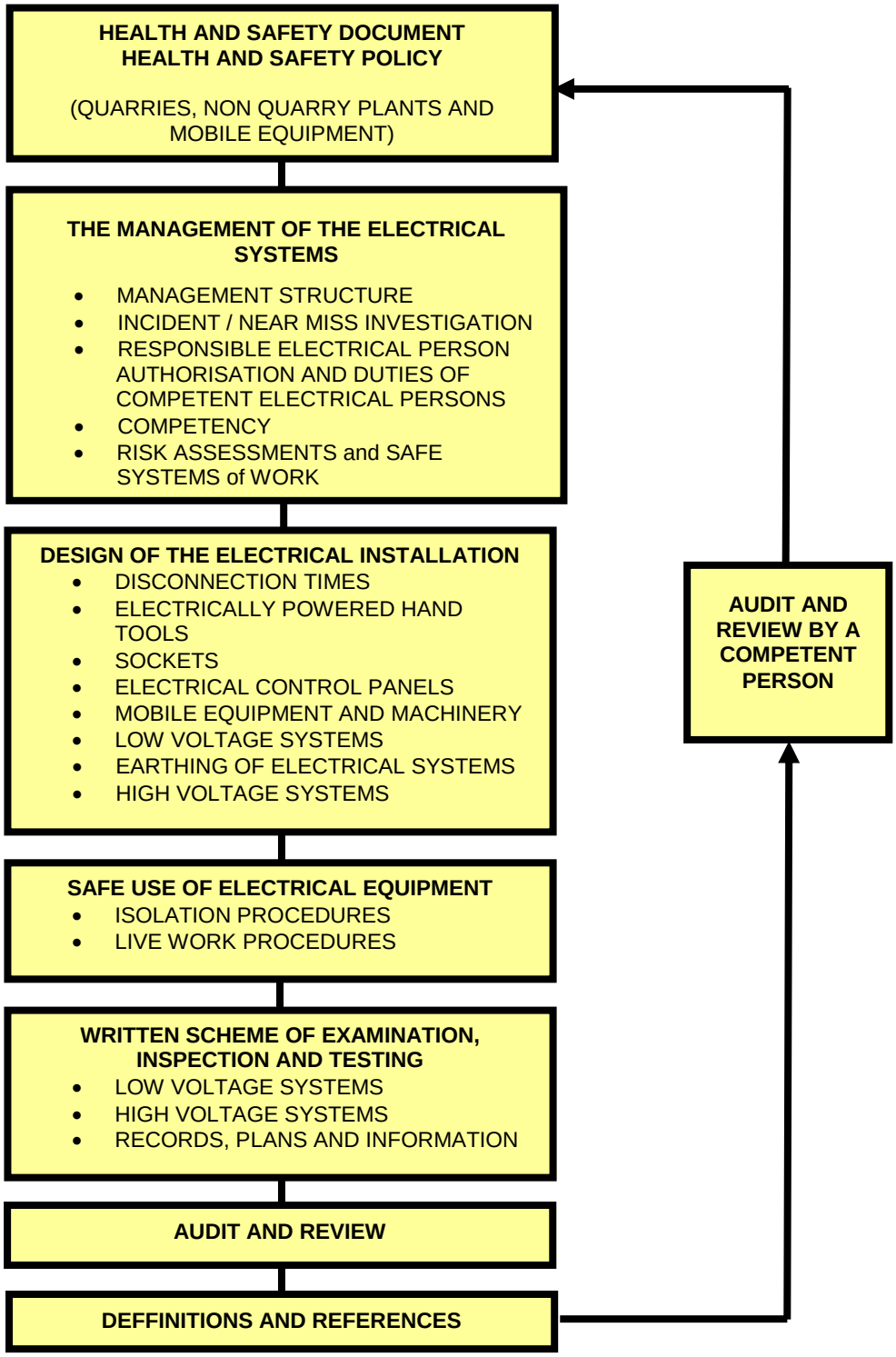
Electrical installations at all sites are required by law to be designed, operated, used, maintained, inspected and tested so that safety is achieved. The principal legislation and standards to be complied with includes.

- Health and Safety at Work Etc. Act 1974.
- Quarries Regulations 1999.
- Management of Health and Safety at Work Regulations 1999.
- The Electricity at Work Regulations 1989.
- PUWER Regulations 1998.
- Current version of BS7671 Requirements for Electrical Installations.
- All relevant health and safety legislation.

