PTCUL
POWER TRANSMISSION CORPORATION OF UTTARAKHAND LIMITED

CENTRAL BOARD OF IRRIGATION & POWER
ESTD. 1927
New Delhi

Code of Practice for Safety

Power Transmission Corporation of Uttarakhand Limited

Central Board of Irrigation and Power

Power Transmission Corporation of Uttarakhand Limited

Code of Practice
For Safety

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Central Board of Irrigation and Power

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Acknowledgement

Safety plays a significant role in our life, whether at work, home, or on the road. Statistics and experience tell us that the majority of accidents have occurred due to lack of supervision, lack of knowledge, overconfidence, and negligence. Short cuts, bypassing the safety systems due to attitudinal problems of the persons at the workplace also have resulting in accidents. The developed countries pay more attention to safety aspects. Developing countries like INDIA have also darted giving it due importance.

Seeing the importance of the subject, Power Transmission Corporation of Uttarakhand Limited (PTCUL) has taken a lead to get their existing document on Safety updated.

In this updated manual, Central Board of Irrigation and Power (CBIP) has retained the basic structure of the existing manual prepared by PTCUL. Moreover, keeping in view the technological developments in the power system the chapters have been suitably revised and updated. We have also included the following important details in this manual for the benefit of the professionals:

1. The amendment in the content, based on relevant codes/ regulations made.
2. Pictures depicting the procedure or function of equipment have been added towards better understanding and clarity.

In the process of updation of manual, many renowned experts have been consulted and relevant documents have been referred to. Dr. Rajesh Arora, a Member of CBIP's Expert Group on Earthing Systems from Delhi Transco Limited, who is one of the prominent experts on the subject, has contributed immensely for updation of this manual. We convey our sincere gratitude to all the experts who have extended their valuable support in updating this unique publication.

We are sure that the updated manual will be useful to the professionals of PTCUL and will ultimately help in further increasing the performance of PTCUL with safety.

We once again congratulate PTCUL for this excellent initiative and we hope for similar initiatives by other state utilities are in the interest of their professionals.

Central Board of Irrigation and Power (CBIP) has earlier updated the existing Manual of PTCUL on Operation & Maintenance of Substations & Transmission Lines. CBIP expresses its deep gratitude to the Management of PTCUL for once again posing the faith in CBIP and entrusting work for vetting and updating their existing Safety Manual.

It will be a matter of great pleasure for CBIP to help in similar endeavors of PTCUL in the future too.

A.K. Dinkar
Secretary
Central Board of Irrigation and Power

September 2021

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GENERAL INSTRUCTIONS

1. Workmen should not wear loose dress
2. Workmen shall be properly trained
3. All lines shall be treated as live till proper line clears is received
4. Adequate clearance between lines on which work is being done and other live wires shall be ensured or line clears taken on those lines also.
5. Lines / equipment shall be earthed before proceeding with the work
6. Display of all precautionary boards such as Danger Boards shall be ensured by both persons issuing / receiving line clear
7. Dresses shall not have metal buttons.
8. Shoes with metal nails etc shall not be used and one those with rubber bottom shall be used.
9. Items made of metal like chains of wrist watch, key bunches, rings, bracelets shall not be used while on work
10. Tools should not be thrown at each other while on work
11. Use a proper tools for each job
12. Rubber gloves / gauntlets can be used only when
    - Line voltage is 5 KV or below
    - While earthing
    - Opening of isolators
    - Working on street light fittings
13. Use of safety belts while works on poles / platforms above 3 meters height shall be properly understood.
14. Proper tool for proper job. Every tool or appliance shall be in good working condition (ex. Slings, pulleys, chain block etc)
15. Non working tools / appliances shall be permanently discarded
16. Damaged pipes, spanners, hammers shall be discarded.
17. Use always insulated pliers & screw drivers (only on LT)
18. When more than one LT circuit is laid from a transformer, ensure that street light circuits are also separate. Better take LC on both CT circuits
19. “Double feeding point – Danger” board shall be displayed when supply from two sources is available

20. When loads on one transformer are transferred on to another, it shall be noted in the log book and intimation given to duty staff.
21. Keep safe distance from rotating equipment. Do not attempt to handle them while in motion.
22. Avoid haste while working.
23. Avoid joking while working.
24. Do not work while feeling exhausted.
25. Mind your personal safety and do not depend on others.
26. Ensure all three blades of isolator are open before working.
27. Loose connections can cause fires
28. While earthing, other personnel shall be 12 to 15 feet away.

DO'S & DON'TS OF ELECTRICITY SAFETY

1. Study the manual carefully.
2. Ignorance of rules and regulations will result in accidents to himself and his co-workers.
3. No operation or activity is so urgent that it has to be performed in an unsafe manner.

DO'S

1. DO obey safety instructions given by the person in-charge.
2. DO insulate yourself from earth by standing on rubber mat while attempting to get the person who is in contact with live line or apparatus.
3. DO remove the casualty from the cause, render first aid and send for doctor or take the casualty to the nearest hospital.
4. DO break the circuit by opening the power switch and release the victim.
5. DO use correct size and quality of fuse wire while renewing the blown out fuse.
6. DO turn your face away whenever an arc or flash occurs.
7. DO ensure controlling switches are opened & locked or fuse holders are withdrawn before working on lines.
8. DO disconnect the supply immediately in case of fire on or near electrical apparatus.
9. DO keep away inflammables from electrical apparatus.
10. DO report all accidents whether minor or major, fatal or non-fatal, departmental or non-departmental immediately to the person in charge.

DON'TS

1. DO NOT replaces a blown fuse until you are satisfied with the cause and you have rectified the irregularity.
2. DO NOT disconnects a plug by pulling flexible cable when the switch is on.
3. DO NOT use wire with poor insulation.
4. DO NOT closes any Switch/GOS/Breaker unless you are familiar with the circuit, which it controls and know the reason for its being kept open.
5. DO NOT work on energized circuits without taking extra precautions, such as use of rubber gloves and gauntlets.
6. DO NOT touches or tamper with any electrical equipment or conductor, unless you have made sure that it is dead and earthed.
7. DO NOT works on the live circuit without the specific orders of the AE/JE and make certain that all safety precautions have been taken.

8. DO NOT disconnects earthing connection or render ineffective the safety gadgets installed on mains and apparatus.
9. DO NOT open or close switch or fuse slowly or hesitatingly.
10. DO NOT touches an electric circuit when your hands are wet, or bleeding, cut or an abrasion.
11. DO NOT use fire extinguisher on electrical equipment unless it is clearly marked for that purpose.
12. DO NOT throws water on live electrical equipment in case of fire.
13. DO NOT attempt to disengage a person in contact with a live apparatus, which you cannot switch-off immediately.
14. DO NOT touches the body of electrical shock victim. Push him with a piece of dry wood.
15. DO NOT discontinues artificial respiration until recovery or death is confirmed by the Doctor.
16. DO NOT allows visitors and unauthorized persons to touch or handle electrical apparatus or come within the danger zone of H.V. apparatus.
17. DO NOT test circuit with bare fingers.

Power Transmission Corporation of Uttarakhand Limited

SECTION 1

PRELIMINARY

1. PHILOSOPHY AND FUNDAMENTALS OF SAFETY

1.1.1 Prevention of accidents requires whole-hearted co-operation of all employees for the execution, operation and maintenance of works. It is, therefore, necessary that the employees should be familiar with the safety rules and regulations and to apply them to their work.

1.1.2 Prevention of accidents calls for extreme discipline while executing the work. Employees should not be allowed to take up the work wearing loose dress.

1.1.3 The place of working should be kept neat, clean and adequately illuminated.

1.1.4 The inherent dangers in power transmission, distribution equipments/systems have to kept in control by the use of protective devices and systematic work procedures to achieve:

(a) Protection of men at work, and

(b) Protection of equipment/system.

DEFINITIONS

1.2.1 In this code, unless the context otherwise requires:

(a) **APPROVED** means of type sanctioned for use by Power Transmission Corporation of Uttarakhand Limited.

(b) **AUTHORISED PERSON** means a competent person appointed by a competent authority to carry out specific duties related to the transmission of power.

(c) **AUTOMATIC** means self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength.

Note : Remote control that requires personal interface is not automatic but manual.

(d) **CANCELLATION OF PERMIT TO WORK OR SANCTION-FOR-TEST** means a declaration by the person to whom the 'Permit-to-work' or 'Sanction-for-test' has been issued stating that the work, for which the permit/sanction was issued, has been suspended or completed and stating that all temporary arrangements including earth connections have been removed and that all men under his direct charge have been warned that it is no longer safe to work on that equipment/apparatus.

(e) **CIRCUIT MAIN EARTH** means an earthing arrangement in a station or sub-station. But this is to be used under the instructions/supervision of the authorized Person before the issue of 'Permit to Work' or 'Sanction for test'.

(f) **COMPETENT PERSON** means a person authorized by competent authority who has sufficient technical knowledge and/or experience of a particular branch of engineering to enable him to avoid danger while working in connection therewith.

(g) **DANGER NOTICE** mean a notice on an approved form to be applied to any electrical/ mechanical equipment to indicate abnormal conditions calling attention to the danger of touching, interfering with unauthorized handling or operation of equipment.

(h) **DISTRIBUTION SYSTEM AND 'DISTRIBUTION LINE** means a system or operating at voltage 33KV or below.

(i) DUCT (in underground work) means a single tubular or otherwise enclosed way for underground cables.

(j) **EARTH** means the conducting mass of earth or a conductor connected to it through very small impedance.

(k) **ELECTRICAL EQUIPMENT** means all electrical apparatus pertaining to generation, transmission, distribution and utilization of electrical energy.

(l) **EMPLOYEE** means a person who is in receipt of pay salary, wages or honorarium in return for services rendered by him to the PTCUL.

(m) **EXPOSED** means not effectively isolated or guarded or insulated to prevent possibility of danger to life or property due to inadvertent approach to or contact with a point of danger by a person or object.

(n) **FIRE OFFICER** means an officer yet to be appointed in PTCUL having qualifications and experience as specified in rules & regulations.

(o) **ISOLATED** means physically disconnected from all sources of electric energy and in a manner that disconnected contacts of the isolating switch are clearly visible.

(p) PERMIT TO WORK means a form of declaration issued by an Authorized Person to another authorized person in-charge of a work to be carried out on or adjacent to any electrical apparatus; for the purpose of making known to such later person exactly what apparatus or equipment have been made dead, isolated and discharged and are safe to be worked on and gives the description of the work required to be carried out under the permit.

(q) **MECHANICAL EQUIPMENT** means all mechanical equipment pertaining to the generation, transmission, distribution and utilization of electrical energy.

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

(s) **SAFETY OFFICER** means an officer yet to be appointed in PTCUL having qualifications and experience as specified in rules & regulations.

(t) **SANCTION FOR TEST** means a form of declaration issued by an Authorized Person to an other authorized person in charge of testing of electrical apparatus/ equipment for the purpose of making known to such person correctly what equipment is to be tested and the condition under which the testing is to be carried out.

Note : 'Sanction for test' may include provisions for carrying out certain works, while under no circumstances can any of the apparatus covered by a 'permit to work' be made live, the

apparatus covered by a 'Sanction for test be made live by or at the request of the sanction holder, for tests for which he is specifically authorized. It is, therefore, necessary that the details of the testing procedures be specified in the 'Sanction for test'

(u) **SELF PROTECTION TAG** means a notice attached by a competent person on any electrical apparatus/equipment calling attention to the fact that persons are working thereon or on the equipment, supply to which is controlled by the apparatus/equipment is tagged and that the same shall not be handled or interfered with while the tag is on without his permission.

(v) **SHIFT INCHARGE** means senior most employees in a shift at substations of PTCUL.

(w) **STATION** means a generating station, auxiliaries, transformers and other work connected with the operation of the same.

(x) **SUB-STATION** or 'Receiving Station' means any premises or enclosure containing an assemblage of electrical apparatus for conversion, transformation and control of electrical power.

(y) **SYSTEM CONTROL** means System Operation under SLDC, which controls and coordinates all switching operations of the System including issues of 'Permit-to-work' etc.

