Electrical Safety Procedure
HSE Management System
PTCL Group

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1. Purpose

Working with electrical equipment is a key part of our operations, but it poses serious risks to people and property. This SOP outlines the minimum requirements to manage electrical safety risks to ALARP during operations but not limited to installation, deployment, testing, commissioning, operation, servicing, and maintenance of network systems and equipment.

2. Scope

This procedure applies to all PTCL group locations and employees including service providers. All service providers must also ensure adherence as part of contractual binding.

3. **Acronym**

Subject	Definition	Subject	Definition
TRIC	Toolbox Talk Risk Assessment Card	**EMF**	Electromagnetic Fields
PETSAC	Pakistan Electric and Telecommunication Safety Code	**IRIP**	Incident Reporting and Investigation Procedure
MSAG	Multi-Service Access Gateway	**UPS**	Uninterruptible Power Supply
NFPA	National Fire Protection Association	**ALARP**	As low as reasonably practicable
SOTs	Safety Observation tour	**HVAC**	Heating, Ventilation, and Air Conditioning

4. **Responsibilities**

Line Managers/Supervisors: Ensure SOP compliance and provide necessary resources; senior management will conduct SOTs to monitor adherence. Confirm all personnel are qualified for their tasks. All electrical safety incidents, unsafe acts/conditions/behaviors, and near misses must be reported to both the HSE team and line management and recorded on the HSE Portal.
HSE Team: Conduct SOTs, inspections, and audits to verify SOP implementation and facilitate training. HSE team shall provide training where raised/needed.
Procurement: Include SOP adherence in service provider contracts.
Employees/Service Providers: Follow all safety protocols as outlined in the SOP and deploy sufficient resources for implementation of HSE protocols. e.g. 1 site manager,1 site engineer and 1 site supervisor for each 1000 ODN lines deployment)

5. **Procedure/ Instructions in PTCL group operations.**

For PTCL Group operations and activities, there are several electrical hazards. Below are major activities highlighted but not limited to, line managers must ensure compliance of all documents highlighted where applicable.

5.1 Aerial Network and buried Network and Pole erection

Below is the summary of the guidelines for aerial and buried network electrical safety.

I. **Restricted approach boundary**: Maintain Safe distance 2' 2" for High-tension voltage: 11kV, low-tension voltage: 440V and other energized electrical conductors. **Working on pole mounted transformer (PMT) and in wet conditions are completely restricted.** Vendor/job executor will submit site survey/risk assessment document before work execution.

II. **Minimum PPE & Tools Requirements**: Class 0 for LT and Class 2 for HT gloves as per the requirement, dielectric helmets, safety shoes, non-conductive ladders, insulated tools, and Voltage detectors must be used as added protection. Where job is being executed by vendor It's responsibility of Vendor to arrange the Certified Tools and Supervision of activities.

III. **Buried Cable Safety**: Ensure at least eighteen inches separation from buried electricity cables; use insulated tools and install insulating socket and insulating rod in hand auger and insulating rod just before cutting blades. Conduct a utility survey to locate buried electrical cables through competent authority. Where necessary and raised, HR must allocate supervision within the budget, following HSE criteria of 1 supervisor per 150 meters in line of sight.

IV. **Safety for Overhead Electrical Cables:** conduct a thorough survey of the site to identify all overhead electrical cables. Assign supervisors to monitor adherence safety protocols while working on/near electrical poles or pole erection.

V. Cable will be erected on ceramic shackles maintaining a safe distance from overhead cables subject to permission from the local authority/ building owner wherever applicable.

VI. Refer to Annexure A-D for further detail.

5.2 Earthing Systems arrangements for Telecom and Allied Equipment

- Earthing systems must meet specific resistance values depending on the equipment and installation size to ensure effective dissipation of fault currents and system safety as defined in **Annexture H.**
- Inspect and test earth pits every three months to maintain resistance within specified limits.
- Use high-quality and corrosion-resistant material as defined in **Annexture H**
- Maintain clear space around earthing systems to prevent accidental contact.
- Label all earthing points clearly for easy identification.
- Installations, especially in lightning-prone areas, must include overvoltage protectors to protect infrastructure and equipment from lightning strikes and surges.
- Keep records of the earthing system's layout and maintenance history.
  For complete detail for earthing refer to the **Annexture H: GL 02 Earthing Arrangements for Telecom and Allied Equipment.**

5.3 Safety Procedure for Installation and Maintenance of MSAG

The installation and maintenance of MSAG are crucial for PTCL Group, ensuring robust network performance and reliable customer service. Strict adherence to safety protocols is essential to prevent unforeseen incidents and protect both personnel and infrastructure. Implementing comprehensive safety measures enhances operational efficiency and reaffirms PTCL Group's commitment to safety. Below are precautions for detailed please refer to Annexture J: Safety Procedure for Installation and Maintenance of MSAG.

