ESCOM
ELECTRICAL SAFETY COMMITTEE

GUIDELINES AND BEST PRACTICES FOR CONSTRUCTION POWER PART 3: ELECTRICAL SAFETY AT CONSTRUCTION SITE

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What is ESCOM?

The Safety, Health and Environment National Authority (SHENA) and Autoriti Elektrik Negara Brunei Darussalam (AENBD) established the Electrical Safety Committee or "ESCOM" in January 2023; with the objectives of promoting regulatory compliance and raising electrical safety standards within Brunei Darussalam.

Who are the ESCOM members?

Members of the ESCOM comprised of industry experts from both government institutions and private organisations with decades of collective experience and a shared passion to drive improvements and promote electrical safety in Brunei Darussalam. The committee is co-chaired by both SHENA and AENBD.

ELECTRICAL SAFETY BEST PRACTICES			
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Disclaimer:

This document was developed as a recommendation and as an industry reference of best practices to improve electrical safety practices.

This document should not be construed as implying any liability nor should it be taken to encapsulate all the responsibilities and obligations of the law.

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1 INTRODUCTION

1.1 Background

Temporary electrical power at the site is subject to the size of construction and demolition, equipment used etc., hence the setup and installation varies with duration or term (generally short-term with extended period).

At the site, electrical equipment is exposed to constant weather, rough use, mechanical impact, frequent relocation and other factors which are not normally encountered compared to permanent installation.

Other complications that arise are un-controlled mobile or portable local generator sets that are brought in by different sub-contractors to which the integrity (i.e., if it was appropriately maintained and tested prior to their use on the site) and safety of that mobile or portable local generator are unknown.

1.2 Validity

This document is valid for five (5) years from the last revision date. Within this period, this document *shall* be assessed for relevance and re-validated in accordance with the review cycle and review process. Any suggestions for further improvement to this document *can* be sent to the Document Owner

1.3 General

This document and associated parts, EIR (Electrical Installation Requirement, DES), Safe Use of Electricity at Construction Sites and SHENA Industry Guidance Note provide the basic and foundation on the requirement for any electrical installations and use of electrical tools serve as guidance reference /or minimum safety.

1.4 Purpose

1.4.1 The purpose of this document is to provide guidance on the minimum electrical standard when setting up mobile equipment and temporary power to be used in the period of construction or demolitions work which is intended to be taken out of service upon completion of the works on *mobile* /or portable electrical tools /or equipment.

1.4.2 Compliance to relevant safety standards and requirements will enable the task to be properly carried out so as to avoid poor quality, and damage to equipment, and facility and endanger people from suffering from electric shock & burns when they use unsafe equipment and in contacting overhead power lines & buried cables.

1.4.3 The requirements apply to fixed or moveable installations. This document deals with selection and application in the installation throughout the construction duration until it is removed. This document is not intended for the design, manufacturing, assemblies and testing of electrical equipment nor to instruct untrained persons.

1.5 Scope

1.5.1 The scope of this Guidance and Best Practices document provides basic awareness to reduce the risk of accidents against hazards of unsafe and unsound electrical installation when using electrical tools (e.g., electrical equipment, machines, tools, electric power cords and appliances) at construction and demolition site from power supply service connections to power socket or receptacle outlets.

1.5.2 It is aimed to provide practical guidance to employers, employees and users of electricity on the management of electrical safety, with particular emphasis on low voltage installation, and safe isolation procedures which are to be followed during construction, refurbishment projects and maintenance activities. The information contained in this document acts as guidance, however, all parties must rely on their own sound judgement and experience when making use of it.

1.5.2.1 Objective

1.5.2.1.1 To protect users of electricity against the hazards of unsafe and unsound electrical installations; and

1.5.2.1.2 To understand the importance of permit-to-work systems and safe isolation in relation to live exposure protection.

1.5.2.2 This Guidance and Best Practices document does *NOT* provide any advice on:

1.5.2.2.1 Building wiring

1.5.2.2.2 Operational safety during Electrical testing and commissioning

1.5.2.2.3 Use of new permanently fixed electrical installation commission under construction/or demolition

1.5.2.2.4 Use of an existing or new fixed installation in a building undergoing modification or after construction

1.5.2.2.5 Qualification and competence of personnel.

1.5.3 This document consists of the following parts, under the general title Guideline and Best Practices for Construction Power:

1.5.3.1 Part 1: Temporary Construction Power

1.5.3.2 Part 2: Standalone Mobile Generator >10kVA to 1250kVA

1.5.3.3 Part 3: Electrical Safety at Construction Site

1.5.4 Words that are in italic font *shall* be make reference to respective definition.

2 DEFINITIONS

2.1 "Shall" - indicates a requirement strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties.

2.2 "Should" - make a recommendation to indicate that among several possibilities one is recommended as particularly suitable without mentoring or excluding others, or that a certain course of action is preferred but not necessarily required.

