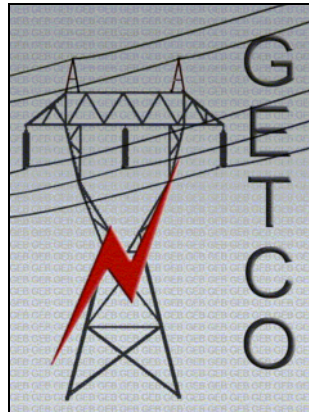




MANUAL OF SAFETY RULES & SAFETY INSTRUCTIONS



GUJARAT ENERGY TRANSMISSION CORPORATION LIMITED



CE (TR)/GETCO/1968
Date :.30.3.2005

To
The Superintending Engineer (TR),
Transmission Circle Office,
GETCO (G. E. Board), Navsari /
Bharuch / Jambuva / Nadiad /
.Mehsana / Palanpur / Gonda! / Amreli
/ Junagadh / Anjar / Asoj

Sub:- Safety Manual

As per Cl. No. 11.3.2 of Gujarat Electricity Grid Code, STU/ Transmission licensee shall prepare his own "Safety Manual" for the Transmission lines: Substations. So, the safety manual is prepared on the basis of 'Power Safety Rules Handbook' and GERC Power System Safety Standard by making necessary modifications.

The Manual is a modest attempt to formulate safety guidelines for EHV Substations and Lines in O&M and Construction areas.

You are requested to circulate the same and see for its proper implementation by -making necessary awareness for the safety among the employees, as safety is the utmost requirement in utility industry

Sd/-
CE (TR) & I/C JMD
GETCO

Cfwcs to : MD (GETCO), HO, Baroda

Copy to : 1. VP(Projects), GETCO / CE (LDC), Jambuva
2. ACE(GETCO), HO, Baroda.



PREFACE

GETCO will be operating and maintaining about 32000 CKM of Transmission Lines, all over Gujarat with a total installed transformation capacity of about 39000MVA distributed in about 750 Sub-Stations.

As operating and maintaining such a vast EHV Transmission network has inherent dangers, it is of utmost importance that a documented Safety Manual to safeguard employees, equipments and system is available and referred to by maintenance & operating personnel.

The Manual is prepared on the basis of 'Power Safety Rules Handbook' and GERC Power System Safety Standard by making necessary modifications.

The Manual is a modest attempt to formulate safety guidelines for EHV Substations and Lines in O&M and Construction areas. However, these are by no means exhaustive as it is not possible to visualize all the conditions that may lead to an accident. Also this being a draft is subject to suggestions reviews & corrections. We solicit co-operation and valuable guidance from all concerned for further improvement in the Manual before it is accepted by the Management and adopted

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CONTROL DOCUMENT

MOVEMENT SHEET

No	Date	Status	Orig. by	Dest. To
1.0	21 st July '04	Draft – Prepared for Circulation and Discussion	Projects – GETCO	M.D. GETCO Cfwcs to – Member(A)
2.0	8 th Sept.'04	Draft - Forwarded to review committee	CE(GETCO)	M.D. GETCO And Committee members
3.0	15 th Feb.'04	Review committee report	ACE(GETCO)	VP(TECH) & I/C JMD
4.0	18 th March'05	Final Draft For Approval	CE(TR) & I/C JMD	MD (GETCO) Chairperson



MANUAL
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DEFINITIONS

Accident	Any unplanned activity-causing disturbance in scheduled or anticipated actions.
Senior Authorised Person/ Shift In Charge/Authorised person	Engineer responsible for all operational activities in substations/lines. Maintenance / Testing Engineer, Maintenance Engineer responsible for carrying out maintenance works of EHV equipments, Transmission lines & HV/LV systems. Also Testing Engineer responsible for carrying out testing of Protective Relays, PLCC panels and other related equipments.
Competent person	Supervisor or Technician or Line Inspector
Approved Procedure	Authorised Company Safety Instructions or other specialised procedures authorised by Competent Authority.
Caution Notice	A notice conveying a warning against interference.
Certificate-No Back Feed	A certificate, which certifies for no feedback with the records 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.
Company	GETCO (Gujarat Energy Transmission Corporation Limited)
Competent Authority	Authority as per DOP/Company Directive authorized to decide, implement and control.
Danger	A risk to health, or of bodily injury.
Danger Notice	An Approved notice reading Danger.
Dead	Not electrically Live or charged.

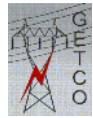


Earthing Device	<p>An approved means of providing connection between a conductor and earth of adequate strength and capability being one of the following</p> <p>a) Primary Earths Earth (s) a fixed Earth Switch (ES) with an equivalent electrical capacity which is applied between the point of work and all points of EHV/HV isolation and which is applied before the Line Clear Permit or Sanction for Test is issued. Primary earths shall be minimum 95 sq. mm copper equivalent.</p> <p>b) Additional Earths Temporary, portable Earths (e.g. Earthing rod) which are applied after Line Clear permit or Sanction for Test 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. millimeters copper equivalent.</p>
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.
Equipment	Electrical and Mechanical assets used to generate, transmit and distribute electricity working on which the safety rules apply.
Extra High Voltage (EHV)	A voltage of 33000 & above.
General Safety	Those actions required to maintain a safety at place of work/testing e.g. safe access, safe methods of work/testing and the correct use of personal protective equipment.
High Voltage (HV)	A voltage above 650 and below 33,000 volts.
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 rated and designed for this purpose.

Isolated	Disconnected from associated Equipment by an Isolating Device(s) in the isolated position, or by adequate physical separation.
Isolated Zone	All items of equipment within a work/testing area for which isolation has been achieved at all point of supply.
Isolation Device	A device for rendering Equipment Isolated.
Safety Key	The key from a unique lock (at a location) which is used for locking an Isolating Device, Earth or Drain/Vents.
Key Safe	A designated lockable cabinet for the safe custody of all Safety Keys.
Live	Equipment / Conductor being connected to a source of electricity.
Lock/Locks	Immobilisation of an item of Equipment
Locked	To secure an item of Equipment with padlocks or other devices such that it is immobilized in the close position
Low Voltage (L.V.)	A voltage not exceeding 250 volts
Medium Voltage (MV)	A voltage between 250 and 650 volts
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.
Purged	A condition of Equipment from which dangerous contents have been removed.
S.L.D.C.	State Load Dispatch Centre - The Centre where the operation of State electricity grids constituting the Gujarat State power system is coordinated.