- Conduct thorough risk assessments prior to any installation or maintenance activity.
- Equip all personnel with appropriate PPE.
- Perform isolation to control energy sources securely.
- Regularly inspect and maintain equipment to prevent malfunctions and safety breaches.
- Regular training/refresher courses be arranged on safe handling practices
- Ensure proper grounding of all equipment to prevent electrical shocks.
- All work activities shall be carried out in buddy system.

5.4 HSE Guidelines for Power System Maintenance

Below are key elements of power system used and maintained in PTCL group. Below highlighted are some basic precautions to be addressed and for detail reference of power system Preventive maintenance routine and precautions refer to **annexture I** have detailed guidelines for predations and required Preventive Maintenance routine.

Diesel Generator Safety

To ensure electrical safety with generators, adhere to the following streamlined guidelines:

- Operate generators outside in well-ventilated, dry areas, placed on stable, flat surfaces to prevent fuel spillage and reduce vibration.

- Use heavy-duty, weather-resistant power cords suitable for the generator's output. Regularly check all connections for security and integrity to prevent electrical hazards.
- Always turn off the generator and let it cool before refueling to avoid fire risks. Conduct regular inspections for any signs of wear, leaks, or damage.
- Ground the generator to minimize shock risks and never operate it in enclosed spaces to prevent carbon monoxide poisoning.
- Ensure all used cords are intact, appropriately rated for outdoor use, and free from damage. Avoid placing cords under carpets or doors to eliminate fire risks.
- Be careful while inspecting /checking the moving parts in DG, take care of your clothes and loose wearables.
- DG Operation guidelines must be displayed in DG Set room Annex-F

To maintain safe generator operation, preventing electrical accidents and ensuring the health and safety of all users also refer to the **Annexture F: DG Room Safety Instructions**

Rectifiers, Battery Banks (Dry and Acid), UPS (Uninterruptible Power Supply), Solar System

- Ensure adequate ventilation, maintain dry conditions to prevent overheating and moisture damage.
- Regularly check for signs of wear, overheating, damage, corrosion, leaks, or bulging.
- Use correctly rated fuses and breakers to prevent electrical fires.
- Carefully handle and properly ground rectifiers & batteries (+ve terminal & battery stand) to prevent damage and electrical shocks.
- Use spill containment systems for lead-acid batteries and wear appropriate PPE during handling.
- Charge batteries in designated areas with emergency equipment like eye wash stations available.
- Isolate battery banks, use insulated covers on terminals during maintenance to prevent accidents.
- Dispose of old batteries following environmental regulations.
- Install, mount UPS and solar panels according to manufacturer’s specifications to ensure stability.
- Ensure UPS is appropriately rated for the load, with accessible fire extinguishers.
- Use circuit breakers or fuses with the UPS to prevent overloads.
- Securely anchor solar panels and provide fall protection on roofs.
- Install surge protection to safeguard against lightning strikes and power surges.
- Label high voltage areas and adopt all safety precautions recommended by OEMs for cleaning solar panels.
- Checking of connection for any loose connection.
- Terminal inspection for rusting/sludge
- Check any heating of wires

HVAC (Heating, Ventilation, and Air Conditioning) Stand Alone Air Conditioning

- Perform regular inspections of all HVAC components for proper function.
- Clean or replace filters regularly to maintain air quality and prevent blockages.
- Regularly inspect and clean ducts to reduce dust and enhance system efficiency.
- Calibrate thermostats and controls for accurate temperature management.
- Handle refrigerants safely to prevent leaks and minimize exposure.
- Ensure proper ventilation to prevent CO2 buildup and overheating.
- Check and maintain electrical connections and wiring to code standards.
- Reduce noise levels and prevent hearing damage through routine maintenance.
- Maintain known and accessible emergency shut-off procedures.
- Install units on stable, level surfaces to prevent tipping and vibration.
- Ground units to mitigate electric shock risks.
- Keep areas around HVAC units clear of debris to ensure airflow and reduce fire risks.

- Use thermal imaging for detecting overheating and potential electrical faults; maintain clear access for maintenance and emergencies.

Transformers, Low tension/High Tension (LT/HT) Rooms

- Restrict access to electrical areas to authorized personnel only, using locks and security systems.
- Verify that all equipment is properly grounded and bonded.
- Implement spill containment measures for potential oil leaks and environmental protection.
- Equip areas with fire extinguishing systems and install tailored fire detection and suppression systems.
- Enforce safe work practices, including proper use of PPE and isolation procedures.
- Clearly label all equipment and circuits to facilitate accurate maintenance.
- Ensure adequate ventilation to prevent overheating.
- Keep areas free from dust and debris to avoid electrical faults.
- Regularly test the insulation and dielectric strength of electrical components.
- Install and regularly inspect lightning arrestors, integrating them with surge protection.
- Keep records of all maintenance activities and check for corrosion to maintain system integrity.