2.3 Can: used for statements of possibility and capability, whether, physical or causal

2.4 Could: used to indicate an allowable course of action within the limits in this standard

2.5 Conductor: of material aluminium or copper metal forming a wire, cable or other designed for carrying electric current.

2.6 Dead: electrically discharged by being disconnected from any electrical supply and not having any charge retained by capacitance.

2.7 Earth electrode: A conductor or group of conductors in intimate contact with, and providing an electrical connection to, earth.

2.8 Earth Resistance: The resistance of the earth between the earth electrode and remote reference earth.

2.9 Mean ground level: average ground level.

2.10 Low voltage: voltage that does not exceed 1000Vac or 1500Vdc

2.11 Live (1): electrically charged by connected to low/high voltage electricity supply or having charge retained by capacitance.

2.12 Live (2): in all circumstances, all electrical equipment is considered electrically charged until it is demonstrated, isolated, proved to be dead and earthed.

2.13 High voltage: voltages exceed low voltage U>1000V

2.14 Insulation: means separated from adjoining conducting material by a non-conducting substance which provides resistance to the passage of current, or to disruptive discharges through or over the surface of the substance at the operating voltage, and to mitigate the danger of shock or injurious leakage of current.

2.15 Sag: the distance measured vertically from a conductor to the straight line joining its two points of support. Unless otherwise stated in the rule, the sag referred to is the sag at the midpoint of the span.

2.16 Clearance: the clear distance between two objects measured surface to surface, and usually filled with a gas such as air.

2.17 Span: the horizontal distance between two adjacent supporting points of a conductor.

2.18 Wayleave: cleared swath of land / area under power overhead line.

2.19 Standalone: able to function independently.

2.20 In addition to the following may or can be taken as the same meanings

2.20.1 Right-of-Way: - also known as Wayleave.

2.20.2 Temporally equipment neither fixed nor stationary equipment.

2.20.3 Termination: - make connection.

2.20.4 Tie-in(s): - make connection.

2.20.5 Transportable / moveable: - as per "mobile".

2.21 Extracted from IEC 60050-212

2.21.1 Clause 212-11-18 "DC (electrification current)" – current after electrification by constant voltage between two electrodes in contact with an insulating material.

2.22 Extracted from IEC 60050-151

2.22.1 Clause 151-11-25 "equipment" - single apparatus or set of devices or apparatuses, or the set of main devices of an installation, or all devices necessary to perform a specific task.

2.22.2 Clause 151-12-01 "electric circuit" - arrangement of devices, media, or both, forming one or more conductive paths and where these devices and media can have capacitive and inductive coupling.

2.22.3 Clause 151-12-07 "connection (1)" - intentional electric contact between conductors or intentional junction between waveguides including optical fibres.

2.22.4 Clause 151-12-08 "connection (2)" - conductor or electric circuit for joining terminals or other conductors.

2.22.5 Clause 151-12-09 "connecting" - the action of establishing a connection.

2.22.6 Clause 151-15-41 "insulation" – all the materials and parts used to insulate conductive elements of a device.

2.22.7 Clause 151-16-44 "fixed" - fastened to a support or otherwise secured in a specified location.

2.22.8 Clause 151-16-46 "mobile" - capable of operating while being moved.

2.23 Extracted from IEC 60050-601

2.23.1 Clause 601-01-10 "distribution of electricity" – the transfer of electricity to consumers within an area of consumption.

2.23.2 Clause 601-03-04 "overhead line" – An electric line whose conductors are supported above ground, generally by means of insulators and appropriate supports.

2.24 Extracted from IEC 60050-602-02-01

2.24.1 Clause 601-01-10 "generator set" – a group of rotating machines transforming mechanical or thermal energy into electricity.

2.25 Extracted from IEC 60050-826

2.25.1 Clause 826-16-04 "mobile equipment" - electrical equipment which can move or can be moved while in operation or which can be moved from one place to another while connected to the supply.

2.25.2 Clause 826-16-06 "stationary equipment" - fixed equipment or equipment that cannot be easily moved.

2.25.3 Clause 826-16-07 "fixed equipment" - electric equipment fastened to a support or otherwise secured in a specific location.

3 ACRONYMS AND ABBREVIATIONS

3.1 For the purpose of this document, the following abbreviation shall applies:

3.1.1 AC - alternating current

3.1.2 OHL - overhead line

3.1.3 HV - high voltage

3.1.4 LV - low voltage

3.1.5 RLV - reduced Low Voltage

3.1.6 PE - protective earth

4 Applicable standards and industry guidance

4.1 This standard is prepared for local electrical safety at the construction site, it cannot be used for the purpose of determining conformity NEITHER apply to individual devices and self-contained components, such as circuit breakers, fuse switches, electronic equipment, etc., Assemblies *shall* comply with associated IEC & British standard but not limited to following:

4.1.1 The Electricity Safety, Quality and Continuity Regulations UK Statutory Instruments.

4.1.2 BS4363, Specification for distribution assemblies for reduced low voltage electricity supplies for construction and building sites.