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
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.
Safety Documents	<p>i) Line Clear Permit (LCP) 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</p> <p>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.</p>
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.
Supervision	Supervision personal/direct by an Authorised Person who is available at point or work or testing at all times, during the course of that work or testing.
System	Items of Equipments which are used either separately or in combination to generate, transmit or distribute electricity.
Vented	Allowing a closed space to have an outlet to atmosphere so that the pressure has equalised to atmospheric.



2.0 POLICY & PRINCIPLES OF SAFETY

2.1 POLICY

One of the major objectives of the Company operations is to recognize and accept its statutory and moral responsibilities for ensuring safe design, construction, operation and maintenance of Transmission Systems and for the provision of safe methods of work and healthy working conditions. While achieving this objective it endeavors to ensure compliance with the requirements of I. E. Rules 1956, GERC Grid Code and Power System Safety Standards.

The Policy relies on all employees, vendors and contractors for complying with safety requirements relevant to their responsibilities.

2.2 PRINCIPLES

2.2.1. It is well understood that electromechanical systems used in EHV & HV Transmission networks are design 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 (Tr. 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 required like during Hotline working, special instructions/procedures are applied.



SECTION I

3.0 SAFETY RULES

3.1 GENERAL SAFETY

3.1.1 Apart from establishing safety while working/testing on electric 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 Company Officer holding the Safety Document before working / testing starts. During the working / testing the Company in charge of the work shall ensure that all members of the working crew maintain General Safety. It is the responsibility of all members of the working party, overseen by the Company Officer, to ensure that their activities do not affect other work areas.

3.1.2 All Safety Rules, Safety Instructions and Procedures are mandatory. Similarly all relevant Safety Rules issued by Competent Authorities shall also be considered mandatory when designated as such in Basic Safety Rules.

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).

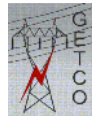
3.3 OBJECTIONS ON SAFETY GROUNDS

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 Project Management Group (PMG) Head or Operation & Maintenance Group Head as the case may be.

3.4 BASIC SAFETY RULES

3.4.1 Company 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 Gujarat Energy 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 while 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.
- 3.5 SAFETY CLEARANCES FOR WORKING ON EXTRA HIGH VOLTAGE (EHV) AND 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)	'X'
Upto 33	0.8	
66	1.0	
132	1.4	
220	2.4	
400	3.1	

- 3.5.2 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.
- 3.5.2 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 Permit (LCP) 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 LCPs may be issued.
- 3.6.5 Within any Isolated Zone only one TP shall be in force at any time. No LCPs 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 LCP 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 the Safety Document as per relevant Safety Instruction.
- 3.7 SAFETY RULES FOR WORKING OR TESTING ON, OR NEAR TO, MV AND LV EQPT.
- 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 either 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 LCP.
- (b) When testing of mechanical Equipment involves the 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 LCP as above, the precautions will be specified in the Line Clear Permit 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 LCP is in force, then the following additional precautions shall be applied.

- (a) All supplies required must be stated on the LCP in accordance with the Safety Rules as above.
- (b) If motive power supplies have been made available, no other LCPs 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.

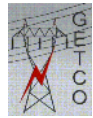
GENERAL RULES TO BE OBSERVED FOR SAFETY OF EMPLOYEES IN CONSTRUCTION AND MAINTENANCE WORKS OF TRANSMISSION LINES

- The excavation for pad or pile type foundations in excess of 1.5-mtr. 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 mtr.
- Wherever the foundation is being constructed on unstable earth, the workmen shall not be permitted to enter the excavated pit unless shoring is done.
- Only responsible and skilled employees shall be deployed for directing mobile equipment adjacent to footing excavations.
- No workmen shall be permitted to remain in the excavated pit where concreting is done using machinery.
- The mobile equipment shall be located only on levelled earth to assure stability.
- 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.
- Tie ropes shall be used wherever necessary for maintaining steel sections or other parts in position to reduce the possibility of tilting etc.
- Adequate supports shall be provided for the tower members and sections of panels during assembly.
- 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.
- 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.
- 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.
- 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.

- 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.
- The erection or maintenance work shall not be carried out during high wind, thunderstorms or unfavorable weather condition, which would make the work hazardous, except during emergency restoration procedures where utmost precautions, shall be taken to avoid any accidents.
- The Engineer in Charge shall regularly arrange to maintain all the equipment and tools and plant in safe operating conditions.
- Stringing of Bundle Conductor shall be carried out with T & P Machine only except where not feasible.
- 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.
- The Engineer in Charge shall ensure the required clearances to be maintained in moving equipment under or near the energised Lines.
- Before commencing the stringing operations or removal of conductors, a briefing shall be held by the supervisor with the workmen setting forth the following:
 - Plan of operation,
 - The type of equipment and tools and plant to be used,
 - Grounding devices and procedures to be followed,
 - Crossover methods to be employed, and
 - The clearance authorisation required.
- 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 buildup 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 Permit shall be obtained and the line grounded on both sides of the cross over. In case the Line Clearance Permit cannot be obtained the Line shall be considered as energised for all practical purposes.



- 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 reclosure 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.
- 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.
- The guard structure shall have sufficient strength and have adequate dimensions and supported adequately.
- 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.
- 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.
- 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.
- Each conductor shall be dead-ended at both ends before commencing stringing of the conductor in the next section.
- 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.
- 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:
 - 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.
 - The possibility of dangerous voltages due to induction, particularly during switching and fault conditions, shall be investigated and attended.
 - The tension stringing method or such other methods shall only be used, which prevent unintentional contact between the lines being pulled and the employee.
 - All the pulling and tensioning equipment shall be isolated, insulated, or effectively grounded.



- 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.
 - 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.
 - The grounds shall be left in place till the conductor installation is completed.
 - These grounds shall be removed at the last phase of cleanup operations.
 - The grounds shall be placed or removed only with a Hot Line equipment/insulating rod.
 - Conductors and ground wires shall be grounded at all dead-end points.
 - 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.
 - 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.
 - 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.
- The following precautions shall be taken for Hot-Line bare hand work in addition to all other applicable precautions specified in these standards:
 - 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.
 - Hot line LCP be availed by Hot line crew engineer before commencement of work.
 - The information of Hot line LCP be informed to SLDC.
 - 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:
 - The voltage rating of the circuit on which the work is to be carried out,
 - The clearances to ground of the lines and other energised parts on which work is to be carried out,
 - The voltage limitations of the aerial-lift equipment intended to be used.
 - The Hot Line equipment to be used shall be of proper design and tested.
 - 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.
 - The work shall not be carried out during thunderstorms and cloudy atmosphere.
 - 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.
 - 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.
 - Only tools and plant intended for Hot-Line bare-hand work shall be used, and these shall be kept clean and dry.
 - 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.
- 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.
 - 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.
 - All the aerial lifts shall have reliable controls and shall be accessible for safe and secure operation.
 - Ground level lift control shall not be operated without the permission of the employee in the lift, except in case of emergency.
 - 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.
 - 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.
 - 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.
 - 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.
 - No conducting material longer than 0.9 meter, other than the jumpers of appropriate length, armor rods, and tools shall be placed in the Bucket.
 - The non standard and unsafe working methods must not be allowed by the supervisor in charge of the Hot Line crew.
 - 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.
 - The recommendations of the manufacturer of the Hot-Line equipment being used shall be strictly followed.



