INSTRUCTIONS & GUIDELINES ON SAFETY PROCEDURES

pstcl

PUNJAB STATE TRANSMISSION CORPORATION LIMITED

400/220KV GRID SUB-STATION, BHALWAN (DHURI)

SAFETY MANUAL

OPERATION SERVICES WING (P&M)

PUNJAB STATE TRANSMISSION CORPORATION LIMITED

Head office- The Mall, Patiala

OPERATING YOUR FIRE EXTINGUISHER

- **P**ULL THE PIN
- **A**IM AT THE BASE
- **S**QUEEZE TRIGGER
- **S**WEEP

Remember:
- Test extinguisher before approaching the fire
- Keep low & approach with the wind at your back
- Back away, watching for rekindle

SAFETY
is as simple as ABC

ALWAYS
BE
CAREFUL

SAFETY
is
EVERYONE'S
RESPONSIBILITY!

From the desk of Chairman-Cum-Managing Director, PSTCL

It gives me immense pleasure to inform all our members of PSTCL family that the Board of Directors of the Corporation has approved the SAFETY MANUAL for implementation in the Corporation. Safety assumes greater importance for all stakeholders of the Corporation dealing with power transmission in the State. The Corporation had no proper documentation of basic rules and regulations on safety measures required to be taken during execution of the transmission works and also during its operation and maintenance. The adoption of the Manual and its proper implementation will go a long way in ensuring safety of our employees and transmission network.

The initiative of the P&M organization of our Corporation in bringing out the Manual is praiseworthy. lt is important that the Manual is followed in letter and spirit.

Dated 1st April 2016

U.K.Panda

Chairman-cum-Managing Director
PSTCL, Patiala

From the desk of Director/Technical, PSTCL

"Carefulness costs you nothing.
Carelessness may cost you your life"

Safety of our employees and officers, toiling day and night on extra high voltage transmission system is of paramount importance to our company. Publication of this safety manual is a step towards "safety culture" because the word 'safety' becomes the first thought before starting any task. The single greatest impact of developing a strong 'safety culture' is the accident reduction, if not total prevention. To develop this 'safety culture', officials working at managerial level will have to demonstrate their commitment towards safety and workers will have to take ownership of their safety. It will help in building morale through the constant celebration of improving our safety goals. Hope, that this safety manual being published by operation services wing of P&M organisation will benefit our workforce and motivate them to achieve better results.

Dated 1st April 2016

(Er (Mrs) Shashi Prabha)
Director/Technical
PSTCL, Patiala

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SAFETY MANUAL

OPERATION SERVICES WING (P&M)
PUNJAB STATE TRANSMISSION CORPORATION LIMITED
HEAD OFFICE- THE MALL, PATIALA

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CHAPTER - 1

DEFINITIONS

1.0 DEFINITONS

1.1 Accident-Any unplanned activity/sudden mishap causing disturbance / interruption in scheduled or anticipated actions.

1.2 Approved-means approved by Punjab State Transmission Corporation Limited.

1.3 Approved Procedure-Safety Instructions or other specialised procedures authorised by Competent Authority of P.S.T.C.L.

1.4 Authorized person-means a competent person authorized by the competent authority as per Rule 3 of I.E. Rules 1956.

1.5 Automatic-means self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength.
Note: Remote control that requires personal interface is not automatic but manual.

1.6 Cancellation of Line Clearance PTW / Test-means a declaration by the person (to whom the 'Line Clearance Permit to Work / Testing' has been issued) stating that the work for which the permit / sanction was issued, has been suspended or completed and stating that all temporary arrangements including men & material, earth connections have been removed and that all men under his direct charge have been warned that it is no longer safe to Work/Test on that equipments/apparatus and equipments/apparatus is ready for energization/use.

1.7 Caution Notice-A notice conveying a warning against interference.

1.8 Certificate-No Back Feed-A certificate by an authorized person which certifies for no back feeding with the details of Isolation and Earthing, carried out at a remote substation in order to achieve Safety from the EHV/HV systems and from test supplies.

1.9 Circuit-means an arrangement of electrical conductors for the purpose of conveying energy

1.10 Circuit Breaker-means a device, capable of making and breaking the circuit under all conditions, and unless otherwise specified, so designed as to break the current automatically under abnormal conditions.

1.11 Commission-means Punjab State Electricity Regulatory Commission.

1.12 Company-means a company formed and registered under the Companies Act, 1956 and includes any corporate under a Central, State or Provincial Act.

1.13 Competent Authority-Authority as per DOP/Company Directive authorized to decide, implement and control the specified activities.

1.14 Competent person-A person authorized by competent authority who has sufficient technical knowledge and/or experience of a particular branch of engineering and is capable of carrying out a particular operation/activity to enable him to avoid danger while working in connection therewith.

1.15 Conductor-means any wire, cable, bar, tube rail or plate used for conducting energy and so arranged as to be electrically connected to a system.

1.16 Corporation-P.S.T.C.L. (Punjab State Transmission Corporation Limited)

1.17 Cut out-means any appliance for automatically interrupting the transmission of energy through any conductor when the current rises above a predetermined amount, and shall also include fusible cut-out.

1.18 Danger-A risk to health/life or any part of body from shock, burn or injury.

1.19 Danger Notice-An approved notice/tag to be attached to any electrical / mechanical equipment to indicate abnormal conditions calling attention to the danger of touching, interfering with unauthorized handling or operation of equipment.

1.20 Dead-Not electrically charged, means at or about earth potential and disconnected from any live system:
PROVIDED that an apparatus separated from a live conductor by a spark gap shall not be deemed to be "dead".

1.21 Earth-means the conductive mass of the earth, whose electric potential at any point is conventionally taken as zero.

1.22 Earthed-means connected to earth in such a manner as to ensure at all times an immediate discharge of electricity without danger.

1.23 Earthing Conductor-means a protective conductor connecting the main earthing terminal (or the equi-potential) bonding conductor of an installation (when there is no earth bus) to an earth electrode or to other means of earthing.

1.24 Earthing Device-An approved means of providing connection between a conductor and earth of adequate strength and capability being one of the following:

a) **Primary Earths**-a fixed Earth Switch (ES) with an equivalent electrical capacity which is applied between the point of work and all points of EHV/HV isolation before the Line Clear PTW or Sanction for Test is issued. Primary earths shall be

minimum 95 sq. mm copper equivalent.

b) **Additional Earths**-Temporary, portable Earths (e.g. Earthing rod) which are applied after Line Clear PTW or Sanction for Test is issued and are included on an Earthing Schedule. They are applied within an Isolated Zone in order to discharge any induced voltage. Additional Earth shall be minimum 35 sq. mm copper equivalent.

1.25 Earthing Schedule- A schedule indicating the Additional Earth requirements for each stage of the work or testing. It must show the number of earths required and either describe or show pictorially their position in the Isolated zone.

1.26 Earth Electrode-means a conductor or group of conductors in intimate contact with and providing an electrical connection to earth.

1.27 Earth Leakage-means a current, which flows to earth or to extraneous conductive parts in a circuit, which is electrically sound.

1.28 Electrical Safety-means recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause accident, injury or death.

1.29 Emergency-for the purpose of this manual means an unusual condition which exists that endangers life and/or property.

1.30 Employee-means a person who is in receipt of pay salary, wages or honorarium in return for services rendered by him to the PSTCL.

1.31 Equipment-- Electrical and Mechanical assets used to generate, transmit and distribute electricity working on which the safety rules apply.

1.32 Exposed-means not effectively isolated or guarded or insulated to prevent possibility of danger to life or property due to inadvertent approach to or contact with a point of danger by a person or object.

1.33 Extra High Voltage (EHV)-A voltage above 33,000 volts.

1.34 General Safety-Actions required to maintain safety at place of work/testing e.g. safe access, safe methods of work/testing and the correct use of personal protective equipments.

1.35 Ground-means the connection, established either intentionally or accidentally of an electric circuit or equipment with reference to ground through a conductor, or other conducting object or substance.

1.36 Grounded system-means a system of conductors in which at least one conductor or

point (usually the middle wire or neutral point of transformer or generator winding) is intentionally grounded, either solidly or through a current-limiting device (not a current-interrupting device).

1.37 Grid Code- means code prepared by the Punjab State Electricity Regulatory Commission (PSERC) in accordance with Transmission licensee (PSTCL).

1.38 Guarded-means protected by personnel, or covered, fenced, or enclosed by means of suitable casings, barrier rails, screens, mats, platforms, or other suitable devices in accordance with standard barricading technique designed to prevent dangerous approach or contact by persons or objects.(Wires that are insulated but not otherwise protected are not considered guarded.)

1.39 High Voltage (HV)-A voltage above 650 and upto 33,000 volts.

1.40 Hot Line Technique-A technique of carrying out repairs/maintenance of electrical apparatus without isolation i.e. without causing interruption in power supply with the help of special equipments which are rated and designed for this purpose.

1.41 Inspector-As per Electricity Act 2003, Part-I (Preliminary) Cl-2,Sub-Clause-21 "*Inspector*" means an Electrical Inspector appointed as such by the appropriate Government under Sub-Section(1) of Section 162 and also includes Chief Electrical Inspector .

1.42 Installation-means any composite electrical unit used for the purpose of generating, transforming, transmitting, converting, distributing or utilising energy

1.43 Isolated-means disconnected from all sources of electric energy by adequate physical separation and in a manner that disconnected contacts of the isolating switch are clearly visible.

1.44 Isolated Zone-All items of equipment within a work/testing area for which isolation has been achieved at all point of supply.

1.45 Isolation Device-A device for rendering Equipment Isolated.

1.46 Isolator-is a manually/electrically operated mechanical switch which separates a part of the electrical power system normally at off load condition and the breaking of the circuit is visible.

1.47 Key Safe-A designated lockable cabinet for the safe custody of all Safety Keys.
1.48 Line Clearance PTW Issue Officer-is a person who is authorized for ensuring that

controlling switches and circuits have been isolated, made dead and inoperative and that adjacent circuits have been made safe for the work to be carried out and who is authorized to issue the "Line Clearance Permit to Work".

1.49 Line Clearance Permit to Work-means a form of declaration signed by and given by one authorized person to another authorized person in charge of work to be carried out on or adjacent to any electrical apparatus, mains or L.T/H.T/E.H.T lines, for the purpose of making known such latter person exactly what apparatus, mains or lines are made dead and earthed and safe for working and gives the description of the work required to be carried out under such Line Clear Permit to Work.

1.50 Live Equipment/Conductor-being connected to a source of electricity.

1.51 Live part-means a conductor or conductive part intended to be energized in normal use including a neutral conductor but, by convention, not a protective earth conductor.

1.52 Lock/Locks-Immobilisation of an item of Equipment

1.53 Locked-- To secure an item of Equipment with padlocks or other devices such that it is immobilized in the close position

1.54 Low Voltage (LV)-A voltage not exceeding 250 volts

1.55 Maintenance/Testing Engineer-Engineer responsible for carrying out maintenance works of EHV equipments, Transmission lines & HV/LV systems. Engineer responsible for carrying out testing of Protective Relays, PLCC panels and other related equipments.

1.56 Medium Voltage (MV)-A voltage between 250 and 650 volts**.**

1.57 Neutral Conductor-means a conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy.

1.58 Points of Isolation-The point at which Equipment has been isolated and where practicable, the Isolation Point is immobilised and locked. Caution Notice shall be attached to all Points of Isolation.

1.59 PPE (Personal protective equipments)-means devices such as helmets, rubber gloves, rubber gauntlets, line hose, safety boots or other insulating devices, such as high voltage detector, earth discharge rod etc. which are especially designed for the protection of workmen.

1.60 PSTCL-means Punjab State Transmission Corporation Limited.
1.61 Purged-A condition of Equipment from which dangerous contents have been

removed.

1.62 Request for Line Clearance PTW -means a request made by a Competent Person or an Authorized Person to the Shift In-Charge of the substation before undertaking construction, repair, testing or maintenance works for issue of a specific clearance, detailing particulars of the work, time during which the work is intended to be carried out, precautions (if any) required to be taken to enable the Shift In-Charge of the substation to determine whether the Line clearance PTW can be issued in conformity with the rules, requirements of service, safety etc.

1.63 Safe Electrical Clearance-A distance of 1.5 meters minimum, which must be maintained by linesman from the conductors or jumpers of a de-energised overhead line which has been Isolated, Primary Earthed and a Safety Document issued, before connection of Additional Earths under the terms of that Safety Document.

1.64 Safety Clearance-The distance from the nearest Extra High Voltage or High Voltage exposed Conductor not Primary Earthed or from its support insulator, which must be maintained to avoid danger

1.65 Safety Documents

i) **Line Clear PTW (Permit to Work)**- A Safety Document specifying the Equipment, the work/testing to be carried out and the actions taken to achieve Safety from the system. Form of document shown in Section I Annexure 1 on Safety Rules

ii) **Test Permit (TP)**-A Safety Document specifying the EHV/HV Equipment, the testing to be carried out which required the removal of primary Earths and the actions taken to achieve Safety from the system. Form of document shown in Section I Annexure 2 on Safety Rules.

1.66 Safety from the System-Those conditions which safeguard persons carrying out the work on a System from the dangers, which are inherent in the System.

1.67 Safety Key-The key from a unique lock (at a location) which is used for locking an Isolating Device, Earth or Drain/Vents.

1.68 Safety Officer-as per CEA(Measures relating to Safety & Electric Supply) Regulations, 2010 Chapter II , Cl-5 (1) ; all suppliers of electricity including Generating Companies, Transmission Companies & Distribution Companies shall designate an Electrical Safety Officer as per the specific prescribed norms for ensuring observance of safety measures specified under these Regulations in their Organisation for construction , operation & maintenance of power stations ,sub-stations , transmission and distribution lines .

1.69 Shift-incharge - means Engineer in-charge of a shift at sub-stations appointed by PSTCL responsible for all operational activities in substations/lines.

1.70 S.L.D.C. (State Load Dispatch Centre) –The Centre where the operation of electricity grids constituting the Punjab State Power System is coordinated.

1.71 Step Voltage-means the potential difference between two points on the earth's surface separated by distance of one pace that will be assumed to be one meter in the direction of maximum potential gradient.

1.72 Sub-station- as per E.Act-2003,Part-I (Preliminary) Cl-2(69); sub-station means a station for transforming or converting electricity for the transmission or distribution thereof & includes transformers , convertors , switchgears , capacitors , synchronous condensers ,structures ,cable and other equipment and any buildings used for that purpose and the site there of .

1.73 Supervision-Supervision personal/direct by an Authorised Person who is available at point of work or testing at all times, during the course of that work or testing.

1.74 Supply- means the sale of electricity to a licensee or consumers

1.75 System - Items of Equipments which are used either separately or in combination to generate transmit or distribute electricity. It means an electrical system in which all the conductors and apparatus are electrically connected to a common source of electric supply.

1.76 System Control-means System Operation under SLDC, which controls and coordinates all switching operations of the System including issues of Line Clearance Permit to work /test etc.

1.77 Switch-means a manually operated device for opening and closing or for changing the connection of a circuit

1.78 Switch Gear-shall denote switches, circuit breakers, cut-outs and other apparatus used for the operation, regulation and control of circuits

1.79 Temporary Earth-means an earth defined under 1.22 above, but applied additionally/temporarily at the point of work on any electrical apparatus during actual working thereon, after the issue of Line Clearance Permit to Work/Test.

1.80 Touch Voltage-means the potential difference between a grounded metallic structure and a point on the earth's surface separated by a distance equal to the normal maximum horizontal reach, approximately one meter.

1.81 Transmission Line-as per E.Act-2003 , Part-I (Preliminary) Cl-2(72); Transmission Line means all high pressure cables and overhead lines transmitting electricity from a

generating station to another generating station or a sub-station, together with any step up and step down transformers, switch gear and other works necessary to and used for the control of such cables or over headlines, and such buildings or part thereof as may be required to accommodate such transformers, switch gear and other works.

1.82 Unauthorized person-means one who is not permitted to work on electrical apparatus except under the personal supervision of an authorized person.

1.83 Vented-Allowing a closed space to have an outlet to atmosphere so that the pressure has equalised to atmospheric.

1.84 Visitor-means a person, other than an Employee permitted to enter a work area under permission by the authorized person.

1.85 Workman-means a person employed directly or through any agency/contractor with or without the knowledge of the principal employer, whether for remuneration or not, who himself carried out or supervise different activities on electrical installations like operation, maintenance, construction, testing & commissioning etc. relating to PSTCL.

NOTE: *All words and expressions used but not defined hereunder shall have the meaning assigned to them in Electricity Act 2003, Indian Electricity Grid Code, Punjab Grid Code and Indian Electricity Rules 1956 respectively assigned to them in the Electricity Act 2003 as amended up to date, CEA (Measures relating to Safety and Electricity Supply) Regulations, 2010 and CEA (Safety requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011 and the Rules and regulations made there under, an amendment thereof, if any, and the Rules made there under as the case may be.*

CHAPTER - 2

POLICY & PRINCIPLES OF SAFETY

2.0 POLICY & PRINCIPLES OF SAFETY

2.1 POLICY- P.S.T.C.L. recognizes and accepts its statutory and moral responsibility for implementing safety standards and maintaining a safe working environment for all its employees in terms of ensuring safe design, construction, operation and maintenance of Transmission Systems in the safest possible manner along with the provision of safe methods of work and healthy working conditions. While achieving this objective it endeavours to ensure compliance with the requirement of I.E. Rules 1956, I.E. Act. 2003, Grid Code, CEA (Measures related to Safety and Electricity Supply) Regulation 2010 and Power System Safety Standards. The Policy relies on all employees, vendors and contractors for complying with safety requirements relevant to their responsibilities.

2.1.1 It is our policy to perform work in the safest practicable manner, consistent with good practice. The health, safety and welfare of our employees and all those likely to be affected by our operations is the responsibility of management, and as a priority it ranks equally with our business objectives. Adequate resources will be made available to ensure the success of this policy.

2.1.2 It is the responsibility of management to provide safe systems of work and do everything practicable to prevent injury by controlling the risks arising out of our work activities. At the same time it is the duty of each employee to exercise due care, caution, personal responsibility for his or her own safety and that of fellow employees and voluntarily co-operate with his or her employer in matter of safety and follow instructions issued by PSTCL from time to time.

2.1.3 The company will provide and maintain safe plant and equipment and ensure the safe handling and use of hazardous substances. Management will provide the necessary information, instruction and training and will ensure the competence of all employees and contractors.

2.1.4 All employees are to be aware that, in the event of any conflict between the demands of business and safety, they will receive management support if they reasonably choose the safety of employees or third parties as the priority.

2.1.5 It is our policy to adhere completely to the requirements of the I.E.Rules 1956, Indian Electricity Act 2003, CEA Regulations 2010 and Grid Code.

2.1.6 The attention of all employees is directed to this Safety Policy and Safety Manual, which is under review / revision.

2.2 PRINCIPLES

2.2.1. It is well understood that electro mechanical systems used in EHV & HV Transmission networks are designed in such a manner that during normal operations they are safe, but have inherent dangers during mal-operations and accidents. Hence, in order to avoid such happenings and consequent dangers, Rules and Instructions have to be framed and implemented. Such Rules and Instructions which form the core part of this Manual define procedures and responsibilities of operating personnel for achieving complete safety of personnel, equipments, system and surroundings.

Safety Rules provide basic ground rules, whereas Safety Instructions lay down the procedures as per the Safety Rules.

2.2.2 Safe conditions have to be ensured during working on Transmission system (Transmission Lines and Sub-stations) and also during Testing. This is achieved by

(i) Limiting the area of working/testing or
(ii) Isolating and discharging the contents to safe working levels.

2.2.3 In conditions where such limiting/isolation is not possible or is not required like during **Hotline** working, special instructions/procedures are applied.

Accidents: Investigation and Reporting.

2.3.1 Accident details, however trivial they may appear to be, must always be entered in the **Accident Book**, copies of which are held by the SSE /Shift in-charge on site and at the company offices. The SSE or Shift in-charge responsible for the work will ensure that each accident book and completed reports are returned to the Safety Head. Accidents reports will be retained for a period of at least three years.

2.3.2 The person in charge of the work must report all injury accidents or dangerous occurrences to the Safety Head by telephone.

2.3.3 All accidents and near misses will be investigated by the Divisional Head in charge of the work in accordance with the company accident investigation procedures and statutory provisions. The Divisional Head will carry out investigation and submit the enquiry report within 24 hours (in case of fatal accident) and within 48 hours (in case of non-fatal accident) to the Safety Head. Copies of the enquiry report may be sent to the statutory authority including Assistant Labour Commissioner, Electrical Inspector and District Administration in prescribed form in accordance with statutory provisions.