The HSE's principal guidance on electrical safety matters is publication HSR25, 'The Electricity at Work Regulations 1989 Guidance on Regulations' and HSG85 'Electricity at work Safe working practices.' The above regulations and guidance work together detailing requirements to have arrangements in place which ensure that electrical systems are properly managed in such a way that, at all times, they are safe. To ensure compliance, a comprehensive Electrical Safety Management System should be used which can form part of the Health and Safety Document as required by Regulation 7 of the Quarries Regulations 1999. The Electrical Safety Management System should contain information in the following main topic areas and is shown in Figure 1 below.

- Management.
- Design and Installation.
- Safe Use.
- Examination, maintenance, inspection and testing.
- Audit and Review.
- References.

Figure 1 – Electrical Safety Management System for installations.



4. THE MANAGEMENT OF ELECTRICAL SYSTEMS.

4.1 Management structure.

The way electrical systems are managed governs whether systems are safe or not. The persons responsible for ensuring the safety of the electrical equipment at any particular site must be clearly identified in the management structure set out in the Health and Safety Document. Electrical safety is a complex topic and requires technical knowledge and experience to be certain that all matters are correctly dealt with. Where a person is identified in the management structure as being responsible for electrical systems but is not himself competent in electrical matters, he must appoint a competent person having the necessary technical knowledge and experience to advise him on electrical safety matters.

4.2 Incident and Near Miss Investigation.

It is a management responsibility to ensure that all electrical incidents and near misses are properly and thoroughly investigated so that a root cause can be established and action taken to prevent like occurrences. Where events are reportable to the Health and Safety Executive or where a claim may be made against the operator, the operator's health and safety advisor supported by a competent electrical engineer should carry out the investigation.

4.3 Responsible Electrical Person, authorisation and duties of competent electricians.

At all quarry and non-quarry sites, it is advisable to have one or more individuals (employee or contractor) identified as the responsible electrical person for the site, whose duties include advising the operator on electrical matters and managing all work on the electrical system. The responsible electrical person should be authorised in writing as to their duties, clearly defining what they are and are not responsible for. The responsible electrical person should authorise all other persons, including contractors, who carry out work on the electrical system at the site, ensuring that they are competent to carry out that work and have the equipment, including suitable test instruments, to enable them to carry out the work safely.

4.4 Competence.

All persons (employees and contractors) working on electrical systems either fixed installations or mobile equipment must be competent to carry out the tasks. The following list of skills and knowledge may be used to determine the competency of persons working on electrical systems. This list is not definitive and is not an absolute requirement.

- Health and Safety training.
- Risk assessments and method statements.
- Qualified to BTEC, C&G or equivalent. Lower qualifications may be used where this can be demonstrated through experience.

- Knowledge of or qualified to the current version of BS7671 Requirements for Electrical Installations.
- Experienced in motor controls, control systems, isolation and commissioning of electrical systems.
- Testing and inspection of fixed installations and portable appliances.
- Manufacturer's training courses particularly for service engineers.
- For high voltage systems. Proof of high voltage training courses, experience in high voltage engineering and equipment.
- For contractors affiliation to trade bodies such as NICEIC, ECA, SELECT or similar.

4.5 Risk Assessments and Safe Systems of Work.

In the most commonly used risk assessment methodology, risk is given as the product of a number of qualifying factors including chance and maximum probable injury. For electrical work minor incidents can result in electric shock, death through electrocution or serious burns. To have an acceptable risk assessment in those circumstances, the chance of an incident happening must be, at least, very unlikely and at best, impossible. The control measures used for electrical work must therefore be adequate to prevent the likelihood of contact with live parts or of causing short circuits when persons are near the live conductors.

Experience shows that failing to undertake suitable risk assessments and utilise safe systems of work are often causal factors in electrical incidents. Electricians should not rely on chance, they should make use of effective control measures to prevent incidents.

It is the quarry operator's duty to comply with the requirements, therefore they must ensure that electricians or electrical contractors are competent and have suitable risk assessments and safe systems of work for the tasks to be undertaken.

The responsible electrical person should therefore ensure that adequate risk assessments have been completed and are included in the health and safety document for all electrical work. In any particular case, work should be carried out in a manner detailed in the risk assessment and safe system of work, or where different conditions apply, a task specific risk assessment and safe system of work should be completed. A non-exhaustive list of risk assessments may include the following.