(z) **TEMPORARY EARTH** means an earth defined under Para (j) above, but applied additionally at the point of work on any electrical apparatus during actual working thereon, after the issue of 'Permit-to-work or 'Self protection Tag'.

(aa) **TRANSMISSION SYSTEM** and 'Transmission Line' means a system or a line operating at voltage 66 KV or above.

(ab) **COMPANY** means Power Transmission Corporation of Uttarakhand Limited (PTCUL).

(ac) **VISITOR** means a person, other than an Employee permitted to enter a work area under a permit by the authorized person.

(ad) **WORKING PARTY** means the persons under the immediate supervision of Competent Person or an Authorized Person and includes the Competent Person or the Authorized Person when working by himself.

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

(af) **ELECTRICAL SAFETY** - Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.

(ag) **COMMISSION** means Uttarakhand Electricity Regulatory Commission.

(ah) **EHV** means Extra High Voltage (132 KV and above).

(ai) **GRID CODE** means code prepared by the UERC in accordance with Transmission licensee (PTCUL).

(aj) **UNAUTHORIZED PERSON** One who is not permitted to work on electrical apparatus except under the personal supervision of an authorized person.

(ak) **DEAD** means at or about earth potential and disconnected from any live system. Provided that the apparatus separated from a live conductor by a spark gap shall not be deemed to be 'Dead'.

Note : The term 'Dead' is used only with reference to current carrying parts, when these parts are not alive.

(al) **EARTHED** means connected to earth in such a manner as it will ensure immediate discharge of electrical energy without danger at all times.

(am) **EMERGENCY** for the purpose of this code means an unusual condition which exists that endangers life and/or property.

(an) **LIVE** Live means electrically charged.

(ao) **PERMIT ISSUING OFFICER** is a person who is authorized for ensuring that all controlling switches and circuits have been isolated, made dead and inoperative and that adjacent circuits have been made safe for the work to be carried out and who is authorized to issue the 'Permit to work'.

(ap) **PROTECTIVE DEVICES** means devices such as rubber gloves, Rubber gauntlets, line hose, rubber boots or other insulating devices, which are specially designed for the protection of workmen.

(aq) **ACCIDENT** may be defined as a sudden mishap that interrupts the operation of an activity.

1.2.2 All words and expressions used but not defined hereunder shall have the meaning assigned to them in Electricity Act, 2003, Indian Electricity Grid Code, Uttarakhand State Electricity Grid Code and Indian Electricity Rules, 1956 respectively assigned to them in the Indian Electricity Act 1910 and the Electricity Act 2003 and the Rules and regulations made there under and the Factories Act, 1948 and amendment thereof, if any, and the Rules made there under as the case may be.

Power Transmission Corporation of Uttarakhand Limited

SECTION 2

GENERAL PROVISIONS

2.1 GENERAL

2.1.1 Operation and maintenance work in Power Transmission and Distribution system is subject to the requirements of the following statutory provisions:

STATUTORY PROVISIONS PERTAINING TO SAFETY

Power Transmission Corporation of Uttarakhand Limited (PTCUL) came into existence with effect from Dt. 01.04.2004. It is therefore absolutely necessary to ensure Safety precautions while carrying out Construction, Operation and maintenance of electrical installations so also the activities of civil wing.

(a) For observance of the above, provisions of various Acts, Rules, standards are to be abided. Briefs of the relevant Acts, rules, and standards are quoted below. Indian Electricity Act, 1910 and Electricity Act 2003, and the Rules made there under.

(b) Electric Supply Act, 1948, Indian Electricity Rules – 1956 and the Rules made there under;

(c) Factories Act, 1948, and the Rules made there under;

(d) Industrial Disputes Act and Rules made there under; and the provisions of this code are in addition and not in substitution or derogation of the statutory requirements, referred to above.

ELECTRICITY ACT 2003

Section 53 : Provisions with Respect to Supply Generally

Provision relating to safety of electricity supply-The authority may, in consultation with the state Government, specify suitable measures for -

Protecting the public (including the persons engaged in the generation, transmission or distribution or trading) from dangers arising from the generation, transmission or distribution or trading or electricity, or use of electricity supplied, or installation maintenance or use of any electric line or electrical plant.

Eliminating or reducing the risks of personal injury to any person, or damage to property of any person or interference with use of such property.

Prohibiting the supply or transmission of electricity except by means of a system which confirms to the specifications as may be specified.

Giving notice in the specified form to the Appropriate Commission and the Electrical Inspector, of accidents and failures of supplies or transmissions of electricity.

Keeping by Generating Company or Licensee the maps, plants and sections relating to supply or transmission of electricity.

Inspection of maps, plants and sections by any person on payment of specified fee.

Specifying action to be taken in relation to any electric line or electrical plant, or any electrical appliance under the control of a consumer for the purpose of eliminating or reducing the risks of personal injury or damage to property or interference with its use.

SECTION 73 OF ELECTRICITY ACT 2003

Functions and duties of Central Electricity Authority (CEA)

Advice the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plants for development of the electricity system and co-ordinate the activities of the planning agencies for the optimal utilization of resources to sub-serve the interests of the national economy and to provide reliable and affordable electricity for all consumers.

Specify the technical standards for construction of electrical plants electric lines and connectivity to the grid.

Specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines.

Specify the Grid Standards for operation and maintenance of transmission lines.

Specify the conditions for installation of maters for transmission and supply of electricity.

The Electricity Rules 2005 (Formerly known as IE Rules1956)

Further to the provision of Electricity Act 2003, the electricity Rules 2005, formerly known as Indian electricity Rules 1956, in the rules 29 through 46 under Chapter IV :

“general safety requirement” lay down the safety requirements for strict observance of Rules 63 through 71 under chapter VII together with rules 74 through 93 further describes provision to be observed for safety.

Provision of the Indian Standards

Provision of Indian Standards vide its specification No.IS:5216 (Part I) 1982 (Reaffirmed 1995) “Recommendations on safety procedures and practices in electrical works - General” and IS:5216 (Part II) 1982 (Reaffirmed 1995) “Recommendation on safety procedures and practices in electrical work - life saving Techniques” detail out the safety instruction and precaution which every employee who may be concerned with the installation, operation and maintenance of electric lines and apparatus to be conversant with.

IS 18001:2007 Occupational Health and Safety Management System - Requirements with guidance for use.

(a) Central Electricity Authority Notification - 2010

In exercise of the power conferred by clause (c) of section 73 read with subsection (2) of section 177 of the Electricity Act 2003, the Central Electricity Authority New Delhi, made the regulations called “ Central electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2010” .

The regulation so formulated shall apply to all the electrical plants & electric lines already commissioned as well as those under construction.

This Regulation 2010 have been amended as Central electricity Authority (Measures relating to Safety & Electric Supply) Amendment Regulations, 2015 for some clauses which have been incorporated in the manual.

(b) Central Electricity Authority Notification-24.01.2011

In exercise of the powers conferred by section 177read with clause (c) of section 73 of the Electricity Act 2003 (36 of 2003), the Central Electricity Authority hereby makes the following regulations, namely "Central electricity Authority (Safety requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations,2011".

The regulation so formulated shall apply to all the electrical plants & electric lines already commissioned as well as those under construction.

(c) Ministry of Power, GOI, New Delhi, the 22nd December, 2004 Notification

In exercise of the powers conferred by the Clause (w) of Sub-section (2) of Section 176 of the Electricity Act, 2003 (36 of 2003) the Central Govt. hereby makes the rules " Intimation of accidents (Form and Time of service of Notice) Rules, 2004. This is the detail instruction on the reporting of any electrical accident to the appropriate authorities.

Central Electricity RegulatoryCommission, NewDelhi

The Indian Electricity Grid Code (IEGC) is a regulation made by the Central Commission in exercise of powers under clause (h) of subsection (1) of Section79readwithclause(g)of sub-section(2)ofSection178oftheAct.

I.E.G.C in their Part-4 Cl.6.4 have mentioned the responsibilities for safety of CTU/STU and the concerned User's safety in accordance with Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007 , Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-state Transmission and related matters) Regulations,2009 and CEA (Safety Requirements for construction, operation and maintenance of electrical and electric lines)Regulations, 2008.

BOCW (Regulation of Employment & conditions of Service) Act 1996 Chapter - VII Cl-38, 39, 40 regarding safety ofworkmen.

FACTORIES Act - 1948 Clause 40, 40 A, 41 regarding safety ofworkmen.

In addition, stipulations made under following Acts and rules/regulations made thereunder, as applicable, shall also be complied with:-

1. The Explosive act,1884
2. The Explosive Substance Act,1908
3. The Workman's compensation Act1923
4. Battery Management and Handling Rules 2001
5. The public Liability Insurance Act 1991
6. Any other rules and regulations in this regard
7. Any specific approvals, permits, clearance issued by any authority under different statutes.

2.1.2 Every revision of or addition to this code shall be issued to the employee concerned against a receipt and incorporated by them in the copy supplied to them.

2.2 AUTHORIZATION

2.2.1 As per IE rules 1956, Section 3, no person shall be authorized to operate or undertake the maintenance of 132 KV and above substations unless he is adequately qualified and successfully undergone the training as specified in IE rules 1956, and no person shall deemed to be authorized unless his name has been entered in a list maintained at the office or premises of person authorizing him and every list maintained should be produced before an inspector. As per draft CEA regulations 2007 (measures related to safety and electrical supply) schedule XV the minimum qualification for engineers/ supervisors to be engaged in operations and maintenance of transmission & distribution system shall be Diploma in Electrical, Mechanical and Electronics & Instrumentation Engineering from a recognized institute/ university. The minimum qualification for the technicians to assist the engineers and supervisors shall be two years certificate course from a recognized Industrial Training Institute (ITI) in appropriate trade.

2.2.2 Authorized Person - In view of the above rules General Managers of concerned zone is appointed as authorizing officers in his zone and he will be authorized the persons by name who has requisite qualification and have taken training as mentioned above. A copy of the list will be send to the Electrical Inspector and CGM office. This list should clearly indicate the names of the persons their qualifications, training, experience and for what work they are authorized. The list should be maintained at concerned substation and in concerned division.

2.3 ADMINISTRATION OF THE SAFETY PROGRAMME

2.3.1 Safety officer shall be responsible for the awareness and co-ordination of Safety programme on the PTCUL's works.

2.3.2 Every Authorized Person and person-in-charge of a working party will be supplied with a copy of this manual against a. receipt. The recipients shall carefully study these instructions, particularly in so far as these refer to their duties. In case of any doubt regarding interpretation of any of these provisions, they shall approach their superiors for clarifications.

2.3.3 Assistant Engineers shall familiarize employee working under them with these instructions, in so far as these concern functions of each employee. To ensure that the employee's knowledge of these instructions is up-to-date, they shall hold periodical test drills.

2.3.4 Instructions contained in this code shall be followed as normal routine duty by all employees. Failure to know these instructions shall not be accepted as an excuse for violation of the same. Willful violation shall be regarded as sufficient cause for disciplinary action.

7(a) Sufficient number of men have been assigned to each job at the time of the allotment of work and that they have properly understood the;

(i) Work to be done,

(ii) Procedure for doing the work properly and safely;

(iii) Hazards that may be encountered:

(b) At least one member of the working party is trained in First Aid and use of firefighting equipment.

(c) Danger signs or barriers tape as may be necessary to warn the public and others of the danger zones and to prevent them from entering the same, are put up before taking the work in hand;

(d) Defective tools, materials and working methods are not employed;

(e) There is co-operation between the operation and maintenance staff;

(f) Persons in immediate charge of the workmen remain on work site till the work is over;

(g) At least one member of the working party is trained in First Aid and use of fire fighting Equipment.

2.3.5 Assistant Engineer (AE)/ Junior Engineer (JE) shall periodically subject persons working under them to tests to ensure that they maintain adequate knowledge of standard practices relating to their work to ensure that they are kept informed of the instructions issued by the Head Office/ Zone/ Division concerned from time to time.

2.3.6 AE/JE shall arrange that the electrical apparatus/equipment under their charge are maintained in good condition and the maintenance there of is carried out in accordance with the schedules laid down thereof.