I. DOCUMENTS

ANNEXURE 1 - LINE CLEAR PERMIT (LCP)

Name Of Circle :

TR. Division :

SUBSTATION :

LCP No.

Date

I. REQUEST:

1. Name Of Line / Bay / Transformer:
2. Work to be done:
3. Period of LCP : (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) :
LCP LCP
(Requested by) (Approved by)

Signature
Name
Designation
Date & Time :

II. ISSUE:

1. Sequence of operations carried out for isolation & earthing:
 - i)
 - ii)
 - iii)
2. LCP 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. LCP issued and entered in LCP register at Page No:

Signature:

Name:

Designation (Shift In charge)

Date:

Time:

- Note: 1 LCP request to be approved by Substation In charge.
2. LCP 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 LCP 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 my control, to carry out work on any other equipment.

Signature :
Name :
Designation :
Date : Time:

IV. RETURN OF LINE CLEAR PERMIT

- 1. MODE OF RETURN (IN PERSON / PHONE):
- 2. DETAILS OF WORK DONE:
- 3. RESTRICTIONS, IF ANY, ON THE 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

- 1. LCP cancelled and entry made in LCP 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 :.....

TR. Division:.....

SUBSTATION :.....

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 LCP 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 LCP/ITP register on Page No.....

2. SEQUENCE OF NORMALIZATION

i)

ii)

iii)

iv)

v)

Name:

Signature

Designation:

Date & Time:



SECTION II

SAFETY INSTRUCTION 01

EHV AND HV SWITCHING, EARTHING AND SAFETY DOCUMENTATION PROCEDURE

1.0 SCOPE

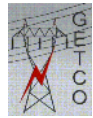
This Safety Instruction 01 explains the procedures for (i) carrying out EHV/HV switching, earthing and isolation from other feeding points and (ii) Safety Documents issue and their control.

2.0 DEFINITIONS

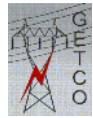
All definitions are Standard Definitions explained earlier (Chapter-1)

3.0 PROCEDURE

- 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 (Ref. Safety Rule 3.6 Sec. I)
- 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 (LCP), (Ref. Safety Rule 3.6.2 Sec. I)
- 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) (ref. Safety Rule 3.6.2 Sec. I)
- 3.4 Within any isolated zone any number of LCPs may be issued at the discretion of the Shift In charge (Ref. Safety rule 3.6.4 Sec. I)
- 3.5 Within any isolated zone, only one TP shall be in force at any time. No LCPs are permitted at the same time when TP is in force in the same isolated zone. (Ref. Safety Rule 3.6.5 Sec. I)
- 3.6 After agreement has been reached between the 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 LCP or TP document. The Request must include the number of Additional Earths required. The Request must be approved by the Substation in-charge.
- 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.
- 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.



- 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.
- 3.10 The Shift In charge at the substation(s) where the LCPs or TPs are to be issued, will record the isolation and earthing in, the relevant portion of the LCP/TP as per sequence of Isolation.
- 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 the 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.
- 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.
- 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 LCP/ITP.
- 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.
- 3.15 The Shift In charge will specify, in relevant part of the LCP or TP before In charge.
- i) Any further precautions to be taken later by the concern holding the LCP or TP to achieve Safety. (Ref. Safety Rule 3.8.3)
 - ii) The motive power supplies that can be restored for the particular work being carried out. (Ref. Safety Rule 3,8,4 issue the Approved written procedure.)
 - iii) The use of any Additional Earths will be specified on an Earthing Schedule drawn up by the Maintenance Engineer.
- 3.16 The Shift In charge will issue the LCP 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 or Test Permit register.
- 3.17 The Executive will sign relevant Part of LCP/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.
- 3.18 On completion of the work, the Executive will sign the Return of LCP 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.
- 3.19 The Shift In charge will receive the cleared LCP or TP and record receipt in the substation logbook and LCP or TP register together with date and time.
- 3.20 The Shift In charge will complete relevant part of the LCP 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 INSTRUCTION (02)

DEMARCATIION OF WORK AND TESTING AREAS IN SUBSTATION

1.0 SCOPE

This Safety Instruction 02 explains the procedures to be adopted for the demarcation of work/test areas in substations.

2.0 ADDL. DEFINITIONS

A Part from the Standard Definitions following Definition can be noted: Test Area Flag- A red flag reading 'Test Area'

3.0 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 works

4.0 DANGERS

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

- The possibility of misidentifying Equipment on which it is unsafe to work, for that on which it is safe to work.
- Inadvertently infringing Safety Clearance.
- Inadequate precautions to suppress or safely discharge any inducted or impressed voltage on the Equipment



- Improper hand and footholds
- Improper use of personal protective equipments.
- Sudden rush of flying insects viz. Bees, flying ants, etc.
- Improper communication among the working teams.

5.0 WORKING/TESTING

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

6.0 DEMARCATION OF WORK/TESTING AREAS

- 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.
- 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.
- 6.3 Boundary marking should
- a) be independently supported
 - b) not be attached to any structure supporting Equipment
 - c) not carry any notice.
- 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.
- 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.
- 6.6 The enclosed work/test area must be additionally identified by green cones for Line Clear Permit 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 6m (20ft).
- 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.
- 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.



6.9 The demarcation equipment must be erected before the issue of the LCP/TP. The demarcation equipment can be removed after the clearance of the LCP/TP.

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

7.0. DANGER NOTICES

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.

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.

8.0 HAZARD AREAS

8.1 Hazard Areas may be barriered using yellow cones and yellow and black plastic/nylon chain/rope.

SAFETY INSTRUCTION (03)

TESTING OF EXTRA HIGH VOLTAGE AND HIGH VOLTAGE EQUIPMENTS

1.0 SCOPE

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

2.0 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.