4.1.3 BS7375, Distribution of electricity on construction and demolition sites – Code of Practice.

4.1.4 IEC 60245-4, Rubber insulated cables – Rated voltages up to and including 450/750 V –Part 4: Cords and flexible cables.

4.1.5 IEC 60309-1, Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements.

4.1.6 IEC 60309-2, Plugs, socket-outlets and couplers for industrial purposes – Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories.

4.1.7 IEC 60364 (all parts), Low voltage electrical installations.

4.1.8 IEC 60364-4-41, Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock.

4.1.9 IEC 60364-5-52, Electrical installations of buildings – Part 5-52: Wiring system equipment.

4.1.10 IEC 60364-5-53, Electrical installations of buildings – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control.

4.1.11 IEC 60364-7-704, Low voltage electrical installations — Part 7-704: Requirements for special installations or locations – Construction and demolition site installations.

4.1.12 IEC 60364-7-717, Low voltage electrical installations — Part 7-717: Requirements for special installations or locations – Mobile or Transportable units.

4.1.13 IEC 61439-1, Low voltage switchgear and control gear assemblies- Part 1: General Rule.

4.1.14 IEC 61439-3, Low voltage switchgear and control gear assemblies- Part 3: Distribution boards intended to be operated by an ordinary person (DBO).

4.1.15 IEC 61439-4, Low voltage switchgear and control gear assemblies- Part 4: Particular requirements for assemblies for construction sites (ACS)

4.1.16 EIR "Electrical Installation Requirements" published by Department of Electrical Services, Prime Minister's Office Brunei Darussalam.

4.1.17 ESCOM document No. ESCOM/2024/01, Title:- Guidelines and Best Practices for Public Lighting.

4.1.18 ESCOM document No. ESCOM/2024/02, Title:- Guidelines and Best Practices for Portable Appliance Testing.

5 Technical Requirement

(for Temporary Power and Standalone / Mobile Generator)

5.1 Refer to Clause 5: Technical Requirement for Temporary Power under the document "Guidelines and Best Practices for Construction Power Part 1: Temporary Construction Power" (ESCOM/2024/04)

5.1.1 Technical requirement for Local Diesel Generator Set

5.2 Refer to Clause 6: Technical Requirement for Standalone / Mobile Generator >10kVA to 1250kVA under the document "Guidelines and Best Practices for Construction Power Part 2: Standalone / Mobile Generator >10kVA to 1250kVA" (ESCOM/2024/05).

ELECTRICAL SAFETY BEST PRACTICES- GUIDELINES TO CONSTRUCTION POWER

PART 3: ELECTRICAL SAFETY AT CONSTRUCTION SITE

6 General electrical safety

6.1 Safe use of electricity does not end at any permanent or temporary electrical installation but it begins at the user, e.g., the moment any personnel inserts the "plug" into a socket outlet or turned the switch on any electrical appliance. Therefore, all users of electricity shall have basic self-awareness of electrical safety.

6.2 In addition, the construction company shall emphasize and cover the following with regard to basic electrical safety:

6.2.1 Hazards related to new development on-site changes.

6.2.2 Temporary erection of scaffolding.

6.2.3 Heavy machinery (lifting, crawler etc.).

6.2.4 Situation awareness, e.g., protruding nail, long trailing rope/wire/hoses.

6.2.5 Construction trash and uncontrol and organizing of site setup, housekeeping.

6.3 Self-awareness program

6.3.1 Construction company shall establish and provide an updated basic briefing on the electrical setup at the site as below:-

6.3.1.1 one (1) introduction awareness to all personnel (this includes all sub-contractors /vendors, visitors etc.).

6.3.1.2 bi-monthly to all personnel using electrical appliances and tools.

6.3.1.3 bi-weekly to all technicians inclusive helper for E&I activities.

6.4 Project site safety program

6.4.1 This program is to minimize hazardous conditions and situations that may arise during the construction or demolition period related to the temporary electrical system, boundary & limitation, personnel awareness, and competency eliminating unsafe practices that could create unnecessary hazards.

6.4.2 This program will focus on the following groups:-

6.4.3 General User:- Introduction awareness for every general user at site. The briefing pack shall not be limited to the following: -

6.4.3.1 Electrical hazards and risks. e.g., directly linked to electrical work are electric shock & electrocution; arc flash, explosion and fire. Indirect non-electrical work such as trenching and shoring, excavation, working at height, welding, cutting etc.,

6.4.3.2 Electrical Do and Don't, see 8.10.3.

6.4.3.3 Condition of electrical appliances and tools i.e., damages, wear and tear, crack, broken, exposed parts.

6.4.3.4 Wiring connection:

6.4.3.4.1 Improper and alterations of wiring connection, use only industrial socket outlet and plugs.

6.4.3.4.2 Loose and trailing wiring / cables/ flexible cord etc., from excessive length.

6.4.3.4.3 Unsupported cables on the ground that are exposed to mechanical damage / water /rain etc.

6.4.3.5 An equipment or structure becoming life as result of damaged insulation causing short-circuit, as a result of switch-on or re-energize which had been made dead, loose earthing etc.