2.3.7 AE/JE shall arrange that the various safety devices, first aid kits, fire-extinguishing equipment are maintained in serviceable condition and the workmen are made aware of the location of the same.

2.3.8 AE/JE shall ensure that the various records, registers etc. relating to their work are maintained properly and up to date.

2.3.9 AE/JE shall encourage suggestions for improvement of working procedure; safety practices etc. from the employees under their charge and arrange consideration of the same.

2.3.10 AE/JE shall encourage co-operation of the employees under their charge with functioning of the working of the safety consciousness.

2.3.11 AE/JE shall arrange that the accident report are properly made and cooperate in investigations relating to accidents causes and in involving procedure for preventing similar accidents in future.

2.3.12 AE/JE shall make frequent and periodic inspections of construction, operation and maintenance works, materials etc under their charge and take immediate action to correct such deficiencies and defects as may be brought to their notice or observed by them.

2.3.13 AE/JE may arrange to hold safety drills along with their staff at least once in three months.

2.4 GENERAL RESPONSIBILITIES OF WORKMEN

2.4.1 All workmen shall act in a manner as to provide for;

(a) Safety to themselves.

(b) Safety to follow workmen.

(c) Protection of the public.

(d) Protection of the property.

(e) Continuity of power supply to the maximum extent possible.

2.4.2 Workmen shall familiarize themselves with the tools, material, method of work, safety devices and regulations, etc. relating to their work and in case of doubt regarding any point they shall consult their JEs.

2.4.3 Workmen shall understand the instruction, whether verbal or written, given by their officers before commencement of the work.

2.4.4 Prior to the use of any tools or equipment the workman shall check up that the same are in safe working condition.

2.4.5 Workmen shall satisfy themselves regarding safe working conditions and place themselves in the safe position while working to avoid falling, stumbling, slipping or moving backwards against live parts.

2.4.6 When working under hazardous conditions, the workmen shall, under no circumstances, hurry to take un-necessary chances and also shall not continue to work under such conditions when tired or exhausted.

2.4.7 Workmen shall not throw the tools/material from one person to another, but transfer them from hand or by a hand line and a tool bag.

2.4.8 Workmen shall not place tools near the edge of scaffolds, roofs or on structures from where they are liable to fall off or be kicked off.

2.4.9 Workmen shall not do anything that may; startle a person working in hazardous location.

2.4.10 Personal Conduct:

(i) Use of intoxicating liquor while on job is strictly prohibited. No employee shall report for work while he is under the influence of liquor and no employee shall knowingly permit a man to go to work while he is under the influence of liquor.

(ii) Practical joking and horseplay while on the job is strictly prohibited.

(iii) No employees shall distract the attention of another worker from his job unless he thinks that the worker is doing something, which is dangerous to his person, other workman or to the equipment.

(iv) Any employee who endangers his own or other's safety by violating the foregoing requirements of personal conduct shall render himself liable to disciplinary action.

2.5 SANITATION AND HOUSE KEEPING

2.5.1 Detailed provisions in this regard are given in the Factories Act, 1948 and the rules made there-under, and all authorized persons shall familiarize themselves with these provisions.

2.5.2 General precautions for observation by Employees are as follows:

(a) Floor of all work places, work rooms, passage ways store rooms shall be kept clean and as far as practicable, in dry and non-slippery conditions.

(b) Passage, stairways and fire escapes shall be kept clear of all obstructions.

(c) Tools and materials shall not be placed, where they may cause tripping or stumbling hazards or where they may fall and strike anyone below.

(d) Splashed oil and chemicals shall be cleaned up immediately.

(e) Protruding nails or any other kind of sharp objects on floors and passage-ways shall be removed immediately.

(f) Dirty and oil waste and rags shall be deposited in approved metal containers and disposed off as soon as practicable.

(g) Broken bulbs and glass, metal scrap and other kinds of sharp objects shall be removed immediately and dumped in metal containers.

(h) Discarded fluorescent and other gas filled tubes shall be disposed of according to Manufacturer's instructions

2.5.3 All places where persons work or pass in emergencies shall be provided during time of use with adequate natural or artificial lighting or both suitable for the operations and the special type of work performed.

2.5.4 The general lighting shall be of uniform level widely distributed to avoid harsh shadow or strong contrast and free from reflected glare.

2.5.5 Intensity of lighting for various conditions shall be as follows:

Sl. No.	Description of area where light is to be provided	Intensity of light (minimum)
1.	Yards, Roadways, thoroughfare etc.	20 lux
2.	Passage ways, corridors, staircases, store rooms for rough and bulky material, handling or sorting operations where discrimination of detail is not essential, storage battery rooms	50 lux
3.	Elevators, store rooms for medium and fine materials, toilets and wash room, handling or sorting operations where slight discrimination of detail is necessary	100 lux
4.	Auxiliary equipment, oil switches, transformers, compressors and blowers etc, rough bench, machine or testing work	200 lux
5.	Control room, medium bench, machine for testing work for desk work involving reading and writing, Switch boards and Meters	300 lux
6.	For fine assembly bench or machine work, book keeping, typing or other types for close and prolonged desk work	500 to 1000 lux

2.5.6 Where large number of persons are employed in buildings, emergency lighting systems capable of providing at least 5 lux for at least one hour from an independent source shall be provided in all important instruments and gauges, stairways, exits from work places and passages to the same.

2.5.7 Adequate ventilation shall be provided in work places by natural or artificial means to avoid insufficient air supply, harmful vapors, etc.

2.6 SAFETY OF PUBLIC AND VISITORS

2.6.1 Any site of hazardous operations should be protected by suitable fencing, guards and signs to prevent unauthorized entries.

2.6.2 Authorized visitors and official guests shall be conducted in the Receiving Stations and substations and shall not be left to find their own way.

2.6.3 All warning signs (i.e. flags by day and red lights by night) should be placed at points visible from a safe distance.

2.6.4 Prompt attention shall be given to all reports obtained from the general public.

Power Transmission Corporation of Uttarakhand Limited

SECTION 3

PERSONNEL PROTECTIVE EQUIPMENT; (PPE)

3.1 GENERAL

This chapter deals with different PPE and protective devices to be used in the operation and maintenance of sub-stations, lines, power stations, machines and equipments etc.

1. The PTCUL shall provide adequate and approved PPE for each job depending upon the hazard as given in the annexure at the end of this section. These PPE shall be procured as per provisions made in DOP of PTCUL, and quality of the equipment is as per respective standards.
2. It shall be the duty of the JEs to explain and to ensure that they adhere to the guidelines.
3. Employees shall use the PPE intended for respective job depending upon the hazard. The PPE shall be examined by the employee before and after its use. If any part of this equipment is found defective the employee shall apprise the same to the JE concerned.
4. A register should be maintained for issue or PPE‟s by the officer-in-charge for the work.
5. These PPE shall not be carried or stored by workers along with other tools and such other objects that are likely to cause damage to the PPEs.

3.2 PROTECTIVE CLOTHING AND FOOTWEAR:

3.2.1 All employees shall wear clothes and footwear suitable for the work.

3.2.2 Working clothes shall fit well; there shall be no loose dhotis, pajamas, flaps, strings, neckties, key chains near moving parts of machines.

3.2.3 Employees, while working, shall not wear shoes with projecting nails or other types of metals parts liable to cause slipping.

3.2.4 Employees exposed to the danger of falling material shall wear safety helmets and shoes.

3.2.5 Employees working near live parts shall:

(a) Avoid use of clothing with metal straps or buttons or buckles or any other metal fittings and shall avoid hand chains or watch chains.

(a) Not roll up their sleeves as dry cloth gives some protection against electric shock.

(b) Should always wear shockproof shoes.

3.3 RUBBER GLOVES, GAUNTLETS, HOODS, MATS AND BLANKETS

3.3.1 The rubber mats should be kept in front of operating panels/switches etc. Rubber goods / gloves shall not be used as protection on circuits having a voltage in excess of 300 volts to grounds or 5000 volts phase to phase.

3.3.2 Rubber gloves (Refer figure 3.1) and gauntlets shall be used when:

(a) Working on or near live voltages not exceeding 5000 volts phase to phase.

(b) Using operating rods under damp or adverse weather conditions.

(c) Cutting primary and common neutral ground wires to install grounding connect plate.

(d) Attaching or detaching leads when using a telephone set

(e) Opening and closing the isolators.

(f) Working on street light circuits

(g) When the JE or workmen may consider it necessary

Fig. 3.1 : Rubber Gloves

3.3.3 Rubber gloves and gauntlets shall not be worn while the men are on their way and from work or for such jobs where possibility of contact with live apparatus does not exist.

3.3.4 The right hand gauntlet wears out more quickly than the left hand one and in cases of this type; the whole pair should be condemned. Under no circumstance should left hand gauntlet be used on the right hand, if allowed, it is cumbersome and the workman is likely to discard it and meet with accidents.

3.3.5 The following procedure shall be observed for inspection and maintenance on rubber equipment:

(a) Rubber equipment shall be examined for scratches and abrasions before and after use. The equipment shall not be used if found defective.

(b) Rubber equipments shall be tested as follow:

(i) Rubber gloves shall be tested for holes by air test before and after use, i.e. by trapping the air in the glove and squeezing the trapped air into various parts.

(ii) In an electrical laboratory for insulation at an interval not exceeding six months in accordance with IS-4770, 1968 and any latest amendment thereof if any. Date of test shall be stamped on the equipment.

(c) Rubber equipment shall not be folded or allowed to come in contact with sharp objects.

(d) Rubber equipment shall not be exposed to oil or grease or sun when not in use.

(e) Rubber equipment shall be kept clean. French chalk shall be used as preservative for storage of gloves.

(f) Rubber deteriorates under high temperatures. As such it is preferable to store rubber equipment in cooler places after drying when wet.

(g) Rubber equipment shall not be stored near batteries or acid stores and near live apparatus, i.e. where ionization or corona may be present, as ozone causes rapid deterioration of rubber.

3.4 SAFETY BELTS

3.4.1 'Safety Belts (Refer figure 3.2) should invariably be used in all cases while working on overhead system like transmission lines, bus-bars, sub-station equipments etc. The belts may be equipped with leather straps or pockets for carriage of tools. Chains and wire hooks shall not be used for this purpose.

Fig. 3.2 : Safety Belt

3.4.2 Safety straps, when in use, shall be passed around the pole and not around the cross arms, pins or braces.

3.4.3 The following procedure shall be observed for inspection and maintenance of leather belts and straps:

(a) No changes and alterations (including punching of extra holes) shall be done to belts and straps without authorization:

(b) Belts and straps shall not be dropped or thrown from an elevation.

(c) Belts and straps shall not be exposed to heat. These belts shall be kept out of range from below torches, furnaces and other sources of heat or sharp objects.

(d) Belts and straps should not be allowed to come in contact with sharp objects, batteries and acids.

(f) Belts and straps shall be wiped with clean rag after work in rain and then allowed to dry at room temperature.

3.4.4 Employees using the safety belts shall be fully conversant with proper and correct method of fixing and removing of belt.

3.5 GOGGLES AND EYE SHIELDS

3.5.1 Employees shall wear approved type of goggles or eye shields (Refer figure 3.3) wherever there is danger from harmful fumes radiations, or flying particles.

Fig. 3.3 Eye Shield

3.5.2 Goggles or eye shields may be worn while performing the following operations:

(a) Welding and burning:

(b) Using grinders, jackhammers, pneumatic tools, chisels, shapers and drills;

(c) Painting and scraping

(d) Brushing or blowing machines for cleaning;

(e) Handling with acids, strong alkalies.

3.5.3 Before re-use, goggles and eye-shields shall be sterilized and thoroughly washed in warm water and dried.

3.6 PROTECTIVE DEVICES

Operating Rods

3.6.1 Employees shall use approved type of operating rods (Refer figure 3.4) when required for applying or energizing devices (e.g. disconnecting switches, transformer cut-outs).

3.6.2 The following procedure shall be adopted for maintenance of operating rods:

(a) Operating rods shall be kept as dry as possible.

(b) Operating rods shall not be dropped from above but shall be raised or lowered on a hand line.