Circuit Breaker Safety

- Check circuit breakers for any signs of wear, damage, or overheating. Faulty breakers may lead to fire.
- Always de-energize the circuit and verify with a voltage tester to ensure no electrical current is present.
- Label All circuit breaker with specification and warning signs for quick identification in case of emergency.
- Always keep breaker panels easily accessible, free from all type of obstructions.
- For high voltage circuit breakers, conduct periodic testing and maintenance as per OEM.

Office Electrical Safety

- Do not overload electrical outlets, power strips, or extension cords.
- Replace any damaged power cords, plugs, and electrical appliances having signs of wear, fraying, or exposed wires.
- Properly grounded all office equipment's to reduce the risk of electrical shock or fire.
- Provide training for employees on how to respond to electrical shocks, fires, or other electrical hazards.
- This training should include first aid for electrical burns and shock.
- Ensure that electrical panels are clearly labeled with contact information for emergencies.

6 Electrical Hazards from power Systems

Electric shock occurs when a person comes into direct or indirect contact with an energized component, resulting in the flow of current through their body. This can cause severe injuries, including burns, cardiac arrest, and even death, depending on the current, voltage, and duration of exposure.

Arc flash is a sudden release of energy caused by an electrical fault or short circuit in the system. The release of energy can result in extremely high temperatures (up to 35,000°F), intense light, pressure waves, and flying molten metal. This hazard can cause severe burns, blindness, and other catastrophic injuries.

Short circuits occur when there is an unintended path created between the positive and negative terminals of a battery, or within the electrical system, leading to a rapid increase in current flow. This can cause equipment damage, fires, and potential safety hazards.

Electrocution: This is fatal, resulting from the passage of electrical current through the human body sufficient to cause death.

Explosions: Electrical equipment can explode, often as a result of fault or short circuit, leading to serious injuries or damage to property.

Fire hazards in battery banks and rectifiers can result from overcharging, short circuits, or electrical faults that cause heat generation. Both batteries and rectifiers can produce enough heat to ignite surrounding materials if not effectively managed.
Battery gassing occurs during charging, particularly in lead-acid batteries, when hydrogen gas is emitted as a byproduct of electrochemical reactions. If not properly ventilated, this gas can accumulate and pose a risk of explosion.

7 Precautionary Measures

Below are minimum measures to be taken, also refer to **Annexture E: Toolbox Talk Electrical Safety** and other below annextures.

- Always de-energize and isolate systems before performing maintenance to prevent accidental re-energization.
- Use insulated tools rated for the equipment's voltage and wear appropriate PPE, including insulated gloves, boots, and face shields.
- Verify all components are de-energized with a certified voltage tester before beginning work.
- Conduct arc flash hazard analysis, risk assessment, and label equipment with arc flash boundary distances.
- Ensure all circuit breakers and protective devices are functional and appropriately rated.
- Install voltage regulators and surge protectors to manage power fluctuations.
- Use power quality meters to monitor for overvoltage or undervoltage conditions.
- Design redundancy into battery bank and rectifier systems to eliminate single points of failure.
- Ensure all wiring and connections comply with manufacturer's guidelines.
- Install and maintain rated circuit breakers and fuses for rapid disconnection.
- Maintain adequate ventilation in battery rooms to prevent hydrogen gas buildup, Fire rated system including using explosion-proof systems where necessary.
- Install hydrogen gas detectors in battery areas to monitor and provide early warning of unsafe gas levels.
- Deploy fire suppression systems appropriate for electrical fires, such as FM200 or CO2 systems.
- Perform regular inspections of batteries, rectifiers, and their components for signs of wear or overheating.
- Ensure that electrical installations, including ventilation and lighting, are explosion-proof in hazardous areas.

8 Application of the 7 Steps

During installations, while equipment may be safely de-energized, other parts might remain active, posing risks. PTCL's 7-step safety protocol ensures worker safety by enforcing a safe distance from all electrical transmissions, applicable across all company operations.

STEP 1 - PREPARE FOR THE WORK: PERFORM AN ONSITE RISK ASSESSMENT BY USING TRIC

1. Possess a clear work order outlining the task.
2. Use Toolbox talk Risk assessment Card (TRIC).
3. Consult the person responsible for the installation/ deployment to review single-line diagrams, schematics, and switching plans. Obtain permission to work on/ near to electrical installation.

STEP 2 - IDENTIFY AND SECURE THE WORK LOCATION

1. Clearly define the work area using barriers, barricading, and signage.
2. Identify all equipment and avoid distractions like mobile phone use.
3. Use visual checks to identify potential hazards.