Adherence to Safety Rules
2.4.1 The Safety Manual and procedure are designed to provide basic guidance for safe

operating practice and procedures that form the Company Policy, and must be strictly adhered to by all employees.

2.4.2 Employees who wilfully violate the spirit of policy or rule or in utter disregard to safety policy / manual / rules carry out any O&M shall be liable for disciplinary action up to and including termination of employment.

NOTE: *THE APPROVED SAFETY POLICY SHOULD BE UPDATED TIME TO TIME AS PER THE AMENDMENT OF THE STATUTORY REGULATIONS AND CHANGING REQUIREMENTS OF THE ORGANIZATION.*

CHAPTER - 3

SAFETY RULES

3.0 SAFETY RULES

3.1 GENERAL SAFETY

3.1.1 Apart from establishing safety while working / testing on electrical system and equipments specified in these Safety Rules and Safety Instructions, General Safety shall always be established and maintained. The person responsible for establishing such General Safety will be the Officer/Official holding the Safety Document before working / testing starts. During the working / testing the Officer/Official in charge of the work shall ensure that all members of the working crew maintain General Safety. It is the responsibility of all the members of the working party, overseen by the Officer/Official to ensure that their activities do not affect other work areas.

3.1.2 SAFETY PRACTICES; All Safety Rules, Safety Instructions and Procedures are mandatory. **'Safety' as a whole may be interpreted as the proper planning of work, proper usage of safety tools, following safety procedures and exercise of good judgment and intelligent supervision.** Experience proves that majority of the accidents are preventable. Prevention of accidents requires the whole hearted co-operation of all employees of the Organization.

Generally capable and mentally alert employees avoid accidents. Employee consistently not adhering to Safety practices & Rules is a liability to the Organization. He is a danger to himself, his fellow workers, his family, the public and Corporation. Accidents **DO NOT "Just Happen"**; accident are the results of unsafe conditions or unsafe acts or a combination of both.

Following "Unsafe Acts" by working personnel may lead to an accident in the Transmission sector:-

1. Lack of knowledge on the existing Incoming & Outgoing Supply system, Bus - system, A/C & D/C Distribution system, earthing position of the Grid.
2. Operating without knowledge on the existing equipments of the Grid.
3. Lack of knowledge on existing PSPCL system linked with the Grid of PSTCL
4. Lack of knowledge on the PSTCL Line Clear PTW, Issue & Return Procedure.
5. Working without availing LC PTW.
6. **Worker, being DRUG ADDICTED AND ALCOHOLIC**.
7. **Working without Mobile phone switch being made OFF**.
8. **Entering the Switch yard without Personal Protective Equipments (PPE).**
9. **Working without the related permanent E/S closed and temporary earthing done in the respective Line/Equipment.**
10. Opening of Isolators or handling equipments without wearing Hand gloves.
11. Working with small tools in pocket, which have got adequate chances to be dropped inside, while working on the top of Transformers, its turrets or inspection chamber being opened.
12. Failure to use safe clothing i.e. tight dress to be worn with the shirt in, no neckties or jewellery, watches.

13. Non adoption of the practice that all light equipment and tools to be used in the Over-head works, should be raised and lowered by means of hand line and canvas bucket, other suitable container, and men on the ground should be with helmet & stay clear of overhead work to prevent being struck by falling objects.
14. Using unsafe equipment or using improper tools such as dull cutting tools or mushroom head chisels, pipe extensions on wrenches not designed for them, wrong tool for the job, using hands instead of hand tools.
15. Casual/ non-serious approach towards work.

Unsafe Conditions which may also result in accidents include the following:-

1. Unguarded equipments such as unshielded moving parts of machines, saws, etc. and un-barricaded floor opening, un-covered cable trenches and excavations.
2. Use of defective material such as poorly constructed scaffolding, broken ladder, torn gloves etc.
3. Improper illumination
4. All anticipated hazards should be well intimated to all workers.
5. Power cable for lighting / air compressor / air conditioner being run together with Common switch box and with less capacity switches.
6. Control cable and power cable running together.
7. Sacrificing safety for speed OR early completion of the work.
8. The person-in-charge of work failing to ensure himself that the power mains & the apparatus are free from dangerous leakage or induction and has been effectively earthed locally before permitting men to work upon it.
9. Failure to place warning boards by the person-in-charge on all switchgear before men are permitted to work which should only be removed by the person who has placed them. It is desirable that the person issuing the LC PTW shall place one warning board on the switch energizing the mains for each LC PTW issued so that he can be sure that all the LC PTW to work are returned when he has to charge the mains.
10. Allowing a person to work above without the presence of any supervisor or co-worker.
11. Visitors and unauthorized persons shall not be allowed to remain in the vicinity of live mains and apparatus, unless accompanied by an authorized person whose responsibility would be to ensure that the visitor complies with all statutory Safety provisions.

No operation or activity is so urgent that it has to be performed in an unsafe manner and at the cost of one's safety.

3.2 SPECIAL RULES

Working or testing carried out on or near to a System to which these Safety rules cannot be applied, or for special reasons should not be applied, shall be carried out in accordance with an Approved procedure and Power System Safety Standards. (For instance EHV/HV Hot

Line working cannot be covered in basic Safety Rules).

3.3 OBJECTIONS ON SAFETY GROUNDS

Any person who has objections on safety grounds in the application of these Safety Rules and Safety Instructions shall explain their reasons to the Company Officer. If the objections cannot be resolved immediately, then the matter should be referred to the higher Authority. If the objections are still not resolved, then the matter should be referred to the **Head** of Project Management or Operation & Maintenance as the case may be.

3.4 BASIC SAFETY RULES

3.4.1 Safety Rules and Safety instructions shall be applied when working on, or near to items of energized / de-energized Equipments / Lines which are owned by Punjab State Transmission Corporation Limited.

3.4.2 Equipments shall be added to and removed from a system only in accordance with an Approved Handing over/Taking Over Procedures. This procedure will determine when the Safety Rules and Safety Instruction shall apply, or do not apply.

3.4.3 No unauthorized person shall be allowed to enter into switching and controlling area of substation. A signboard distinctly displaying this notice shall be provided on the gate meant for entry in to the switching & controlling area of substation.

3.4.4 The staff should take care that the conducting material such as ladders, steel tape etc. should not be used in the switchyard, however if it is to be used one should take care that it should not come within the induction zone during movement of such material. **Also, staff should avoid use of umbrella in the switchyard.**

3.4.5 Normally, a standard first aid box with medicines & bandages etc. available in the market made of steel sheet shall be provided in each & every control room.

3.4.6 Temporary changes or change over made in the switchyard or control room or on the EHV line should be displayed on the board near to the sitting arrangement of the shift in charge till such arrangement exists.

DO'S & DON'TS OF ELECTRICAL SAFETY

DO's

1. **DO** obey all statutory rules and regulations in force for Line Clear Permit to Work Issue / Return of PSTCL.

2. **DO** use correct size and quality of fuse wire while replacing the blown out fuse.

3. **DO** ensure controlling switches are opened & locked or fuse cut outs are withdrawn

before working on lines**.**

4. **DO** keep away inflammables from electrical apparatus.

5. **DO** disconnect the supply immediately in case of fire on or near Electrical Apparatus / Equipment.

6. **DO** insulate yourself from earth by standing on rubber mat or any insulating material while attempting to get the person who is in contact with live line or apparatus.

DON'Ts

1. **DO NOT** work, being DRUG ADDICTED AND ALCOHOLIC.

2. **DO NOT** replace a blown fuse until you are satisfied with the cause and you have rectified the irregularity in the related system**.**

3. **DO NOT** disconnect a plug by pulling flexible cable when the switch is on.

4. **DO NOT** use wire with poor insulation.

5. **DO NOT** close any Switch/Isolator/Breaker unless you are familiar with the circuit, which it controls and know the reason for its being kept open.

6. **DO NOT** work on energized circuits without taking extra precautions, such as use of rubber gloves and gauntlets.

7. **DO NOT** touch or tamper with any electrical equipment or conductor, unless you have made sure that it is dead and earthed.

8. **DO NOT** work on the live circuit without the specific orders of the authorized Engineer in-charge and make certain that all safety precautions have been taken.

9. **DO NOT** disconnect earthing connection or make ineffective the safety gadgets installed on mains and apparatus unless you are sure or instructed by the appropriate authority..

10. **DO NOT** open or close switch or fuse slowly or hesitatingly.

11. **DO NOT** touch an electric circuit when your hands are wet, or bleeding, cut or an abrasion.

12. **DO NOT** use fire extinguisher on electrical equipment unless it is of proper class and desired for use for that purpose.
13. **DO NOT** throw/inject water on live electrical equipment in case of fire.

14. **DO NOT** touch the body of electrical shock victim. Push him with a piece of dry wood.

15. **DO NOT** allow visitors and unauthorized persons to touch or handle electrical apparatus or come within the danger zone of E.H.V. apparatus.

16. **DO NOT** test circuit with bare fingers.

3.5 SAFETY CLEARANCES FOR WORKING ON (EHV) EXTRA HIGH VOLTAGE AND (HV) HIGH VOLTAGE SYSTEMS.

3.5.1 Persons shall not be allowed any part of their body or objects to approach within the following Safety Clearances exposed EHV/HV conductors, which are Live. (Except during approved live line work):-

Rated Voltage(KV)	**Safety Clearance (Meters)**
Upto 33	0.8
66	1.0
132	1.4
220	2.4
400	3.1

3.5.2 Following minimum safety clearance shall be maintained for bare conductors or live parts of any apparatus in outdoor Sub-stations, excluding overhead lines of HV and EHV installations:-

Highest system Voltage(KV)	**Safety Clearance (Meters)**
Upto 12	2.6
36	2.8
72.5	3.1
145	3.7
245	4.3
420	10.3

3.5.3 When Points of Isolation are established and exposed conductors/parts could be subject to EHV or HV, the only object permitted to approach within Safety Clearance shall be Approved voltage measuring devices or Earthing Devices.

3.5.4 When Points of Isolation are established and Danger is excluded by application of Earthing Devices, approach is allowed under an appropriate Safety Document within the specified Safety Clearance.

3.6 SAFETY RULES FOR WORKING OR TESTING ON, OR NEAR TO EHV OR HV EQUIPMENTS

3.6.1 When working or testing is to be carried out on or near to EHV/HV equipments first the means of achieving Safety must be assessed then the EHV/HV equipments must be identified.

3.6.2 When working or testing on the EHV/HV equipment does not require the removal of Primary Earths, a Line Clear PTW as per Annexure shall be issued. When testing of the EHV/HV equipment does require the removal of Primary Earths, a Test permit (TP) as per Annexure shall be issued.

3.6.3 The Safety Document must show the Safety Precautions taken to achieve safety from the EHV/HV system and also further precautions required to protect persons from inherent dangers in other systems.(e.g. Purging for the removal of substances injurious to health, venting, draining and removal of stored energy and LV/MV supplies).

3.6.4 Within any Isolated Zone, any number of LC (Line clear) PTWs may be issued. Separate LC PTW to be issued to separate working party. LC PTW on Line bay does not mean LC PTW on concerned line.

3.6.5 Within any Isolated Zone only one TP shall be in force at any time. No LC PTWs are permitted at the same time when TP is in force in the same Isolated Zone.

3.6.6 If motive power supplies are made available, no other LC PTW shall be issued on the same equipment.

3.6.7 When Danger from induced voltages could arise during the course of working or testing, Additional Earths shall be applied. The number of these Earths and their application must be stated on Safety Document as per relevant Safety Instruction.

3.7 SAFETY RULES FOR WORKING OR TESTING ON, OR NEAR TO MV AND LV EQUIPMENT.

3.7.1 Where reasonably practical, working on, or near to, MV and LV equipments should be carried out with that equipment 'Dead'.

3.7.2 When working or testing is to be carried out on or near to MV/LV Equipments, then means of achieving safety must be assessed according to relevant Safety Instruction and also comply with the following rules:

(a) The MV/LV Equipment shall be identified.
(b) The MV/LV Equipment shall be Isolated and those Points of Isolation shall be secured.
(c) The method of instructing how the working or testing is to take place can be

described either by a Safety Document or Personal Supervision.

3.7.3 When it is unavoidable to carry out working or testing on MV/LV equipment Dead, then suitable precautions to avoid Danger must be followed and detailed in relevant Safety Instructions.

3.8 SAFETY RULES FOR WORKING OR TESTING ON OR NEAR TO MECHANICAL EQUIPMENT

3.8.1 When working or testing is to be carried out on, or near to mechanical equipments, the means of achieving safety must be assessed according to relevant Safety Rules as above.

3.8.2
(a) For working or testing with the Equipments Isolated and either non-operational or with limited restoration of motive power supplies, the Safety Document issued will be an LC PTW.
(b) When testing of mechanical Equipment involves application of test pressures, the Safety Document issued will be a TP.

3.8.3 When the working or testing requires the issue of a LC PTW as above, the precautions will be specified in the Line Clear PTW and must include the following :-

(a) The mechanical equipment must be Isolated and Points of Isolation established for the work.
(b) Further precautions taken to protect persons from inherent dangers in mechanical systems. This must include draining, venting, purging and removal of stored energy.
(c) Venting emissions shall be dissipated so as to avoid Danger. Where reasonably practicable, vents shall be locked open and Caution Notice fixed.
(d) The removal of the stored energy must be carried out in a manner to contain or dissipate that stored energy safely.
(e) Where internal access is required and the residue of the contents could cause Danger, the mechanical equipment must be Purged and that residue disposed of safely according to an Approved Procedure.

3.8.4 Where working or testing is to be carried out on Mechanical Equipment and it is essential to restore motive power for that working or testing while the LC PTW is in force, then the following additional precautions shall be applied.

(a) AlI supplies required must be stated on the LC PTW in accordance with the Safety Rules as above.
(b) If motive power supplies have been made available, no other LC PTWs shall be issued on the same Equipment.

3.8.5 When testing requires issue of a TP according to Safety Rule as above, then the

procedure will be as described in relevant Safety Instruction. It is essential that the maintenance/testing engineer properly assess the risks of testing. This procedure should only be used when such testing is an operational necessity.

3.9 OPERATION OF EQUIPMENT

3.9.1 The operation of any Equipment to achieve Safety from the system shall never involve pre-arranged signals or the use of time intervals.

3.10 DEMARCATION OF WORKING AND TESTING AREAS

3.10.1 The working and testing area shall be clearly demarcated.

3.10.2 Where necessary, physical protection must be provided to prevent Danger to persons in a demarcated area from adjacent system hazards.

3.11 IDENTIFICATION OF EQUIPMENTS

3.11.1 Equipments shall be clearly marked with a unique code and/or description, which must be the information used on Safety Documents and in switching instructions.

3.12 GENERAL RULES TO BE OBSERVED FOR SAFETY OF EMPLOYEES IN CONSTRUCTION AND MAINTENANCE WORKS OF TRANSMISSION LINES

1) The excavation for pad or pile type foundations in excess of 1.5 meter depth located on unstable earth, shall be either sloped to the angle of repose or shored if entry is required. Ladders shall be provided for access to pad or pile type footing excavations in excess of 1.2 meter.

2) Wherever the foundation is being constructed on unstable earth, the workmen shall not be permitted to enter the excavated pit unless shoring is done.

3) Only responsible and skilled employees shall be deployed for directing mobile equipment adjacent to footing excavations.

4) No workmen shall be permitted to remain in the excavated pit where concreting is done using machinery.

5) The mobile equipment shall be located only on levelled earth to assure stability.

6) Sufficient care shall be taken during tower erection to see that more than the minimum numbers of workmen are not deployed. This will minimise injury due to exposure of falling objects on workmen, when working at two or more levels. Proper protection such as use of helmets, safety belts etc., shall be insisted upon.

7) Tie ropes shall be used wherever necessary for maintaining steel sections or other parts in position to reduce the possibility of tilting etc.

8) Adequate supports shall be provided for the tower members and sections of panels during assembly.

9) The construction of transmission towers, erection of poles, the tools and machinery, employed for the work shall meet the requirements of the relevant Indian Standard Specifications and Code of Practices along with the CBIP manual on Transmission Lines. The wire ropes, pulley blocks etc., shall be of tested quality and inspected by a responsible employee for its fitness before commencing the work.

10) Other than the supervisory staff and such of the workmen required to guide and assist the section being erected, no one else shall be permitted to come under a tower being erected.

11) During erection of towers using hoisting equipment adjacent to existing Transmission Lines, the lines shall be de-energised wherever possible. When this is not practicable, extraordinary precautions shall be exercised to maintain more than the minimum clearances required for safe working.

12) Wherever cranes are used for erection, the same shall be set on firm foundations. The outriggers of the cranes shall be used wherever available. The wheels shall be locked in position to prevent dislocation during handling.

13) Suitable tie ropes shall be used to maintain control of tower sections being raised and positioned wherever possible and proper care shall be taken to see that they do not create a greater hazard. The wire rope used for carrying the section shall not be detached before the section is adequately secured.

14) The erection or maintenance work shall not be carried out during high wind, thunderstorms or unfavourable weather condition, which would make the work hazardous, except during emergency restoration procedures where utmost precautions, shall be taken to avoid any accidents.

15) The Engineer in Charge shall regularly arrange to maintain all the equipment and tools and plant in safe operating conditions.

16) Stringing of Bundle Conductor shall be carried out with T & P Machine only except where not feasible.

17) Adequate traffic control shall be maintained wherever erection work is being carried out at highway crossings. The permissions required from the concerned

authorities, such as the department of highway, police etc., shall be obtained prior to commencement of work. Similarly, for erection work at railway crossings, the permission of the railway authorities shall be obtained before commencing the work. **The crossing of railway tracks under power lines shall be as nearly as possible at right angles**.

18) The Engineer in Charge shall ensure the required clearances to be maintained in moving equipment under or near the energised Lines.

19) Before commencing the stringing operations or removal of conductors, a briefing shall be held by the supervisor with the workmen setting forth the following:
   a– Plan of operation,
   b– The type of equipment and tools and plant to be used,
   c– Grounding devices and procedures to be followed,
   d– Crossover methods to be employed, and
   e– The clearance authorisation required.

20) Wherever there is a possibility of the conductor being handled coming in contact with an energised conductor, or there is a possibility of a dangerous voltage build up due to induction, the conductor being handled shall be grounded, unless a provision is made to insulate or isolate the employee. If the existing line is de-energised, a Line Clear PTW shall be .obtained and the line grounded on both sides of the cross over. In case the Line Clearance PTW cannot be obtained the Line shall be considered as energised for all practical purposes.

21) While executing the work of crossing over an existing Line, suitable guard structures with rope nets shall be installed to isolate the conductors and workmen coming within the required minimum clearances specified for the voltage and if there is any auto-reclose installed on the energised line, the same shall be made inoperative. In addition the line being handled shall be grounded on either side of the cross over.

22) The conductors being strung or removed shall be kept under control by using adequate reels, guard structures, tie Lines, or any other appropriate means to prevent accidental contact with energised wires.

23) The guard structure shall have sufficient strength and have proper dimensions and supported adequately.

24) The wire ropes, come-along clamps, anchors, guys, hoists shall have ample capacity to prevent failure and accidents. The load rating specified by the manufacturers for stringing equipment, pulley blocks and all other load bearing hardware and tools shall not be exceeded during operations. These shall be inspected regularly and

replaced and repaired when damaged or when dependability is doubtful.

25) Came along clamps designed for the specific conductor range only shall be used. During stringing or removal of conductors, no workmen shall be permitted to come directly under overhead operations, or on the cross arms. The dead end points of the conductors at section towers shall be adequately anchored before commencing operations. The grounds provided to the conductor shall be maintained intact until the conductors are hooked on to the insulators.

26) The reel handling equipment, including pulling and braking machines shall have ample capacity, operate smoothly, and levelled and aligned in accordance with the manufacturer's operating instructions. Reliable communication between the operator of these machinery and the stringing operators shall be provided.

27) Each conductor shall be dead-ended at both ends before commencing stringing of the conductor in the next section.

28) The sequence of stringing of conductors and ground wires shall strictly follow the design conditions of erection loads considered for the structure. The method of erection followed shall not impose loads in excess of design loads on the structure.