6.4.3.6 Construction trip, slip and fall.

6.4.3.7 Overhead hazard, etc.

6.4.3.8 Environmental impacts like damp, wet conditions, rain etc.

6.4.4 Electrical technicians:- are responsible for site planning & management, and those who control the installation and use of electrical systems and equipment. The briefing pack shall describe workplaces and workplace facilities that are not limited to the following: -

6.4.4.1 type of electrical system and voltages, LV 1-phase 230Vac, RLV 50V-0-50V (110Vac), 3-phase 400Vac etc.,

6.4.4.2 type of load and power consumption, e.g., lighting circuit, socket outlet, site ACS/DB, OHL/cabling, generator set

6.4.4.3 limitation and authorities of the user, e.g., who is authorized to make connection to ACS/DB, switching on/off generator main circuit breaker including starting and stopping etc.,

6.4.4.4 change(s) to electrical system/network, e.g., adding ACS/DB, SOA, TA, meddling with wiring etc.

6.4.4.5 earthing system, e.g., TNS, earth wire connection

6.4.4.6 type of electrical protection e.g., O/C, E/F, short circuit, personal protection, MCBs, ELCB, RCBo, fuses etc.,

6.4.4.7 managing tools /or equipment from different contractor /sub-contractors

6.4.5 Requirements and Supplementary:- project site/owner – accountability throughout the construction and demolition period.

6.4.5.1 Drawing on Electrical network and distribution

6.4.5.2 Information and instruction.

6.4.5.3 Training and Supervision.

6.4.5.4 Personal Protective Equipment.

6.4.5.5 Safety officer / worker monitoring system.

6.4.5.6 Electrical safety and First aid equipment.

6.4.5.7 Certified first aider and fire warden.

6.4.5.8 Control isolation, de-isolation, switching, including work permit, padlocking etc.

6.4.5.9 Incident reporting, share and learning

7 Permit to work

7.1 General Notes

7.1.1 An electrical permit-to-work is primarily a statement that a circuit or item of equipment is safe to work on as it has been isolated, discharged and, where appropriate, earthed. You must never issue an electrical permit-to-work for work on equipment that is still live or to authorize live work.

7.1.2 A typical example of an electrical permit-to-work form can be found in **Appendix 1**.

7.1.3 The information it contains should be precise, detailed and accurate. It should state which equipment has been made safe, the steps by which this safety has been achieved, and exactly what work is to be done.

7.1.4 Do not allow anyone to work on equipment that is not specified in the electrical permit-to-work as having been made safe. This restriction should be understood and complied with by everyone in the premises, including directors and senior staff.

7.1.5 If a programme of work must be changed, the existing electrical permit-to-work should be cancelled, and a new one be issued before any variation is made to the work. The only person who has the authority to agree to the change in programme and issue the new electrical permit-to-work is either the person who issued the original permit or the person nominated by management to take over the responsibility, e.g., at the end of a shift or during absence on leave.

7.1.6 Only a designated competent person should be issued an electrical permit-to-work (EPTW). Before issuing the permit, they should work-out, in detail and in writing, what are the various steps ***to disconnect, isolate, prove dead, lock OFF, earth the equipment, post warning notices, and identify the equipment to be worked on and adjacent equipment which will still be live before they both sign the permit.***

7.1.7 It is preferable to include a single-line diagram (SLD) on, or attached to, the permit confirming the abovementioned information and showing the zone for work.

7.1.8 In cases where there may be divided responsibility, the roles must be clearly defined to ensure that there is no confusion over respective responsibilities.

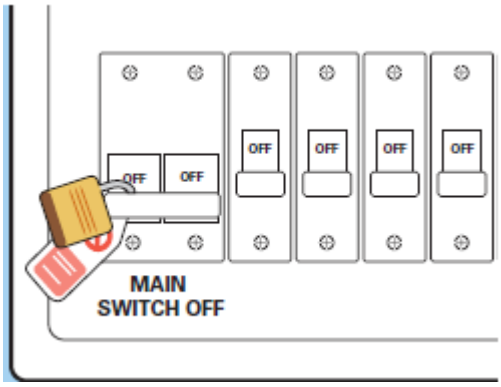
7.1.9 If the person issuing the electrical permit-to-work will also be doing the work, it is strongly recommended that someone else makes an independent check of the precaution taken. The person doing the work should then issue a permit to themselves. This routine helps to ensure that the full safety procedure is applied.

7.1.10 When the work is complete, whomever the permit was issued to shall then sign it to declare that any earths and tools have been removed and people in the group have been withdrawn and instructed not to approach the equipment again. The person clearing the permit should also indicate

whether or not the equipment is fit for service. The permit is then returned, preferably to the designated competent person who had originally issued it, for cancellation before the equipment is re-energised.