- Use of electricity.
- Operation and use of high voltage equipment including maintenance.
- Periodic inspection and testing of all installations and equipment.
- Operation and use of low voltage equipment.
- Working on or near to live electrical equipment for the purpose of fault finding, commissioning and testing.
- Testing isolated equipment to prove it is dead.
- Protection against contact with overhead lines and underground cables.

- Installation of equipment including cables.
- Access to equipment at high level.
- Risks from overhead line contacts by drivers of owned vehicles and contracted vehicles.

5. THE DESIGN OF AN ELECTRICAL INSTALLATION.

Electrical equipment that has been properly designed, constructed, installed and maintained does not present a risk of electric shock or burn injury when properly used. The general requirement for the design and construction of electrical equipment is that it is suitable for its intended use and the environment in which it is to be used. Electrical equipment is susceptible to failure from water and dust ingress, damage by impact and general deterioration and should therefore be protected from these effects by installing it in a dry environment free from damage or in suitable weather proofed and protected enclosures.

Electrical installations must conform to relevant British, CENELEC and IEC standards. All equipment must be marked with an appropriate CE marking.

All installations, including those for the control of motor drives, must be capable of being effectively isolated by readily accessible lockable isolating devices. The means of isolation, whether isolating switches, fused isolators, circuit breakers or other devices, must be capable of being locked in the open or off position and clearly labelled to show the equipment or circuit that it controls.

Where emergency stopping devices and or safety interlocking devices are fitted to equipment and machinery these should be designed to be readily accessible, not easily defeated and fail to safety in the event of fault.

5.1 Disconnection times

The disconnection of faults is extremely important for the following reasons.

- To protect persons from electric shock and
- To protect persons and plant from the risk of fire and or explosion.

Therefore equipment must be designed to withstand all foreseeable excess currents and be protected against faults such as short circuits, earth faults and sustained overloads. The electrical protection used, whether simple fuses or complex tripping systems operating circuit breakers, should be set at the correct level (i.e. the size of the fuses or tripping levels of complex systems) to trip in the minimum time consistent with avoiding nuisance trips. Requirements dealing with tripping times are set out in the current version of BS7671. Requirements for Electrical Installations, but it is recommended that the following disconnection times are adopted.
For 230V / 400V TN earthing systems.

- Production plant and equipment 0.2 seconds for 230V / 400V.
- Offices, weighbridges and welfare facilities 0.4 seconds.

These disconnection times above are only advisory but in all circumstances disconnection times must meet the requirements of those set out in the current version of BS7671 Requirements for Electrical Installations and applies to all low voltage circuits.

5.2 Electrically powered hand tools

Where possible all electrically powered hand tools should be either.

- Rechargeable battery type or,
- 110V fed from centre tapped earth supply.

Consideration should be given with regard to the environment where electrically powered hand tools are used, for example inside tanks, silos, mixer drums etc. The risk assessment for the task may identify the use of battery powered hand tools only.

Where 230V hand tools and test equipment have to be used then the equipment should be protected by a suitably rated 30mA RCD.

5.3 Socket outlets

All 230V / 400V socket outlets should be protected by RCD's unless they are covered under the exceptions set out in the current version of BS7671 Requirements for Electrical Installations.

5.4 Electrical control panels

The design of electrical control panels is an important feature for electrical safety. They must be safe when being commissioned, tested and maintained. To ensure that such equipment is safe when commissioning or fault finding is being carried out the risk of contact with dangerous live parts should be prevented. The internal conducting parts of the electrical panels should be arranged so that when doors are opened, all live conductors above 50 Volts AC 120 Volts DC inside the panel are covered so that accidental or inadvertent contact cannot occur. BSEN 60204 – Electrical Equipment for Machinery sets the minimum standard of protection as IP2X (i.e. finger proof), this should be used as the minimum standard of protection of conductors**.**

It is also advised to build integral test circuits into motor control electrical panels to allow testing of control circuits, normally live at 110V AC, without the power circuits being energized where possible. These test circuits can also be retrofitted into existing panels to enable safe fault finding.

5.5 Mobile Equipment and Machinery

With regard to mobile equipment and machinery where a low voltage generator is used as the source of power the electrical installation should still follow the principles of the current version of BS7671, Requirements for Electrical Installations, and any manufacturer's standards.