29) Before commencing the stringing or releasing operations of any conductor adjacent to an energised Line, the following precautions, in addition to all the above, shall be taken:
   a. Only skilled and trained labourers competent to work on Transmission Line construction shall be deployed for the work. The workmen should be in good health, able bodied and normally sound mental state.
   b. The possibility of dangerous voltages due to induction, particularly during switching and fault conditions, shall be investigated and attended.
   c. The tension stringing method or such other methods shall only be used, which prevent unintentional contact between the lines being pulled and the employee.
   d. All the pulling and tensioning equipment shall be isolated, insulated, or effectively grounded.
   e. A ground rod shall be installed between the tensioning reel setup, and the first structure in order to ground each bare conductor, sub-conductor, or overhead ground wire during stringing operations.
   f. During stringing or unstringing operations, each conductor or ground wire shall be grounded at the first tower adjacent to both the tensioning and pulling setup and in increments so that no point is more than 10 stringing spans away.
   g. The grounds shall be left in place till the conductor installation is completed.
   h. These grounds shall be removed at the last phase of cleanup operations.
   i. The grounds shall be placed or removed only with a Hot Line equipment/

insulating rod.

j. Conductors and ground wires shall be grounded at all dead-end points.

k. A ground shall be located at each side and within 10 feet of working areas where conductors or ground wire are being jointed at ground level. The two ends to be jointed shall be bonded to each other. The jointing shall be carried out on either an insulated platform or on a conductive metallic grounding mat bonded to grounds. When grounding mat is used, the same shall be barricaded and an insulated walkway provided for access to the mat.

l. All the conductors and ground wire shall be bonded to the end tower where the work is to be completed. At the dead end tower, the de-energised line shall be grounded.

m. The grounds can be removed on completion of the work making sure that the Line is not left open circuited at any tower at which the work is carried out.

30) The following precautions shall be taken for Hot-Line bare hand work in addition to all other applicable precautions specified in these standards:

a. Only qualified and trained employees, trained for Hot-Line bare-hand technique and the pertinent safety requirements thereto, shall be permitted for the work as well as for supervision.

b. Hot line LC PTW be availed by Hot line crew engineer before commencement of work.

c. The information of Hot line LC PTW be informed to SLDC.

d. The following checks shall be made before commencing Hot-Line bare-hand work on energised high-voltage conductors or equipment to ensure adequacy of tools and capability of personnel:

e. The voltage rating of the circuit on which the work is to be carried out,

f. The clearances to ground of the lines and other energised parts on which work is to be carried out,

g. The voltage limitations of the aerial-lift equipment intended to be used.

h. The Hot Line equipment to be used shall be of proper design and tested.

i. If any automatic reclosing feature is available on the circuit breakers or switches, the same shall be made inoperative before commencing the work on any energised line or equipment.

j. The work shall not be carried out during thunderstorms and cloudy atmosphere.

k. The employee shall be connected to the bucket liner of Hot Line equipment in use through conducting shoes, leg clips or by any other suitable means.

l. Adequate electrostatic shielding for the rated voltage of the line or equipment on which work is being carried out shall be provided to the workmen wherever necessary or conducting clothing shall be provided.

m. Only tools and plant intended for Hot-Line bare-hand work shall be used, and these shall be kept clean and dry.

n. The outriggers on the aerial truck shall be extended and adjusted to stabilise the body of the truck before the boom is elevated. The body of the truck shall be bonded to an effective ground, or barricaded and considered as energised equipment for all purposes.

o. All the controls at ground level and Bucket available in the truck shall be checked and tested to determine their proper working condition before moving.

p. Every day, and each time, before commencing the work "arm current tests" shall be carried out. Aerial buckets used for hot-Line bare-hand work shall also be subjected to these tests. This test shall be carried out by placing the Bucket in contact with an energised source equal to the voltage to be worked upon for a minimum period of three (3) minutes and the leakage current shall not exceed one (1) microampere per kilo-volt of nominal Line-to-Line voltage. The work shall be suspended immediately if any indication of a malfunction in the equipment is noticed.

q. All the aerial lifts shall have reliable controls and shall be accessible for safe and secure operation.

r. Ground level lift control shall not be operated without the permission of the employee in the lift, except in case of emergency.

s. The conducting Bucket Liner of Hot Line equipment in use shall be bonded to the energised conductor by means of a reliable connection before the employee contacts the energised part. This shall remain attached to the energised conductor until the work is completed.

t. The adequate minimum clearance shall be maintained from all grounded Objects and from lines and equipment at a different voltage than, to which the insulated aerial device is bonded, unless such grounded insulated guards cover objects or other lines and equipment. These distances shall be maintained when approaching, leaving, and when bonded to the energised circuit. These distance shall be in line with the prevailing standard practice and consistent with the manufacturer's specification/guidelines.

u. The adequate minimum distances shall also be maintained between all parts of the insulated boom assembly and any grounded parts including the lower arm or portions of the truck, while approaching, leaving or bonding to an energised circuit.

v. The table, comprising the minimum clearance for hot line bare handwork, shall be printed on a plate of durable non-conducting material, mounted in the buckets or its vicinity in such a position that the same is clearly visible to the operator of the boom. Insulated measuring sticks only shall be used to verify the clearances. During positioning the bucket alongside an energised bushing or an insulator string, the appropriate minimum Line-to-ground clearances must be maintained.

w. No conducting material longer than 0.9 meter, other than the jumpers of appropriate length, armour rods, and tools shall be placed in the Bucket.

x. The non standard and unsafe working methods must not be allowed by the supervisor in charge of the Hot Line crew.

y. The bucket and the upper insulated boom shall not be over stressed by attempting to lift or support weights in excess of the manufacturer's rating.

z. The recommendations of the manufacturer of the Hot-Line equipment being used shall be strictly followed.

3.13 PERSONAL PROTECTIVE EQUIPMENT (**PPE**)

3.13.1 GENERAL

Personal Protective Equipment (**PPE**) is defined as the equipment or device used by an individual in the construction / operation and maintenance of substations, lines, power stations, machines and equipments, during Civil works etc. which protect him from any accidental hazard or near miss incident & ensure his safety as well as the safety of the co-workers .

Corporation must provide required **PPE of ISI mark** and of reputed make for each Workman / Engineer engaged in the construction / operation and maintenance of sub-stations, lines, power stations, machines and equipments etc. It is also mandatory for all Civil work site. Site Engineer/Supervisor must ensure adherence of each individual to the guidelines regarding use of PPE at the work site. Employees shall use the PPE intended for respective job depending upon the hazard. The PPE shall be examined by the employee before and after its use. If any part of this equipment is found defective the employee shall immediately bring this to the knowledge of the Site Engineer/Supervisor concerned.

The following are the minimum requirement of Safety devices & Special tools/Personal Protective Equipment (PPE) having ISI mark to be provided.

1 Rubber hand Gloves
2 Safety Shoes
3 Safety Harness
4 Ladder
5 Earthing devices
6 Helmet
7 EHV Detector
8 Ropes
9 Hand tools like pliers, screw driver, chisel etc.
10 Goggles and Eye Shields

3.13.2 General Instructions

1) It is the responsibility of the employee to make use of PPE and safety device properly.
2) The Person-in-charge of the work should ensure proper maintenance and use of the safety equipment. The safety tools/ equipment shall always be maintained in sound & efficient working condition. All safety equipments shall be inspected periodically. Any safety device found defective on inspection shall be repaired/ replaced immediately; if it is not possible to effect repair/replacement, the defective ones shall be discarded at once.
3) Rubber hand gloves should not be roughly handled so as to be damaged. After the work, they should be cleaned, and powdered with French chalk and stored in a safe place. Rubber equipment should be kept clean and free from oil. They should not be

stored near a source of heat, or exposed unnecessarily to direct Sun ray's/ heat. They are best stored in protective container and should not be tied by cords or threads which may cut it.

4) Safety harness should be properly handled. Before and after each use the straps and ropes must be checked. Care should be taken to see that sharp tools or edges do not cut dents and holes in it. Extra holes should not be punched as it weakens the belt. It is best preserved in a separate case.

5) All employees shall wear clothes and footwear suitable for the work. Avoid use of clothing with metal straps or buttons or buckles or any other metal fittings and shall avoid hand chains or watch chains. Employees exposed to the danger of falling material, must wear safety helmets

3.13.3 **SAFETY RUBBER HAND GLOVES**

The rubber mats of appropriate quality should be kept in front of operating panels /switches. **Rubber gloves shall be used in both the hands when;**

1. Working on or near live voltages.
2. Cutting primary and common neutral ground wires to install grounding connect plate.
3. Attaching or detaching leads in use
4. Opening and closing the isolators.
5. Working on street light circuits
6. And any other time when the Site Engineer or workmen may consider it necessary
7. The right hand glove tears out more quickly than the left hand one and in cases of this type, the whole pair should be condemned. Under no circumstance should left hand gauntlet be used on the right **which may lead to near miss incident/accidents**.

3.13.4 **FULL BODY SAFETY HARNESS (SAFETY BELT)**

Safety Belts should invariably be used in all cases while working on overhead system, above two meters, like transmission lines, bus-bars, sub-station equipments etc. The belts may be equipped with leather straps or pockets for carriage of tools. Chains and wire hooks shall not be used for this purpose. Safety straps/hooks, when in use, shall be passed around a dependable member of the tower/structure and not around any cross arms, pins or braces. No changes and alterations (including punching of extra holes) shall be done to belts and straps without authorization: Belts and straps shall not be exposed to heat. These belts shall be kept out of range from blow torches, furnaces and other sources of heat or sharp objects. Belts and straps shall be wiped with clean rag after work in rain and then allowed to dry at room temperature. Employees using the safety belts shall be fully conversant with proper and correct method of wearing and removing of belt. Safety Belt should be checked for its wear and tear before and after each use.

3.13.5 **SAFETY HELMET**

Helmet should be an Industrial Safety Helmet having ISI mark and of reputed make. It

must be used by everybody, employee or authorized visitor , when entering the switchyard of a sub-station or entering any work site .

3.13.6 GOGGLES AND EYE SHIELDS

Employees shall wear approved type of goggles or eye shields wherever there is danger from harmful fumes radiations, flying particles or continuous sparks. Goggles or eye shields should be worn while performing the following operations:

1. Welding and burning:
2. Using grinders, jackhammers, pneumatic tools, chisels, shapers and drills;
3. Painting and scraping
4. Brushing or blowing machines for cleaning;
5. Handling acids, strong alkalis.

3.13.7 PROTECTIVE DEVICES: EARTH DISCHARGE ROD

Approved Earth discharge rod having ISI mark & of reputed make shall be used on all works to maintain proper/effective earthing and ensure that its clamps are in good condition, cables are not broken or frayed and all connections are sound.

3.13.8 EHV DETECTOR

EHV Detector must be used to check the bus-bar / equipment / jumpers / lines before doing any work inside the Switchyard and EHT Lines. Before checking, it should be ensured that EHV Detector is in good working condition & safety hand gloves should be used in both the hands while using the EHV Detector.

3.13.9 HANDLINES AND CANVAS BAGS

All tools, protective equipment and light material shall be raised or lowered by means of hand lines or canvas bags. No tool shall be tossed up or down. Hand line shall be of fiber rope and at least twice as long as the highest point of suspension from where the work is being done. Hand lines shall not have wire reinforcements and where it is necessary to connect two hand lines permanently a splice shall be used. No metal wire or clamps shall be used in making the splice. Before commencing work, employees shall free themselves from the hand line and fasten the same to a solid attachment for use as supply line. Hand lines shall not be left lying on street or road and shall not be used for lacing of scaffolding or for handling heavy material or equipment. Hand lines shall be kept dry, free from oil, kinks or knots.

3.13.10 MINIMUM TOOLS FOR WORK

1. Six sets of cable type discharge rods with ISI mark.
2. Good quality focus Torch (4nos.) with fresh cells
3. First Aid Box with prescribed contents
4. Tool Box (2nos.) containing Insulation tape, all size Ring & DE spanners, Allen key set, insulated pliers (big, small size) Insulation cutter etc.
5. H.R.C. fuses of various capacities as used in the control panels.

6. Ladder (4nos. of different sizes)
7. Poly Propylene Rope of different diameters
8. A/C extension Board with adequate wiring set.
9. Tongue Tester.
10. Motorized Meggar (5 KV & 2.5 KV)
11. Multi meter with cord.
12. Danger Boards / MEN AT WORK boards
13. Good quality safety hand gloves
14. Good quality Rain Coat

3.13.11 **DISPLAY LIST OF IMPORTANT TELEPHONE NUMBERS (at an easily accessible/visible space in the Gird Station & the construction work site);**

1. Police station
2. Ambulance service
3. Govt. Hospital(s) (nearest to S/S)
4. Any other private hospital(s) (nearest to S/S)
5. Fire brigade
6. Electrical Inspector of that zone

3.13.12 **Mobile number of the following persons should also be displayed;**

1. SE (Substation in-charge)
2. Sr. Xen (P & M Division In-charge)
3. Sr. Xen (Protection Division)
4. S.E. (P & M Circle In-charge)
5. Superintendent of Police
6. District Collector

ANNEXURE 1
LINE CLEAR PERMIT TO WORK (LC PTW)

Name Of Circle : .....
Name Of Division : ---------- KV SUBSTATION----------
LC PTW No._____ Date_____

I. REQUEST:

1. Name Of Line / Bay / Transformer :
2. Work to be done :
3. Period of LC PTW : (From) (Date/time) (To) (Date/time) .
4. Details of isolation & earthing required:

5. Precautions taken to achieve Safety:
6. Name and number of persons to execute work:
7. Mode of request (i.e. in person / phone) :

LC PTW (Requested by) LC PTW (Approved by)

Signature
Name
Designation
Date & Time :

II. ISSUE:

1. Sequence of operations carried out for isolation & earthing:

i)
ii)
iii)

2. LC PTW allowed (From) (Date/time) (To) (Date/time).
3. Further precautions to be taken to achieve Safety:

4. No back feed certificate No…… Dt…….. time.....
5. Details of Safety keys used:
6. Work area is isolated and it is safe to work on:
7. LC PTW issued and entered in LC PTW register at Page No:

Signature:
Name:
Designation (Shift In charge)
Date: Time:

Note: 1 LC PTW request to be approved by Substation In charge.
2. LC PTW to be issued to Competent person only.
3. Earthing to be done at the place of work.
4. Colour codification : 1st , 2nd & 3rd copy of LC PTW will be Light Pink, White & light Yellow respectively.

III. RECEIPT

I hereby declare that I have inspected and satisfied myself that such equipment has been switched off, isolated and earthed, where the work is to be carried out. I also accept responsibility for carrying out work on equipment detailed on this permit and that no attempt will be made by me or by any man under may control, to carry out work on any other equipment.

Signature :
Name :
Designation :
Date : Time:

IV. RETURN OF LINE CLEAR PERMIT TO WORK

1. MODE OF RETURN (IN PERSON):
2. DETAILS OF WORK DONE:

3. RESTRICTIONS, IF ANY, ON EQUIPMENT BEING RETURNED TO SERVICE:

4. CLEARANCE:

I hereby declare that all men and material have been withdrawn and warned that it is no longer safe to work on the equipment specified in this permit and all tools and additional earths are clear and equipment is ready for charging.

Signature :
Name :
Designation :
Date : Time:

V. CANCELLATION OF LINE CLEAR PERMIT TO WORK

1. LC PTW cancelled and entry made in LC PTW register on Page No.....

2. SEQUENCE OF NORMALIZATION:

i)
ii)
iii)
iv)
v)
vi)

Signature
Name
Designation(Shift In charge)
Date : Time:

ANNEXURE - 2
TEST PERMIT (TP)

Name Of Circle : .....
Name Of Division :_____ KV Sub-Station :_____
TP No _____ **Date** _____

I. REQUEST

1. Name of Line/Bay/Transformer:

2. Test to be carried out (Name Of equipment):

3. Period of TP: From (Date/Time): To (Date/Time):

4. a) Details of isolation required:

   b) Details of SAFETY KEY required:

5. Precaution(s) taken to achieve safety:

6. Name and number of person to carry out testing:

TP (Requested by)	TP (Approved by)
Signature :	
Name :	
Designation :	
Date :	Time:

II. ISSUE

1. Sequence of operations for isolation:
i)
ii)
iii)
2. TP Allowed: From (Date/Time) To (Date/Time)
3. Further precautions to be taken to achieve safety:

4. Safety key (s) handed over
5. Test area is isolated and it is safe to carry out test.

Name	Signature:
Designation	Date & Time
(Shift In charge)	

Note: 1. TP request to be approved by Substation In charge.
2. TP to be issued to Company Executive only
3. Earthing to be done at the place of test.
4. Colour codification: 1st, 2nd & 3rd copy of TP will be light Green, White & light yellow respectively.

Caution: TP should not be issued if any LC PTW is pending on the same isolated zone.

III. RECEIPT

I hereby declare that I have personally inspected and have satisfied myself that such equipment has been switched off and isolated, where the test(s) to be carried out. I also accept responsibility for carrying out test (s) on equipment detailed on this permit and that no attempt will be made by me or by man under my control, to carry out tests on any other equipment.

Name: Signature
Designation: Date & Time:

IV. RETURN OF SANCTION FOR TEST

A Details of Tests carried out :

B Restrictions, if any , on the equipment being returned to service :

C Clearance :

I hereby declare that all men and material have been withdrawn and following exceptions are recorded.

Name: Signature
Designation: Date & Time:

V. CANCELLATION OF TP

1. TP cancelled and entry made in LC PTW / TP register on Page No.....

2. Sequence of Normalization
i)
ii)
iii)
iv)
v)

Name: Signature
Designation: Date & Time:

CHAPTER - 4

SAFETY INSTRUCTIONS

SAFETY INSTRUCTIONS (SECTION-1)

4.1 Extra High Voltage and High Voltage SWITCHING, EARTHING and SAFETY DOCUMENTATION PROCEDURE

4.1.1 SCOPE
This Safety Instruction explains the procedures for (i) carrying out EHV/HV switching, earthing and isolation from other feeding points & (ii) Safety Documents issue and their control.

4.1.2 DEFINITIONS
All definitions are Standard Definitions explained earlier (Chapter-1)

4.1.3 PROCEDURE

4.1.3.1-- When work is to be carried out on or near EHV/HV equipments the Maintenance Engineer and the Shift In charge will assess the means of achieving safety from the system.

4.1.3.2-- When the work on the substation equipment/transmission line does not require the removal of primary earths, then the safety document issued must be a Line Clear Permit to Work (LC PTW).

4.1.3.3-- When the work/testing in the substation equipment/transmission line requires the removal of primary earths, then the safety document issued must be a Test Permit (TP).

4.1.3.4-- Within any isolated zone any number of LC PTWs may be issued at the discretion of the Shift In charge.

4.1.3.5-- Within any isolated zone, only one TP shall be in force at any time. No LC PTWs are permitted at the same time when TP is in force in the same isolated zone.

4.1.3.6-- After agreement has been reached between Substation Shift In-charge & the Maintenance Engineer/Testing Engineer and the SLDC that the shutdown on the specified substation equipment/transmission line can be availed, the Maintenance / Testing Engineer requests the shutdown by completing all items of 'Request' part of LC PTW or TP document. The Request must include the number of Additional Earths required. The Request must be approved by the Substation in-charge.

4.1.3.7– The Maintenance/testing engineer will confirm with the Shift In-charge that the shutdown can be availed and both will record that instructions in their logbook(s) together with the message number , date and time that the instruction was given.

4.1.3.8--The Shift In-charge will carry out switching operations as per the Substation in-

charge. These switching operations will be recorded in the substation logbook(s) together with message number, the date and time.

4.1.3.9-- If, during a switching operation, a piece of Equipment shows any sign of distress, switching must cease immediately and the Shift-In charge notified. All persons must be warned that a potential hazard exists.

4.1.3.10-- The Shift In-charge at the substation(s) where the LC PTWs or TPs are to be issued, will record the isolation and earthing in the relevant portion of the LC PTW / TP as per sequence of Isolation.

4.1.3.11-- The Shift In-charge will then carry out all isolation and will Lock Open those points of isolation. When necessary, any shift in-charge at the remote end will isolate and Lock Open all points of isolation and confirm back to this Shift In- charge. Any isolation of the secondary side of voltage transformers and auxiliary transformers (tertiary, where applicable) will also be carried out including locking. **Caution Notices must be fixed on all control handles on the control panel and also attached to the padlocks used to Lock Open all points of isolation and Lock Closed all earth switches.** These switching operations will be recorded in the substation logbook(s) together with message number, date and time that instruction was given.

4.1.3.12-- Once all Isolations including voltage transformers and auxiliary transformers (tertiary, where applicable), has been completed (including remote ends where necessary) and confirmation has been received that the isolation has been completed at the remote end), earth switches are closed and Locked. These switching operations will be recorded in the sub-station logbook together with message number, date and time.

4.1.3.13-- No Back-Feed Certificates must be obtained from all concerned stations. All details of the No Back-Feed Certificate must be entered in the substation logbook along with message number, date and time. The message number, date and time must be recorded on the LC PTW / TP.

4.1.3.14-- All Safety Keys, fuses and links etc which have been used to Lock all points of isolation and earth switches etc will be Locked in a Key Safe under the safe custody of the Shift In-charge.

4.1.3.15-- The Shift In-charge will specify, in relevant part of the LC PTW or TP before leaving the charge:

i) Any further precautions to be taken later by the concern holding the LC PTW or TP to achieve Safety.
ii) The motive power supplies that can be restored for the particular work being carried out.
iii) The use of any Additional Earths will be specified on an Earthing Schedule drawn

up by the Maintenance Engineer.