7.1.10.1 Any electrical permit-to-work system should have a procedure for monitoring (audit) to ensure that the safety rules are complied with and the documents are accurate. The monitoring should preferably be carried out by an individual with managerial responsibilities, who is not involved in the day-to-day issuing of permits, and should be random and ongoing so that bad habits and inaccuracies can be identified and eliminated quickly.

7.2 Isolation:- Basic isolation using padlock and tag



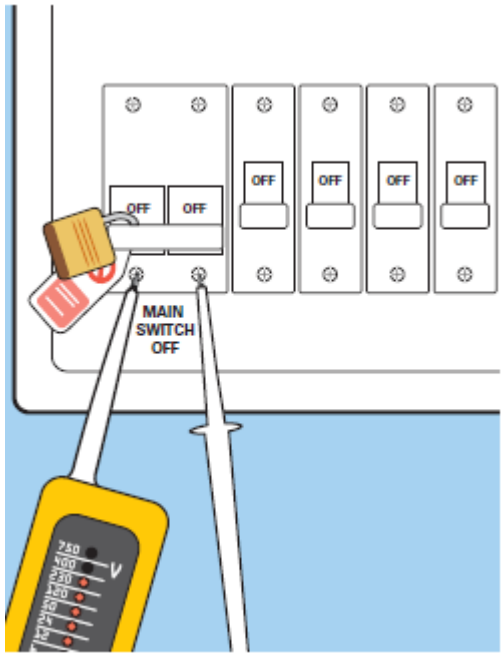
7.2.1 Ensure that any switch disconnector or other means of disconnection is secure.

7.2.2 Switches, including circuit breakers, should be locked in the OFF position preferably using a 'safety' lock, i.e., a lock or padlock having a unique key or combination. A safety warning tag shall be attached to the lock.

7.2.3 All keys should be retained in a secure place. If a plug has been withdrawn, ensure that it cannot be reconnected to the electrical supply while work is taking place on the circuits or apparatus – the use of proprietary lock-out devices for this purpose is encouraged.

7.2.4 Where a number of people are working, the use of a multiple locking hasp attachment, lock-out box or key-safe may be appropriate to ensure that all the locks has been removed before the equipment can be re-energised. Everyone involved in the work should apply a lock to the multiple locking hasp and keep personal possession of the key.

7.3 Test and proving



7.3.1 Having isolated the circuit or equipment, and before working on it, check that the parts to be worked on or near really are dead, even if the isolation has been achieved automatically through an interlocking system. If it is a three-phase system or equipment has more than one supply, ensure that all supply conductors are dead.

7.3.2 The instrument to do this should be properly constructed in order to be protected against electric shock and is designed to prevent short circuits occurring during use.

7.3.3 Voltage detectors such as two-pole voltage detectors, test lamps, or voltmeters with insulated probes and fused leads can be used (see HSE Guidance Note GS38).

7.3.4 The use of multimeters, which can be set to the wrong function, is not recommended for proving dead on low-voltage systems, and neither is the use of non-contact devices such as 'volt stick'.

7.3.5 It is necessary to test the instrument before and after use. This may be done by means of a proving unit with a low power output. If live circuits are used to prove instruments, adequate precautions against electric shock and short circuits should be taken. Training in the correct use of voltage detectors is essential to avoid risk in the event of unexpected use on a live conductor.

7.3.6 All instruments used for checking circuits should be maintained and inspected frequently.

7.3.7 Where there are underground cables that cannot be positively identified and proved dead at the point of work, it may be necessary to spike the cable using a properly designed, cartridge-operated spiking gun if available or a hydraulic cable cutter with remote controls.

8 Planning, Installation and Maintenance & Inspection

8.1 Planning

The amount of planning needed will depend on the complexity and size of the project. Detailed guidance on Construction (Design and Management) Regulations, (CDM 2015) is available at www.hse.gov.uk/construction/cdm/2015

8.1.1 Designers should consider the electrical risks associated with the design work they do. They must take into account any pre-construction information provided by the client, eliminate foreseeable health and safety risks, and take steps to reduce or control any risks that cannot be eliminated. They should also consider the electrical risks of work on any new electrical installations which include the appropriate isolation measures to enable dead working.

8.1.2 Before any work could start, everyone involved in the planning should, depending on the project, have considered:

8.1.2.1 the power requirements needed for the construction activities and how will these change as the work progresses;

8.1.2.2 who will design, supply, install and maintain the site's temporary electrical systems;

8.1.2.3 who will be responsible for making electrical services available to the sub-contractor;

8.1.2.4 the types of electrical equipment permitted to be used on-site; and

8.1.2.5 the environmental factors i.e., weather, condition of the ground, any works taking place that generate dust etc.

8.2 Installation

8.2.1 BS 7671 Requirements for Electrical Installations and EIR (Electrical Installation Requirements) provides guidance on inspection and testing to determine whether an electrical distribution system is safe for continued use.

8.2.2 Further, refer to WSHCR PART V ELECTRICAL SAFETY in Approved Code of Practice (ACOP) "SAFE USE OF ELECTRICITY AT CONSTRUCTION SITES".