The earthing of mobile equipment and machinery should follow the principles set out in BS 7430 2011 Code of practice for protective earthing of electrical installations. For example.

- For equipment and machinery with an on board low voltage generator the power system neutral / star point should be connected to the frame of the mobile plant which would act as the system earthing point. The mobile plant need not be connected to the general mass of earth. However the frame or chassis of the mobile equipment should not be used as a live or neutral conductor.
- For equipment and machinery fed from a separate low voltage generator the power system neutral / star point should be connected to the general mass of earth via one or more earth electrodes. Where it is not practicable to install to install earth electrodes other measures must be taken to ensure the installation is safe and to comply with Regulation 8 of The Electricity at Work Regulations 1989 and associated guidance – HSR25.

5.6 Low voltage systems

The current version of BS7671, Requirements for Electrical Installations, should be the governing standard for the safety of electrical installations within quarries. Wire armoured cables used for fixed installations should generally be XLPE insulated and sized appropriately for the load and fault current. It is advised where possible that the armouring is not used as the sole means of earthing and a separate core, either internal or external, should be used for the circuit protective conductor. Where the armouring is used as the sole means of protection this should comply with the requirements of the current version of BS7671 Requirements for Electrical Installations. Cables should be correctly installed, supported along their length or located where there is no risk of them being damaged. Flexible cables, either armoured or non- armoured, may be used for certain applications such as mobile equipment and machinery, and moving machinery such as screens or feeders. But consideration must still be taken into account with regard to protection against mechanical damage.

Following completion of a new circuit, the installation electrician should provide a completion certificate in a format set out in appendix 6 of the current version of BS7671, Requirements for Electrical Installations, with measurements of earth fault loop impedance or line and protective earth conductor resistance measurements, commonly known as R1 and R2 values, from those values the time to disconnect in the case of fault can be determined.

5.7 Earthing of electrical installations.

Proper and effective earthing of the electrical system is necessary for ensuring safety of the electrical installation. There are a number of ways of earthing an electrical system, which are as follows.

- The site may have its own separate earthing point to which the supply system is connected.
- The Electricity Distribution Company may provide an earthing connection to which the supply system will be connected.
- For mobile equipment and machinery as defined in section 5.5 above.
- The use of protective multiple earthing (PME) systems is not advised in Quarries due the difficulty in ensuring the electrical bonding of all metalwork.

Whichever system is in place the earthing must be properly designed to ensure that the system is disconnected safely when a fault develops.

BS 7430 2011, Code of practice for protective earthing of electrical installations, the current version of BS7671, Requirements for Electrical Installations, and associated guidance notes should be used as guidance on earthing systems.

For earthing to be effective, the resistance of all earth paths from any equipment must be sufficiently low to ensure that should a fault occur the power will be disconnected in a short a time as possible and comply with the disconnection times set out in section 5.1 above.

5.8 High voltage systems.

High voltage equipment is technically complex and if not correctly managed can be a source of extreme danger. All high voltage systems should be placed under the control of a competent person (employee or contractor) who has the necessary competence to properly design, use and manage the HV system on behalf of the operator. Switchgear in excess of 30 years old should be separately assessed and replaced as and when appropriate.

High voltage switchgear should be installed in locked enclosures with access restricted to competent and authorised persons only.

High voltage installations are not within the scope of BS7671, Requirements for Electrical Installations. These installations therefore should be designed and installed by a person or company competent in high voltage systems and equipment.

6. THE SAFE USE OF EQUIPMENT.

Most serious electrical incidents within quarries occur when people work on electrical equipment without taking adequate precautions to ensure safety. The Electricity at Work Regulations 1989 clearly states the requirements for working on electrical systems. Normal practice is for all work to be carried out on dead equipment which is properly and effectively isolated, but in certain exceptional circumstances work may have to be carried out on or near live equipment, such as the diagnostic testing to locate a fault, electrical testing and commissioning of equipment. Whenever live working takes place safety precautions must be sufficient to prevent any incident. Section 6.2 gives guidance on live working procedures.