4.1.3.16-- The Shift In-charge will issue the LC PTW or TP to the competent person who will retain the Safety Document in his possession until all work has been completed. The Shift In-charge will record all the details in the substation log book and Line Clear Permit to Work or Test Permit register.

4.1.3.17-- The Executive will sign relevant Part of LC PTW / TP (Receipt), to accept the responsibility for carrying out the work / testing on the substation equipment / transmission line. The Executive responsible for the work will draw up the Earthing Schedule, if required, to show the position and use of Additional Earths.

a) In substations, Additional Earths must be applied in a similar manner to primary portable earths, using the same earthing equipment.
b) On overhead transmission lines, Additional Earths can be applied within Safety Clearance but not less than Safe Electrical Clearances elsewhere specified.

4.1.3.18-- On completion of the work, the Executive will sign the Return of LC PTW or TP at relevant parts to declare that all work/testing is completed, to describe any restrictions and to confirm that all men, tools, plant and Additional Earths have been removed.

4.1.3.19-- The Shift In-charge will receive the cleared LC PTW or TP and record receipt in the substation logbook and LC PTW or TP register together with date and time.

4.1.3.20– The Shift In-charge will complete relevant part of the LC PTW or TP to describe the sequence of normalisation. He will then carry it out after consultation with SLDC & Maintenance/Testing Engineer and Shift In-charge of remote end.

All switching operations in their substation must be recorded in the logbook together with date and time.

SAFETY INSTRUCTIONS (SECTION-2)

4.2 DEMARCATION OF WORK & TESTING AREAS IN SUBSTATION

4.2.1. SCOPE

This Safety Instruction explains the procedure to be adopted for the demarcation of work/test areas in substations.

4.2.2. Additional DEFINITIONS

Apart from the Standard Definitions following Definition can be noted:

Test Area Flag - A red flag reading 'Test Area'

4.2.3. EQUIPMENT IDENTIFICATION

Equipment on which work is to be carried out must be readily identifiable. Where necessary a means of identification must be fixed to it which will remain effective and visible throughout the course of the work.

4.2.4. DANGERS

The main Dangers to personnel working in substation are electric shock, burns or falling arising from --

a) The possibility of misidentifying Equipment on which it is unsafe to work, for that on which it is safe to work.
b) Inadvertently infringing Safety Clearance.
c) Inadequate precautions to suppress or safely discharge any inducted or impressed voltage on the Equipment
d) Improper hand and footholds
e) Improper use of personal protective equipments.
f) Sudden rush of flying insects viz. Bees, flying ants, etc.
g) Improper communication among the working teams.

4.2.5. WORKING/TESTING

4.2.5.1-- When working or testing is to be carried out on or near to Equipment in a substation, the area demarcation is to be determined by the maintenance engineer to the satisfaction of the Shift In-charge.

4.2.5.2-- Working/testing in a substation must be carried out under the supervision of a maintenance engineer.

4.2.6. DEMARCATION OF WORK/TESTING AREAS

4.2.6.1– Where work is to be carried out near to Equipment which may be Live, or must be regarded as Live, then the limits of the work area must be defined as above and followed for

Safety Distance as per Safety Rules.

4.2.6.2-- Boundary marks must be clearly identifiable and easy to see. They must only be fixed or moved by maintenance personnel under the Supervision of the maintenance engineer and Shift In-charge.

4.2.6.3-- Boundary marking should

a) be independently supported
b) not be attached to any structure supporting Equipment
c) not carry any notice.

4.2.6.4-- In general, the boundary marking must be arranged so that it is impossible for structures supporting Equipments which are Live to be climbed from within the work area. Where it is not possible, unsafe access to the structures must be identified by attaching Red Danger Notices at working level before work commences.

4.2.6.5-- The boundary of the work area must be identified using red cones/self supporting props painted in red and white bands for supporting red and white plastic chain or nylon rope of about 12 mm diameter.

4.2.6.6-- The enclosed work/test area must be additionally identified by green cones for Line Clear PTW and red flags in green cones for Test Permit placed 600 mm to 1 m (2 to 3ft) inside the work area at intervals not exceeding 6 m (20ft).

4.2.6.7-- Where the work/test area is separated from adjoining areas by fixed divisions or screens, the work/test area must be identified by green cones placed within the safe area and visible from the outside at each point of access. The fixed divisions or screens must remain in position during the course of the work.

4.2.6.8-- Safety Distance must be maintained at all times to Equipments on which it is unsafe to work. This includes any overhead conductors, which pass over the work area and on which work is not to take place.

4.2.6.9-- The demarcation equipment must be erected before issue of the LC PTW / TP. The demarcation equipment can be removed after clearance of LC PTW / TP.

4.2.6.10-- Consideration should be given, if necessary by the Maintenance Engineer, to provide physical protection to personnel in the demarcated area, from adjacent System hazards.

4.2.7. DANGER NOTICES

4.2.7.1– Danger Notices must be placed to inform personnel that adjacent Equipment is not

included in the specified work area. The notice must be attached to or fixed adjacent to adjoining Equipment in sufficient numbers to be visible from the work area at all times.

4.2.7.2-- Danger Notices must only be fixed or moved by maintenance personnel under the supervision of Maintenance Engineer/Testing Engineer and Shift In-charge

4.2.8. HAZARD AREAS

Hazard Areas may be demarcated by using yellow cones and yellow and black plastic/ nylon chain or rope.

SAFETY INSTRUCTIONS (SECTION-3)

4.3 TESTING OF EHV AND HV EQUIPMENTS

4.3.1. SCOPE

This safety instruction applies precautions to achieve safety from the system for personnel during the testing of EHV/HV Equipment.

4.3.2. EQUIPMENT IDENTIFICATION

Equipment on which testing is to be carried out must be readily identifiable. Where necessary a means of identification must be fixed to it which will remain effective throughout the course of testing.

4.3.3. DANGERS

The main dangers to personnel during the course of testing are electric shocks, burns and other injuries arising from

a) accidental contact with Live Equipment due to improper isolation or discharge.
b) electrical energy and mechanical pressures and forces derived from testing sources.

4.3.4. PREPARATION FOR TESTING

4.3.4.1-- Testing must be carried out by a Competent Person.

4.3.4.2-- Testing which does not require the removal of primary earth may be carried out under a LC PTW.

4.3.4.3-- Testing which requires the removal of primary earth must be carried out under a TP.

4.3.4.4-- The test area and its boundaries/limits must be identified in accordance with the Safety Instruction's "Demarcation of Work And Testing Areas in Substations".

4.3.4.5-- Points of isolation must be maintained from all supplies other than those required for the tests.

4.3.4.6-- The Safety Keys for those of Points of Isolation, which are required to be maintained during the tests, must be kept in a Key Safe.

4.3.4.7-- Safety Keys, which are necessary for the tests, must be issued to the Competent Person.

4.3.5. TESTING

4.3.5.1.-- The Authorised Person in receipt of the appropriate Safety Document is responsible for all matters of safety concerned with the test and for the control function

within the test area. He may operate, or instruct others to operate Equipment within the test area.

4.3.5.2– If specified in a TP the Competent Person may remove, replace or instruct others to remove or replace, Primary Earths.

4.3.5.3-- Connections used for test purpose must be of adequate capacity and be easily visible to prevent accidental access/contact.

4.3.5.4-- The Test Supply must be applied under the Supervision of the Competent Person who has received the Safety Document.

4.3.5.5-- Equipment, which is associated with a test and likely to retain an electrical charge, must be discharged to earth before and after the application of the test supply.

4.3.5.6-- Where a test voltage is to be applied to Equipment which has a remote end that may become Live, then that end must be safeguarded so as to prevent Danger.

4.3.5.7-- If the remote end of the Equipment which may become Live by the test voltage is accessible, then it is the responsibility of the Authorised Person carrying out the test to ensure that it is cordoned off and under the control of the Person before a test voltage is applied. It is the responsibility of that Person to ensure that no one, including himself, approaches the Equipment unless instructed to do so by the Authorised Person in charge of the testing.

4.3.5.8-- During testing by generator supply, the generator supply should not be utilized to run control room appliances such as fans or tube lights unless change over switch provision is made in Control Room.

4.3.6. COMPLETION OF TESTING

When a Safety Document, which includes testing as part of the work activity, is to be cleared, the Authorised Person must ensure that any safety precautions that were used for the testing and not restored to the original state are listed as exceptions.

PRIMARY EARTHS AND ADDITIONAL EARTHS FOR
APPLICATION IN SUBSTATIONS

Sl No.	Item	Qty/Set	Total Qty
1	**Primary Earths** Line-end clamp	4	4 x no. of S/S in the circle
2	Line end clamp	4	-do-
3	Earthing lead with terminal lugs (Min. 95 Sq. mm of Cu, Equivalent with capacity of 25 KA/1 sec.)	4	-do-
4	Earthing pole telescopic 2.5 Mtrs in Closed position, 5 Mtrs. in fully open position with two intermediate stop positions.	1	1 x no. of S/S in the circle
5	**Additional Earths** Line end clamp	4	4 x no. of S/S in the circle
6	Line end clamp	4	-do-
7	Earthing lead with terminal lugs (Min. 35 Sq. mm of Cu, Equivalent with capacity of 7 KA/1 sec.)	4	-do-
8	Earthing pole telescopic 2.5 Mtrs in closed position, 5 Mtrs. In fully open position with two intermediate stop positions	1	1 x no. of S/S in the circle

APPLICATION : THESE EARTHING EQUIPMENTS ARE TO BE USED FOR WORKING ON EHV, AC SYSTEM UNDER INDUCED VOLTAGE CONDITIONS

NOTE : The number of Substations are as per actual no of Substations (PSTCL) plus giving other utilities where PSTCL lines are terminated

SAFETY INSTRCUTIONS (SECTION-4)

4.4 SAFETY PRECAUTIONS FOR LOW VOLTAGE AND MEDIUM VOLTAGE EQUIPMENT

4.4.1. SCOPE

This Safety Instruction applies the principles to achieve Safety for personnel working or testing on Low/Medium Voltage Equipment.

4.4.2. EQUIPMENT IDENTIFICATION

Equipment on which work or testing is to be carried out must be readily identifiable. Where necessary a means of identification must be fixed to it, which will remain effective throughout the course of the work.

4.4.3. DANGERS

The main Dangers to personnel working or testing on LV/MV Equipment are electric shock or burns arising from

a) The possibility of personnel mistaking Equipment on which it is unsafe to work for that on which it is safe to work.
b) The possibility of the Equipment being worked on accidentally or inadvertently being made Live.
c) Dangerous voltages on open-circuited current transformer.

4.4.4. GENERAL REQUIREMENTS

4.4.4.1-- Where reasonably practicable the preferred mode to work on or near to LV/MV Equipment is Dead one. Work on Live LV/MV Equipment should rarely be permitted.

4.4.4.2-- A substation in-charge must carry out an assessment to determine under what conditions the work is to take place and if a Safety Document is to be issued.

4.4.4.3-- When work is to be carried out on LV/MV Equipment, which is part of Extra High Voltage/High Voltage Equipment, adequate precautions must be taken to achieve Safety from the System from the EHV/HV Equipment.

4.4.4.4-- When tests are to be carried out on LV/MV Equipment which is in proximity to exposed EHV/HV Equipment which may be Live, or become Live, the relevant requirement of Safety Instruction "Demarcation of Work and Testing Areas in Substations." must be met.

4.4.4.5– When work on Live Equipment required portable instruments to be used for voltage or resistance measurements the instruments must be provided with insulated probes.

4.4.4.6-- When working on protection or metering Equipment extreme care must be taken

out to open circuit current transformers. These must be short-circuited before work is carried out.

4.4.5. WORKING/TESTING ON OR NEAR TO DEAD LV/MV EQUIPMENT

4.4.5.1-- Substation in-Charge must assess the work required on or near to the Dead LV/MV Equipment and decide whether it must be carried out under :

a) Line Clear PTW or
b) Personal Supervision

4.4.5.2-- Equipment must be isolated. **Time switches, float switches, thermostats, sequence switching devices or similar automatic switching devices are not Isolating Devices.**

4.4.5.3-- Points of Isolation must be established. Any fuses and links and/or Safety Keys used to secure the points of Isolation must be retained in a Key Safe.

4.4.5.4-- Where work is to be done on portable or hand-held LV/MV Equipment isolation must be achieved by the removal of the plug from the socket outlet.

4.4.5.5-- The work must be carried out by an Authorized Person.

4.4.5.6-- Before commencing work the Competent Person must check, by means of an Approved voltage testing device, that the LV/MV Equipment on which he is to work is not Live. The device must be tested immediately before and after use.

4.4.5.7-- If the work is interrupted the Competent Person who is to continue the work must check that the Equipment is not Live as in 4.4.5.6 above.

4.4.5.8-- Before commencing work on exposed LV/MV overhead conductors, which have been isolated, in addition to proving that they are not Live, the conductors including the neutral, must be short circuited and Earthed.

4.4.6. WORKS OR TESTING NEAR TO LIVE LV/MV EQUIPEMENT

4.4.6.1-- Work near to Live LV/MV Equipment must only proceed after a satisfactory assessment by substation in-charge.

4.4.6.2-- The work must only be done by a Competent Person.

4.4.6.3-- The Competent Person who is to do the work must first remove any metallic objects such as wristwatch, rings, wristlets, cufflinks, pendants etc.

4.4.6.4-- Where necessary to prevent injury, approved insulated tools, insulating stands, mats or gloves, as appropriate, must be used.

4.4.6.5-- Only suitable test instrument with insulated test probes must be used.

4.4.6.6-- Consideration must be given to the Competent Person**,** if the presence of such a person could contribute significantly to ensure that injury is prevented.Any accompanying competent person must be trained to recognize **Danger** and if necessary to render assistance in the event of an emergency.

4.4.6.7-- Before commencing work in areas where there is a possibility of the presence of gas, which might be inadvertently ignited by electric sparks, Substation In-charge must be consulted.

4.4.7. WORKING ON LIVE LV/MV EQUIPMENT

4.4.7.1-- Works on **Live LV/MV Equipment** is to be avoided as far as practicable.

4.4.7.2-- If there is no alternative to work on **Live** Line/Equipment, then the following procedure must be adopted.

a) The Substation In-charge and the Maintenance Engineer must thoroughly review the requirement for the work.
b) A written procedure for the **Live** work must be drawn up by the Substation In-charge and the Maintenance Engineer. That procedure will comprehensively describe the precautions required to carry out the work.
c) Approved insulated tools and equipment must be specified and provided.
d) The work will be carried out only under the **Direct Supervision** of Maintenance Engineer.

SAFETY INSTRUCTIONS (SECTION-5)

4.5 SAFETY PRECAUTIONS FOR ADDING/REMOVING EQUIPMETS (NEW/OLD) TO & FROM EHV/HV SYSTEM

4.5.1 SCOPE

This Safety Instruction defines procedure to achieve Safety of personnel and/or transmission system safety while adding/removing equipments to/from the EHV system.

4.5.2 DEFINITIONS

Additional Definitions are as follows:

Bay- An array of Switching and Protective Equipment (Circuit Breaker, Current Transformer, Isolation Wave Trap, Control and Relay Panels etc.) for control and protection of a feeder i.e. Transmission Line of Transformer / Reactor etc. which are to be commissioned or added/removed to a transmission system.

Bay Equipment- Circuit Breaker, Current Transformer, Wave Trap, Control & Relay Panel etc. which are part of the bay.

Inter Connecting Transformer (ICT)- Transformer used to step Up / step down the system voltage.

Reactor- Line or bus reactor used for controlling the system voltage.

Maintenance Engineer- Engineer responsible for carrying out maintenance works of EHV equipments, transmission lines & LT system.

Erection Engineer- Engineer responsible for all construction activities related to addition of a bay.

Substation In-charge- Engineer responsible for erection, operation and maintenance activities being done / to be done in the substation.

4.5.3. PROCEDURE

4.5.3.1 **Adding bay or bay equipment to EHV/HV system.**

4.5.3.1.1 **Bay:** When new bay is to be added to existing EHV/HV system then before connecting the same, pre-commissioning checks are to be completed first. Once pre-commissioning checks are completed, necessary LC PTW/TP is to be requested by Erection Engineer, which should be approved by Substation In-charge. Work of connecting jumpers etc. is to be completed taking safety precautions as per Safety Instructions. After connecting to existing EHV system all commissioning checks are to be performed. All control-cables, protection relays are to be connected taking all safety precautions. Safe electrical clearance needs to be maintained during movement of crane for carrying out erection / dismantling work.

4.5.3.1.2 **Bay Equipment :** When existing bay equipment is to be replaced by new type/design equipment then work should be carried out only after taking safety document i.e. LC PTW/TP duly approved by substation in charge and safety precautions are to be taken care of.

4.5.3.2 **Removing bay or bay equipment from EHV/HV system.**

4.5.3.2.1 **Bay:** When any bay is to be removed from EHV/HV system the LC PTW /TP is to be issued which should be approved by substation in-charge. Safety precautions are to be taken during dismantling work. Bay, which is to be removed, should be identified / isolated from rest of the system, including maintaining Safe electrical clearance to be taken care of during movement of crane for carrying out dismantling work.

4.5.3.2.2 **Bay Equipment:** When any bay equipment is to be removed from EHV/HV system then LC PTW / TP is to be issued which should be approved by substation in-charge. Safety precautions are to be taken during dismantling work. Bay Equipment, which is to be removed, should be identified / isolated from rest of the system. Maintaining Safe electrical clearance etc need to be taken care of during movement of crane for carrying out dismantling work.

SAFETY INSTRUCTIONS (SECTION-6)

4.6 SAFETY PRECAUTIONS FOR EHV OVERHEAD LINES

4.6.1 SCOPE

This Safety Instruction explains the procedures for maintenance on a de-energised circuit of an EHV transmission line. It does not provide for work on live circuits.

4.6.2. DEFINITIONS

Following Additional Definitions are applicable for these Instructions:

Earth End Clamp -The End Clamp of an Additional Earth which is to be connected to tower members, cross arm members or a suitable earth spike driven into the ground at ground potential.

Line End Clamp - The End Clamp of an Additional Earth which is to be connected with conductor or jumper.

Earth Lead - A lead made of aluminium strands protected with a transparent cover for connection between the Line End Clamp and the Earth End Clamp.

Socket - The sliding socket for holding and operating the Line End Clamp which is a part of a Telescopic Pole or Bridging Pole.

Earthing Pole - An insulated pole with a Socket which is to be used for tightening the Line End Clamps on to conductors or jumpers while maintaining Safe electrical Clearance.

Pole Extension - A suitable length of extended pole which is to be connected with the Earthing Pole for achieving the Safe Electrical distance when connecting line End Clamps to conductors or jumpers.

Trailing Earth - An Earth of sufficient length of earth lead suitable for connection between conductor and the tower when lowering or raising conductors. This can be the form of additional earth.

Bridging Pole - A short insulated pole with a Socket which is used for applying and tightening Bridging Earths. First part of earthing pole can be used as bridging pole.

Bridging Earth - An earth used for bridging across insulator strings or when a conductor is to be cut or jointed. An additional earth with line and clamp on both ends can be used as bridging earth.

Working Phases - The conductor phase on which linesmen will carry out work.

Field Equipment Earth - Approved connections for bonding items of field and access equipment such as scaffold, hydraulic platforms, mobile cranes, winches etc. to earth. The earths are coloured orange to identify them from Additional Earths and are not included on an Earthing Schedule. They shall have a minimum cross sectioned area of 35 mm2 copper equivalent. An additional earth can be used in the form of field equipment earth.

4.6.3 DANGERS

The main Dangers when working on transmission lines are:

1) The possibility of personnel mistaking identification of the circuit on which it is safe to work with the one that is still energised.
2) Infringing Safety Clearance before Additional Earths are applied.
3) Inadequate precautions to exclude any induced voltages present on the conductors of fittings.

4) Improper use of safety equipments.
5) Effect of atmosphere / surroundings which may cause imbalance of hand and Foot holds.
6) Imbalance state of mind.

4.6.4 GENERAL PRECAUTIONS TO BE TAKEN BEFORE CLIMBING OR WORKING ON TRANSMISSION TOWERS OR WORKING ON CONDUCTORS
These general safety precautions are to be taken in addition to the safety precautions detailed in Schemes 1 to 6. (Detailed after these instructions)

4.6.4.1 One Responsible Officer (Supervisor/Engineer) should always be present at the site of work.

4.6.4.2 The "CIRCUIT UNDER SHUT DOWN" as per LC PTW should be identified at the working locations with the help of a circuit plate, name plate, location number, phase plate or any other reliable method.