8.3 Maintenance & Inspection

8.3.1 It is a requirement that electrical installations and equipment be maintained, so far as is reasonably practicable, so that they are safe (EAWR 1989 Regulation 4(2)) and EIR (Electrical Installation Requirements - 2011).

8.3.2 Ensure that the electrical systems and equipment used on site are maintained in a way that is appropriate for the equipment and to the risks that are present on site.

8.3.3 Regular inspection is important to identify electrical systems and equipment that may have become damaged. Further, it is good practice to keep records of testing and maintenance.

8.3.4 If the circuit breakers, fuses or RCDs repeatedly trip then there is likely to be something wrong and the fault should be investigated by a competent person. NEVER bypass or disable RCDs to stop the nuisance tripping.

8.4 User-Self check

Before commencing any activity, users shall conduct a self-check to look out for:-

8.4.1 Damages to lead/flexible/wire cord including fraying, cuts or heavy scuffing, e.g., from floor box covers.

8.4.2 Damages to plug and socket, e.g., crack, broken cover, bend pins, loose pins, burn mark etc.

8.4.3 Damages to outer cover /or expose or cut on wire/cable outer sheath.

8.4.4 Wrong plug, e.g., 2-pin, household outlet/plug.

8.4.5 Wire/cable trapped.

8.5 Visual Check

8.5.1 This is a thorough check of the equipment conducted by a competent person to determine whether an item remains safe for continued use. Visual inspection is done by checking for any loose cables or signs of fire damage and if it is possible to view the inside of a plug for internal damage, bare wires and the correct fuse. A visual inspection can detect about 95% of faults or damage.

8.5.2 Check for healthy RCD protection.

8.5.3 Verify that the plug sockets are not overloaded.

8.5.4 Ensure the plugs and sockets are not damaged.

8.5.5 Before proceeding with any electrical testing, a comprehensive visual inspection of each appliance should be performed. The visual inspection serves to identify any damages, apparent defects or hazards that may compromise the appliance's safety. The visual inspection should include the following:

8.5.5.1 Check for any signs of damage, such as frayed or damaged cables, cracked casings, or loose parts.

8.5.5.2 Examine the plug and socket for damage, proper wiring, and appropriate fuses.

8.5.5.3 Inspect the appliance for signs of overheating, such as discolouration or burn marks.

8.5.5.4 Verify the presence of safety labels, including the CE mark or relevant safety standard mark.

8.5.5.5 Check that any cable connections are secure and properly terminated.

8.5.6 Damaged and faulty equipment are to be removed from the site without delay.

8.5.7 Beside PAT, the continuity/insulation resistance tester shall be in good condition.

8.5.8 Multifunction tester for voltage and current measurement is to be in good working condition.

8.5.9 Ensure that all electrical equipment is tagged with a valid inspection tag.

8.5.10 Depending on the type of equipment, class setup inspection intervals are not to be more than 6 months.

8.5.10.1 For class 1 that are not double insulated - 6-months with PAT.

8.5.10.2 Review maintenance/inspection duration.

8.5.10.3 Construction basic rule on the electrical system.

DO NOT

8.5.10.4 Assume electricity is safe or tripped until it is tested and verified.

8.5.10.5 Use any electrical tools/appliance/equipment if has not been inspected.

8.5.10.6 Operate any electrical tools/appliances/equipment if it is not in good condition.

8.5.10.7 Switch on or off any electrical tools/appliances/equipment.

8.5.10.8 Begin any activity if the associated hazard is not briefed or explained.

8.5.10.9 begin any activity without PPE e.g., insulation glove, floor mat.

8.5.10.10 there is no safety stick or officer.

8.5.10.11 Meddle with any wiring at the site.

8.5.10.12 Allow an untrained person works alone without supervision.

8.5.10.13 Work on live or energize electrical equipment.

DO

8.5.10.14 Ensure all workers understand the emergency procedures on-site in case an incident does occur.

8.5.10.15 Conduct checks on all equipment to ensure it is fit for purpose and is in good condition before starting.

8.5.10.16 Promote a safe culture, e.g., clean and dry work area, no outdoor work during rain or the right to stop work if it is unsafe.

8.5.10.17 Prepare for risks with every electrical activity/work.

8.5.10.18 Assess the work site to identify and where possible, eliminate the risks to health and safety.

8.5.10.19 Switch off, isolate, and disconnect or unplug before making any change, e.g., drill bit, replace cutting disc etc.

8.5.10.20 Carry out testing using an approved electrical multimeter (use of test pen, bulbs etc., to indicate no-power is prohibited).

8.5.10.21 Access to electrical equipment is limited by competent electrical persons only.

8.5.11 Electrical system Basic of self-awareness shall provide updates on and not limited to:-

8.5.11.1 all final circuits (tools) shall be plugged into an industrial socket outlet equipped with 30mA sensitivity RCBs.

8.5.11.2 RCBs shall be tested and verified by a competent person and adhered to with a verified/checked sticker with a valid/expiry date.