3.0 DANGERS

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

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

4.0 PREPARATION FOR TESTING

4.1 Testing must be carried out by a Competent Person.



- 4.2 Testing which does not require the removal of primary earth may be carried out under a LCP.
- 4.3 Testing which requires the removal of primary earth must be carried out under a TP.
- 4.4 The test area and its boundaries/limits must be identified in accordance with the Safety Instruction's 02 "Demarcation of Work And Testing Areas in Substations".
- 4.5 Points of Isolation must be maintained from all supplies other than those required for the tests.
- 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.
- 4.7 Safety Keys, which are necessary for the tests, must be issued to the Competent Person.

5.0 TESTING

- 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.
- 5.2 If specified in a TP the Competent Person may remove, replace or instruct others or replace, Primary Earths.
- 5.3 Connections used for test purpose must be of adequate capacity and must easily visible to prevent accident access/contact.
- 5.4 The Test Supply must be applied under the Supervision of the Competent Person who has received the Safety Document.
- 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.
- 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 do as to prevent Danger.
- 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 barriered 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.



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 CR.

6.0 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 are not restored to the original state are listed as exceptions.



**PRIMARY EARTHS AND ADDITIONAL EARTHS FOR APPLICATION IN
SUBSTATIONS**

Sl. No.	Item	Qty/ Set	No. of S/S.	Total Qty./ Region
1	<u>Primary Earths</u> Line-end clamp	4	As per actual no of S/S (Company) plus giving other utilities where Co. lines are terminated	4 x no.of S/stn in the Circle
2	Line end clamp	4	--do--	--do--
3	Earthing lead with terminal lugs (Min. 95 Sq. mm of Cu, Equivalent with capacity of 25 KA/1 sec.	4	--do--	--do--
4	Earthing pole telescopic 2.5 Mtrs in closed position, 5 Mtrs. In fully open position with two intermediate stop positions.	1	-do-	1 x no. of S/stn in Circle
1	<u>Additional Earths</u> Line end clamp	4	As per actual no of S/S (Company) plus other utilities where Co. lines are terminated	4 x no. of S/stn in the Circle
2	Line end clamp	4	--do--	--do--
3	Earthing lead with terminal lugs (Min. 35 Sq. mm of Cu, Equivalent with capacity of 7 KA/1 sec.	4	--do--	--do--
4	Earthing pole telescopic 2.5 Mtrs in closed position, 5 Mtrs. In fully open position with two intermediate stop positions	1	--do--	1 x no. of S/stn in Circle

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



SAFETY INSTRUCTIONS (04) : SAFETY PRECAUTIONS FOR EXTRA HIGH VOLTAGE OVERHEAD LINES

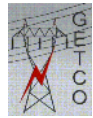
1.0 SCOPE

This Safety Instruction 04 explains the procedures for maintenance on a de-energised circuit of an EHV transmission line. It does not provide for work on live circuits.

2.0 DEFINITIONS

Following Addl. Definitions are applicable for these Instructions:

- 2.1 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.
- 2.2 Line End Clamp- The End Clamp of an Additional Earth which is to be connected with conductor or jumper.
- 2.3 Earth Lead- A lead made of aluminum strands protected with a transparent cover for connection between the Line End Clamp and the Earth End Clamp.
- 2.4 Socket- The sliding socket for holding and operation the Line End Clamp which is a part of a Telescopic Pole or Bridging Pole.
- 2.5 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.
- 2.6 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.
- 2.7 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.
- 2.8 Bridging Pole- A short insulated pole with a Socket which is used for applying and tighten Bridging Earths. First part of earthing pole can be used as bridging pole.
- 2.9 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.
- 2.10 Working Phases- The conductor phase on which linesmen will carry out work.
- 2.11 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.



3.0 DANGERS

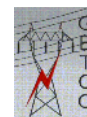
The main Dangers when working on transmission lines are:

- The possibility of personnel mistaking identification of the circuit on which it is safe to work with the one that is still energised.
- Infringing Safety Clearance before Additional Earths are applied.
- Inadequate precautions to exclude any induced voltages present on the conductors or fittings.
- Improper use of safety equipments.
- Effect of atmosphere / surroundings which may cause imbalance of hand and footholds.
- Imbalance state of mind.

4.0 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)

- 4.1 One Responsible Officer (Supervisor/Engineer) should always be present at the site of work.
- 4.2 The "CIRCUIT UNDER SHUT DOWN" as per LCP should be identified at the working locations (s) with the help of a circuit plate, name plate, location number, phase plate or any other reliable method.
- 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.
- 4.4 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.
- 4.5 One green flag should be provided at the circuit under shut-down and one red flag should be provided at the circuit under charged condition at the sub-station at the LA structure.
- 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.
- 4.7 Safe Electrical Clearance shall be maintained by all linesmen until all the Additional Earths are correctly connected to conductors or jumpers of circuitries under shut-down.



- 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.
- 4.9 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.
- NB. 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.
- 4.10 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.
- 4.11 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.
- 4.12 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.
- 4.13 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.
- 4.14 While coming down from the tower, the linemen will remove the red flags and the green flags.
- 4.15 One number spare Additional Earth should be carried to the working tower to provide a spare in case of any contingencies.
- 4.17 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.



5.0 SCHEME 1

WORK ON TOWERS WHICH DO NOT INVOLVE THE DISCONNECTION OF ANY CONDUCTOR OR JUMPERS

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 work:

5.1.1 Replacement of suspension or tension insulators.

5.1.2 Any other work on a suspension or tension string.

5.1.3 Fixing/replace of spacer or vibration damper adjacent to the suspension or tension string.

5.2 PROCEDURE

5.2.1 Apply general procedures as in section 5 of this Safety Instruction.

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

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

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.

NB. Adjacent towers can be earthed instead of bridging the sub-conductors as an extra safety measures.



6.0 SCHEME 2 BREAKING AND RE-MAKING JUMPER CONNECTIONS

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 work on tension towers:

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

6.2 PROCEDURES

- 6.2.1 Apply general procedures as in section 5 above.

- 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.

- 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.

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

- 6.2.5 Disconnect the jumper from one or both ends as applicable.

- 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.

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

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

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



- 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.
- 6.2.11 An Additional Earth shall be applied to the jumper before connecting it to the dead end compression joints.
- 6.2.12 Connect the jumper at both ends with dead end compression joints.