4.6.4.3 All linesmen who work on the transmission towers, conductors or fittings, shall wear and make use of safety belts/harnesses and other safety equipments provided for their safety and protection.

4.6.4.4 The D/C line should be provided with the colour code for the circuits. The line staff should be clearly told about the circuit under shut-down with the colour code.

4.6.4.5 One green flag should be provided at the circuit under shut-down and one red flag at the circuit under charged condition at the sub-station at the LA structure.

4.6.4.6 Additional Earths shall be carried on the tower in such a way to avoid any damage to the Additional Earths. Alternatively, the Additional Earths can be carried manually by the linemen on their shoulders.

4.6.4.7 Safe Electrical Clearance shall be maintained by all linesmen until all the Additional Earths are correctly connected to conductors or jumpers of circuits under shut-down.

4.6.4.8 All Earth End-Clamps of all Additional Earths at the point where the lineman is standing or sitting in order to apply the Additional Earths, shall be connected first to the tower/cross arm member.

4.6.4.9 After connection of the Earth End Clamps with the tower/cross arm members, all Line End Clamps shall be connected to conductor or jumper from the point where lineman is sitting or standing. To ensure that a proper connection of the Line End Clamps with the conductor or jumper has been made a check of the tightness by attempting to rotate the Line End Clamps on the conductor or jumper should be made by the use of the Earthing Pole.

4.6.4.10 The Earthing Pole/Bridging Pole shall be kept suitably on the tower after connection of the Line End Clamps until disconnection of all Additional Earths.

4.6.4.11 If during working on conductors, jumpers, insulators or fittings, an Earth End Clamp or Line End Clamp of an Additional Earth become loosen or disconnected for any reason, linesmen must shift away from tower/cross arm members to maintain Safe Electrical Clearance. He must not touch the disconnected end of the Additional Earth and should maintain Safe Electrical Distance from the disconnected end of the Additional Earth. In such a case, an extra Additional Earth shall be fitted in parallel with the faulty earth. Then the disconnected Additional Earth shall be removed, by the use of the Earthing Pole.

4.6.4.12 After completing the work, all tools, plant and men shall be removed from the conductors and fittings. The last linesman shall remove the Line End Clamps from the conductors/jumpers sitting or standing at the point of connection of these Additional earths to the tower/cross arm side. After this, the Earth End Clamps shall be removed. This procedure shall be repeated for the disconnection of all other Additional Earths.

4.6.4.13 On completion of work, the Additional Earths shall be carried to the ground from the tower in gunny/suitable bags to avoid any damage to the Additional Earths. To avoid damage, no Additional Earths should be thrown from the tower.

4.6.4.14 While coming down from the tower, the linemen will remove the red flags and the green flags.

4.6.4.15 One number spare Additional Earth should be carried to the working tower to provide a spare in case of any contingencies.

4.6.4.16 Isolation of Line Reactors: To reduce induced voltage on dead circuit of Transmission Lines, isolate Line Rectors at both ends of line (wherever provided) in the dead circuit. This shall be done before closing earth switch at line ends of dead circuit.

4.6.5. SCHEME 1--- WORK ON TOWERS WHICH DO NOT INVOLVE THE DISCONNECTION OF ANY CONDUCTOR OR JUMPERS

4.6.5.1 WORK

For work on the de-energised circuit which does not involve the disconnection or lowering of any conductors to the ground. This scheme is to be followed during earthing for the following works:

a) Replacement of suspension or tension insulators.
b) Any other work on a suspension or tension string.
c) Fixing/replacement of spacer or vibration damper adjacent to the suspension or tension string.

4.6.5.2 PROCEDURE

4.6.5.2.1 Apply general procedures as in section 4.6.4 of this Safety Instruction.

4.6.5.2.2 Apply Additional Earths to all phases and to all sub-conductors (wherever applicable) at the working tower of de-energized circuit.

4.6.5.2.3 As an extra safety measure, both sub-conductors of working phases (s) may be bridged with an Additional Earth.

4.6.5.2.4 Carry out the maintenance on strings and vibration dampers as per the normal procedure. However, if a winch is used for replacement of insulators, the winch must be earthed by the use of a Field Equipment Earth attached to an earth spike driven into the ground. All the pulleys used should have good electrical connection with the tower. The pulleys should not have any insulation i.e. rubber lining etc. Adjacent towers can be earthed instead of bridging the sub-conductors as an extra safety measures.

4.6.6 SCHEME 2--- BREAKING AND RE-MAKING JUMPER CONNECTIONS

4.6.6.1 WORK
For work on the de-energised circuit which does not involve the disconnection or lowering of conductors between towers to the ground. This scheme is to be followed during earthing for the following works on tension towers:

a) Breaking or re-making jumper connections, including lowering and raising a jumper.

4.6.6.2 PROCEDURES
4.6.6.2.1 Apply general procedures as in section 4.6.4 above.

4.6.6.2.2 Apply Additional Earths to all phases and to all sub-conductors (wherever applicable) at the working tower of de-energised circuit on the jumpers.

4.6.6.2.3 If only one end of the jumper is to be disconnected apply Additional Earths at the end of conductors on line side of the dead end compression joint where the jumper is to be disconnected. If both ends of the jumper are to be disconnected for replacement / repair of the jumper, Additional Earths must be provided at both ends of the conductors on line side of the dead end compression joints.

4.6.6.2.4 Apply Additional Earths on all working phases and on all sub-conductors (wherever applicable) on adjacent towers.

4.6.6.2.5 Disconnect the jumper from one or both ends as applicable.

4.6.6.2.6 If the jumper is to be lowered to the ground disconnect the Line End Clamp of the Additional Earth from the jumper before lowering the jumper to the ground. The disconnected Additional Earth shall be kept suitably at tower cross arm.

4.6.6.2.7 Lower the jumper in such a way that Safety Clearance is maintained from all live conductors.

4.6.6.2.8 Before any person on ground touches the jumper, it should be discharged by the use of an Additional Earth fixed to an earth spike driven into the ground.

4.6.6.2.9 Carry out the maintenance work on the jumper as per the normal procedure.

4.6.6.2.10 Raise the jumper to the cross arm maintaining Safety Clearance to all live conductors. **Precautions shall be taken so that the jumper is not raised in the horizontal position.**

4.6.6.2.11 An Additional Earth shall be applied to the jumper before connecting it to the dead end compression joints.

4.6.6.2.12 Connect the jumper at both ends with dead end compression joints.

4.6.7 SCHEME 3 -- WORK ON CONDUCTORS BETWEEN TOWERS

4.6.7.1 WORK

For work on the de-energised circuit which does not involve the disconnection or lowering of conductors to the ground. This scheme is to be followed during earthing for the following works:

a) Fixing/repair of line spacers.
b) Fixing/repair of rigid spacers.
c) Fixing/repair of spacer / dampers.
d) Providing repair protector rod/repair sleeve on conductors.

4.6.7.2 PROCEDURE

4.6.7.2.1 Apply Additional Earths on all phases and on all sub-conductors (wherever applicable) on towers at the both end of the working zone. These towers should not be more than 10 spans apart. At tension towers within the working zone, apply Additional Earths to the jumpers and to all the sub-conductors (Where applicable).

4.6.7.2.2 Carry out the maintenance work as per the normal procedure. While working following safety precautions shall be taken:

(a) The men on the conductor shall always maintain Safe Electrical Clearance from tower steel parts or any other material at earth potential at towers where conductor is not earthed.
(b) If any tool or plant is required by the linemen on the conductors, they shall be lifted to the working position by using a polypropylene / insulated rope / bag.
(c) If access to any tower is required, all the conductors at that tower shall be earthed with Additional Earths.

(d) If before work commences, there is a risk of thunder / lighting stroke, no work shall be started. If during the course of the work, there is a risk of thunder / lighting stroke, all work shall immediately stop and all men shall return to the ground.

4.6.8 SCHEME 4 --- PAINTING OF TOWERS WHICH DOES NOT INVOLVE ANY DISCONNECTIONS AND ANY ACCESS TO CONDUCTOR

4.6.8.1 WORK

For work on the de-energised circuit which does not require any contact with insulators, associated fittings or conductors. This scheme is to be followed during earthling for the following works:

a) Painting up to vertical centre line of tower towards the de-energised circuit.

4.6.8.2 PROCEDURE

4.6.8.2.1 Apply Additional Earths on all phases and on all sub-conductors (wherever applicable) at more than 10 towers apart of the de-energized circuit. At tension towers, the Additional Earths shall be connected to the jumpers.

4.6.8.2.2 In case only one or two towers are to be painted only the working towers need to be earthed as per normal procedure of earthing for suspension or tension towers as the case may be.

4.6.8.2.3 Carry out the painting work on towers as per the normal procedure.

4.6.9 SCHEME 5 --- RAISING AND LOWERING PHASE CONDUCTORS AT SUSPENSION TOWERS, FITTING REPAIR SLEEVES/JOINTS TO PHASE CONDUCTORS.

4.6.9.1 WORK

For work on the de-energised circuit of a transmission line which involves raising and lowering phase conductors and the fitting of repair/sleeves/joints to the phase conductors. This scheme is to be followed during earthing for the following works:

a) Lowering of conductor at suspensions tower.
b) Raising of conductor at suspension tower.
c) Providing the repair sleeves on the lowered conductor.
d) Cutting and jointing of lowered conductor.

4.6.9.2 PROCEDURE

4.6.9.2.1 LOWERING AND RAISING CONDUCTORS

(a) Additional Earths shall be fixed on all phases of conductors and on all sub conductors (wherever applicable) at the suspension towers and at adjacent towers.
(b) If a manual winch is used, it shall be Earthed to the tower using a Field

Equipment Earth. All the pulleys used should have good electrical connection with the tower. The pulleys should not have any insulation i.e. rubber lining etc.

(c) Connect the rope with the conductor through Pulley at suitable places in the tower and through winch.

(d) If scaffolding is used in the span below conductor, the scaffolding shall be earthed by providing an earth spike.

(e) Before lowering the conductor, the Additional Earth (s) shall be removed from that conductor and this Additional Earth (s) shall be kept suitably at the tower.

(f) When the lowered conductor is at approx. four meters from ground, additional earth's shall be applied from ground spike/tower on to the lowered conductor(s).

(g) When on the ground the conductor has to be cut, bridging Earth (s) shall be provided on both sides of cutting point with ground spike on tower legs. Then as per working procedure, the conductor shall be cut and joined. After jointing the conductor, the Additional Earth (s) shall joined. After joining the conductor, the Additional Earth (s) shall be removed.

(h) The conductor(s) shall be raised upto 4 meters height from ground and additional earth(s) shall be removed.

(i) Raise the conductor(s) up-to the cross arm level and apply the additional earths on the conductors.

(j) On completion of work, remove all additional earths.

4.6.9.2.2 RAISING CONDUCTOR FOLLOWING BREAK DOWN

(a) Additional Earths shall be fitted to all conductor phases and on all sub-conductors (wherever applicable) at the tower(s) on either side of breakdown and either side of work area with ground spike. In case lowering of conductors from adjacent towers are required, follow the procedure of lowering the conductors from SI. no.4.6.9.2.1 of this procedure and if required from tension towers, then follow Scheme No.6.

(b) If a manual winch is used for lowering or raising conductor(s), it must be earthed by the use of a Field Equipment Earth attached to an earth spike driven into the ground / tower. All the pulleys used should have good electrical connection with the tower. The pulleys should not have any insulation i.e. rubber lining etc.

(c) After raising up to 4 meter from ground, remove additional earths from the conductors.

(d) After raising the conductor up to the cross arm level, Additional Earths should be attached to the conductor.

(e) After completion of work, additional earths shall be removed

4.6.10 SCHEME 6 --- LOWERING & RAISING OF CONDUCTOR FROM TENSION TOWERS

4.6.10.1 WORK

For work on the de-energized circuit of transmission line which involves lowering and raising phase conductors and the fixing of repairs sleeves/joints to the phase conductors. This scheme is to be followed during earthing for the following works:

a) Lowering of conductor at suspension tower.
b) Raising of conductor at suspension tower.
c) Providing the repair sleeves on the lowered conductor.
d) Cutting and jointing of lowered conductors.

4.6.10.2 PROCEDURE

4.6.10.2.1 LOWERING AND RAISING OF CONDUCTOR

(a) Repeat scheme 2 for disconnection of jumpers. During repeating scheme 2, care shall be taken for bridging earth's shall be connected to tower side yoke plate / maintenance block and on to conductors.
(b) Provide additional earth on the wire bond end (splice position) connected to cross arm with cross arm.
(c) Lower the conductor on the ground up-to 4 Mts. height & provide additional earth with ground spike.
(d) Lower the conductor up-to the ground level.
(e) Providing additional earth's on either side if break of conductor is to be done for joining purpose.
(f) After repair work, raise the conductor upto 4 Mts. height and remove all additional earth's from ground spikes.
(g) Raise the conductor up to cross arm level.
(h) Follow scheme 2 for making jumper connections.
(i) After completion of work, remove all additional earth's.

4.6.10.2.2 RAISING OF CONDUCTORS AFTER BREAK DOWN

(a) Provide Additional Earth's on the conductor lying on ground with ground spike/tower.
(b) Provide Additional Earth's on both end of towers of failed span as per scheme 1 for suspension tower and tension towers.
(c) In case any cutting of conductor is required, provide Additional earth's on both side of cutting points with ground spikes before cutting the conductors.
(d) Carry out the cutting & jointing of conductors & other repair work.
(e) Follow the balance above procedure of 2.1 for raising the conductors.

4.6.11 SCHEME 7 --- WORK ON EARTH WIRES

4.6.11.1 WORK

Replacement of vibration dampers, copper bond and tightening of clamp etc.

4.6.11.2 PROCEDURE

4.6.11.2.1 No earthing procedure is required as no shut down is to be taken for climbing up the Double Circuit towers.

4.6.11.2.2 For single Circuit towers, follow the earthing scheme- 1 for Suspension towers and tension towers.

4.6.12 SCHEME 8---WORK ON EARTH WIRES AFTER BREAKDOWNS.

4.6.12.1 WORK

Raising of earth wire after break down.

4.6.12.2 PROCEDURE

a) Obtain the shut down of affected circuit.
b) Provide earthing as per scheme 1 on all towers which require to be climbed.
c) Provide Additional earth's on the earth wire ends (2 Mts away from ends) with earth spikes before starting the job for mid span joints.
d) During rigging, the pulley used at cross arm end shall be provided with additional earth on the cross-arm. fibre round sling in place of wire rope sling has been used for connecting the pulley.
e) Carry out repair & maintenance work on earth wire.
f) Raise the earth wire up to 4 meters height form ground and then remove additional earth form spikes.
g) Raise the earth wire up to cross arm level.
h) Remove all additional earth's on completion of work.

4.6.13 SCHEME 9 – INSPECTION / PATROLLING OF TOWERS AND LINE MATERIALS/FITTINGS

4.6.13.1 WORK

a) Entire tower inspection of single circuit tower with shut down.
b) Tower inspection up to vertical centreline of tower towards circuit under shut down (only one circuit under shut down).
c) Inspection of all insulators, fittings, accessories etc. of de-energized circuit of single circuit and double circuit line.
d) Tightening of bolts and nuts, fixing split pin etc.

4.6.13.2 PROCEDURE

4.6.13.2.1 Follow scheme of earthing procedure as per scheme 3 if inspection is being down by trolley work.

4.6.13.2.2 Follow scheme 1 for earthing procedure in case access to any conductor point is needed from tower cross arm.

4.6.13.2.3 Carry out minor works like tightening of bolts and nuts, fixing split pin, relocation of vibration dampers etc.

4.6.13.2.4 Remove Additional earth after completion of inspection & minor works.

SAFETY INSTRUCTIONS (SECTION-7)

4.7 MOBILE ACCESS EQUIPMENT, VEHICLES, CRANES AND LONG OBJECTS IN SUBSTATIONS

4.7.1. **SCOPE**

This Safety Instruction applies the principles established by the Safety Rules to achieve Safety from the System when mobile access equipment, vehicles, cranes and long objects are being moved or used within substations containing exposed Live EHV/HV Equipment.

4.7.2. **DEFINITIONS**

Following are additional definitions, which only apply to this Safety Instruction.

Field Equipment Earths- Approved connections for binding items of field access equipment such as scaffold, hydraulic platform, mobile crane/ winches etc. to earth. The earths are coloured orange to identify them from Additional Earths and not included on an Earthing Schedule. They shall have a minimum cross section of 25 mm^2 copper equivalent.

Long Objects - Items of equipment such as ladders, scaffold poles, ropes, measuring tapes etc which if not controlled during handling could infringe safety Clearance.

Operator - A Person trained, assessed and appointed to use specific types of mobile access equipment, vehicles or cranes within substations.

4.7.3. **EQUIPMENT IDENTIFICATION**

Equipment on which work is to be carried out must be readily identifiable. Where necessary a means of identification must be fixed to it which will remain effective throughout the course of the work.

4.7.4. **DANGERS**

The main Dangers to personnel during the movement and use of access equipment, vehicles, cranes and Long Objects in substations containing exposed Live EHV/HV conductors are electric shock, burns or falling, arising from

a) Infringing Safety Clearance
b) Induced voltage

4.7.5. **USAGE INSTRUCTIONS**

4.7.5.1-- When mobile access equipment, vehicles or cranes are to be used in Substation Maintenance/Testing Engineer on site must assess the risks.

4.7.5.2-- The Maintenance/Testing Engineer shall ensure that the Mobile access equipment are operated by a trained operator only.

4.7.6. **MOVEMENT INSTRUCTIONS**

4.7.6.1-- When mobile access equipment, vehicles or cranes are to be moved to and from the safe working area and any part of this equipment in the transport position is higher than 2.3 meters from ground level, then a maintenance/testing engineer must assess the risks.

4.7.6.2-- The Maintenance/Testing Engineer must specify on site the route to be followed with adequate protection.

4.7.6.3 -- The Maintenance/Testing Engineer may also specify when during the movement, the mobile access equipment, vehicle or crane must be bonded to earth using Field Equipment Earths.

4.7.6.4-- The Maintenance/Testing Engineer when deciding on the route to be taken must also ensure that the bus bar zone protection wherever provided and adjacent circuit protection is in service.

4.7.6.5-- The Maintenance/Testing engineer must provide **Personal Supervision** during the whole period of movement.

4.7.6.6-- At no time **Safety Clearance** is infringed.

4.7.7. **OPERATION INSTRUCTIONS**

4.7.7.1-- Working areas must be identified in accordance with Safety Instruction "Demarcation of Work/Testing Areas in Substations.

4.7.7.2-- Approach to within **Safety Clearance of Equipment** by mobile access equipment vehicles or cranes are only allowed under **Line Clear Permit to Work or Test Permit.**

4.7.7.3-- The Operator must ensure that the effective use is made of any equipment stabilizing devices or outriggers.

4.7.7.4-- The maintenance/testing engineer holding the **Safety Document** must consider whether it is necessary to consult an appropriate qualified specialist (e.g. Civil Engineer) to ensure that safe ground bearing pressure will not be exceeded. This is particularly important where wheels, stabilizing legs or outriggers may need to be positioned over ducts. Where necessary, load spreading device must be used.

4.7.7.5-- The recipient of the Safety Document must ensure that, as soon as practicable after reaching the demarcated working area, a Field Equipment Earth is applied to the equipment.

4.7.7.6**--** The recipient of the Safety Document must satisfy himself that the Operator knows what work is to be done and that the equipments controls are operating correctly.

4.7.7.7– The recipient of the Safety Document must consider whether to select a member(s)

of his working party as a safety observer(s). He must assess the risk in relation to the work being done, the equipment being used, the field of vision of the Operator and the proximity of exposed Live EHV/HV Equipment.

4.7.7.8-- The Safety Observer must use agreed signal for halting the movement of crane to avoid danger.

4.7.7.9-- Equipment provided for personal access must be electrically bonded to the Earthed EHV/HV Equipment as near to the point of work as practicable to provide an equi-potential zone. This can be achieved by connecting the access equipment through a Field Equipment Earth to the same point as the Primary Earth or Additional Earth attached to the EHV/HV Equipment. It is essential that there is an adequate bond between the access platform and the vehicle chassis.

4.7.7.10-- If other nearby Earthed EHV/HV connections associated with the Equipment being worked on, are accessible from the access equipment, additional Field Equipment Earths must be applied as in 4.7.7.9 to extend the equi-potential zone.

4.7.7.11-- At no time must any part of the equipment encroach over exposed Live EHV/HV Equipment.

4.7.8 MOVEMENT AND USE OF LONG OBJECTS

4.7.8.1 a) Long Object must be stored, moved and used in controlled manner to ensure that they do not infringe Safety Clearance.

b) Umbrellas must not be carried in switchyard areas.