Fig. 3.4 : Operating Rods

(c) Charred operating rods and rods with metal heads deformed by flashover shall not be used.

3.7 HANDLINES AND CANVAS BUCKETS

3.7.1 All tools, protective equipment and light material shall be raised or lowered by means of hand lines or canvas bags. No tool shall be tossed up or down.

3.7.2 Hand line shall be of fibre rope and at least twice as long as the highest point of suspension from the work is being done.

3.7.3 Hand lines shall not have wire reinforcements and where it is necessary to connect two hand lines permanently a splice shall be used. No metal wire or clamps shall be used in making the splice.

3.7.4 Before commencing work, employees shall free themselves from the hand line and fasten the same to a solid attachment for use as supply line.

3.7.5 Hand lines shall not be left lying on street or road and shall not be used for lacing of scaffolding or for handling heavy material or equipment.

3.7.6 Hand lines shall be kept dry, free from oil kinks or knots.

3.8 TOOLS

3.8.1 Employees shall use the right tools (Refer Figure 3.5) for each job and tools, which develop defects while in use, shall not be used until the defects have been rectified.

3.8.2 Portable electric tools shall be equipped with 3-wire chord having the ground wire permanently connected to the tool frame and means for grounding the other end. Portable hand lamps shall be equipped with proper guards. The lamp holder shall not be in metallic contact with the handle and the guard.

3.8.3 The extension chords shall not be dragged over sharp or rough surfaces or subjected to pressure by passing vehicles or material over them.

3.8.4 For work in transformer tanks, oil circuit breaker tanks and other confined locations, which, due to earthing conditions present a serious widespread electrical contact hazard, only low voltage lighting equipments not exceeding 24 volts shall be used.

Fig. 3.5 : Tools

3.8.5 Pliers, wrenches, etc., whether insulated or not, shall not be used without rubber gloves while working near live parts.

3.8.6 Metal measuring taps and rules and tapes having metal threads woven in them shall not be used in the vicinity of live apparatus.

3.8.7 Impact tools such as, chisels, punches, hammers and wedges with mushroomed heads shall not be used.

3.8.8 Axes, shovels and similar tools shall not be used if handles are loose, cracked or splintered.

3.8.9 Defects open and adjustable wrenches with spread jaws or pipe wrenches with dull teeth shall not be used.

3.8.10 Pipe or other extensions shall not be used on wrench handles to increase the leverage unless the wrenches are specifically designed for such end extension.

3.8.11 Only competent persons shall be allowed to handle blowtorches and fire pots.

3.8.12 Pipe poles shall be kept free splinters. The spear points must be sharp and securely fastened to the poles.

3.9 SAFE SUPPORTS

3.9.1 No employee or any material or equipment, shall be supported, or permitted to be supported, or any portion of a tree pole structure, scaffold, ladder (Refer figure 3.6) or any other elevated structure unless the support is adequately strong and properly secured in place.

Fig. 3.6 : Safe Support Ladder

3.9.2 All supports shall have a factor of safety of at least 4. This however, does not apply to supports for electrical overhead lines.

3.9.3 The following precautions shall be taken in relation to portable ladders:

(a) All portable ladders shall be equipped with non-slip bases and care shall be exercised in placing and blocking or lashing or having the ladder held by some one specially upon oily, metal or concrete surfaces.

(b) The bottom of the ladder shall not be kept away from the wall more than one fourth of the length of the ladder.

(c) Step ladders shall be fully opened before being used.

(d) While going up or down a ladder, always face the ladder and use both hands.

(e) Ladders shall not be placed in front of doors or windows opening towards the ladder, unless doors or windows are locked.

(f) Ladders, when fallen or struck, shall be carefully inspected for possible damage, ladders with weakened, broken or missing steps or otherwise defective shall not be used.

(g) Wooden ladders for outdoor use shall be given a suitable coating of clear varnish or linseed oil or bituminous paint. Metallic paint shall not be used in wooden ladders.

(h) Portable ladders shall not be used in sub-station or switching station containing exposed high voltage conductor without the authority of authorized person. All portable ladders when used in a sub-station shall be locked to suitable anchorage when not in use. Portable ladders shall not be used in the vicinity of live parts.

3.10. PROTECTIVE TEMPORARY BARRIERS

3.10.1 When work is conducted along a public street or highway, pedestrians and vehicular shall be warned by signs and red flags by day and red lights or flares by night. Whenever necessary, a signalman shall be posted (Refer figure 3.7)

Fig. 3.7 : Temporary Barriers

3.10.2 Barriers shall be placed around hazardous operations, open manholes and exposed open ditches.

3.10.3 Barriers for protection from live parts shall be made of dry plywood, plastic or Masonite.

3.10.4 Protective barriers for use near live parts shall not be made of material not known to have high insulating qualities and care shall be taken to observe adequate clearance with live part.

3.10.5 The safety zone shall be clearly recorded and caution/danger notices applied.

3.11 EARTHING DEVICES

3.11.1 Approved earthing devices shall be used on all work.

3.11.2 Care shall be taken to maintain earthing to ensure that clamps are in good condition, cables are not broken or frayed and all connections are sound.

3.11.3 Neon-line tester may be used to check the bus-bar area, cable etc. whether they are charged or not. Before checking it should be ensured that tester is in good working condition.

Part of the Body to be Protected	Personal Protective Equipment	Protection Against
Head	Industrial safety helmet Firemen's safety helmet	Falling objects and striking against objects
Face	1. Face Shield with replaceable Acrylic Vision	1. Frontal Hazards against Splash of Chemicals.
	2. Dust respirator	2. Protection from Dust.
	3. Gas Mask / Breathing Apparatus	3. Protection from heavy pollution / smoke & UMS/Gases
Eyes	1. Zero Power Plain Goggles with Cup Type Filters on Both Sides	1. Eye Injuries due to flying objectswhile Grinding, Machining etc.
	2. Zero Power Goggles with Cup Type Filter on Both Sides and Blue colour Glasses.	2. Radiation Due to Sparks/ Flames during Gas Cutting.
	3. Welders Equipment for Eye an Face protection	3. Radiation due to Electric Welding and Cutting.
Body	1. Acid/Alkali Proof Hand Gloves & Apron	1. Contact with abrasive and chemicals.
	2. Leather Hand Gloves	2. Sharp edge Works
	3. Electrical Safety Gloves	3. Electric Shock.
	4. Cotton Canvas Gloves	4. Contact with Moderately Hot Substances During Welding, Cutting and Grinding.
	5. Safety Belts	5. Work while on ladders / Overhead equipment.
Foot	Electric Safety Shoes / Industrial Safety Shoes with Steel Toe / Gum Boots / Leather Shoes	Electric Shock Project/Plant work Hazards / Contact with Chemicals and Fire Hazards.

Power Transmission Corporation of Uttarakhand Limited

SECTION – 4

CLEARANCE (SHUTDOWN) PROCEDURE

4.1 GENERAL PROVISIONS

4.1.1 The clearance procedure is intended to meet the following principal requirements in relation to potentially dangerous jobs :

(a) Protection of men at works

(b) Protection of equipment

(c) Safety of the systemic environment.

4.1.2 The above requirements are to be achieved by providing safe working conditions, essential information and guidance to the men at work, checking arrangements to ensure reliability of highest order through the use of PTW, Sanction for Test, Station Guarantee, Self Protection Tag and Danger Notice.

4.1.3 Clearance procedure is equally applicable to electrical and mechanical work.

4.1.4 For Shutdown of 132 KV or above permission with code of SLDC/ALDS is to be taken except in emergency.

4.1.5 The following shall be authorized persons for issue and cancellation of clearance under various conditions for safe and expeditious execution of works.

Shifts In-charge of shift (must be authorized person also) preferably not below the rank of JE. However if only TG-2 Electrical (Sub Station Operator) is present in shift he can also issue the shutdown. The person issuing shutdown should take the permission of his higher officer also before issuing the shutdown.

4.1.6 The following officers are authorized to receive clearances and get the work done under their supervision:

Authorized person preferably not below the rank of JE.

4.1.7 When work is to be done on any electrical apparatus which can be made live from more than one station or sections thereof, clearance shall be issued by the receiving stations and sub-stations involved in consultation with System operation before commencing work.

4.1.8 When more than one clearances are to be issued to one particular person or more than one clearances covering any electrical apparatus is to be issued, the System Control/ Authorized person shall ensure that:

(a) The work to be carried out under subsequent clearance/clearances does not in any way endanger the holder of the clearance/clearances already issued:

(b) Two nos. of sanctions-for-tests or a permit-to-work and a sanction-for-test are not issued on the same electrical apparatus at the same time.

(c) The clearances are given with suitable identification marks and include special instructions, if any, in the interest of safety.

4.1.9 Persons issuing clearances shall ensure that: -

(a) Clearance is issued only for identified work on electrical or mechanical equipment or lines.

(b) Clearance is issued in the name of the person under whose supervision the work is to be carried out. In case the nature of the work requires personal supervision of the authorized person, he shall issue the clearance to himself also.

(c) Before issuing a clearance, the electrical apparatus or mechanical equipment, as the case may be, is made entirely safe for working on a danger notices attached at conspicuous, places and in an appropriate manner.

(d) The person taking clearance understands the particulars of the work to be done; particulars of the operations carried out including those of earthing arrangements to make the working safe and the extent of the area safe for working.

(e) The electrical apparatus or mechanical equipment covered by the clearance remains safe for working until the clearance has been duly surrendered and cancelled.

(f) Particulars of clearance (e.g. type, Serial No., time of issue and cancellation) are recorded in the receiving station/sub-station on a log sheet/register sheet to be kept for this purpose.

(g) Before going off-duty they formally hand over records relating to clearances issued by them, indicating clearly the clearances remaining un-surrendered. The Authorized person taking over shall correspondingly acknowledge the records and the information as above and make sure that they have a clear understanding of the situations in each case.

(h) Precaution, if any, to be taken shall be clearly indicated.

4.1.10 Persons taking clearance shall ensure that:

(a) All electrical apparatus are treated as alive by the persons under their charge until a specific clearance has been issued;

(b) The area covered by the clearance is made safe for working and proper danger notices have been placed on switches and/or the controlling points

(c) Where a possibility of hazard exists in the vicinity of the work site, the boundaries of the area, safe for working are clearly marked cordoned off and persons other than members of the working party of those specifically authorized by the Authorized person are not allowed to enter the hazardous portion of the work site;

(d) All persons under their control who are to work on the electrical apparatus or mechanical equipment, covered by the clearance, understand the extent of the area safe for working;

(e) In case where the work involves hazards in the vicinity of the work site, one of the members of his party is appointed as a safetyman and it shall be his duty to maintain a continuous watch over the workmen under his care and to issue warnings of any unsafe conditions, which he observes.

(f) Before starting work, the person in charge of the working party shall check, in the presence of Authorized person, by visual inspection whether the line or equipment concerned is de-energized and effectively earthed;

(g) The safety measures, as above continue to be in force until the work is completed or suspended (e.g. earthing arrangements shall not be removed);

(h) On completion of the work (i) material, tools, etc., and (ii) persons under their control are immediately removed and made clear of the equipment under clearance.

(i) Here any changes which may affect the operation of the equipment or the line, have been made this shall be clearly brought to the notice of the officer issuing the clearance while surrendering the clearance;

(j) The clearance is surrendered for cancellation to the issuing officer immediately after the action referred to under (h) above is completed;

(k) If, due to any circumstances, the clearance cannot be surrendered by its holder within the period originally estimated the fact, shall be immediately brought to the notice of the officer issuing the clearance to be recorded in the log sheet register;

(l) The person returning the clearance shall initial the log entry.

4.1.11 When it is necessary to transfer a clearance from one authorized person to another, the original clearance shall be duly surrendered and cancelled and a new clearance given to the authorized person taking over charge of the work. It may be insured that clearances are being issued on correct line/equipment.

4.1.12 The clearance issuing officer may in the event of unforeseen circumstances, require the Authorized Person to surrender the clearance. If the equipment is unsafe for use, or the work has to be advanced that the equipment cannot be made available for service immediately, the Authorized persons shall apprise him of the position for a reconsideration of the order.