7.0 SCHEME 3

WORK ON CONDUCTORS BETWEEN TOWERS

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 work:

- 7.1.1 Fixing/repair of line spacers.
- 7.1.2 Fixing/repair of rigid spacers.
- 7.1.3 Fixing/repair of spacer / dampers.
- 7.1.4 Providing repair protector rod/repair sleeve on conductors.

7.2 PROCEDURE

- 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 (s) within the working zone, apply Additional Earths to the jumpers and to all the sub-conductors (Where applicable).
- 7.2.2 Carry out the maintenance work as per the normal procedure. While working following safety precautions shall be taken:
 - 7.2.2 (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.
 - 7.2.2 (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.
 - 7.2.2 (c) If access to any tower is required, all the conductors at that tower shall be earthed with Additional Earths.



7.2.2 (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.

8.0 SCHEME 4

PAINTING OF TOWERS WHICH DOES NOT INVOLVE ANY DISCONNECTIONS AND ANY ACCESS TO CONDUCTOR

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 earthing for the following work:

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

8.2 PROCEDURE

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.

8.2.2 In case only one or two towers 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.

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

9.0 SCHEME 5

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

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 work:

9.1.1 Lowering of conductor at suspensions tower.

9.1.2 Raising of conductor at suspension tower.

9.1.3 Providing the repair sleeves on the lowered conductor.

9.1.4 Cutting and jointing of lowered conductor.

9.2 PROCEDURE



9.2.1 LOWERING AND RAISING CONDUCTORS

9.2.1 (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.

9.2.1 (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.

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

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

9.2.1 (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.

9.2.1 (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).

9.2.1(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 be cut and joined. After joining the conductor, the Additional Earth (s) shall be removed.

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

9.2.1 (i) Raise the conductor(s) upto the cross arm level and apply the additional earths on the conductors.

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

9.2.2 RAISING CONDUCTOR FOLLOWING BREAK DOWN

9.2.2 (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 or 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. 2.1 of this procedure and if required from tension towers, then follow Scheme NO.6.

9.2.2 (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.

- 9.2.2 (c) After raising up to 4 meter from ground, remove additional earths from the conductors.
- 9.2.2 (d) After raising the conductor up to the crossed arm level Additional Earth (s) should be attached to the conductor.
- 9.2.2 (e) After completion of work, additional earths shall be removed

10.0 SCHEME 6

LOWERING & RAISING OF CONDUCTOR FROM TENSION TOWERS

10.1 WORK

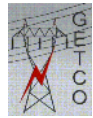
For work on the de-energized circuit of transmission line which involves lowering and raising phase conductors and the fixing of repairs sleeves/joints to the phase conductors. This scheme is to be followed during earthing for the following work:

- 10.1.1 Lowering of conductor at suspension tower.
- 10.1.2 Raising of conductor at suspension tower.
- 10.1.3 Providing the repair sleeves on the lowered conductor.
- 10.1.4 Cutting and jointing of lowered conductors.

10.2 PROCEDURE

10.2.1 LOWERING AND RAISING OF CONDUCTOR

- 10.2.1 (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.
- 10.2.1 (b) Provide additional earth on the wire bond end (splice position) connected to cross arm with cross arm.
- 10.2.1 (c) Lower the conductor on the ground upto 4 Mts. height & provide additional earth with ground spike.
- 10.2.1 (d) Lower the conductor upto the ground level.
- 10.2.1 (e) Providing additional earth's on either side if break of conductor is to be done for joining purpose.
- 10.2.1 (f) After repair work, raise the conductor upto 4 Mts. height and remove all additional earth's from ground spikes.
- 10.2.1 (g) Raise the conductor up to cross arm level.



10.2.1 (h) Follow scheme 2 for making jumper connections.

10.2.1 (i) After completion of work, remove all additional earth's.

10.2.2 RAISING OF CONDUCTORS AFTER BREAK DOWN

10.2.2(a) Provide Additional Earth's on the conductor lying on ground with ground spike/tower.

10.2.2(b) Provide Additional Earth's on both end of towers of failed span as per scheme 1 for suspension tower and tension towers.

10.2.2(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.

10.2.2(d) carry out the cutting & jointing of conductors & other repair work.

10.2.2(e) follow the balance above procedure of 2.1 for raising the conductors.

11.0 SCHEME 7

WORK ON EARTH WIRES

11.1 WORK

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

11.2 PROCEDURE

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

11.2.2 For single Circuit towers, follow the earthing scheme, 1 for Suspension tower and tension towers.

12.0 SCHEME 8

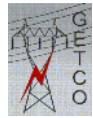
WORK IN EARTH WIRES AFTER BREAK DOWNS.

12.1 WORK

Raising of earth wire after break down.

12.2 PROCEDURE

12.2.1 Obtain the shut down of affected circuit on double circuit line and shut down of circuit of single circuit line.



- 12.2.2 Provide earthing as per scheme 1 on all towers which require to be climbed.
- 12.2.3 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.
- 12.2.4 During rigging, the pulley used at cross arm end shall be provided with additional earth on the cross-arm. This is required if fiber round sling in place of wire rope sling has been used for connecting the pulley.
- 12.2.5 Carry out repair & maintenance work on earth wire.
- 12.2.6 Raise the earth wire up to 4 meters height from ground and then remove additional earth from spikes.
- 12.2.7 Raise the earth wire up to cross arm level.
- 12.2.8 Remove all additional earth's on completion of work.

13.0 SCHEME 9

INSPECTION/PATROLLING OF TOWERS AND LINE MATERIALS/FITTINGS

13.1 WORK

- 13.1.1 Entire tower inspection of single circuit tower with shut down.
- 13.1.2 Tower inspection up to vertical centerline of tower towards circuit under shut down (only one circuit under shut down).
- 13.1.3 Inspection of all insulators, fittings, accessories etc. of De-energized circuit of single circuit and double circuit line.
- 13.1.4 Tightening of bolts and nuts, fixing split pin etc.

13.2 PROCEDURE

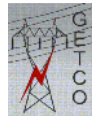
- 13.2.1 Follow scheme of earthing procedure as per scheme 3 if inspection is being done by trolley work.
- 13.2.2 Follow scheme 1 for earthing procedure in case access to any conductor point is needed from tower cross arm.
- 13.2.3 Carry out minor works like tightening of bolts and nuts, fixing split pin, relocation of vibration dampers etc.
- 13.2.4 Remove Additional earth after completion of inspection & minor works.