STEP 3a - DISCONNECT ALL SOURCES OF SUPPLY

1. Perform switching as needed while wearing PPE identified in through TRIC in Step 1 or observe from a safe distance beyond the arc-flash boundary.
2. If switching is done before arrival, the Person in charge or Line supervisor must inspect isolation points with the responsible personnel in charge.

STEP 3b - SECURE AGAINST RECONNECTION USING Isolation methods.

1. The Line Supervisor must ensure se isolation. For multiple energy sources or working parties, implement group isolation with the Line Supervisor
2. If isolation involves removing a fuse, ensure it is held by the Line Supervisor and that the fuse cabinet is locked with the key retained by the Line Supervisor.
3. Work supervisor must be trained for required job.

STEP 4 - VERIFY THE ABSENCE OF OPERATING VOLTAGE

1. Use only properly rated and inspected voltage detection devices, and wear PPE from Step 1.
2. Test for absence of voltage using a contact voltage detection device. Check phase-to-phase (A to B, B to C, A to C) and all phases to ground/neutral.
3. Test the voltage detection device on a known source before and after use.
4. Test absence of Electricity on all PTCL MSAG, DBs and Poles or in path of installation.

STEP 5 - APPLY EARTHING/GROUNDING AND SHORT-CIRCUITING

1. Close and lock grounding switches or apply portable grounding equipment.
2. Ensure grounding devices meet approved design standards and are rated appropriately.

STEP 6 - PROTECT AGAINST ADJACENT LIVE PARTS AND ENSURE SAFE DISTANCES/ USING ISOLATING SOCKET

1. Identify minimum approach distances 2’ 2’’and apply barriers/screens to exposed live electrical parts and cables.
2. Maintain a safe distance from exposed electrical components as per PETSAC standards.
3. Use insulated tools and rulers/tape measures made of non-conductive material.
4. Use Insulating sockets in hand auger boring tools.
5. No jewelry, watches, or conductive items are allowed to avoid risks of burns or arc-flash incidents.

STEP 7 - COMPLETE THE TASK AND VALIDATE SAFETY MEASURES

1. The person in charge must validate that no live wire is in the path of activity or circuits are de-energized and cannot be re-energized during work.
2. Gather the working party and walk through the TBT for electrical Safety, TRIC, HSE Instructions for aerial and buried network ensuring the following:
    i. Isolation points are checked especially working at/ near electrically operated equipment.
    ii. Circuits are verified as isolated and secured.
    iii. Grounds are properly applied.
    iv. Work can proceed safely without danger.
3. All members of the working party must sign the TRIC to validate their understanding and send Picture to supervisor.
4. The Supervisor must perform SOTs to ensure compliance with safety requirements.

- **Training and Competence**

All employee working on electrical installation must be trained enough to safely carry out all activities. Training must be conducted through training department from Professionals

- All employees must receive appropriate training to perform assigned tasks safely, including specific HSE measures identified in risk assessments.

- Personnel required to work on/near electrical installations must be trained to handle the relevant voltage ranges safely and apply PTCL's "Seven Steps" principles on electrical safety.
- Possess practical skills for the scope of electrical installation work.
- Know and apply safe working methods and Lifesaving rules.
- Handle electrical emergencies, including providing first aid and CPR.
- Ensure all personnel are informed about the dangers of electricity, its effects on the human body, and basic safety precautions.

- **References**
  - NFPA 70E-2021. Standard for electrical safety at workplace.
  - Pakistan Electric and Telecommunication Safety Code (PETSAC) 2014

- **Annextures**

Refer to the latest versions of all below annexures.

Annexture A: H&S Instructions for Aerial and Buried Network	HS Instructions for Aerial and Buried Net
Annexture B: H&S Guidelines of Field Staff for Aerial and Buried Network	Guidelines_for_Aerial _and_Buried_Network
Annexture C: TBT Aerial and Buried network for field staff	TBT # Aerial and Buried network for fie
Annexture D: Aerial Optical Fiber Cable Installation (TR 192 B) & TR 192 C	TR-192B (OFC Aerial installation) - Issue VI TR-192C (OFC Laying) - GPON Netw
Annexture E: Toolbox Talk Electrical Safety	TBT# 01-24 on Electrical Safety.pdf
Annexture F: DG Room Safety guidelines, shall be displayed.	TBT# DG Room Safety Instructions.pd
Annexture G: TBT Underground cables safe digging practices Guidance	TBT # Underground cables safe digging pr
Annexture H: GL 02 Earthing Arrangements for Telecom and Allied Equipment	GL-02(Earthing-Issue -III-July 2013).pdf
Annexture I: GL 16 Preventive Maintenance Routines (PMR) of AC/DC Power Systems	GL-16 (Power system-PMR 2020) II
Annexture J: Safety Procedure for Installation and Maintenance of MSAG	Safety Procedure for Installation and Maint