The measures concerning the safe use of equipment identified in the health and safety document should include written procedures for the effective isolation of electrical equipment and machinery, procedures for work on or near live equipment and the use of permits to work. HSE guidance document HSG85 (Electricity at work: safe working practices) should be used for reference

6.1 Isolation procedures.

A great number of incidents occur in all industries including quarries when electrical equipment or machinery is not isolated when work is being carried out on or near it. Proper isolation must take place before work is undertaken on any equipment. Effective rules for the isolation of electrical equipment, sometimes called plant lock off, test and try procedures will provide the necessary framework for such proper isolation. Where possible the isolation rules for electrical equipment should be incorporated within the site lock off test and try procedures, where this cannot be achieved separate electrical procedures should be drawn up. For sites having high voltage equipment, separate isolation rules including permits to work will be necessary.

Isolation is defined as the disconnection and separation of the equipment from every source of energy or harm in such a way that the disconnection and separation is secure.

Although this document specifically deals with electricity it is important to stress that isolation of equipment and machinery must also include the following energy sources where applicable.

- Pneumatic – compressed air or other gases.
- Hydraulic – oil, water and other fluid.
- Chemical.
- Radiation.
- Gravitational.
- Mechanically stored potential energy.
- Thermal.
- Powder or other solids.

The procedures must ensure that equipment cannot be made live, or machinery move, whilst it is isolated.

The isolation rules for low voltage equipment should require that work should not be undertaken on equipment unless it is.

- Dead.
- Isolated at all points of supply, caution notices applied and locked in the off position.
- Verified as being dead at the point of work by measurement or with voltage indicators which have been proved before and after the verification.
- Where applicable released for work by a permit to work.

The isolation may be carried out by competent electricians authorised to undertake low voltage isolations.

For high voltage equipment additional precautions are necessary to prevent danger, work should not be undertaken on any high voltage equipment unless it is.

- Dead.
- Isolated at all points of supply including voltage transformers, caution notices applied and locked in the off position.
- Connected to earth at all points of isolation. Local earths at the point of work may also be necessary if the isolation point is remote.
- Screened from all adjacent live equipment, with ‘danger live’ notices applied to all live equipment.
- Released for work by the issue of a permit to work, the permit must be issued to the person in charge of the work.

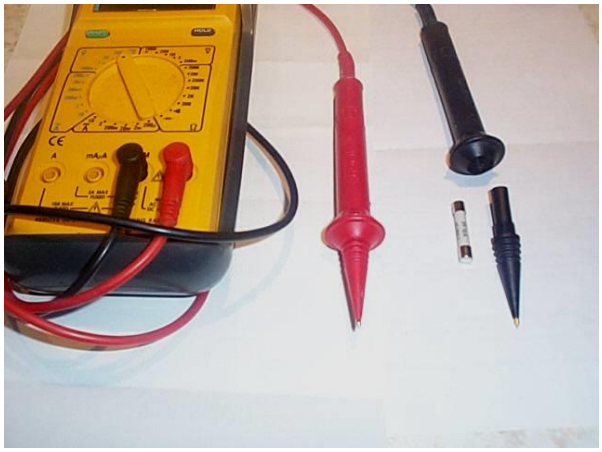
The isolation and issue of the permit to work should be carried out by a person with relevant high voltage competence, normally authorised as a Senior Authorised Person by the Operator.

6.2 Live working.

Work on or near live low voltage equipment should not occur other than in exceptional circumstances. The live working procedures should be drawn up to detail when work on or near live equipment is allowed and what precautions should be in place to ensure that work is done without the risk of injury. The work should not be carried out unless agreed by the responsible electrical person and a risk assessment and safe system of work has been agreed prior to the work commencing. Consideration should be given to the use of motor control test circuits built into the motor control panel that allows the live testing of control circuits with the power circuit being isolated. Such an arrangement allows electrical staff to undertake fault finding without exposing themselves to the risk of serious shock or burn injuries from high power circuits.

The operator should ensure live working rules are in place which must detail the precautions necessary for live work. The precautions usually comprise the following.

- The equipment being worked upon is safe to work on, all conductors are covered or screened to a minimum standard of IP2X so that they cannot be touched or tools dropped on them.
- If using the control circuit test switch method for diagnostic testing, the control circuit conductors, if greater than 50 V AC, must be screened to a level of at least IP2X.
- Test leads and probes are fitted with fuses in accordance with HSE guidance note GS 38 (Electrical test equipment for use on low voltage electrical systems) and tools are insulated.
- Persons are competent to undertake the work and recognise the precautions necessary to avoid danger.



Typical GS38 test leads with fused probes.