NUMBER OF ADDITIONAL EARTHS REQUIRED DURING WORKING ON EHV, AC TRANSMISSION LINES UNDER INDUCED VOLTAGE CONDITIONS.

EARTHING SCHEDULE

SL. NO.	EARTHIN G SCHEME	NO. OF ADDITIONAL EARTH REQUIRED					RE M AR KS
		FOR TOWER EARTHING	FOR EQUIPMENT T&P EARTHING	FOR BRIDGING/ DURING DISCONNE -CTION	SPARE	TOTA L	
1	SCHEME 1	17	01	---	1	20	
2	SCHEME 2	17	---	5	2	25	
3	SCHEME 3	24	---	---	2	26	
4	SCHEME 4	17	---	---	1	19	
5	SCHEME 5	17	02	2	2	24	
6	SCHEME 6	17	03	4	2	27	
7	SCHEME 7	17	---	---	1	19	
8	SCHEME 8	17	01	2	1	22	
9	SCHEME 9	24	---	---	2	26	
MAXIMUM NUMBER OF ADDILTIONAL EARTHS/SET 27							



SAFETY INSTRUCTIONS (05)

SAFETY PRECAUTIONS FOR LOW VOLTAGE AND MEDIUM VOLTAGE EQUIPMENT

1.0 SCOPE

This Safety Instruction (05) applies the principles established by the Safety Rules to achieve Safety from the System for personnel working or testing on Low/Medium Voltage (LV/MV) Equipment.

2.0 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. Ref. Safety Rule 3.6.1.

3.0 DANGERS

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

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

4.0 GENERAL REQUIREMENTS

4.1 Where reasonably practicable the preferred is to work on or near to LV/MV Equipment, which is Dead. Ref. Safety Rule 3.7.1. Work on Live LV/MV Equipment should rarely be permitted, but where no alternative method of work is possible can be carried out as in section 9 of this Safety Instruction. Ref. Safety Rule 3.7.3.

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. Ref. Safety Rule 3.6.1.

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 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." –02 must be met.
- 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.
- 4.6 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.
- 5.0 WORKING/TESTING ON OR NEAR TO DEAD LV/MV EQUIPMENT
- 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 Permit or
 - b) Personal Supervision
- Ref. Safety Rule 3.7.2.
- 5.2 Equipment must be isolated. Time switches, float switches, thermostats, sequence switching devices or similar automatic switching devices are not Isolating Devices.
- 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. Ref. safety Rule Instruction 3.14.
- 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.
- 5.5 The work must be carried out by an Authorized Person.
- 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.
- 5.7 If the work is interrupted the Competent Person who is to continue the work must be check that the Equipment is not Live as in 5.6 above.
- 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.



6.0 WORKS OR TESTING NEAR TO LIVE LV/MV EQUIPEMENT

- 6.1 Work near to Live LV/MV Equipment must only proceed after a satisfactory assessment by substation in-charge.
- 6.2 The work must only be done by a Competent Person.
- 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.
- 6.4 Where necessary to prevent injury, Approved insulated tools, insulating stands, mats or gloves, as appropriate, must be used.
- 6.5 Only suitable test instrument with insulated test probes must be used.
- 6.6 Consideration must be given to the **Competent Person** accompanied by another **Competent Person** if the presence of such a person could contribute significantly to ensuring 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.
- 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.

7.0 WORKING ON LIVE LV/MV EQUIPMENT

- 7.1 Works on **Live LV/MV Equipment** is to be avoided as far as practicable.
- 7.2 If there is no alternative to work on **Dead/discharged** 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) Approval insulated tools and equipment must be specified and provided.
 - d) The work will be carried out only under the **Direct Supervision** of Maintenance Engineer.
- 7.3 When this work involves working on or near to **EHV/HV** or mechanical Equipment the requirements of Safety Rules 3.6 and 3.7.4 must be met.



SAFETY INSTRUCTIONS (06)

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

1.0 SCOPE

This Safety Instruction (06) defines procedures to achieve Safety of personnel and/or transmission system safety while adding/removing equipments to/from the EHV system.

2.0 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 / 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 erection 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.

3.0 PROCEDURE

3.1 Adding bay or bay equipment to EHV/HV system.

- 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 LCP/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 (01). 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.

Safety precautions as per 01 including maintaining Safe electrical clearance need to be taken during movement of crane for carrying out erection / dismantling work.

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. LCP/TP duly approved by substation in charge and safety precautions are to be taken as per.

3.2 Removing bay or bay equipment from EHV/HV system.

3.2.1 **Bay:** When any bay is to be removed from EHV/HV system the LCP/TP is to be issued which should be approved by substation in charge. Safety precautions as per 01 are to be taken during dismantling work.

Bay, which is to be removed, should be identified/isolated from rest of the system.

Safety precautions as per 07 including maintaining Safe electrical clearance never to be taken during movement of crane for carrying out dismantling work.

3.2.2 **Bay Equipment:** When any bay equipment is to be removed from EHV/HV system then LCP/TP is to be issued which should be approved by substation in charge. Safety precautions as per 01 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 during movement of crane for carrying out dismantling work.



SAFETY INSTRUCTION (07)

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

1.0 SCOPE

This Safety Instructions (07) 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.

2.0 DEFINITIONS

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

Field Equipment Earths- **Approved**, connections for bending items of field and 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 sections are of 25mm² 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.

3.0 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.

4.0 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

- Infringing Safety Clearance
- Induced voltage



5.0 USAGE INSTRUCTIONS

- 5.1 When mobile access equipment, vehicles or cranes are to be used in substation Maintenance/Testing Engineer on site must assess the risks.
- 5.2 The Maintenance/Testing Engineer shall ensure that the Mobile access equipment are operated by a trained operator only.

6.0 MOVEMENT INSTRUCTIONOS

- 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.
- 6.2 The Maintenance/Testing Engineer must specify on site the route to be followed with adequate protection.
- 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.
- 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.
- 6.5 The Maintenance/Testing engineer must provide **Personal Supervision** during the whole period of movement.
- 6.6 At no time **Safety Clearance** is infringed.

7.0 OPERATION INSTRUCTIONS

- 7.1 Working areas must be identified in accordance with Safety Instruction 02 "Demarcation of Work/Testing Areas in Substations.
- 7.2 Approach to within **Safety Clearance of Equipment** by mobile access equipment vehicles or cranes are only allowed under **Line Clear Permit or Sanction for Test**.
- 7.3 The Operator must ensure that the effective use is made of any equipment stabilizing devices or outriggers.
- 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.