8.5.11.3 Hand tools shall also be inspected by a competent person and adhered with verified/checked sticker with valid/expiry date.

8.5.11.4 Do not connect your hand-held tool or electrical equipment directly to a mobile generator without any protective devices and proper earthing system.

8.5.11.5 Only use socket outlet assembly (SOA) with individual RCBs and **NOT** multi-port socket outlet.

8.5.11.6 Only industrial socket and plugs shall be used at the construction site.

8.5.11.7 Use only industrial socket outlets.

8.5.11.8 Ensure the plug and socket-outlet are in good condition.

8.5.11.9 Ensure that cable glands are fully tightened.

8.5.11.10 Do not re-wire the industrial plugs & socket outlet yourself.

8.5.11.11 Do not use household socket outlets and plugs or any household socket outlet assembly or extension cord.

	
Typical industrial socket	**Typical industrial plug**

	
Household socket outlet	**Household 3 pins plug**

	
Typical household multiple socket outlets	**Typical industrial multiple socket outlets**


IP44 Waterproof 3-way Industrial Socket

9 Generator set

Refer to "Guidelines and Best Practices for Construction Power Part 2: Standalone Mobile Generator >10kVA to 1250kVA" (ESCOM/2024/05).

9.1 Three-phase generator provides power to an entire site and is likely to supply more than one item of equipment. Generators should be earthed, and the outgoing circuits should be RCD-protected. Correct earthing to TNS configuration is essential to ensure that the protective devices will operate in the event of a fault.

9.2 Engage competent people (electrical) to make sure that the installation is safe for use.

9.3 Fenced off and suitably signed the area for the generator set. This will protect people (especially children) from site dangers and the site from any vandalism and theft.

9.4 Do not set up or use generators in enclosed spaces because of the hazards of carbon monoxide generation. Take appropriate precautions for the storage of fuel and during refueling.

9.5 Metallic (exposed conducting) parts of the generator should be earthed. If this earth connection is lost, there is a possibility of the exterior body of the generator becoming "live", with a potentially fatal result. Anyone touching live metal will be in contact with electricity.

9.6 Warning sign to indicate the non-removal of safety system generator earthing, **"Do not remove."**

9.7 Warning and access sign for entering the generator area.

10 Overhead Lines (OHL) and Aerial Cables

Where any work is done nearby electric overhead power lines and aerial cables, it must be carefully planned and carried out to avoid dangers from accidental contact or close proximity to the lines. The respective owner shall be informed of the methodology of work.

10.1 Construction team shall provide proper barricading when setting up scaffoldings that are adjacent to OHL or aerial cables.

10.2 Do not work close to or below the electrical overhead line bare conductors.

10.3 Be aware of the location of overhead power line or electrical aerial cables.

10.4 Tight, confined or limited space

10.5 Tight, confined or limited space can be:

10.5.1 a place which is substantial, though not always entirely, enclosed;

10.5.2 a place where there is reasonably foreseeable risk of serious injury from hazardous substances or conditions within the space or nearby; or

10.5.3 a space where multiple concurrent activities are being carried out.

10.6 If work in a confined space cannot be avoided, it will often be safer to bring in a specialist suitable for the job.

10.7 Ensure that the confined space has enough ventilation to make the air fit to breathe with an oxygen meter. A mechanical ventilation might be needed.

10.8 There should be a safe system of work for operations inside confined spaces. Everyone should know and follow the system. A permit-to-work system may be required.

11 Hazard

Hazard arises through faulty installations, lack of maintenance and abuse of equipment which can cause electric shock or electrocution, burns, fires and explosions.