7. WRITTEN SCHEME OF EXAMINATION, INSPECTION AND TESTING.

The objective of periodic examination, inspection and testing is to ensure that work places and equipment are safe, in efficient working order and in a good state of repair. Not all defects can be identified by inspection, it is necessary to carry out tests on parts of the installation, particularly on earth fault paths and electrical protection systems, to ensure that equipment will be safe.

Electrical equipment must be maintained as necessary to ensure safety and for the prevention of loss. The degree of maintenance will depend on many factors such as safety, duty of equipment, potential loss etc. It is necessary to have a comprehensive preventative maintenance system that includes periodic examination, inspection and where appropriate testing to ensure safety and productivity are maintained.

7.1 Low voltage systems.

The written scheme of examination, maintenance, inspection and testing required by the Quarries Regulations 1999 should be in line with the requirements of the current version of BS7671, Requirements for Electrical Installations. With a proviso that operators should select the frequencies following an assessment of the risks at the site. For guidance purposes the table shown in section 7.1.1 shows the recommended frequencies to be used. Where insurance companies or contractors carry out the work it is important that the operator states what will be done rather than let others decide on what will ultimately be the operator's responsibility. It will be advantageous to carry out the work and report in line with an agreed specification drawn up by the responsible electrical person.

7.1.1 Frequencies of Inspection and Test.

The following table gives guidance on the frequency of inspections and tests of an electrical installation (including mobile equipment and machinery).

Type of inspection	**Frequency**
Emergency stops and safety interlock devices	Monthly
Manual testing of RCD's	3 monthly
Visual inspections (quarries)	6 monthly
Thermographic surveys (all sites)	12 monthly
Visual inspection, R2 tests and earth loop impedance results using historical R1 values. (quarries)	12 monthly
Earth electrode testing (quarries)	12 monthly (in dry period)
Visual inspections (non quarries)	12 monthly
Visual inspection, R2 tests and earth loop impedance results (non quarries)	3 yearly
Earth electrode testing (non quarries)	3 yearly (in dry period)
Verify circuit conductors (R1) (all sites)	3 yearly
Insulation resistance tests (all sites)	3 yearly

Note: - When R2 tests are carried out at least one earth loop impedance must be measured per distribution transformer or incoming mains supply to verify the results.

7.1.2 Defect rectification.

Operators should have, as part of the inspection and test system, a means of ensuring defects are remedied in an appropriate time scale. The defect action report should be included in the health and safety document.

The operator should agree a specification for the inspection and tests setting out what must be done, the reporting procedures and action necessary if equipment is found to be a source of immediate danger.

As defined in the current version of BS7671, Requirements for Electrical Installations 17th Edition, defects reported from an inspection are split into 3 categories as follows.

Code 1 which are defined as.

- Where danger currently exists and an immediate issue of safety is apparent. These defects are a source or have the potential to be a source of immediate danger to persons, plant, machinery or buildings (and livestock in domestic type dwellings), arising either from the normal use or from foreseeable faults of electrical equipment and
- They should be considered as requiring immediate attention to rectify the defects. Where it is not possible to rectify the defects immediately they shall be rectified as soon as possible in line with an assessment of the risks and after consultation with the responsible electrical person.

Code 2 which are defined as.

- Not immediately dangerous but a dangerous condition could occur due to a fault. These defects include those that are serious but are not or do not have the potential to be a source of immediate danger to persons (and livestock in domestic type dwellings), or to cause immediate danger to plant, equipment and buildings and
- They shall be considered as requiring urgent action to rectify the defects. The defects should be rectified within one month. Where it is not possible to complete matters within one month, they shall be completed as soon as possible in line with the assessment of risks.

Code 3 which are defined as.

- Defects that are not directly safety related but which are non-compliance with the requirements of the Electrical Safety Management System, The current version of BS7671, Requirements for Electrical Installations 17th Edition, and
- These defects can be used to identify areas or equipment where improvements can be made both to the installation.

7.1.3 Portable appliances.

With regard to portable appliance testing there are no set frequencies of inspection and test, but guidance can be found in HSE publication HSG107 Maintaining portable electrical equipment and IET COP for in- service inspection and testing of electrical equipment 4th edition.

7.2 High voltage systems.

The purpose of inspection, maintenance and testing of a high voltage electrical installation is to assess its actual condition at the time of the inspection and to assess whether for a period up to the next inspection it will not be a source of danger if it is properly used and maintained during that period. The types of inspection include.