4.1.13 Whenever it is necessary to request issue or transfer or return of a clearance by telephone the following procedure shall be adopted by the parties concerned:

(a) All authorized person shall be given a telephone message book and before requesting clearance they shall fill in particulars of the request in the Telephone message book. In case of surrender of a clearance they shall make relevant entries in their copy of the permit-to-work, sanction-far-test or station guarantee, as the case may be.

(b) The person requesting action shall read out the entries made by him in the message book or the clearance form concerned as the case may be, and the authorized person using the clearance shall enter the same in the relevant form. Station log or any other book prescribed for the purpose, and read back the same to confirm accuracy of his entries.

(c) The person requesting action shall then get into telephone communication with the person concerned on the other side. Before giving or taking any message each person shall identify him by station, Receiving station and sub-station, his name and designation and shall ensure that his identity is clearly known by other party.

(d) The Authorized Person issuing the clearance shall then record his orders at the appropriate place and read the same over telephone to the person requesting action, who in turn, shall make a word to word entry in his telephonic message book and read the same back to confirm the accuracy of his entries.

(e) Duplicate copies of the permit to work, sanction for test or station guarantee when issued/ cancelled ever telephone, if necessary, shall be forwarded to the other party concerned by post soon after completion of action.

(f) The above procedure shall be adopted in the matter of all telephonic messages made in substitution of written requests, instructions or orders as provided for in this Code.

(g) No action shall be taken on any telephonic communication if the communication is not intelligible or if any of the parties fail to recognize the other.

4.1.14 In following the above mentioned procedure it has to be remembered that in giving and receiving instructions, each party shall convey to the other any other additional information which might assist the other in intelligently carrying out the work.

4.1.15 Forms relating to request for clearance, permit-to-work, shall be numbered in duplicate, bound in books and kept with the appropriate person. These shall be issued to clearance issuing persons against receipts in a register to be kept for this purpose.

4.1.16 The records of the used forms, tags, notices etc. shall be maintained for one year.

4.2 REQUEST FOR CLEARANCE

4.2.1 Before undertaking any construction, repair, testing or maintenance jobs, the person in-charge of the work shall intimate the authorized person for issuing clearance, the particulars of the work, time during which the work is intended to be carried out, precautions, if any, required to be taken (e.g. isolation of circuits, earths to be applied, additional apparatus to be covered for working space, suggestions for safeguards from neighboring live apparatus) and request for appropriate clearance as follows :

(a) In the case of jobs to be undertaken under a permit-to-work, the request shall either be made in writing by an authorized person or on the prescribed form in the format given as Annexure I .

4.2.2 The Authorized person for issuing clearance shall satisfy himself regarding correctness and completeness of the information furnished by the applicant and if necessary shall obtain by enquiry all the information which is necessary to enable to determine whether or not the clearance can be issued in conformity with the rules, requirements of service, safety etc.

4.2.3 In case of approval of the details given in the request for clearance, the Authorized person shall arrange to;

(a) Provide alternative feeds to consumers and others wherever practicable or get notified in Press.

(b) Get the requisite clearance issued with such instructions as may be necessary and instruct the operator and/or any other person/persons that may be concerned in the operations required to be carried out.

4.2.4 In case an application for clearance is not approved, the Authorized person shall record an order stating reasons thereof and return the same to the officer approving the request for clearance.

4.2.5 Station Guarantee shall be prepared induplicate and conveyed to the system operation.

4.2.6 In case an applicant is not able to do the work according to the original application for clearance or he wishes to cancel the same, he shall inform the Authorized Person immediately, who, in turn, shall record a suitable order and inform the person concerned.

4.2.7 All applications for clearance shall be dealt with promptly and the decision communicated to the applicant and any other persons that may be concerned immediately.

4.2.8 Records of the requests for clearance shall be maintained as follows:

(a) Applications rejected - with the Authorized person requesting for clearance.

(b) Applications approved - with the System Operation and the person issuing the clearance.

4.3 PERMIT- TO WORK

4.3.1 Permit to work (Refer figure 4.1) is a means to make known to a person undertaking construction, repair or maintenance job exactly what electrical apparatus or mechanical equipment have been made safe to work on, description of the job, Special precautions, if any, for safety of workmen on the job etc. It ensures safe working conditions until it is surrendered.

Fig. 4.1 : Permit to work

4.3.2 No construction, repair or maintenance work on or in the proximity of HV or EHV apparatus or mechanical equipment where technical knowledge or experience is required to avoid danger, shall be carried our unless a permit-to-work on the prescribed form has been issued by an Authorized Person.

4.3.3 In cases where (i) the work is to be carried on apparatus/plant and equipment, or (ii) the work requires extra ordinary care in supervision of the work, the permit shall be issued with the approval of the competent authority.

4.3.4 The person issuing a permit-to-work shall ensure that the apparatus/equipment, is made perfectly safe to work on as follows:

(a) In the case of electrical apparatus the isolation is complete, the metal parts, adequately earthed and danger notices attached at appropriate places.

(b) In the case of mechanical equipment, the isolation is complete and conditions rendered safe and danger notices applied at appropriate places.

(c) Maintenance of above conditions until the permit is surrendered and cancelled.

4.3.5 Permit shall be prepared in duplicate in the format placed at Annexure-I. One copy of the permit shall be handed over to the person in-charge of the work (also known as permit holder) and the other copy shall be retained by or forwarded to the operator or any other person in-charge of operations. Permit works books should be treated as important records. The sheets and the books themselves should be serially numbered. No page should be detached or used for any other purpose except bonafide work. If any page is inadvertently detached, a dated and initialed statement should there and then be recorded in the book by the person concerned.

4.3.6 The permit-holder shall be responsible for identifying the isolated and de-energized circuits in the case of work on multi-circuit lines or on single circuit lines situated close together.

4.3.7 After surrender of the permit to the person issuing the permit, the same copy duly completed, shall be forwarded to the concerned station in charge for information and record and the other copy shall be retained in the records of the Permit Issuing authority.

Important Points:

1. In case of remote closing arrangement the auxiliary supply of source D.C or A.C shall be switched off or fuses removed for isolators, circuit breaker etc. to avoid accidental closing manual or by leakage.
2. No PTW shall be issued or received unless the equipment under reference is:
   (a) Dead
   (b) Isolated from all possible sources of supply.
   (c) Connected to earth

4.4 SANCTION-FOR-TEST

4.4.1 Sanction-for-test is a means to make known to a person undertaking tests on electrical apparatus or mechanical equipment exactly what apparatus is to be tested and the conditions under which the testing is to be carried out. It guarantees safe working conditions until it is surrendered and cancelled.

4.4.2 No tests on high or extra High Voltage apparatus or any electrical apparatus or mechanical equipment where technical knowledge is required to avoid danger shall be carried out unless a sanction-for-test on the prescribed form has been issued. The person in-charge to whom a sanction for test is issued shall be an Authorized Person who may be authorized to receive sanction-for-test under certain specific circumstances.

4.4.3 Sanction-for-test may include provisions for carrying out certain works. Under no circumstances any of the apparatus covered by a permit-to-work be made alive, till the permit is surrendered. The apparatus isolated and earthed for testing under the terms of the sanction-for-test comes under the temporary control of the sanction holder. He may, without further reference to the issuing authority operate the apparatus, i.e. remove the earths and make it live from a testing supply either by himself or through the operator. Sanction holder shall be responsible for coordinating all such operations on the isolated equipment and ensuring safety during the tests. This does not mean that the sanction holder shall make test personally.

4.4.4 The following limitations shall apply to the work under sanction for tests:

(a) Two sanctions for test or a sanction-for-test and a permit to work shall not be issued simultaneously on the -same electrical apparatus or mechanical equipment.

The apparatus under test or work shall not be allowed to be connected to, or in any way involved with, other apparatus not covered under the sanction

4.4.5 Provisions of paragraphs 4.3.3 to 4.3.7 shall apply in relation to the procedure to be followed under a sanctions-for-test.

4.5 STATION GUARANTEE

4.5.1 Station guarantee is issued by an assisting station to a System Operation l when more than one generating stations or transmission systems or Distribution Systems interconnected with each other are concerned in creating safe working conditions in the assisting stations to guarantee that specified isolating devices or de-energising devices are in a specified position and will remain in that position until the guarantee is surrendered to enable the System Operation to issue permit-to-work or sanction-for-test for a work on that system.

4.5.2 The Assistant Engineer/ Junior Engineer shall, request from the System Operation to issue station guarantee/guarantees in the prescribed form as may be required to make the work safe in so far as the scope of its/their working is concerned.

4.5.3 While asking for a station guarantee, the System Operation shall give sufficient information to the assisting station/stations concerned about the nature of the work to be done, working conditions called for and the assisting station may if it considers necessary for any sufficient reason, offer its comments for consideration of the System Operation before issuing the station guarantee.

4.5.4 If the System Operation has any reason to suspect that any assisting station operator has in any way failed to satisfactorily carryout his duties in connection with the issuance of the Station Guarantee, it shall not accept the Station Guarantee from it.

4.5.5 Station Guarantee shall be prepared in duplicate and conveyed to the System Operation.

4.6 SELF-PROTECTION-TAG

4.6.1 Self-protection-tag is a prescribed form of notice to be put up by a competent person working on an electrical apparatus or on the equipment supply to which is controlled by that apparatus to ensure that the same shall not be handled or interfered with by any other person, while it is under the tag.

4.6.2 Self-protection tags shall be used only by competent persons doing the work by themselves and under the following conditions;

(a) For work on low or medium voltage electrical apparatus of minor importance.

(b) For work on equipment in unattended sub-stations of receiving stations.

Provided that self-protection-tag shall not be used as a substitute from the ‘Permit-to work’, unless in emergency conditions requiring immediate action to effect repairs or to establish service and when it is not possible for the employees to establish contact with the Authorized Person within reasonable time.

4.6.3 Self protection tag shall be utilized only by competent persons capable of taking responsibility for the following:

(a) Identification, isolation, de-energization, etc. of all apparatus necessary for ensuring safety on the job.

(b) Application of temporary earths as may be necessary, for safety on the job.

(c) Execution of the job in a proper manner

4.6.4 When the work is finished, the person using the self-protection tag shall:

(a) Get all men clear of the apparatus and/or the equipment concerned;

(b) Remove all de-energizing devices.

(c) Remove the self-protection tag placed by him.

(d) Restore normal working conditions (if there is no other self-protection tag, and

(e) Complete the relevant particulars in the self-protection tag and forward the same to the Authorized Person

4.6.5 The authorized person shall maintain a register and enter particulars of self protection tags utilized within his jurisdiction every day.

4.7 DANGER NOTICE

4.7.1 Danger Notice (Refer figure 4.2) is a notice to be applied to any electrical apparatus or mechanical equipment to indicate abnormal conditions on dead or live apparatus.

4.7.2 No construction, repair or maintenance work on all voltage apparatus, controlled from a Receiving Station/Sub-Station shall be carried out unless the circuit is made safe to work upon and danger notices placed on the control switches.

4.7.3 A danger notice can be applied under the instructions of an Authorized Person or as a pre requisite of safety of works under a permit to work or on the request of workmen who are competent to carry out certain minor works under their own responsibility to indicate:

(a) Isolation of equipment or danger of interfering therewith.

(b) That the men are working near live parts or in the event of tripping of the switch the same shall not be closed without consulting the person in charge of the working team, and

Fig. 4.2 : Danger Notice

(c) Change in on rating conditions, i.e. any apparatus or equipment having been put out of service due to execution of maintenance works tests or repairs.

4.7.4 Before applying a Danger Notice, the operator shall ensure that:

(a) Automatic opening device of the circuit breaker is in working order made in operative;

(b) The automatic re-closure of feature of the circuit breaker, if any, has been made inoperative.

(c) No other person has already been issued 'Danger Notice' on the same equipment and

(d) In case of the lines, Danger Notices are put on both controlling ends simultaneously.

4.7.5 Danger Notice shall not be applied on circuits while relay test are being conducted or while relays are out of service on any circuit breaker, which might energize or de-energize the circuit upon which work is being performed.