4.7.8.2 LADDERS

a) Only Approved ladders must be used which are of no greater length than is required for the work.

b) When not in use all ladders within substations must be securely Locked to a suitable anchorage.

c) Ladders for operational purpose must not be used without the permission of a Shift Engineer.

d) The movement and erection of ladders must be carried out under the **Personal Supervision** of Shift Engineer/Maintenance Engineer.

e) When moved in a substation ladders must be carried in a horizontal position and as near to the ground as possible.

f) If ladders have to be moved within a defined safe working area after the initial placement, the movement must be carried out in accordance with the specific instructions of the Maintenance/Testing Engineer.

g) Before use, ladders provided to give access to fixed ladders which terminate above ground level must be **Locked** in position by a maintenance/testing engineer. These must remain **Locked** in position during the period the

ladders are in use.

4.7.8.3 **SCAFFOLDING**

a) The Maintenance/Testing Engineer must finalise on the site, the movement route of scaffolding.

b) Subsequent movement of scaffolding to the required location must be carried out under the Personal Supervision of the Maintenance/Testing Engineer.

c) When moved in a substation, long scaffolding components must be carried in a horizontal position and as near to the ground as possible.

d) Before scaffolding is erected or dismantled the Maintenance/Testing Engineer must assess the risks in relation to the proximity to exposed Live EHV/HV Equipment.

e) Field Equipment Earths must be applied to scaffolding erected near to the Live EHV/HV Equipment as soon as it is practicable to do so. As erection proceeds. Field Equipment Earths must be applied as approximately 5m (15ft) intervals, vertically and horizontally, or as determined by the Maintenance/Testing Engineer.

f) The recipient of the Safety Document must assess the risks in relation to the method of erection and the proximity to exposed Live EHV/HV Equipment. He must consider whether to select a Safety Observer.

g) No bamboo/wooden scaffolding to be used.

SAFETY INSTRUCTIONS (SECTION-8)

4.8 EXTRA HIGH VOLTAGE / HIGH VOLTAGE STATIC CAPACITOR BANKS

4.8.1 **SCOPE**

This Safety Instruction applies the principles to achieve **Safety** including the removal of stored energy, for personnel working on EHV/HV Static Capacitor Banks

4.8.2. **DEFINITIONS**

Additional Definitions are as under :

Rack - An individual framework containing capacitors connected together.

Capacitor Bank - A group of capacitors consisting of a number of Racks connected together. If the Equipment consists of only one Rack the term Capacitor Bank will also apply.

Shorting Switch - A fixed device for short-circuiting the capacitors in Racks to dissipate stored energy safely. It may also provide a direct connection to earth.

Short-Circuiting Lead - An Approved (6mm2 11 KV insulation) lead with insulated clips or standard lead supplied by the manufacturer for this purpose. Used for short-circuiting an individual capacitor. This can be a clip on short used during the disconnection of a capacitor or a bolt-on short used during removal and temporary storage.

Continuity Lead - An Approved lead supplied by the manufacturer used as a temporary means of maintaining continuity of the connections between other Capacitors, during the disconnection of a capacitor.

Discharge Stick - An Approved device for the purpose of discharging any residual charge in a capacitor.

4.8.3 **EQUIPMENT IDENTIFICATION**

Equipment on which work is to be carried out must be readily identifiable. Where necessary, a means of identification must be fixed to it which will remain effective throughout the course of the work.

4.8.4 **DANGERS**

The main Dangers to Personnel are electric shock or burns arising from

a) The discharge of electrical energy retained by the static capacitors after they have been Isolated.
b) Inadequate precautions to guard against any induced voltages in the conductors or associated fittings.

4.8.5 **PREPARATION OF WORK/TESTING**

4.8.5.1 The Capacitor Bank must be **Isolated, Points of Isolation** established and **Primary Earths** applied.

4.8.5.2 Shorting Switches, where installed on the Racks, must be closed. The control of Shorting Switch is the responsibility of the maintenance / testing engineer.

4.8.5.3 A **LC PTW** or **TP** must be issued.

4.8.6. **WORK/TESTING**

4.8.6.1 No Capacitor must be handled unless it is short-circuited.

4.8.6.2 The Maintenance Engineer requesting the **Safety Document** must specify the position for application of clip-on Short Circuiting Leads and Continuity Leads. Short Circuiting Leads and Continuity Leads must be applied to the appropriate capacitors under the Personal Supervision of the Maintenance/Testing Engineer.

4.8.6.3 Before the application of a Short-Circuiting Lead to an externally fused capacitor, it must be discharged using a Discharge Stick under the Personal Supervision of the Maintenance/Testing Engineer.

4.8.6.4 Before an individual capacitor is removed from a Rack

a) The clip-on Short Circuiting Lead must be replaced by a bolt-on Short Circuiting Lead
b) The bolt-on connection must be made before the clip-on one is disconnected.
c) Continuity of the connections of adjacent capacitors must be maintained using the Continuity Leads.

4.8.6.5 During storage and transport, capacitors must be short-circuited using at least two complete turns, between terminals, of tinned copper wire of not less than 30 Amp fuse wire.

4.8.6.6 When the work activity requires the opening or removal of Shorting Switches and special requirement for subsequent access to capacitors, these actions must be carried out under the Personal Supervision of the Maintenance / Testing Engineer.

SAFETY INSTRUCTIONS (SECTION-9)

4.9 STATION STORAGE BATTERY

4.9.1 **SCOPE**

This Safety Instruction applies the principles to achieve Safety from the System for personnel working on Station Storage Batteries.

4.9.2 **DEFINITIONS**

Additional Definitions as follows :

Battery Bank - All battery cells, connections and stands comprise a battery bank.

4.9.3 **EQUIPMENT IDENTIFICATION**

Battery Bank on which work is to be carried out must be readily identifiable. Where necessary a means to identification must be fixed to it, which will remain effective throughout the course of the work.

4.9.4 **DANGERS**

The main Dangers to personnel working on a Battery Bank are electric shock or burns arising from

a) The possibility of personnel inadvertently shorting battery terminals.
b) Dangerous spilling of electrolyte on body.
c) Asphyxiation or suffocation due to fuming of storage battery acid.

4.9.5 **GENERAL REQUIREMENTS**

4.9.5.1 A substation in-charge must carry out an assessment to determine under what conditions the work is to take place and if a Safety Document is to be issued.

4.9.5.2 When work is to be carried out on a Battery Bank, adequate precautions must be taken to achieve safety from the danger of electrolyte and DC voltage.

4.9.5.3 When working on Live Equipment, required portable instruments to be used for impedance or voltage measurement, the instruments must be provided with Insulated probes.

4.9.5.4 When handling acid, care must be taken and personnel protective equipment like face shield, apron, gloves etc., must be used before work is undertaken.

4.9.5.5 Proper ventilation along with water supply in washbasin shall be ensured in the battery room.

4.9.5.6 Add **ACID TO WATER, DON'T MIX WATER TO ACID** while preparing electrolyte.

4.9.5.7 Always clean spilled acid immediately.

4.9.5.8 During handling acid, sufficient quantity of water must be available.

4.9.6. **WORKS/TESTING ON STATION BATTERY BANK**

4.9.6.1 Points of Isolation must be established. Any fuses and links and/or Safety keys used to secure the Points of Isolation must be retained in a Key Safe.

4.9.6.2 Substation in-charge must assess the work required on a Battery Bank and decide whether it must be carried out under

a) **Line Clear Permit to Work**, and/or
b) **Personal Supervision**

4.9.6.3 The work must be carried out by a Competent Person

4.9.6.4 The Competent Person who is to do the work must first remove any metallic objects such as wristwatch, rings, wristlets, cufflinks, pendants etc.

4.9.6.5 Where necessary to prevent injury, Approved insulated tools, insulating stands, mats or gloves, apron, face shields, as appropriate, must be used.

4.9.6.6 Only suitable test instrument with insulated test probes must be used.

4.9.6.7 Consideration must be given to the accompanying Competent Person if the presence of such a person could contribute significantly to ensure that injury is prevented. Any accompanying Competent Person must be trained to recognize Danger and if necessary to render assistance in the event of an emergency, e.g. accidental spilling of acid on eyes, unconsciousness due to inhalation of toxic gases etc.

SAFETY INSTRUCTIONS (SECTION-10)
4.10 SF6 GAS FILLED EQUIPMENTS

4.10.1 **SCOPE**
This Safety Instruction lays down procedure for working on SF6 gas filled equipments and to protect all personnel from inherent dangers/hazards of SF6 gas.

4.10.2 **DEFINITIONS**
Additional Definitions are as under:

Impurities: Impurities toxic or non-toxic contained by SF6 gas filled in EHV equipments.

De-composition products: Electrical discharge decomposes SF6 gas in SF4, SF2 etc. These are called de-composition products. In some cases sulphur-fluorine gas is also formed due to electrical discharge.

4.10.3 **EQUIPMENT IDENTIFICATION**
Equipment on which work is to be carried out must be readily identifiable. Wherever necessary, identification tags must be fixed to it, which will remain effective throughout the course of the work.

4.10.4 **DANGER**
Following are the dangers while working on SF6 gas filled equipments:

a) Since SF6 gas is heavier than air, in the storage / work area in the absence of proper ventilation there is a danger of asphyxiation (Suffocation).
b) Decomposition products e.g. Sulphur-fluoride & other toxic gases having pungent or unpleasant odour causes irritation of nose, mouth and eyes.

4.10.5 **WORKING PROCEDURES**
4.10.5.1 A Line Clear Permit to Work must be issued before starting the work.

4.10.5.2 The work equipment must be electrically isolated from other equipment

4.10.5.3 The equipment must be earthed at two points.

4.10.5.4 Using Gas evacuation trolley, SF6 gas should be taken out from the equipment and evacuation up to about 50 mbar should be achieved.

4.10.5.5 After ensuring that total gas has been evacuated / removed then only the equipment should be opened / dismantled.

4.10.5.6 In general, mask or other protective measures are not necessary when no appreciable amount of dust (fluoride powder)/ odour exists. However, during internal

inspection of the interior parts of apparatus, personnel should take precautions to avoid exposure to the breakdown products and suitable protective equipment like gas mask (preferably incorporating molecular filter etc.), Industrial type goggles (SF6 gas dust can sometimes attack the glass of goggles, spectacles etc) and rubber gloves may be used.

4.10.5.7 After completing the work on the equipment, equipment should be reassembled.

4.10.5.8 Before refilling SF6 gas, evacuation up to 6 mbar should be carried out for about 2 hours , thereafter SF6 gas should be filled in the equipment.

SAFETY INSTRUCTIONS (SECTION-11)

4.11 FIRE PROTECTION

4.11.1 INTRODUCTION:

Fire is a great destructive natural force. It can destroy vital stores, equipments, accommodation and amenities. Majority of Fires are due to carelessness, ignorance, arson, lack of discipline and failure to observe statutory and general regulations. A little knowledge on this subject may save loss of lives and properties.

4.11.2 BASICS OF FIRE: Ordinary Fire is a chemical reaction between a fuel and oxygen in presence of heat. In other words, it may be stated that three things are essential to initiate a Fire viz. **OXYGEN, FUEL & HEAT**. A Fire cannot take place in the absence of any one of these three factors. In extinguishing a Fire, all that is done is removal of Heat or Fuel or Oxygen from Fire.

4.11.3 METHOD OF EXTINCTION:

Whatever may be the equipment or extinguishing media for Fire Fighting, the three under mentioned method are used:

1) Cooling Method: The method, in which Heat of burning substance is removed, generally by using water, is known as cooling method. Water brings the heat of substance under Fire below the ignition temperature of substance. This method is normally applied in extinguishing Fire of solid combustible materials. This method must not be adopted for fighting live electrical Fire. This method is applied for extinguishing electrical originated Fire only after ensuring the cut off of power supply.

2) Smothering Method: The method in which Oxygen is removed from burning substance is known as smothering method. In this method oxygen is restricted to Fire by using layers of Foam or inert gases like CO2, Nitrogen, Chlorofluorocarbon or Dry Chemical Powder or Dry sand. Sometimes this is achieved by proper blanketing of Fire using Fire blanket or Asbestos blanket or Aluminium blanket or other available non-combustible materials. This method is normally used for extinguishing Fire in Flammable liquids.

3) Starvation Method: The method in which Fuel or combustible material is removed from Fire is known as starvation method. This is achieved by removing burning substance from the scene of Fire. Fire in pipe lines, cylinders, Tankers containing flammable liquid or gas is controlled by closing the valves. By closing valves the Fuel or combustible materials are isolated from Fire and thus starvation is achieved. This method is best used for extinguishing Fire in pipelines, cylinders containing flammable liquid or gas.

4.11.4 CLASSIFICATION OF FIRES:

Fires are categorized in to four different classes mentioned as below:

1) CLASS – A: Fires involving solid materials normally of organic nature are categorized as

Class – A Fire. Fire in paper, wood, cotton, plastic, rubber etc. are the example of Class-A fires. Cooling method is normally used for extinguishing Class-A Fires.

2) CLASS – B: Fires involving liquids or liquefiable solids are categorized as Class-B Fire. Fires in petrol, kerosene, diesel, oil etc. are the examples of Class – B Fires. Smothering method is normally used for extinguishing Class – B Fires.

3) CLASS – C: Gaseous Fires are categorized as Class – C Fire. Fires in LPG, Acetylene, natural gas etc. are the examples of Class- C Fires. Starvation method is normally used for extinguishing Class-C Fires.

4) CLASS – D: Fires in metals are categorized as Class-D Fire. Fires in Sodium, Magnesium, Potassium etc. are the examples of Class-D Fires. A special type of powder is used for fighting Class – D Fires. There is no chance of Class-D Fire in Sub-Station.

4.11.5 FIRE EXTINGUISHERS:

It is very easy to extinguish a Fire when it is small. If Fire is not controlled in its incipient stage then it may require lots of manpower, time and money to control. Hence, it is better to attack Fire when it is small. To extinguish small Fire, First-aid Fire Fighting extinguishers are kept at the strategic locations in all the Sub-Stations. This can be easily identified by its red coloured and cylindrical in shape. These Fire extinguishers must be used for extinguishing small Fires by a person nearest to it. Therefore, the operational knowledge of Fire extinguishers is inevitable for each and every person working in Sub-Station. There are various types and capacities of Fire extinguishers provided in Sub-Stations. These Fire extinguishers should be operated on Fire according to their suitability. Before operation, it is very important to read the information given on the sticker of a particular Fire extinguisher:

1) The name of Fire extinguisher is written in bold capital letters on the sticker.

By name, the inside contents and discharge of Fire extinguishers can be identified. The following are the examples of names and contents of Fire Extinguishers:

Name of Extinguishers	**Contents**	**Discharge**
Water CO2 type	Water & CO2 gas cartridge	Water
Co2 type	CO_2 gas	CO_2 gas
Dry Chemical powder (DCP)	Powder (Normally sodium bicarbonate) and CO2 gas cartridge Powder	Powder
Mechanical Foam	Water mixed with Foam compound	Foam
Halon Type	Halon Gas (Normally Bromo Chloro	Halon gas

Difinoro Methane)

2) The information regarding suitability of Fire extinguishers is given in form of capital letters in circle. If character 'A' is written inside the circle then it is suitable for Class-A Fires. If characters 'B' &'C' are written then it is suitable for Class-B & Class-C Fires.

3) The method of operation of Fire extinguishers varies from type and capacities. It is, therefore, essential to read carefully the method of operation written on the sticker of particular Fire extinguishers. A stepwise drawing for operation is also shown.

The date of checking and due date of refilling must be checked before the operation of Fire Extinguisher. It must be ensured that the Fire extinguisher is well maintained and ready for use.

4.11.6 USEFUL FORMATS FOR SUB-STATION:

1) **Fire occurrence report:** For reporting a Fire incidence a format has been prepared as Appendix-A. This format covers almost all details required in preparing Fire report.

2) **Daily Occurrence Book:** The format of daily occurrence report is given as Appendix-B. A register may be prepared and maintained by Fire Staff of respective 400KV Sub-Station. All the information regarding Fire Service day to day work should be logged in this book.

3) **Fire-Order:** A format of Fire-order is given as Appendix-C. The Fire order in form of posters may be prepared and fixed at the strategic locations inside the Sub-Station.

4) **Vehicle and Pump Register:** A format for making entries of Fire vehicle and Fire Pumps is given as Appendix-D. A register may be prepared and entries should be made by the Fire staff of respective Sub-Station invariably.

5) **Fire Pump Test Register:** Fire pumps are installed in all major Sub-Stations. A format for keeping test record of Fire Pump is given as Appendix-E.

6) **Fire Hose Test Register:** A number of Fire hoses are kept at major Sub-Stations for suction and delivery of water for fighting Fires. Periodical tests may be carried out and the record of tests may be kept as format given as Appendix-F.

7) **Yearly Electrical Installation Check-up Register:** A format regarding electrical installation check-up is given as Appendix-G. After duly check up of electrical installations the report may be filled in this register.

APPENDIX-A
FIRE OCCURRENCE REPORT

NAME OF SUB-STATION _____

01. Address of premises where fire occurred:

02. Date of Fire incident :

03. Time at which Fire occurred :

04. Time at which Fire Discovered :

05. Fire Discovered by :

06. Person in-charge at the time of Fire :

07. Property involved in Fire :

08. Location/region of Fire :

09. Time at which Fire fighting action started by Staff :

10. Time at which Fire Extinguished :

11. By what means fire was extinguished :

12. Was outside Aid required? Give brief details of time they were informed, time they reported, and nature of assistance rendered :

13. Cause of Fire :

14. List of equipments damaged by Fire :

15. Equipment data
    a) Serial No. :

    b) Equipment No. :

    c) Manufacturer :

    d) Type :

    e) Rating :
f) Type of insulation :
g) Any other information :

16. What fire protection arrangement the building or equipment had? :

17. List of extinguishing equipments found
Defective or unsuitable on fire :

18. Estimated Loss: -
a) Equipment :

b) Store :

c) Building :

d) Production/ revenue :

e) Miscellaneous :

f) Total :

19. Was there any casualty?
If yes, then state name & address of casualty/ casualties, extent of loss & action taken in this regard. :

20. Loss of property of others (other than PSTCL) :

21. Incidence of Importance :
a) Prior to incident :

b) During Fire :

c) After Fire :

22. Estimated length of time the equipment will be out of service :

23. Any other relevant information of interest :

24. Brief report including remarks, recommendations & remedial measures to avoid reoccurrence of Fire :

Reported by _____

Signature_____

Designation_____

APPENDIX-B

FIRE STATION DAILY OCCURRENCE BOOK

DATE	TIME	ENTRY No.	DETAILED REPORT	INITIAL

APPENDIX-C

FIRE-ORDER

IN CASE OF FIRE

1. SHOUT…….FIRE…….FIRE AND ENDEAVOUR TO PUT IT OUT.

2. SOUND THE ALARM.

3. INFORM FIRE BRIGADE ON TELEPHONE NO. 101 OR PERSONALLY.

4. ALL ESSENTIAL PERSONS OF AFFECTED SECTIONS WILL NOT LEAVE PLACE OF WORK AND CONTINUE IMPORTANT OPERATIONS & FUNCTIONS.

5. NON-ESSENTIAL PERSONS WILL BE EVACUATED TO SAFE PLACE AND WILL STAND IN LINE.

6. FIRE PERSONS SHALL RUSH TO THE SCENE OF FIRE WITH THEIR APPLIANCES AND FIGHT FIRE.

7. ALL PERSONS OF NON-AFFECTED SECTIONS SHALL REMAIN AT THEIR PLACE OF WORKING AND SHALL EXTEND FULLEST CO-OPERATION IF CALLED FOR BY EFFECTED SECTION.