- Routine visual inspection and
- Thorough visual inspection and test including maintenance.

All inspections, maintenance and tests should be carried out by a competent person.

For guidance purposes the table shown in section 7.2.3 shows the recommended frequencies to be used.

7.2.1 Routine visual inspection.

This comprises of an inspection of the external parts of the installation to determine its general condition and is carried out at intervals between the thorough inspection and maintenance.

7.2.2 Thorough inspection and maintenance including testing.

This comprises of the inspection, maintenance and testing of the external and internal parts of the installation and equipment to determine its condition and whether or not the equipment is safe for continuous use.

Due the many different types of high voltage equipment in service it would not be feasible to list all of the checks required in this guidance document, therefore the inspections, maintenance and testing of high voltage systems should be carried out in accordance with manufacturer's guidelines where available and /or HSE publication HSG230 Keeping Electrical Switchgear Safe. British standard BS 6626: 2012 Maintenance of electrical switchgear and control gear for voltages above 1 kV and up to and including 36 kV – Code of practice also provides guidance on these matters.

Maintenance of high voltage equipment shall also include any work required as a result of a notification by the Energy Networks Association fault reporting system.

7.2.3 Frequencies of Inspection maintenance and test.

The following table gives guidance on the frequency of inspections and tests of an electrical installation (including mobile equipment and machinery).

Type of inspection	Frequency
Routine visual inspection	12 monthly
Thorough inspection and maintenance	5 yearly (3 yearly for oil filled switchgear)
Post fault maintenance of oil filled switches and circuit breakers.	Immediately after operation under fault conditions.

7.2.4 Defect Rectification.

As with the low voltage defects there is no set guidance on defect coding and rectification on high voltage systems. Where defects are found on high voltage equipment these should be rectified in accordance with guidance from the competent person carrying out the inspections and maintenance or where possible Energy Network Association may also be used for information on high voltage equipment faults as further guidance on rectifying defects.

7.3 Record, plans and information.

The following information should be kept on site as part of the management of electrical installations and systems. Where defects have been identified on any part of the system then records of the rectification should also be kept on site. All inspection records should be signed by the person carrying out the inspection. All defect rectification records should be signed by the person carrying out the rectification and countersigned by site management.

- Underground and overhead site service plans
- Installation test certificates high and low voltage
- High voltage inspection and maintenance records
- Low voltage inspection and test records
- Portable appliance test records
- RCD test records
- Emergency stop / safety interlock test records
- Defect rectification records for all inspections and tests
- Distribution line diagrams low and high voltage
- Motor control circuit diagrams
- Operating and instruction manuals for equipment

8. AUDIT and REVIEW.

The Electrical Safety Management System for installations should be audited and reviewed by the responsible electrical person to ensure compliance and where required actions put in place to rectify any deficiencies. The audit frequency should be no longer than 12 monthly or any change in legislation.

9. DEFINITIONS.

- Quarry - as defined by Regulation 3 of the Quarries Regulations 1999.
- Non quarry site - means any plant or building outside of the scope of Regulation 3 of the Quarries Regulations 1999.
- LV - means voltages up to and including 1000V AC or 1500V DC.
- HV - means voltages above 1000V AC or 1500V DC.
- RCD – Residual Current Device.
- R1 - circuit line conductor.
- R2 - circuit protective conductor.

10. REFERENCES.

- The Electricity at Work Regulations 1989 and associated guidance – HSR25.
- Provision and use of Work Equipment Regulations 1998.
- Supply of Machinery (Safety) Regulations (amendment) 2011.
- Electrical Equipment (Safety) Regulations 1994.
- The Electricity Safety, Quality and Continuity Regulations 2002.
- BS7671 17th Edition and associated guidance notes.
- Electricity at Work: Safe working practices – HSG 85.
- Electrical Test Equipment for Use by Electricians - GS 38.
- BS 7430 2011 Code of practice for protective earthing of electrical installations.
- HSG47 Avoiding danger from underground services.
- GS6 Avoidance of danger from overhead electrical lines.
- HSG107 Maintaining portable electrical equipment.
- HSE HSG230 Keeping Electrical Switchgear Safe.
- BS 6626: 2012 Maintenance of electrical switchgear and control gear for voltages above 1 kV and up to and including 36 kV – Code of practice.