4.7.6 The Danger Notice shall be removed only either by the person applying the same or under instructions from the person responsible for its application. Before removing the Danger Notices applied for work on low and medium voltage apparatus:

1. Person working on apparatus, tools, material shall be made clear of the apparatus.

2. The temporary earth and short circuit devices applied at the side of the work shall be removed.

4.8 EMERGENCY PROCEDURE

4.8.1 Whenever necessary, for protection of life or property or in emergency (Refer figure 4.3) when communicated with the Authorized Person is not possible, any competent person may have electrical apparatus or mechanical equipment de-energised and/or isolated; or repaired.

Fig. 4.3 : Emergency Procedure

4.8.2 Before undertaking repairs, the person in charge of the working party shall ensure that the apparatus concerned is:

(a) Made dead;

(b) Isolated and practical steps taken to have it screened or hooked off from live apparatus.

(c) Effectively connected to earth at both ends.

(d) Having self- protection tags and/or danger notices applied at appropriate place.

4.8.3 The person in charge of the working party shall not undertake such operations or repairs where he may be in doubt regarding action required to be taken for isolation or for effecting remedies to meet the situation.

4.8.4 As soon as practicable, the person in charge of the working party shall report detailed particulars of the work and action taken by him to the Authorized Person concerned.

4.8.5 All works carried out under emergency procedure shall be recorded in the Station log book or in a register maintained for the purpose.

Power Transmission Corporation of Uttarakhand Limited

SECTION 5

OVERHEAD LINES

5.1 ISOLATION GUARDING AND PROTECTION

5.1.1 Isolation Guarding and Protection shall fulfill the following basic requirement of safety in overhead lines;

(a) Provisions of safe clearances from the ground, building and structure.

(b) Arrangement to prevent unauthorized persons from ascending any of the support of overhead lines without the help of ladder or special appliances.

(c) Provisions of protective devices for rendering the line electrically harmless in case of conductor breaks.

(d) Earthing of non-current carrying metal parts to ensure safety to general public and employees and

(e) Protection against lightening.

5.1.2 The above points of safety shall be complied in accordance with the provisions of IE Rules, 1956 and amendments thereof.

5.1.3 The danger notice shall be affixed in Hindi on all supports of High and Extra High voltage overhead lines as per prevailing practices.

5.1.4 Lines, which are not in service, shall either be removed or they shall be contained in a safe-mechanical condition and before bringing them back into service they shall be checked for compliance.

5.2 ELECTRICAL OPERATIONS

5.2.1 All switching and other operations requiring engineering knowledge shall be carried out by Authorized person or persons acting under the immediate supervision of the Authorized person (Refer figure 5.1).

5.2.2 When connecting dead mains to live mains all connections to the live phases shall be made last and in all cases the phases shall be tested to ensure the sequence.

Fig. 5.1 : Electrical Operation

5.3 INSPECTION AND TESTING OF LINES

5.3.1 The Executive Engineer (O&M) shall arrange preparation of transmission route maps and records to show particulars of transmission lines installations.

5.3.2 The following precautions shall be taken for inspection of equipment on or in the vicinity of live lines:

(a) Inspection shall be carried out by authorized persons only.

(b) No tool shall be supplied over the line/conductor.

(c) No employee shall climb above the anti-climbing device on the live cut.

(d) Inspection shall be carried out from within the body of the tower.

5.3.3 Line patrolmen shall avoid:

(a) Patrolling line alone in darkness or under bad weather conditions.

(b) Walking into fallen wires or metal fences, which may be energized by fallen conductors.

(c) Stumbling hazards, poisonous snakes, plants etc.

5.3.4 In case an employee has noticed a fallen aerial wire, he shall immediately inform the departments concerned and arrange to protect the traffic till the arrival of repair gang.

5.4 WORK ON OVERHEAD LINES

5.4.1 Before any work is begun on overhead lines the leader of the working party shall ensure that each person, who is to work on the poles, towers, conductors or other components is clearly informed and thoroughly understands on which components the work is to carried out.

5.4.2 All persons, while at work on towers, poles and high structures shall make proper use of their safety and no man shall work alone at any high structure (Refer figure 5.2).

Fig. 5.2 : Work on Overhead Lines

5.4.3 Safety straps shall not be placed above the top cross arm when it is at the top of the pole.

5.4.4 Broken insulators and other sharp edged material shall not be left in vacant plots or in a location where the hazard of injury may be caused for men or animals,

5.4.5 When stringing wires across streets and highways avoid interfering with traffic or causing injury to workmen or pedestrians. Danger signs shall be erected on both sides of the work site and where conditions warrant flagmen shall be stationed.

5.4.6 All employees working on live wires, wherever possible, shall work from below the wires

5.4.7 Each working party shall be provided with a portable earthing chain and discharging rod and the leader of the working party shall satisfy himself that the line conductors and discharge to earth by attaching the earthing chain to earth conductor and then to all the line conductors near the point where he is to work and subsequently ensure that earthing chains are removed before re-energizing the line.

5.4.8 No work shall be begun on any high or Extra High Voltage overhead line unless the temporary earthing have been attached at the point or points where work is to be carried our and short circuited at a point on each side of the section of line on which the work is to be carried out.

5.4.9 No employee shall work on any electrical apparatus or line which is live unless he is authorized to carry out such work and unless he is accompanied by a person competent to assist him.

5.4.10 Work may be carried out by a competent person on any pole or tower supporting live high conductors provided that he does not ascend a position in which it is possible for him to bring any part of his body or any working tool within the following distances of any exposed high voltage conductor:

Sl.No.	Rated Voltage	Clearance
1.	Not exceeding 11 KV	1.0 Meter
2.	Exceeding 11 KV but not exceeding 33 KV	1.2 Meter
3.	Exceeding 33 KV but not exceeding 66 KV	2.0 Meter
4.	Exceeding 66 KV but not exceeding 132 KV	3.7 Meter
5.	Exceeding 132 KV but not exceeding 220 KV	4.6 Meter
6.	Exceeding 220 KV	5.5 Meter

5.4.11 The following minimum safety working clearances shall be maintained for the bare conductors or live parts of any apparatus in out door sub-stations excluding overhead lines, of HV and EHV installations.

High Voltage System (KV)	Safe Working Clearance (Meters)
12	2.6
36	2.8
72.5	3.1
145	3.7
245	4.3
420	6.4
800	10.3

5.4.12 In the event of likelihood of lightening and or storm, all work on overhead lines shall be discontinued immediately and employees concerned shall descend from the tower or poles and shall keep clear of the line until the danger has passed and inform the Authorized Person.

5.4.13 Before climbing elevated structures the employees shall ensure that the structure is sound enough to sustain his weight safely.

5.4.14 When two or more linemen are ascending a pole or structure the second man should not start climbing until the first man is in a safe position or when descending the lower man should reach the ground first before the other man starts descending.

5.5 ADDITIONAL PROVISION RELATING TO TRANSMISSION SYSTEMS

5.5.1 Work on single or multiple circuits" overhead lines with all conductors dead.

(a) The work shall be carried out under a suitable P.T.W

(b) The employee in charge at each tower shall be provided with a green flag and shall place the green flag in position before allowing any man to ascend the tower on which work is to be carried out.

(c) The conductors shall be connected to earth by the Authorized Person or a competent person working under his direct supervision at the point of work unless they are to be removed / segregated for examination. During this time the conductor shall be earthed at those nearest towers where they are still secured in the clamps, but in no case shall the earth be more than six spans apart.

5.5.2 Work on Double Circuit Overhead line with one circuit live

Where work similar to that under paragraph 5.5.1 is to be carried out on double circuit overhead lines with one of the circuit live, the provisions of paragraph 5.5.1 shall apply, and the following additional precautions shall be taken:

(i) After placing in position the green flag, which shall fit the socket on the dead side of the tower and before any other employee is allowed access to the tower, the Authorized person at the point of work shall climb the tower on the DEAD side, and shall efficiently connect, to each all three conductors on that side. He shall then affix red pennants to the cross arms supporting the live conductors at the junction of these cross arms with the tower body. The conductors shall remain efficiently earthed, and the red pennants shall remain in position throughout the progress of the work, and the earths and pennants shall be removed by the authorized person or competent persons working under his direct supervision only after

all other members of the working party have descended the tower on completion of work. While affixing or removing earths and red pennants, the person concerned shall be under observation by another employee at ground level.

(ii) The authorized person in charge shall see that danger notices are fixed to make it clear to all concerned on which portion it is safe to work and shall issue to each person, who is to work on the poles or towers, an armlet or wristlet bearing the distinguishing number of symbol of the overhead line on which he is to work. The armlet or wristlet shall be worn by the person to whom it is issued during the whole period that he is engaged on the work. He shall not bring any part of his body or any working tool within the distance, specified under para 5.4.11 above, or any live conductor. On the conclusion of the work, the above, or any live conductor. On the conclusion of the work, the armlets or wristlets shall be collected by the authorized person.

(iii) Work the TEE-OFF tower shall only be carried out in the presence of an authorized person and special care shall be taken at terminal and large angle towers.

5.6 PAINTING AND OTHER WORK ON TOWERS

5.6.1 The following additional precautions shall be observed in case of towers carrying live conductors:

(a) No employee shall climb above the anti-climbing device unless under observation by a safety man

(b) No tools above 80 cms. in length shall be taken up the tower;

(c) As for as practicable, the work shall be carried out from within the body of the tower.

(d) No employee shall work in a manner that his access way or arms or any tool extend beyond the clearance limitations fixed.

All safety requirements as detailed under 5.4, 5.5 as applicable on working on EHV lines (Double circuit live line, single circuit live line or double circuit one sided live line) will be applicable in the case of OPGW installations/modification/jointing.

Only the certified equipments like hotline rolling machines, pullies, tension sets, suspension sets, buffer jacket etc shall be used for OPGW works.

5.7 RADIO ANTENNA AND CARRIER CURRENT

5.7.1 Radio antennas automotive equipment shall be securely tied down and removed from the base before a car is driven under or near energized equipment where there is the slightest possibility of the actual making contact or coming close enough to cause an arc.

5.7.2 The following precautions shall be observed in connection with carrier equipment:

(a) Carrier line Trans shall not be worked on while the conductor is energized on unearthed.

(b) Coupling capacitor stacks shall not be worked on while the conductor is energized or unearthed. After the capacitor has been disconnected from the line conductor the top connection shall be discharged by momentary earthing with an earthing stick.

(c) No contact shall be made with the carrier lead in conductor, except when using rubber gloves, or with lead in conductor, solidly earthed through the earthing switch in the event of safety gaps are breaking down the earth switch shall be closed before any contact is made with the carrier load-in-conductor line turning connections.

(d) Carrier lead-in-conductor shall not be disconnected from the line tuning unit unless the load-in-conductor is definitely earthed at the coupling capacitor with the earthing switch which is provided. Operating rod shall be used for operation of the earth switch.

(e) When working on the transmitter or power amplifier unit, extreme case should be taken due to dangerous voltage which exists in each of these units. More than one person, preferably with one JE, is present when working on this equipment.

5.8 GENERAL

1. **Material and strength** : All conductors of overhead lines shall have a breaking strength of not less than as specified in the relevant IS.

2. **Joints** : Joints between conductors of overhead lines shall be mechanically and electrically secure under the conditions of operation. The ultimate strength of the joint shall not be less than 95 % of that of the conductor, and the electrical conductivity not less than that of the conductor provided that no conductor of an overhead line shall have more than two joints in a span.

3. **Maximum stresses : Factors of safety:**

   (1) The load and permissible stresses on the structural members, conductors and ground wire of self supporting steel lattice towers for overhead transmission lines shall be in accordance with the specifications laid down, from time to time, by the Bureau of Indian Standards.

   (2) The minimum factor of safety for conductors shall be 2, based on their ultimate tensile strength. In addition, the conductor's tension at 32°C, without external load, shall not exceed the following percentages of the ultimate tensile strength of the conductor :

   Initial unloaded tension 35 per cent

   Final unloaded tension 25 per cent

   (3) For the purpose of calculating the factors of safety prescribed in clause (2):

      (a) The maximum wind pressure shall be as specified in the relevant Indian Standards;

      (b) For cylindrical bodies the effective area shall be taken as full projected area exposed to wind pressure; and

      (c) The maximum and minimum temperatures shall be such as specified in the relevant Indian Standards.