APPENDIX-D

VEHICLE / PUMP LOG BOOK

Date	Reading (KM)	Fuel Drawn (Litres)			Time		Place visited	Reading (KM)	Run (KM)
		Petrol	Diesel	Oil	Departure	Arrival			

Static Run		Fuel consumed	Fuel balance in Tank		Initial DCO	Initial Fire Officer
Hrs.	Mins.	Litres	Departure	Arrival		

APPENDIX-E
RECORD OF TEST OF FIRE PUMPS

Appliance No. : _____ Date Commissioned :_____
Capacity:_____ Make:_____

Date	Monthly Output Test	Monthly Vacuum Test	Suction Test	Deep Lift Test Six Monthly	Initial Of Operator	Remarks of Officer

APPENDIX-F

RECORD OF DELIVERY /SUCTION HOSE PIPES

Serial No._____ Location:_____

Type:_____ Date of Commissioned:_____

Length:_____ Size:_____

Date	Details of use, check, test, repair etc. with remarks	Initial

APPENDIX-G

ELECTRICAL INSTALLATION, WIRING, FUSE AND FIXTURE YEARLY INSPECTION REGISTER

(To be decided & looked after by concerned Engineer In-charge)

Sr. No.	Date of Inspection	Remarks of the Inspector	Action by Engineer In charge of section	Remarks of Fire Officer	Head of Sub-Station

4.11.7 PROCEDURE FOR HOT WORK.

Purpose -- The purpose of safety permit for Hot work and vessel entry is to save the human life and control the Fire hazards. This is achieved by establishing the fool proof procedure for giving clearance of Hot-job. Any job inside Sub-Station requiring the use of following must be covered by a safety permit. Such jobs as well operation or use of equipment, which in the opinion of Fire Section may create a source of ignition, will be classified as **"HOT WORK"**. This may include the following.

a. Welding
b. Burning & cutting
c. Torches & open flames
d. Tar pots/mastic work
e. Soldering of equipments
f. Portable electrical tools & appliances
g. Forges
h. Electrical arc of any kind and any other equipment, which may create a source of ignition.
i. Chipping
j. Sand blasting
k. Heaters
l. Hot plates
m. Operation of mobile crane near high voltage lines / equipments.
n. Any equipment, line or vessel which contain or has contained any Hydrocarbon, corrosive or toxic material and removed from services for discarding in and around work shop to a location where "Hot Work" is already permitted.

Validity

a. Safety permit will remain valid for specified period of time.
b. Safety permit will become void if the work stipulated in the permit is not started within one hour of issue of safety permit. While issuing the new permit all tests should be repeated.

Person competent to sign the permit

JE and above of Sub-Station are authorized to sign the safety permit for hot jobs.

4.11.8 ACTION TO BE TAKEN AT VARIOUS LEVEL ON OUT-BREAK OF A FIRE

1. By Person noticing Fire:

On discovery of a Fire, remain calm and think quickly to accomplish the following functions:

a) Raise alarm by shouting Fire---Fire---Fire.
b) Break the glass of Manual Call Point if available near to Fire.

c) Give message of Fire to Fire Section on telephone or Loud phone or in person. Give full and clear message of Fire.
d) If Fire is small enough for tackling by person alone, immediately attempt to extinguish it by using nearby Fire Fighting equipments.

2. By Person/persons arriving next to scene:

a) Make sure that the fire Station has been informed about the Fire by dialling internal telephone or on Loud phone or by personal contact. Give full and clear message of fire to the Fire Station.
b) Inform respective control room on Telephone.
c) Attempt to control the spread of Fire by taking due care of personal danger.
d) Make sure that exit routes are free and road for approaching Fire vehicles are clear & unobstructed.

3. By other persons of Fire affected area:

a) All essentially required persons will not leave place of work and continue their functions and operate essential equipment and emergency systems till ordered to evacuate, considering the grave danger to their personal safety.
b) The work will only stop in affected area of the building/section and in the immediate surroundings.
c) All non-essential persons will be evacuated safely and shall muster in safe place of assembly, earmarked on Sub-Station layout.

4. Sub-Station Fire staff:

a) On hearing Fire Alarm, the Sub-Station Fire staff will double up to the scene of Fire with Fire Fighting equipments and initiate Fire Fighting operations till arrival of city Fire Brigade and later on assist Fire Staff, if required.
b) The crew on duty will mount in Fire vehicle if available. The senior most Fire person after ensuring that all members of the crew are in the vehicle will ask Driver-cum-operator to start the vehicle. Driver-cum-operator shall park the vehicle at safe place in such a manner so that Fire appliance can be quickly moved away in case it is found exposed to dangerous conditions due to Fire of Explosion.
c) On arrival at the scene of Fire, In-charge of Fire crew shall dismount from the vehicle and double up to scene of Fire to enquire about the details of Fire, quickly size up the situation and instruct his men to come into action immediately without any delay. Fire crew will immediately operate Fixed Fire Fighting system if kept on manual or not operated as the situation demands. Fire crew will also start laying of hose pipes or operation of equipment or will initiate other appropriate action according to situation in consultation with senior most engineer present.

5. In charge of Sub-Station:

a) On hearing the Fire alarm or on receipt of message regarding Fire in his area, he will immediately proceed to the scene of Fire in his area.

b) He will ensure:
   I. That Fire Station is informed about the Fire.
   II. That Fire alarm is sounded on siren, if required and will inform Main Gate security persons for sounding hooter.

c) He will ensure that all-important documents, precious material are salvaged & removed to safe place with the help of his sectional staff.

d) He will decide in consultation with senior Engineer present and arrange to switch off power/gas/air or other equipment or system if so warranted to control the situation.

e) He will not leave the Fireplace till normal condition is established.

6. Engineer-in-charge of Control Room.

a) He will give top priority to the calls of Fire and immediately inform the location of Fire to the following:
   i. Fire Station
   ii. Main Gate
   iii. Fire Office/Fire Supervisor
   iv. Head of Sub-Station
   v. Security Officer
   vi. Medical officer if available.
   vii. Other Senior Engineer if available in the substation.

b) He will take all steps necessarily required in the emergency regarding operation & control of the plant.

c) He shall guide/assist Fire Fighting staff in combating the emergency situation.

d) He shall mobilize all spare trained personnel to help in tackling the jobs such as Fire, rescue, moving of causalities and salvage operations.

e) He will arrange to send vehicle under his control during non-working hours to collect all-important personnel from the colony.

7. By Inspector at Main Gate:

a) Security Inspector of Main Gate on receipt of Message of a Fire will immediate sound the Fire Alarm on "Siren" in wavering sound for 5 Minutes.

b) He will close the Sub-Station "MAIN GATE".

c) He will not permit any one to leave/enter Main Gate except essential persons of Sub-Station after thorough check and verification.

d) He will arrange to keep the Sub-Station road clear for assistance of outside Fire Services / Fire Fighting parties.

e) He will provide watchman or suitable guides for assistance of Fire brigade

arriving at Main Gate for help to reach the scene of Fire.

f) On receipt of "ALL CLEAR" message from Head of Sub-Station, he will sound "ALL CLEAR" siren by continuous blast of one minute.

4.11.9 FIRE ALARM ARRANGEMENT

1. Location of all types of Fire alarms viz hooter, sounders, siren with their locations and instructions on different occasions will be clearly explained.
2. Fire alarm must always be raised when Fire is discovered or reported, even if the Fire is small.
3. Sub-Station siren will be sounded on the information from Fire Section in-charge or Senior Engineer/Officer available in the s/s. The Fire siren will be sounded in distinct way then normal siren as per the manner given below.

The Fire or emergency siren will be sounded for 5 Minutes and in wavering sound as under:
15 Seconds on-- 5 Seconds off, 5 Seconds on-- 5 Seconds off
And so on for 5 Minutes.

4. All clear siren will be sounded in continuous blast for 1 minute.
5. Fire Alarm shall be installed at Security Main Gate of the Sub-Station.

4.11.10 VARIOUS TYPE OF FIRE FIGHTING SYSTEM INSTALLED AT SUB-STATION

01. EMULSIFIER SYSTEM: The emulsifier system is installed in Sub-Station for fighting Fire of higher capacity transformers. The system not only extinguishes Fire of transformer but also cools down the transformer. The system is fixed type and installed around the top of transformer of higher capacity. The system normally works automatically. The emulsifier system is fitted with quartzite glass bulb inside which coloured liquid is filled. When the temperature below the glass bulb increases the liquid inside the glass bulb expands. At certain temperature depending upon the colour of liquid, the glass bulb breaks and pressurized air in the pipeline comes out. As the air releases the air pressure on the deluge valve drops down and the pressurized water enters in the water line. Thereafter water in form of mist comes out through water projector with high velocity at different angles. The high velocity water in form of mist penetrates into the oil tank of transformer and generates large quantity of steam over burning oil tank. Also, small bubbles of water are created inside the oil are converted into steam. In this way, due to deficient of oxygen around the burning oil and cooling effect, the Fire is extinguished. The temperature identification according to the colour of liquid inside glass bulb is as under:

Colour of Liquid	Temperature (degree Celsius)
ORANGE	**57**
RED	**68**

YELLOW	**79**
GREEN	**93**
BLUE	**141**
MAUVE	**182**
BLACK	**204 to 260**

02. HYDRANT AND PUMPING SYSTEM: This is the most common system which is installed in most of the 400 KV Substations. The system consists of a large water reservoir, Pumps, network of water lines covering the yard area, Hydrant points, Hose pipes, Hose Boxes etc. Water with pressure for extinguishing Fire can be tapped easily by using Fire hoses form the hydrant points nearest to the scene of Fire. The water in the water line is fed through centrifugal pump driven by electrical motors or by diesel engines. The pump driven by diesel engine is useful in case of failure of power supply in the station as the diesel engine can run on battery. The pressure switches are provided for each pump and common header to regulate the pressure in the water line. The Jockey Pump is also provided in the system. Therefore, the system can run automatic. The Hose boxes are provided near to the hydrant points. Delivery Fire hoses and branches are put into the hose boxes. In case of Fire the pressurized water can be directed on Fire by using delivery Fire hose with end connected with branch.

03. FIRE DETECTION & ALARM SYSTEM: Normally smoke is generated before the actual Fire takes place. By early detection of smoke the occurrence of Fire can be prevented. If Fire has already taken place, the early detection of smoke is helpful in attacking Fire in its incipient stage. For the detection of smoke and raising alarm, Fire Detection and Alarm system is installed in most of the 400 KV S/S. The system consists of Smoke detectors, Heat detectors, Main Panel, Mimic panel, Repeater Panel ,Hooter etc. The detectors connected with the panel of the system detect smoke and heat and gives alarm in the Fire Section and Main control room. The exact place where smoke or heat is detected is also indicated on the panel so that exact Fire spot can be traced and necessary preventive measures can be started immediately. Most of Fire Detection and Alarm systems are conventional type and automatic in action. If maintained properly, the system is very useful in early detection of Fire, which in turn confines the infinite loss of lives and properties.

SAFETY INSTRUCTIONS (SECTION-12)

4.12 WORK ALLOCATION TO PERSONS

4.12.1 SCOPE

The Safety Instruction sets down procedure for appointment of personnel such as Maintenance Engineer, Testing Engineer, Shift in-charge, Substation In charge, Line In-charge, Lead Shift In-Charge, Operator and Authorized Persons.

4.12.2 DEFINITIONS

Additional Definitions are as under:

Maintenance Engineer – Engineer responsible for carrying out maintenance works of EHV equipments, Transmission lines & LT system.

Testing Engineer - Engineer responsible for carrying out testing of protective relay, PLCC panels and other related equipments.

Shift In-charge – Engineer responsible for all operations activities in substations.

Substation In-charge – Engineer responsible for all operation and maintenance activities being done/to be done in the Substation.

Line In-charge – Engineer responsible for patrolling and maintenance activities nvolved for carrying out line maintenance.

Lead Shift In-charge – Shift in-charge responsible for coordinating operation activities involved for carrying out line maintenance.

Operator – Person authorized to carry out operations of EHV equipments or to use specific type of vehicles or cranes within S/S.

Authorized Person – Person authorized to carry out operation/maintenance works on EHV equipments/transmission lines.

4.12.3 PROCEDURES

4.12.3.1 -- Only appointed persons shall be allowed to carry out operation and maintenance activities in substation / transmission lines.

4.12.3.2 -- Safety guidelines during O&M of S/S shall be issued by substation in charge. All operation and maintenance activities shall be carried out under the control of Sub Station In-charge.

4.12.3.3 -- For carrying out maintenance work, safety document (LC PTW / TP) shall be approved by Sub Station In-charge.

4.12.3.4 -- Substation In-charge shall appoint Shift In-charge and Maintenance Engineer for carrying out O&M activities in S/S. Safety document i.e. LC PTW / TP shall be filled by Maintenance/Testing Engineer for carrying out maintenance/testing activities in S/S. LC PTW / TP are to be approved by Substation In-charge before being issued by Shift In-charge.

4.12.3.5 -- All operation including isolation and earthing of equipments shall be carried out by Operator in presence of Shift In-charge.

4.12.3.6 -- After physically confirming isolation and earthing in the work area. Maintenance/Testing Engineer shall advise authorized persons for carrying out maintenance/testing activities. All authorized persons shall be appointed by Substation In-charge. Maintenance/Testing Engineer shall be responsible for taking all safety precautions during maintenance works including use of **PPEs** (Personal Protective Equipment).

SAFETY INSTRUCTIONS (SECTION-13)

4.13 Reporting of Accidents

4.13.1. Every case where a person receives an electric shock whether mild or serious or suffers an injury or burn or fatality, directly or indirectly due to electrical causes shall be treated as an "electrical accident". The concerned jurisdictional engineer of PSTCL shall report the same immediately to the authorized representative of Commissioner in charge of the area within 24 hours. A copy shall also be sent to the Chief Electrical Inspector of the Government of Punjab. This shall be followed by detailed report within 48 hours whenever an accident occurs resulting in or likely to have resulted in loss of human life.

4.13.2. An enquiry shall be conducted into every electrical accident. It shall be completed within a reasonable time frame, but in any case not exceeding fifteen days, to guard against the possibility of destruction or disappearance of material evidence, to escape responsibility. It shall be a searching probe to uncover the root cause of the accident, which sometimes are quite difficult to ascertain. The enquiry shall not only fix responsibility for the accident, but it is more important, to spell out steps to be taken to prevent reoccurrence of such accidents in future.

4.13.3 Safety to general public

Accidents can occur in the Transmission System due to the following causes, which may result in injury to public.

a) Breakage of Transmission line supports, Insulators / wires either due to substandard quality or improper erection or reasons beyond Transmission Licensee's control.
b) Snapping of overhead bare conductors.
c) Improper earthing on Transmission line.
d) Inadequate clearances between overhead conductors and ground or buildings.
e) Non-observance of Safety Rules, and abuse of the components of the Transmission System.
f) Digging of underground power cables.

To avoid accidents to the public, Danger Board should be provided at each location of transmission line. Proper care should be taken for not exposing the live part to the public. Public should be educated about the sub-stations and transmission lines to avoid possibility of the accidents.

SAFETY INSTRUCTIONS (SECTION -14)

4.14.1 FIRST-AID

First aid is the first assistance or treatment given to a person for any injury or sudden illness, with the available resources at the place of occurrence, before the arrival of an ambulance or a qualified paramedical /medical person. It may involve improvising with facilities and materials available at the site.

4.14.1.1 GENERAL

1. Immediately remove the patient from the source of accident or remove the cause of injury.
2. **Keep the affected person lying down in a comfortable position; his head in level with his body. This is prevention against fainting. Never pick him up by head and heel.**
3. Severe haemorrhage must receive immediate attention, no matter what other injuries are present.
4. If the breathing is ceased, immediate measures must be taken to restore it. The patient should be in a position to breathe freely.
5. If the patient has received burns attend to them.
6. When the patient has fractured a bone, no attempt must be made to move the patient until the bone has been rendered as much immovable as practicable unless life is in danger from some other cause.
7. Treat the patient for shock.
8. Send for medical help or ambulance immediately.
9. **Never give water or liquid to an unconscious patient.**
10. Keep bye-standers away from the patient.
11. Don't allow the patient see his own injury.
12. Keep the patient warm. Avoid over application of external heat, but maintain normal body temperature.
13. Air should not be blocked in place where the patient has been kept.

You can start the FIRST-AID with the simple notation **D R A B C:**

D **:** DANGER REMOVAL -- Remove the danger from the casualty or remove the casualty from the danger.

R **:** RESPONSE -- Check the response of the casualty by three simple methods;

(i) Call near the patient's ear in a bit louder voice & observe the response.

(ii) Shake both the shoulders of the casualty & observe the reaction.

(iii) Give a gentle pain to the ear lobe or below the foot & observe.

A : AIR WAYS OPENING -- Lift the chin and tilt the head resulting in removal of obstruction of air passage due to falling of tongue or any foreign body in the mouth

B : BREATHING - Check the breathing of the casualty by LOOK, LISTEN & FEEL

(i) Look for chest or abdominal movement

(ii) Listen for breathing sounds
(iii) Feel the air coming out of the nose or mouth

The rate of breathing per minute on an average is 18 (eighteen).
Count the breathing rate for 10 seconds, if it is other than 3 or 4, it may be abnormal.

C : CIRCULATION OF BLOOD - Check the pulse rate at the neck from CAROTID PULSE. This pulse can be felt by placing the finger tips gently on the voice box & sliding them down into the hollow between the voice box and the adjoining muscle.

The normal pulse rate per minute on an average is 72.
Count the breathing rate for 10 seconds, if it is other than 12 to 14, it may be abnormal.

If you assess the condition of the casualty normal from above **A B C,** you can put the casualty in RECOVERY POSITION and continue observing his breathing & circulation.

If the breathing and circulation is not normal, you can immediately start ARTIFICIAL RESPIRATION & CARDIO PULMONARY RESUSCITATION (CPR) till the normal breathing & pulse rate is restored or till the casualty reaches the hospital. (Process of Artificial respiration and CPR are described subsequently)

4.14.1.2 EXTERNAL HAEMORRHAGE (BLEEDING): Bleeding wounds should be treated as follows:

1. Elevate the bleeding part from the heart level except in the case of a fractured limb.
2. Clean the wound and apply antiseptic all over the wound and the surrounding skin and cover with a dry dressing. Cover the dressing with cotton wool, lint etc. and apply a bandage over the dressing.

4.14.1.3 INTERNAL HAEMORRHAGE:
4.14.1.3.1 BLEEDING FROM LUNGS:
4.14.1.3.2 **SYMPTOMS:**

1. If the bleeding is from the lungs the blood will be bright red and frothy arid will be coughed out.
2. If the bleeding is from the stomach, the blood will be brownish and is vomited.
3. Send for the nearby doctor at once, if not possible to move the patient to the dispensary or hospital immediately.
4. Keep the patient lying on his back as flat as possible. Turn the head to one side for vomiting and coughing.
5. If the seat of the haemorrhage is known, apply an ice bag of a cold compress over the region.
6. Give nothing by mouth, except in case of haemorrhage from the lungs when ice may be given.

4.14.1.4 PHYSICAL SHOCK:
4.14.1.4.1 **Condition**: Shock is a condition of sudden depression of the nervous system resulting from and occurring after every case of accident or sudden illness out of a near miss incident. It may vary from the slight feeling of faintness to a condition of collapse in which

the vital forces of body are so exhausted that death may result.

4.14.1.4.2 **Symptoms**: Symptoms of shock may reflect as pale face and murmuring lips, cold moist skin, rapid and weak pulse, shallow and irregular breathing, fall of the body temperature, nausea and vomiting may often occur.

4.14.1.4.3 **TREATMENT (IMMEDIATE):**

1. Keep the patient lying on back with head low and turned to one side.
2. Loosen clothing about the neck, chest and waist and ensure free circulation of air. Cover with rugs or coats.
3. Raise well the lower limbs
4. May apply smelling salts, if available, to the nose except in the case of head injury.
5. Use encouraging words to the patient.
6. Ensure freedom from excitement and worry and avoid unnecessary questioning of patient.
7. Remove the patient to shelter in an airy place.

4.14.1.4.4 **TREATMENT ON ARRIVAL AT SHELTER:**

1. Wrap the patient in blanket and apply hot water bottles to the sides of the body between the legs and to the feet. Too much heat can be dangerous. Always test temperature of heated objects against your own face or wrist before you wrap them in cloth or a paper to the affected person.
2. If the patient is able to swallow, give freely hot strong tea or coffee with plenty of sugar, except when injury to an internal organ is present or suspected. Do not pour fluids down the throat of unconscious person. Avoid alcoholic stimulants.

4.14.1.5 **FAINTING**

1. Lower patient's head between knees, loosen tight clothing around neck. If impossible to lower victim's head, elevate his lower limbs and keep him lying down until recovery seems assured. If unconsciousness persists, cover patient, call for a doctor.
2. Sprinkle the face with luke warm and cold water alternately, and apply warmth to the pit of the stomach and over the heart. Vigorous rubbing of the limbs upwards has a stimulating effect. Smelling salts, if available, may be held to the nose.

4.14.1.6 **SUN STROKE AND HEAT STROKE:**

1. Sun stroke and heat stroke have the same symptoms but the cause may be slight different. Sun stroke results from excessive direct exposure to the sun rays, while heat stroke results from excessive indoor heat such as in boiler rooms.
2. **Symptoms**: Red and flushed face, hot and dry skin, no sweating, rapid and strong pulse, very high temperature, headache and usually unconsciousness.
3. **Treatment**: Send for a doctor immediately, lay victim with head elevated. Sponge body with cold water continuously and apply ice bags, if available, to head and spine until symptoms subside. When consciousness returns, patient may be given Epsom salt, if available, with water. Give cold water abundantly.

4.14.1.7 **FRACTURES:**

Do not move the patient unless absolutely necessary. Call a doctor to the spot of the accident. If it is necessary to move the patient, always apply splints before moving him. Handle him carefully to prevent sharp bends of bones cutting through flesh.