- 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.
- 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.
- 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 working being done, the equipment being used, the field of vision of the Operator and the proximity of exposed Live EHV/HV Equipment.
- 7.8** The Safety Observer must use agreed signal for halting the movement of crane to avoid danger.
- 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 equipotential 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.
- 7.10** If other nearby Earthed EHV/HV connections associated with the Equipment being work on, are accessible from the access equipment, additional Field Equipment Earths must be applied as in 7.9 to extend the equipotential zone.
- 7.11** At no time must any part of the equipment encroach over exposed Live EHV/HV Equipment.

8 MOVEMENT AND USE OF LONG OBJECTS

- 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.

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 to 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.

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 at 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 (08)

EXTRA HIGH VOLTAGE/HIGH VOLTAGE STATIC CAPACITOR BANKS

1.0 SCOPE

This Safety Instruction (08) applies the principles established by the Safety Rules to achieve **Safety from the System**, including the removal of stored energy, for personal working on EHV/HV Static Capacitor Banks.

2.0 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 1.1 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.

3.0 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.

4.0 DANGERS

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

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



5.0 PREPARATION OF WORK/TESTING

- 5.1 The Capacitor Bank must be **Isolated, Points of Isolation** established and **Primary Earths** applied.
- 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.
- 5.3 A **LCP** or **TP** must be issued.

6.0 WORK/TESTING

- 6.1 No Capacitor must be handled unless it is short-circuited.
- 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.
- 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.
- 6.4 Before an individual capacitor it's 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.
- 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.
- 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 INSTRUCTION (09)

STATION STORAGE BATTERY

1.0 SCOPE

This Safety Instruction (09) applies the principles established by the Safety Rules to achieve **Safety from the System** for personnel working on Station Storage Batteries.

2.0 DEFINITIONS

Additional Definitions as follows:

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

3.0 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.

4.0 DANGERS

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

- The possibility of personnel inadvertently shorting battery terminals.
- Dangerous spillage of electrolyte on body.
- Asphyxiation or suffocation due to fuming of storage battery acid.

5.0 GENERAL REQUIREMENTS

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.

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.

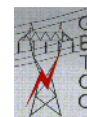
5.3 When work on Live Equipment requires portable instruments to be used for impedance or voltage measurement, the instruments must be provided with insulated probes.

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.

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



- 5.6 Add **ACID TO WATER, DON'T MIX WATER TO ACID**- while preparing electrolyte.
- 5.7 Always clean spilled acid immediately.
- 5.8 During handling acid, sufficient quantity of water must be available.
- 6.0 **WORKS/TESTING ON STATION BATTERY BANK**
- 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**.
- 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**, and/or b) **Personal Supervision**
- 6.3 The work must be carried out by a **Competent Person**
- 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.
- 6.5 Where necessary to prevent injury, **Approved** insulated tools, insulating stands, mats or gloves, apron, face shields, as appropriate, must be used.
- 6.6 Only suitable test instrument with insulated test probes must be used.
- 6.7 Consideration must be given to the **Competent Person** being accompanied by another **Competent Person** if the presence of such a person could contribute significantly to ensuring 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 INSTRUCTINOS (10)

SF – 6 GAS FILLED EQUIPMENTS

1,0 SCOPE

This Safety Instruction (10) lays down procedures for working on SF₆ gas filled equipments and to protect all personnel inherent dangers/hazards of SF₆ gas.

2.0 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 discharged.

3.0 EQUIPMENT IDENTIFICATION

Equipment on which work is to be carried out must be readily identify wherever necessary, identifications tags must be fixed to it, which will remain effective throughout the course of the work.

4.0 DANGER

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

- 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).
- Decomposition products e.g. Sulphur-fluoride & other toxic gases pungent or unpleasant odour and / or irritation of nose, mouth and eyes.

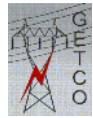
5.0 WORKING PROCEDURES

5.1 A Line Clear Permit must be issued before starting the work.

5.2 The work equipment must be electrically isolated from other equipment

5.3 The equipment must be earthed at two points.

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



- 5.5 After ensuring that total gas has been evacuated / removed then only the equipment should be opened / dismantled.
- 5.6 In general, mask or other protective measures are not necessary when no appreciable amounts 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.
- 5.7 After completing the work on the equipment, equipment should be reassembled.
- 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 (11)

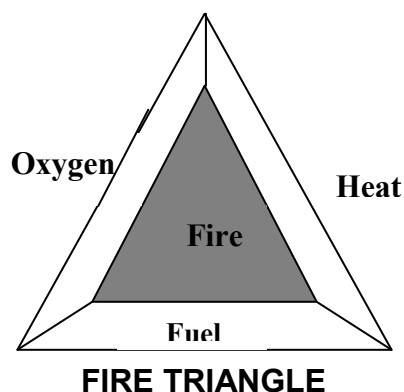
FIRE PROTECTION AREAS

INTRODUCTION:

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

BASIC 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 which can be represented as three arms of a triangle. The triangle is known "Fire Triangle". A Fire cannot take place in absence of any one of these three factors.



In extinguishing a Fire, all that is done is to break any of the arms of the "Fire Triangle" removal of Heat or Fuel or Oxygen from Fire.

METHOD OF EXTINCTION:

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

- 1) Cooling Method:** The method, in which Heat of burning substance is removed, generally by using water, is known as cooling method. Water brought 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, Chlorofluoro carbon or Dry Chemical Powder or Dry sand. Sometimes this is achieved by proper blanketing of Fire using Fire blanket or Asbestos blanket or Aluminum 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.

CLASSIFICATION OF FIRES:

Fires are categorized into 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.

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 colored and cylindrical in shape. These Fire extinguishers must be used



for extinguish 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 on 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 CO ₂ type	Water & CO ₂ gas cartridge	Water
CO ₂ type	CO ₂ gas	CO ₂ gas
Dry Chemical powder (DCP)	Powder (Normally sodium bicarbonate) and CO ₂ gas cartridge Powder	Powder
Mechanical Foam	Water mixed with Foam compound	Foam
Halon Type	Halon Gas (Normally Bromo Chloro Difinoro Methane)	Halon gas

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

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 Checkup Register:** A format regarding electrical installation checkup is given as Appendix-G. After duly check up of electrical installations the report may be filled in this register.