4. **Transporting and Storing of material near overhead lines.**

   (1) No rods, pipes or similar materials shall be taken below or in the vicinity of any bare overhead conductors or lines if they are likely to infringe the provisions for clearances as per Indian Electricity Rules, unless such materials are transported under the direct supervision of a competent person authorized in this behalf by the owner of such overhead conductors or lines.

   (2) Under no circumstances rods, pipes or other similar materials shall be brought within the flash over distance of bare live conductors or lines; and

   (3) No material or earth work or agricultural produce shall be dumped or stored or trees grown below or in the vicinity of bare overhead conductors / lines so as to reduce the requisite safety clearances specified in Indian Electricity Rules, 1956.

5. **Clearances**

(1) For the purpose of computing the vertical clearance of an overhead line, the maximum sag of any conductor shall be calculated on the basis of the maximum sag in still air and the maximum temperature. Similarly, for the purpose of computing any horizontal clearance of an overhead line the maximum deflection of any conductor shall be calculated on the basis of the wind pressure specified for the relevant zone.

(2) No blasting for any purpose shall be done within 300 meters from the boundary of sub-station or from the electric supply lines of voltage exceeding 650V or tower structure without the consultation of the owner of such sub-station or electric supply lines or tower structures and in case of mining lease hold area, without the written permission of the Chief Inspector of Mines or the Electrical Inspector of Mines.

(3) Where an overhead line crosses or is in proximity to another overhead line, guarding arrangements shall be provided so to guard against the possibility of their coming into contact with each other.

Where an overhead line crosses another overhead line, clearances shall be as under:-

Minimum clearances in meters between lines crossing each other shall be as follows:

Sl. No.	Nominal System Voltage	11-66 KV	110-132 KV	220 KV	400 KV	800 KV
1.	Low & Medium	2.44	3.05	4.58	5.49	7.94
2.	11- 66KV	2.44	3.05	4.58	5.49	7.94
3.	110 -132 KV	3.05	3.05	4.58	5.49	7.94
4.	220KV	4.58	4.58	4.58	5.49	7.94
5.	400 KV	5.49	5.49	5.49	5.49	7.94
6.	800 KV	7.94	7.94	7.94	7.94	7.94

Where two lines cross, the crossing shall be made as nearly at right angles as the nature of the case admits and as near the support of the line as practicable, and the support of the lower line shall not be erected below the upper line.

6. **Earthing**

All metal supports and all reinforced and pre-stressed cement concrete supports of overhead lines and metallic fittings attached thereto shall be permanently and efficiently earthed. For this purpose, a continuous earth wire shall be provided and securely fastened to each tower and connected with earth at each tower.

7. **Unused overhead lines**

Where an overhead line ceases to be used it shall be maintained in a safe mechanical condition.

8. **Laying of Underground Telecommunication Cables in proximity to Underground Power Cables of voltage exceeding 33 kV.**

(1) No power cable of voltage exceeding 33 kV shall be laid without a minimum underground depth of 1.2 meters.

(2) No underground telecommunication cable shall be laid without a minimum separation distance of 0.6 meters to the underground power cable of voltage exceeding 33 kV.

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SECTION 6

SUB-STATIONS

6.1 GUARDING OF LIVE APPARATUS

6.1.1 Permanent enclosures, covers of other suitable guards shall, where practicable be provided for all current carrying parts of electric circuits or equipment operating at 50 Volt or more to ground including parts exposed through windows or wall openings, unless parts are isolated by location in a manner as to be accessible to authorized person only.

6.1.2 Barriers cutting of access to enclosure within chambers, cubicles or cells containing live high and/ or extra high voltage apparatus shall normally be kept locked. No. person except an authorized person or a person acting under his immediate supervision shall have access to any enclosure, chamber, cubicle or cell in 'which a live conductor is exposed.

6.1.3 Master key of the locks on all chambers, cubicles on switchgear shall be retained with the Authorized Person and the other keys with the operator on duty of the person in-charge of the working party concerned. Boxes fitted with locks shall be provided at suitable position for the retention of key.

6.1.4 A key ledger shall be maintained wherein issue and receipt of all keys which secure switches, barriers, spout shutters, lock out equipment and other similar devices, shall be entered and holders of such keys shall be personally responsible for their safe custody.

6.2 OPERATIONS GENERAL PROVISIONS

6.2.1 All switching and other operations requiring engineering knowledge or skill shall be carried out by Authorized persons or competent persons acting under the immediate supervision of Authorized persons or competent persons.

6.2.2 Except for agreed routing or switching required in case emergency, no high voltage switching shall be carried out without the sanction of the System Operation in case of Grid S/stn.

6.2.3 No high voltage earthing switch shall be operated or circuit main earth connection attached or removed except under the instructions of the System Operation in case of Grid Substation.

6.2.4 The following precautions shall be observed in relation to switching operations:

(a) Extra High Voltage apparatus shall be operated using rubber gloves or standing on insulated stools, platforms or PVC mats and in the case of operations, they shall be accompanied by another person competent to render first aid and artificial respiration.

(b) When low or Medium Voltage fuses, which are not in series with a circuit breaker, are to be operated, the attendants shall use rubber gloves, insulated platforms or PVC mats. Where there is a possibility of arcing in the switching operations, the operator shall use goggles or eye shields and keep his body as far as possible from the switch.

(c) When replacing a low voltage fuse, which is in series with the switch, the same shall first be opened.

(d) Where isolators are in series with circuit breakers the circuit breakers shall always be opened before opening isolators and conversely when the circuit is being closed the circuit breaker shall be closed last.

(e) If switching operations in a particular system cause any effect on other system, the control engineer shall get clearance from the corresponding control engineer/engineers of the other system affected.

(f) Any abnormality in the condition or operation of any switch shall be reported to the person in charge of switching operations immediately.

(g) Where there is interlock system to guard against irregular sequence of operation in switching the failure of interlock shall, not be taken as an excuse for incorrect operations.

6.2.5 Following incidents and events shall be recorded promptly and accurately in permanent ink on the Receiving Station/Sub-station log or registers maintained for this purpose.

(a) All disturbances, interruptions to service or imposed restriction of load together with reasons thereof.

(b) Particulars of defects observed or reported in the plant or apparatus taken out of services as a result of the same, operating errors etc.

(c) Particulars of major overhauls, repairs routine inspections.

(d) All operating orders issued or received or relayed through the Receiving Station/Substation together with the identity of the parties concerned.

(e) All switching operations on High &. Extra High Voltage switches, their timings and explanation of the reasons thereof.

(f) All clearance orders (i.e. permit-to-work, Sanction for test Station Guarantee, Self Protection tag etc.) received, issued or refused.

(g) Particulars relating to telephonic message in connection with operations on high and Extra High Voltage Switches.

6.2.6 No entry on the log or register shall be erased under any circumstances. A wrong entry shall be cancelled by a single line drawn across is so that it is not rendered illegible. The log sheet and the corrections thereon shall be signed and initiated by the Shift In charge.

6.2.7 In case of telephonic instructions the operator shall not take any action until he has recognized the person giving instructions and read back the massage to confirm the accuracy of the same.

6.2.8 Before changing shift the outgoing shift in-charge shall personally explain and record a summary of any conditions in vital matters requiring particular attention of the incoming shift in-charge shall thoroughly understand the same before taking over shift.

6.3 MAINTENANCE & GENERAL PROVISIONS:

6.3.1 Equipment wears out gradually and the efficiency may drop off almost imperceptibly day by day. These gradual changes in wear and equipment performance can be determined only systematic checking of the daily operation records and inspection of electrical apparatus.

6.3.2 All switch-gear shall be inspected and tested after every major overhaul or repairs at periodical intervals not exceeding one year, as follow:

(a) For cleaning of all parts and lubrication where required.

(b) Tightening of connections on wiring terminals, particularly those subjected to vibration;

(c) Checking condition of tripping battery, fusible elements, indicator lamps, contacts and interlocks and affecting such replacements as may be necessary.

(d) Checking of relays, instruments and meters and affecting such re-adjustments as may be necessary.

6.3.3 The Assistant Engineer shall prepare and maintain in a suitable manner History Book of each item of apparatus under his charge.

6.3.4 No person shall carry out any work including maintenance repairs or testing on or in the vicinity of any electrical apparatus unless;

(a) In the case of high and/or extra high voltage apparatus, the work is covered under a permit to work or sanction-for-test or the emergency procedure and the safety requirements connected therewith have been complied with.

(b) In the case of low and/or medium voltage apparatus, .the circuit has been made dead and tested with an approved indicator the conductors short-circuited and where practicable earthed and self-protection tagged and/or danger notices as necessary may be applied.

(c) In the case of work on live apparatus on lines no employee shall work on or touch any exposed parts of any apparatus or live line except when using adequate and approved protective device.

(d) Rubber mats should be provided of adequate insulation strength on the places of operation of OCB"s and ACB"s and the same should be kept neat and clean.

6.4 SAFETY PRECAUTIONS FOR WORK IN AREA CONTAINING EXPOSED LIVE

6.4.1 Before commencement of a construction or maintenance work in an energized S/Stns., PTW shall be obtained from the designated authorized person and necessary precautions for safety of personnel shall be ensured.

6.4.2 Adjustments, cleaning and painting of earthed metal enclosures and structures may be carried out from ground level by competent persons only, under a danger notice, provided clearances specified are maintained.

6.4.3 Mobile cranes and derricks shall be effectively earthed when being moved or operated in close proximity with energized lines or equipment. It is not presumed that the equipment shall be considered energized.

6.4.4 No person will be allowed to enter the switchyard with umbrella during rainy season.

The Isolating of electrical apparatus should include.

(a) Isolation from all points from which it is possible for the apparatus to become alive (e.g. voltage and auxiliary transformers, common neutral earthing equipment.

(b) Locking of circuit breakers, isolators, control handles and safety device wherever such arrangements exist, in guaranteed position, and

(c) Locking of all enclosures leading into live sections from the work area to avoid wrong opening of doors.

6.4.5 The section made dead for working should be only that section required for execution of the work and it should be defined by use of barriers, screens and danger notices, etc., so that the minimum specified clearance are maintained. The section should be bound by red flags by day and red lights by night.

6.4.6 While working on or near any exposed live parts, minimum clearances from the nearest exposed conductors to the place of work (e.g. ground level or working platform) should be maintained as given on page 78.

6.4.7 No material or tools should be carried on shoulders. Long material and tools should be carried in horizontal position and in a manner to maintain the applicable clearances.

6.4.8 Following precautions should be observed in the use of ladders and long objects in the work area:

(a) Ladders should be suitable for the work and of no greater length than required for the work involved. These should be transported horizontally in the yard.

(b) Movement and erection should be subject to direct super vision of the authorized person.

(c) Portable ladders, when not in use, should be securely locked to a suitable anchorage.

(d) Portable ladders provided for giving access to fixed ladders, which terminate above level should be padlocked in position by an authorized person while work is being carried out on the structures.

6.4.9 Number of accidents has taken place in switchyards which are partly commissioned and where by extension works are under taken by contractors. As work site in the close proximity of charged bays therefore utmost care has to be exercised during erection of equipments and movements of materials, Tools & mobile crane etc. It is necessary to restrict entry & movement of contractor's men & materials in the charged areas of switchyard by barricading. Further, all erection works should be undertaken under strict supervision of engineers as well qualified staff from contractor's side.

6.4.10 During Pre-commissioning checks on equipments in extension bays, PTW should be taken prior to starting work and engineer/staff should always be associated for such works.

6.5 WORK ON REMOTELY AND/OR AUTOMATICALLY CONTROLLED EQUIPMENT

A permit-to-work shall be obtained for all work on controlling equipment, its wiring or relays. Before work is carried out on remotely or automatically controlled equipment such as circuit breakers, isolators tap changing gear, or compressors the automatic or remote control features shall first be rendered inoperative.