1. **TRANSPORTATION OF PATIENT**: Don't hurry in moving an injured patient.

Always be careful in handling and transporting an injured person. Improper or careless methods increase the severity of injury and may even cause death. Acquaint yourselves with the various methods of carrying and transportation.

4.14.1.8 **BURNS:**

Burns are caused by heat of any kind, friction and chemicals such as acids and alkalis. Burns are classified according to degree as follows:

(a) First Degree : Skin reddened.
(b) Second Degree : Skin blistered.
(c) Third Degree : Deeper destruction of tissues such as charring.

4.14.1.8.1 **Electrical burns:** Two kinds of electrical burns occur:

1. When current passes through the body burning or destroying the tissues, it makes a deep third degree burn which may be lesser on surface than inside the body, and slow to heal.
2. Flash burns of the skin are not usually happen and are of first or second degree. Flash burns of the eye may not show up immediate, until sometime later. In first aid to flash burns of the eye, light should be excluded by using moist compress cotton held lightly on the eye instead of a bandage.
3. Eye burn should get a doctor's attention as soon as possible.
4. First-aider's duties are to relieve pain, prevent infection and treat for shock. Death in a day or two, after a burn, is usually the result of shock. Death, later on, may be the result of infection.
5. For burns of limited extent, apply burn ointment over the burnt area. Cover ointment with a layer or two, of fine mesh gauze and secure with a roller bandage. Take the patient to a doctor for further treatment.
6. Extensive burns may be much more serious. Mental shock of the affected person is always present with extensive burn. Keep victim lying down with his head low and avoid exposure or cold. Leave his clothing on, cover him with blankets and get him to a hospital as quickly as you can.
7. If hospital is not nearby, remove all loose clothing from the burnt area unless it sticks to skin. Cut the adhering cloth around the burn and leave the remaining for the doctor to remove.
8. Do not break blisters. You may dip strips of clean freshly laundered sheet of cloth into a solution of baking soda or salt in warm water, and apply to burnt area.

4.14.1.8.2 **CHEMICAL BURNS:** Burns caused by an acid or alkali should be washed immediately with large quantity of water until chemical is thoroughly washed away. Then apply an antiseptic ointment on it, dress and send for medical help.

4.14.1.9 **EYE INJURY:**

1. Loose particles may be removed using corner of clean bandage or handkerchief. If the particle cannot be removed easily, relieve irritation with a few drops of olive oil / castor oil and consult a doctor immediately.
2. If a foreign particle is imbedded in the eye ball, do not try to remove it. Drop castor / medical paraffin oil over the eye ball, close the two eye lids, apply a soft pad of cotton wool and secure it by a bandage till the medical aid is made available.
3. When quick lime, acid or alkali falls into the eye, wash freely with the fresh water and consult a doctor immediately.

4.14.1.10 **SPRAINS AND STRAINS:**

1. **SPRAINS:** These are very common injuries caused by abnormal twisting of a joint or movement of a joint beyond range. It causes tearing or stretching of the tissues around the joint. It causes pain, swelling and dislocation of the joint.
2. **TREATMENT**:
3. Place the limb in the most comfortable position and prevent any movement.
4. Apply a firm and approved bandage for the limb.
5. Wet the bandage with cold water and consult a doctor.
6. **STRAINS:** These are the injuries to muscles or tendons caused by overstretching or overexertion.
7. **TREATMENT**:
8. Advice the patient to take complete rest in a comfortable position.
9. Apply heat and massage gently.
10. **BRUISES:** A bruise is caused by a blow which breaks the small block vessel in the tissue under the skin. Ice or cloth dip in very cold water should be applied immediately. It helps to prevent discoloration, keeps down swelling and relieves pain.

4.14.1.11 **TREATMENT FOR ELECTRIC SHOCK**

1. IT MUST BE WELL REMEMBERED;

2. YOU MUST ACT AT ONCE, DELAY MAY BE FATAL.

3. DEATH FROM ELECTRIC SHOCK IS **RARELY INSTANTANEOUS.**

4. **HEART FIBRILLATIONS** (HEART MUSCLE TREMORS) PERSIST AS LONG AS 30 MINUTES AFTER AN ELECTRIC SHOCK, THEREFORE LIFE CAN BE SAVED BY IMMEDIATE **ARTIFICIAL RESPIRATION** AND **CPR**.

5. IMMEDIATELY START FIRST AID / **ARTIFICIAL RESPIRATION** & **CARDIO PULMONARY RESUSCITATION (CPR)**. SEND FOR A DOCTOR IMMEDIATELY.

6. CONTINUE ARTIFICIAL RESPIRATION & CPR TILL THE DOCTOR ARRIVES.

7. **GENERAL**

a) In most cases of electric shock and collapse, it is the lungs and the diaphragm that are most affected and there is a very good chance of revival by applying quick artificial respiration & CPR in appropriate method and procedure. Methods of artificial respiration & CPR generally used, are described below and all employees concerned should practice themselves by practical study and drill in the treatment for electric shock including (CPR) according to these methods.

b) While rendering CPR, violent operations should be avoided as injury of the internal organs may result from excessive and sudden pressures.

c) In case of severe electric shock, respiration is seldom established within an hour, while 3 to 4 hours or more may be necessary to restore normal breathing. It is, therefore, essential that in all cases of electric shock, where the condition of the patient is doubtful or patient is unconscious or not breathing, artificial respiration & CPR should be continued until death is diagnosed by a physician.

8. **REMOVAL FROM CONTACT**

a) If the person is still in contact with the apparatus that has given him shock, switch off the electric circuit at once. If it is not possible to switch off the circuit immediately, no time should be lost in removing the victim from contact with the live conductor, self being properly insulated.

b) The victim's body should not be touched with bare hands; instead rubber gloves should be worn. However, if the rubber gloves are not available the victim should be pulled off from the live conductor by dry newspaper folded into 3 or more folds. Dry wooden bamboo or broom handle may also be used to raise the body or to detach it from live conductor. A good plan is to stand on dry board or stool or on few layers of thick newspaper bundles or even dry sacking and remove the victim from the live conductor.

c) Preliminary Steps- If the patient's clothes are smouldering, the sparks should first be extinguished. The doctor should be immediately sent for and, in case the breathing has stopped, immediate action for artificial respiration (CPR) should be taken.

9. **IMMEDIATE ACTION TO RECOVER PATIENT**

a) When a man has received a severe electric shock, his breathing may not be as usual. In accidents of this kind, speed of first-aid action may save the injured man's life. Hence, no time should be wasted in sending for a doctor, but the patient should not be neglected during this period so far extending first-aid (artificial respiration &CPR) is concerned.

b) Artificial respiration& CPR, without interruption, until natural breathing is

restored, should be continued. Cases are on record of success after about 3 to 4 hours effort and even more.

c) Artificial respiration &CPR should be carried on at the nearest possible place of accident. The patient should not be removed from this place until he is found breathing normally, and then also moved only in a lying position. Should it be necessary due to extreme weather conditions or other reasons to remove the patient before he is breathing normally, he should be kept in a lying position with face upward, and placed on a hard surface or on the floor of a conveyance, CPR being carried on during the time that he is being moved.

d) A brief return of spontaneous respiration is not a certain indication for terminating the treatment. Not infrequently, the patient, after a temporary recovery of respiration, stops breathing again. The patient should be watched, and if normal breathing stops, artificial respiration should be resumed at once.

e) Upon Recovery; when the patient recovers, he should be kept lying down and not allowed to get up or be raised under any circumstances without the advice of a doctor. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as a drink of hot ginger tea or coffee. The patient should then have any other injuries attended to and be kept warn, being placed in the most comfortable position.

f) First aid treatment should be given to all the burns.

4.14.1.12 **ARTIFICIAL RESPIRATION**

Normal air contains 21% of oxygen along with Carbon dioxide, Nitrogen with other poison gases amounting to 79% . During respiration process, we consume only 5% from above 21% oxygen inhaled and exhale 16%. If forcibly we can continue to give this exhaled oxygen to a casualty during artificial respiration he may regain normal breathing.

4.14.1.12.1 **Mouth to mouth Respiration**

1. Remove any obvious obstructions over the face or constrictions around the neck; open the air way and remove any debris seen in the mouth and throat.
2. Take a deep breath, pinch the casualty's nostrils with fingers and open the mouth of the casualty and place your mouth on the casualty's mouth.
3. The rescuer breathes out and inflates the victim's chest. Take a deep breath and repeat inflation. Give two breaths with 4 seconds gap when rescuer has to take deep breath. Each breath should last two seconds, with enough volume to make the chest rise, inflation at a rate of 3 to 4 per 10 seconds until normal breathing is restored.

4.14.1.12.2 **Mouth to Nose Respiration**

If for some reason or other, mouth to mouth respiration is not possible at all, carry out mouth to nose respiration, close the casualty's mouth while placing the rescuer's mouth on

the nose of the casualty and proceed as was carried out for the mouth to mouth respiration.

4.14.1.13 **CPR (CARDIO PULMONARY RESUSCITATION)**

Administering CPR

1. **Place the victim on his back**. Make sure he is lying as flat as possible - this will prevent injury while you're doing chest compressions.

2. **Place the heel of one hand on the victim's breastbone, exactly between the nipples**.

3. **Place your second hand on top of the first hand, palm down**.

4. **Position your body directly over your hands, so that your arms are straight and somewhat rigid**.

5. **Perform 30 chest compressions**. Press down with both hands directly over the Breast bone to perform a compression, which helps the heart beat. Chest compressions are more critical for correcting abnormal heart rhythms (ventricular fibrillation or pulse less ventricular tachycardia).

6. You should press down by about 2 inches (5 cm). **Continue the process until help or Doctor arrives**

4.14.1.14 CONTENTS OF THE FIRST-AID BOX

Sl. No.	Contents	Quantity
1	Sterilized wound dressing bandage 4" inch	4 pcs
2	Sterilized burn dressing bandage large	3 pcs
3	Adhesive plastering 2 cm x 1 mtr	1 no.
4	Washable bandage	6 pcs
5	Triangular bandage for fractures large	1 no.
6	Safety pins	1 bunch
7	Stainless steel scissors	1 pair
8	Absorbent cotton wool	150 grams
9	Potassium permanganate B.P	1 bottle
10	Tincture Iodine B.P	1 bottle
11	Dettol	1 bottle
12	Neosporin ointment	1 tube
13	Burnol ointment/ Silverex ointment	1 tube
14	Betadine solution	

4.14.1.15 FIRST AID EXERCISE

1. First-aid is the basic necessity for the post accident management which is very important for any power sector.

2. Based upon First-aid training in the field / during 5-days 'safety training' at HQ level & the Mock Safety exercise carried on by the Safety Cell in different Grid / work site, some important practices are to be done during the first-aid exercise in the grid / work-site among the employees.

3. Inspection of the first-aid box whether it is properly furnished as per the list prescribed above including its expiry date.

4. Display of important telephone numbers of nearby doctor / hospital / clinic / nursing home, availability of Anti Snake Venom (ASV) in the nearby hospital.

5. **It is better to start the First-aid exercise with D R A B C.**

6. Artificial Respiration & CPR practice

7. Wound management;
   Dressing
   Bandaging
   - Types of Roller bandaging
   - Use of Triangular bandaging
   - Type of knot with Triangular bandage

8. **Fall from structure/tower resulting fracture;**
   a. Hand or leg in a comfortable manner not to harm the affected person any more.
   b. Identification of the affected persons breathing condition for applying Artificial respiration / CPR if required
   c. Type of knot to be placed using a triangular bandage to give comfort to the affected person
   d. Shifting to a nearby doctor / hospital

4.14.1.16 Acid injury

a. Cleaning the affected area by running water
b. Shifting to a nearby doctor / hospital

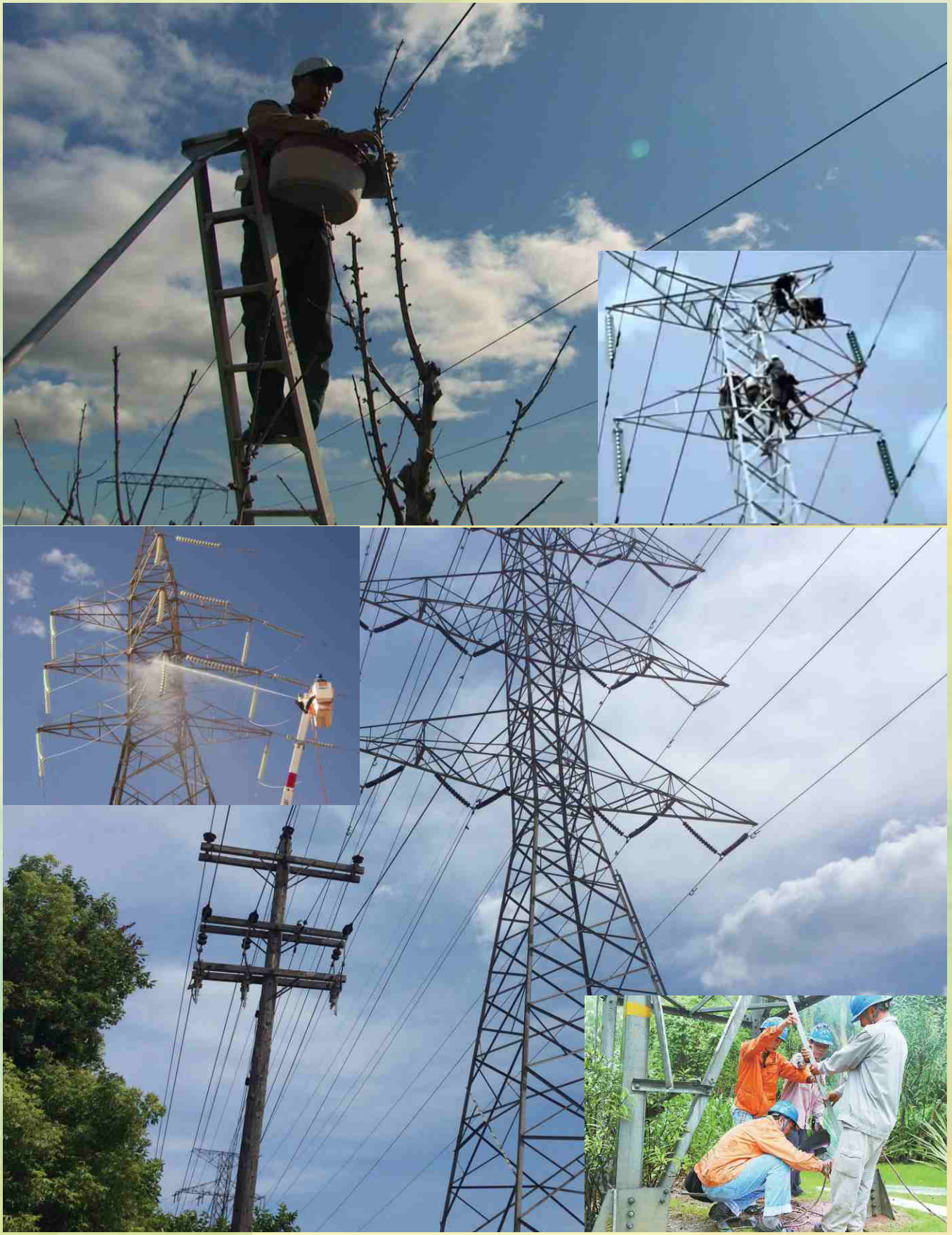
4.14.1.17 Normal Burn injury

a. If minor burn (when skin becomes redden and/or blisters, than it should be treated with running water & burns lotion to be applied there after
b. For 2nd & 3rd degree burn, the patient should be taken to control room and

shifted to a nearby doctor / hospital

4.14.1.18 Electric shock

a. Supply should be disconnected immediately
b. Should be removed carefully from the place of occurrence
c. Identification of the affected persons breathing condition for applying Artificial respiration / CPR, if required
d. Immediate shifting to a nearby doctor/hospital




TAKE THE TIME
TO LOCK IT OUT !
SAFETY
LASTS
A LIFETIME
DANGER
DO
NOT
OPERATE


CAUTION
Boots
must be
worn


SAFETY
FIRST
DO NOT ENTER
UNLESS WEARING
SAFETY EQUIPMENT


WARNING
ALWAYS ADD
ACID TO
WATER
ACID

CHAPTER - 5

SAFETY AUDIT

5.0 SAFETY AUDIT

5.1 INTRODUCTION

It is essential that the highest Safety Standards are maintained throughout the Company and that the quality of these standards are assured by audit. The audit is to be used solely as a means for establishing the quality of safety standards so that procedure can be reviewed and if necessary, improved to ensure that safety practices are satisfactory throughout the Company. **It should not be seen as a means of judging an individual's performance.**

5.2 The audit process will be in three stages:-

5.2.1 The Substation In-charge and Transmission Line In-charge will personally audit at random, one working situation per month. The records are to be kept on site, but a list of audits carried out and their results are to be sent to the Safety Officer at the Circle level.

5.2.2 The Safety Officer at the Circle level will personally audit at least twenty-five substations per annum. The records are to be kept in the Circle Office, but a list of the audits carried out by site staff and circle staff, with their results, are to be sent HOD.

5.2.3 HOD will audit all Circles for Substation or Transmission Line working situations per annum.

5.2.4 HOD will maintain a record of all the audit results and review them annually.

5.2.5 HOD will propose Safety Rule or Safety Instruction revisions if required, based on the review of the annual audit. These proposals will have to be agreed by Chief Engineer before implementation.

5.2.6 The format for the audit is attached to this section as Appendix A.

SAFETY RULE AUDIT APPENDIX A

Safety Document LC PTW / TP No –

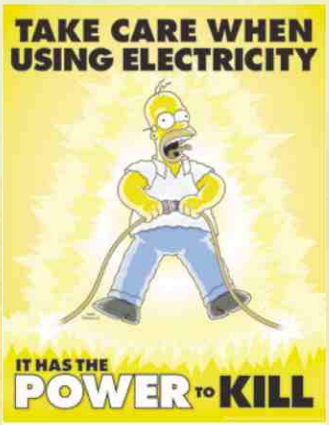
Substation --

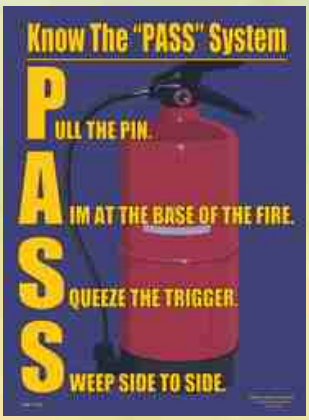
Equipment --

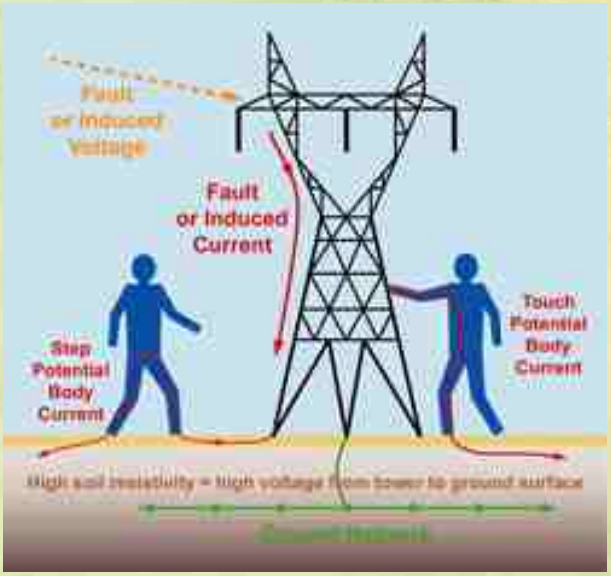
Date of issue --

Date of audit –

Item	Description	Comments
1	Safety Document	
2	Correct document for Work/Testing	
3	Isolating/ Earthing	
4	Demarcation	
5	Staff	
6	Knowledge of recipient/issuing person	
7	Work/Testing being carried out	
8	Additional safety measures applied	
9	Other staff working/testing	
10	General safety	
11	Hazards in /near work area	
12	Protective clothing	
13	Personal safety equipment	
14	Documentation	
15	Switching recorded	
16	Safety document recorded	







A	Paper, Wood, Plastics, Fabric, Rubber, Trash	
B	Gasoline, Oil, Grease, Some Paints and Solvents	
C	Energized Electrical Equipment, Appliances, Computers, Circuit Breakers, Wiring	

Instructions & Guidelines on Safety Procedures

pstcl

PUNJAB STATE TRANSMISSION CORPORATION LIMITED

SAFETY MANUAL

OPERATION SERVICES WING (P&M)

PUNJAB STATE TRANSMISSION CORPORATION LIMITED

Head office- The Mall, Patiala