APPENDIX-A

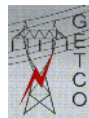
FIRE OCCURRENCE REPORT

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 GEETCO 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,
Nature of assistance rendered :
13. Cause of Fire :
14. List of equipments damaged by Fire :
15. Equipment data
a) Sr. 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 other (other than GETCO) :
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

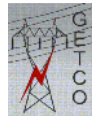


APPENDIX-C

FIRE-ORDER

IN CASE OF FIRE

1. SHOUT.....FIRE.....FIRE AND ENDEAVOR TO PUT IT OUT.
2. SOUND THE ALARM.
3. INFORM FIRE BRIGADE ON TELEPHONE NO. 101 OR ON PERSONNALLY.
4. ALL ESSENTIAL PERSONS OF AFFECTED SECTIONS WILL NOT LEAVE PLACE OF WORK AND CONTINUE IMPORTANT OPERATIONS & FUNCTIONS, NON-ESSENTIAL PERSONS WILL BE EVACUATED TO SAFE PLACE AND WILL STAND IN LINE.
5. FIRE PERSONS SHALL RUSH TO THE SCANE OF FIRE WITH THEIR APPLIANCES AND FIGHT FIRE.
6. ALL PERSONS OF NON-AFFECTED SECTIONS SHALL REMAIN AT THEIR PLACE OF WORKING AND SHALL EXTEND FULLLIEST CO-OPERATION IF CALLED FOR EFFECTED SECTION.



APPENDIX-D

VEHICLE / PUMP LOG BOOK

Date	KM Reading	Fuel drawn (Ltrs.)			Time		Place Visited	KM Reading	KM Run
1	2	3			4		5	6	7
		Petrol	Diesel	Oil	Departure	Arrival			

Static Run		Fuel consumed		Fuel Balance in Tank		Initial DCO	Initial Fire Officer
8		9		10		11	12
Hrs.	Min.	Ltrs.		Departure	Arrival		



APPENDIX-E

RECORD OF TEST OF FIRE PUMPS

Appliance No.: _____

Date Commissioned: _____

Capacity: _____

Make: _____

Date	Monthly Out-put 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

ELECTICAL INSTALLATION, WIRING, FUSE AND FIXTURE YEARLY INSPECTION REGISTER

(To be decided & looked after by concerned E.I.C.)

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



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 full 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 operations 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 & appliance
- g. Forges
- h. Electrical are 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 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.



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

1. By Person noticing Fire:

On discovery of a Fire be 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 Land 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:

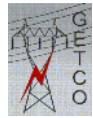
- a) Make sure that the fire Station has been informed about the Fire by dialing internal telephone or on Land phone or by personal contact. Give full and clear message of fire to Fire Station.
- b) Inform respective control room on Telephone.
- c) Attempt to control the spread of Fire by taking due 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 latter 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 or 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 immediate 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 casualties 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 through 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.



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 plant. 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.

VARIOUS TYPE OF FIRE FIGHTING SYSTEM INSTALLED AT SUB-STATION

- 01. Mulsifyre System:** The mulsifyre 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 mulsifyre system is fitted with quartzite glass bulb inside which colored liquid is filled. When the temperature below the glass bulb increases the liquid inside the glass bulb expands. At certain temperature that depends 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:

<u>Colour of Liquid</u>	<u>Temperature</u>
ORANGE	57 ⁰ C
RED	68 ⁰ C
YELLOW	79 ⁰ C
GREEN	93 ⁰ C
BLUE	141 ⁰ C
MAUVE	182 ⁰ C
BLACK	204 ⁰ C to 260 ⁰ C



- 02. HYDRAND AND PUMPING SYSTEM:** This is the most common system, which is installed in most of the 400 KV S/S. The system consists of large water reservoir, Pumps, network of water lines covering yard area, Hydrant points, Hose pipes, Hose Boxes etc. Water with pressure for extinguishing Fire can be tapped easily by using Fire hoses from 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 through 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 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 losses of lives and properties.

SAFETY INSTRUCTIONS (12) WORK ALLOCATING TO PERSONS

1.0 SCOPE

The Safety Instruction (12) sets down procedures 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.

2.0 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 involved 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.

3.0 PROCEDURES

- 3.1 Only appointed persons shall be allowed to carry out operation and maintenance activities in substation/transmission lines.
- 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.
- 3.3 For carrying out maintenance work, safety document (LCP/TP) shall be approved by Sub Station In charge.
- 3.4 Substation In charge shall appoint Shift In charge, Maintenance Engineer and Testing Engineer for carrying out O&M activities in S/S. Safety document i.e. LCP/TP shall be filled by Maintenance/Testing Engineer for carrying out maintenance testing activities in S/S, LCP/TP are to be approved by Substation In charge before being issued by Shift In charge.
- 3.5 All operation including isolation and earthing of equipments shall be carried out by Operator in presence of Shift In charge.
- 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 (personnel Protective Equipment).



SAFETY INSTRUCTINS (13)

Reporting of Accidents

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 the Company shall report the same immediately to the authorized representative of Commissioner of Electricity in charge of the area within 24 hours. A copy shall also be sent to the Chief Electrical Inspector/ Commissioner of Electricity to the Government of Gujarat. This shall be followed by detailed report within 48 hours whenever an accident occurs resulting in or likely to have resulted in loss of life a human being.
2. An enquiry shall be conducted into every electrical accident. It shall be completed within 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 causes of the accident, which some times 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.

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 sub-standard 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 educate for the sub-stations and transmission lines to avoid possibility of the accidents.



SECTION III

SAFETY AUDIT

1.0 INTRODUCTION

It is essential that the highest Safety Standards are maintained throughout the Company and that the quality of those 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.

2.0 The audit process will be in three stages:-

- 2.1 The Substations 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 Office.
- 2.2 The Safety Officer at the Circle Office 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 HO.
- 2.3 HO will audit all Circles for Substation or Transmission Line working situations per annum.
- 2.4 HO will maintain a record of all the audit results and review them annually.
- 2.5 HO 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.
- 2.6 The format for the audit is attached to this section as Appendix A.



SAFETY RULE AUDIT
Safety Document LCP/TP No
Substation
Equipment
Date of issue
Date of audit

APPENDIX A

Item	Description	Comments
1.0	Safety Document	
1.1	Correct document for work/testing	
1.2	Isolating/earthing	
1.3	Demarcation	
2.0	Staff	
2.1	Knowledge of recipient / issuing person	
2.2	Work/testing being carried out	
2.3	Additional safety measures applied	
2.4	Other staff who are working/testing	
3.0	General Safety	
3.1	Hazards in/near work area	
3.2	Protective clothing	
3.3	Personal safety equipment	
4.0	Documentation	
4.1	Switching recorded	
4.2	Safety document recorded	