11.1 Types of Electrical Hazard are:

11.1.1 Faulty wiring or loose connections

11.1.2 Badly installed or maintained electrical equipment

11.1.3 Exposed live wires

11.1.4 Overloaded sockets

11.1.5 Electrical exposure to water

11.1.6 Overhead power lines

11.1.7 Damaged insulation

11.1.8 Improper grounding

11.1.9 Exposed live wires and electrical parts

11.1.10 Unsafe wiring installations

Figure 11-1 Exposed live wires and electrical parts

Figure 11-2 Unsafe wiring installations

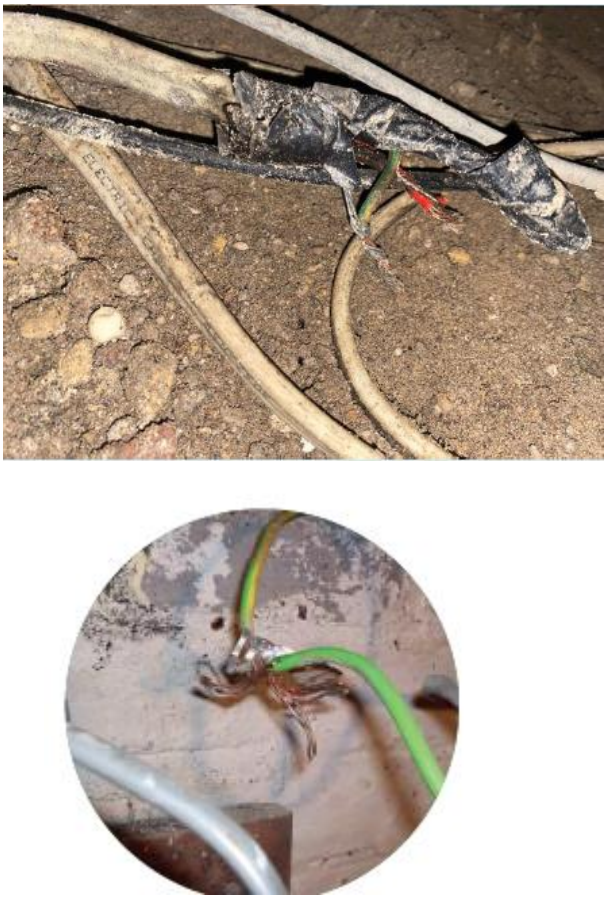


Figure 11-3 Bad connections and exposed wiring

11.2 Overhead power line hazard - provide signage to avoid:

11.2.1 Contact during uploading, unloading, lifting etc.

11.2.2 Driving through the overhead line

11.2.3 Long object positioning toward OHL, timbering/tree cutting

11.3 Underground Services Hazard

Damage to underground electrical cables can cause severe injury or fatality, therefore precautions must be taken to avoid danger. These precautions include a safe system of work based on planning, use of plans, cable locating devices and safe digging practices.

11.3.1 use a cable locator by a competent person to trace the proposed cable route / excavation site and obtain permit to dig where applicable.

11.3.2 conduct hand-dig trial or pilot trenches.

11.3.3 Do not use an excavator in any ground without a prior hand-dig trial.

12 Electrical protections for tools

12.1 Electrical equipment i.e., power tools and other portable equipment and their leads face harsh conditions and constant rough use, which as a result, is likely to be damaged and become dangerous. Electrical equipment must be safe, and properly maintained. Only in exceptional circumstances should work be carried

out on live systems, and even then it is done only by a competent authorised person.

12.2 Modern double-insulated tools are well protected, but their leads are still vulnerable to damage and should be regularly checked. If the main voltage is to be used, the risk of injury is high if any of the equipment, tools, leads etc. are damaged.

12.3 RCD with a rated tripping current, not greater than 30mA with no time delay will be needed to ensure that the current is promptly cut off if contact is made with any live part. RCDs have to be kept free of moisture and dirt and protected against vibration and mechanical damage. They need to be properly installed and enclosed, including sealing of all cable entries. They should be checked daily by operating the test button. Ensure that the tools can only be connected to sockets protected by RCDs.

13 Signage

13.1 Typical signages

		
CS-1: to be provided at every location where there are excessive lengths of unsecured loosely trailing wiring / cables/ flexible cord.	Prohibition signs are specific to actions that are not permitted. These could be actions such as 'you cannot use your mobile phone', 'you cannot smoke in this area', 'high voltage', 'you cannot enter' and so on.	These signs are specific to a mandatory action that must take place in certain areas of your construction site. These could have actions such as 'headgear must be worn', 'protective clothing must be worn', 'foot protection must be worn in this area' and so on.

		
These workplace signs help workers find the location of emergency-related facilities and equipment. These could be facilities such as emergency exits, first aid kits and so on. An emergency information sign usually has white text on a green background.	These signs are specific to **warning** of hazards or **potential** hazards or dangerous goods that are likely to be life-threatening.	Fire safety signs are used to help workers and visitors find the location of fire alarms, fire extinguishers and other safety equipment in the event of a fire.

APPENDIX 1

Typical example of an electrical Permit-to-Work

1 Issue

To_____in charge of this work.

I hereby declare that the following electrical appliances in the area specified is dead, isolated from all live conductors and are connected to earth:

Treat all other appliances and areas as dangerous

The appliance is efficiently connected to EARTH at the following points:

The points of isolation are:

CAUTION NOTICES have been posted at the following points:

SAFETY LOCKS have been fitted at the following points:

The following work is to be carried out:

Diagram

Signed_____Time_____Date_____

Permit-to-work (front)

2 Receipt

I accept responsibility for carrying out the work on the appliances detailed on this permit-to-work and no attemptwill be made by me or by any person under my charge to work on any other apparatus or in any other area.

Signed_____ Time_____ Date_____

Note: After signing the receipt, this permit-to-work should be retained by the person in charge at the place where the work is being carried out until work is complete and the clearance section is signed.

3. Clearance

The work for which this permit-to-work was issued is now suspended*/completed* and all people under my charge have been withdrawn and warned that it is no longer safe to work on the appliances detailed on this permit-to-work.

All work equipment, tools, test instruments etc. have been removed.

Additional earths have been removed.

*Delete words not applicable and where appropriate state:

The work is complete*/incomplete* as follows:

Signed_____ Time_____ Date_____

4. Cancellation

This permit-to-work is cancelled.

Signed_____ Time_____ Date_____