6.6 WORK ON EQUIPMENT OPERATED BY OR CONTAINING COMPRESSED AIR

6.6.1 A permit-to-work shall be obtained before start of the work.

6.6.2 Work, other than operating adjustments, shall be carried out only under the following conditions:

6.6.3 Operating adjustment on equipment operated by or containing compressed air, which require the normal air, supply, may be carried out only when necessary and then under the directs supervision of the authorized person.

6.7 WORK IN UNDERGROUND SYSTEM:

1. No. person shall enter or be permitted to enter any underground chamber or other confined space in which dangerous fumes are likely to be present to such an extent as to involve risk of the person being overcome thereby unless :
   (a) It is provided with a manhole of adequate size or other effective means of access.
   (b) A certificate in writing has been given by competent person based on a test carried out be himself, that the space is free from dangerous fumes and fit for person to enter, or
   (c) The employee is wearing a suitable breathing apparatus and a belt securely attached to rope, the free end of which is held by a person standing outside the confined space.
2. Open flames and smoking shall be avoided in under-ground chambers.
3. Tools and materials shall be kept clear of the man-hole.

6.8 WORK ON OIL CIRCUIT BREAKERS, TRANSFORMER AND OIL STORAGE TANKS

1. Before an employee is permitted to enter any tank it shall first be adequately ventilated and if necessary, the process of ventilation shall be continued during the entire period of work.
2. When an employee enters a tank another employee shall be detailed to stay in the immediate vicinity to render any aid that may be required.
3. Under no circumstances shall a bulb of portable electric lamp be replaced inside a tank.
4. Smoking or the use of open flame (unless necessitated for repair of coils) shall not be permitted inside a tank or near an open manhole. A permit-to-work shall be obtained for use of flame inside a tank.
5. Transformers removed from service due to internal trouble are likely to contain poisonous and explosive gases in large quantities. These shall be properly ventilated before undertaking repair work.
6. Oil storage tanks shall, in addition to being ventilated, be properly purged and cleaned before any employee is allowed to enter the same.
7. The fixed C.B opening cannot be treated as isolation point, thus all isolating switches/isolator shall be in open position.
8. In case of moveable trolley of C.B in withdrawal position can be treated as isolating point.

6.9 WORK ON TRANSFORMER

1. A permit-to-work (P.T.W.) shall be obtained for all work on transformers (Refer figure 6.1).
2. For isolation purpose, both the primary and secondary voltage switches and isolators be opened. Similarly when isolating transformers to which voltage transformers are connected the voltage transformer shall be isolated and low voltage fuses withdrawn to prevent the possibility of transformer being made live through the synchronizing or voltmeter plug.
3. The transformers shall be isolated from all common neutral earthing equipment from which it may become live. This does not require the disconnection of solidly earthed neutral or neutral equipment connected solely to the transformer on which work is to be done.
4. Whenever transformer is replaced the new transformer shall be checked carefully for voltage, polarity and phase relation, before taking into service.

Fig. 6.1 : Work on Transformer

5. Transformers without conservators shall be treated as if the space above the oil level contains highly explosive gas and, therefore, the space shall be suitably ventilated before entering the tank, e.g., by keeping the manhole cover open for sufficiently long time or by circulating dry compressed air.

6. Transformers which are provided with inert gas as a precaution against ignition of explosive gases in the space above the oil level shall not be entered until the tank has been ventilate with dry air or left open long enough to permit adequate natural ventilation.

7. Open flames or inadequately protected portable lamps shall be kept away from the manhole and smoking shall not be permitted when working on or in the transformers.

8. Persons working in transformers shall not carry any loose articles like key bunches in their pockets and persons working in or on the top of transformers shall not keep any loose tools about themselves.

9. After the testing or Maintenance work done on the Transformer it should be ensured that the tap position of transformer which is selected before the work carried out shall be same as per the other transformers operating in parallel.

6.10 WORK ON CIRCUIT BREAKER

A permit-to-work shall be obtained for all work on HT/EHT circuit breakers (Refer figure 6.2). For isolation purpose it shall be ensured that:

(a) Breaker is open before opening disconnects.

(b) Line and bus isolator have been checked open.

(c) There is no back-feed from potential transformers.

(d) Main fuses at the switch board panel have been removed and DC voltage is disconnected from breaker mechanism.

(e) Tools and equipments are in safe working condition.

Fig. 6.2 : Work on Circuit Breaker

(f) When working on the mechanism with the breaker closed wire the trip latch or block the breaker closed so that it cannot be tripped accidentally.

(g) Be sure that auto-re closure feature has been by-passed during maintenance work.

(h) After maintenance work is over, the breaker should be operated by relay operation as test check. This ensures safety of the system for future faults.

(i) Disconnecting switches on sides, control switches (or control fuses), relay trip blocking switches and compartment doors are open.

(j) Mechanical blocking, when necessary to prevent unauthorized movement of the mechanism, installed.

(k) In case where there are no disconnecting switches between (i) the transformer winding terminals and the circuit breaker, the transformers are isolated, (ii) the transformer winding terminals and the circuit breaker, the transformers are isolated.

(l) In compressed air circuit breakers main air line isolating valve is closed or air receiver tank drain valve is opened.

(m) Circuit breakers, which have pneumatically operated mechanisms, shall not be blocked mechanically while the pressure remains in the breaker storage tank or tanks. Mechanical blocking may result in damage to the breaker.

The following additional precautions shall be taken in relation to work on Minimum Oil type Circuit Breakers:

(a) With the exception of control cabinet, all parts of the circuit breaker shall be considered live.

(b) As the operating springs are under tension in both the open and closed positions of the breaker, extreme care shall be taken when adjusting the operating mechanism to avoid accidental operation.

(c) Where possible, when working on contacts of these breakers the spring tension should be completely released and the control circuit opened at the breaker.

When a circuit breaker is situated in a chamber or in a room which contains two or more such breakers suitable barriers shall be erected to define an area for safe work.

Following additional precautions shall be taken in relation to work on Air blast circuit breakers:

(a) With the exception of control cabinet all parts of the circuit breaker shall be considered as alive.

(b) When it is required to operate an air blast circuit breaker for test, all workmen or others in the vicinity shall be warned and men working on the breaker ordered to stand clear

(c) When working on an air blast circuit breaker where each phase has a separate storage tank the control switch and disagreement switch shall be opened in each phase control cabinet at the breaker.

When working on manually operated panel-mounted circuit breakers, when the operating handle is on the front and the circuit breaker is on the rear of the switchboard or on another panel, a danger notice shall be placed on handle.

6.11 WORK ON VACUUM CIRCUIT BREAKER:

1. All conductors must be assumed to be energized unless their potential has been measured as ground and adequate capacity grounding assemblies have been applied to prevent accidental energizing.

2. It is strongly recommended that all equipment be completely de-energized, verified to be “dead”, and then grounded with adequate capacity grounding assemblies prior to any maintenance. The grounding cable assemblies must be able to withstand energizing fault levels so that protective equipment may clear the circuit safely.

3. Although interlocks to reduce some of the risks are provided, the individual’s actions while performing service or maintenance are essential to prevent accidents. Each person’s knowledge; mental awareness; and planned and executed actions often determine if an accident will occur. The most important method of avoiding accidents is for all associated personnel to carefully apply a thorough under-standing of the specific equipment from the viewpoints of its purpose, its construction, its operation and the situations which could be hazardous.

4. All personnel associated with installation, operation and maintenance of electrical equipment, such as power circuit breakers and other power handling equipment, must be thoroughly instructed, with periodic retraining, regarding power equipment in general as well as the particular model of equipment with which they are working.

5. To avoid loss of any parts when unpacking, the contents of each container should be carefully checked against the packing list before discarding the packing material. When lifting the breaker, use of the specially designed lift truck is recommended.

6. Lifting holes are provided in the four corners of the frame members. Use a spreader wider than the breaker to prevent slings from contacting the interrupter supports.

7. Do not work on the interrupters or the mechanism unless the circuit breaker is in the “open” position and both the closing and opening springs are either discharged or gagged and all electrical power is removed.

8. After the spring is completely charged, further forcing charging handle may cause damage to the closing latch and its associated parts.
9. Do not allow anything to come in contact with the interlock roller on the right side of the mechanism.
10. Repeated operations at a rate exceeding two per minute may cause charging motor overheating and failure.
11. If DC high potential testing is required, the dc high potential machine must not produce peak voltages exceeding 50 KV.
12. Use of a DC hi-pot is not recommended, but can be used for quick field checks only. Always recheck with an AC tester if initial results are questionable. Prior to performing any vacuum interrupter integrity test, the outside (external surface) of the vacuum interrupters should be wiped clean of any contaminates i.e. dirt, debris, dust, oil with a non-linting cloth or industrial type wiper.
13. X-radiation will be produced if an abnormally high voltage is applied across a pair of electrodes in a vacuum. X-radiation will increase as voltage increases and/or as contact separation decreases.
14. Only test a correctly adjusted circuit breaker.
15. During a high potential or a vacuum integrity test, any x-radiation which may be produced will not be hazardous at a distance safe for high potential testing, if the test is conducted at the recommended voltage and with the normal open circuit breaker gap. Do not apply voltage that is higher than the recommended value.
16. Do not use contact separation that is less than the recommended open position breaker contact gap.
17. To measure the breaker secondary circuit insulation resistance, disconnect the motor leads and thread a wire connecting together all secondary disconnect pins the ground pin. The measurement is made by connecting a 500 Volt Megger from the wire to ground.
18. Before any maintenance work is performed, make certain that all control circuits are de-energized and that the breaker is removed from the metalclad unit.
19. Do not work on the breaker or mechanism while it is in the closed position without taking pre- cautions to prevent accidental tripping. Do not work on the breaker while the closing spring is charged unless it is secured in that position by the closing-spring gag.
20. Do not attempt to remove or reinsert the vacuum interrupter in the interrupter support assembly.

STORAGE OF CIRCUIT BREAKER

It is recommended that the breaker be put immediately in its permanent location. If this is not possible, the following precautions must be taken to assure proper breaker storage.

1. The breaker should be protected against condensation, preferably by storing it in a warm dry room of moderate temperature such as 40° - 100° F. Circuit breakers for outdoor metalclad switchgear should be stored in the equipment only when power is available and the heaters are in operation to prevent condensation.
2. The breaker should be stored in a clean location, free from corrosive gases or fumes; particular care, for example, should be taken to protect the equipment from moisture and

cement dust, as this combination is present at construction sites and has a very corrosive effect on many parts.

3. Rollers, latches, etc., of the operating mechanism should be coated with grease to prevent rusting. If the breaker is stored for longer period, it should be inspected periodically to see that rusting has not started and to ensure good mechanical condition. Should the breaker be stored under unfavorable atmospheric conditions, it should be cleaned and dried out before being placed in service.

6.12 WORK ON HIGH VOLTAGE AND E.H.V. FUSES:

1. Replacement of H.V. and E.H.V. fuses shall be done by authorized person only.
2. When it is necessary to work on live circuit proper hot line tools shall be used and the work carried out in accordance with the instructions regarding Hot line working.

6.13 WORK IN LOW/MEDIUM VOLTAGE FUSES:

1. Persons taking up work on fuses shall wear approved gloves while handling fuses. Eyes shall be protected against possible flash by wearing goggles or by turning head and shielding eyes and face.
2. In case where the fuse is in series with the disconnecting switch, the switch shall be opened before replacement of the fuse.
3. Where necessary the neutral link shall be withdrawn after all phase fuses have been withdrawn and replaced before the phase fuses have been put in.
4. All the secondary fuses shall be removed or MCB shall be opened to avoid back feed from Control panel.

6.14 WORK ON SWITCH BOARD PANELS

1. A permit-to-work or sanction-for-test shall be obtained for all work on H.V or E.H.V Switch Board Panel (Refer figure 6.3).

Fig. 6.3 : Work on Switch Board Panels

2. The panel to be worked upon shall be differentiated from others by wrapping red tape. Where the work is to be carried out both on the front and the backside, the red tape shall be wrapped on both side of the panel.

3. The switchboard panel -shall be discharged and before handling any metal part or equipment check shall be made to ensure that the same is dead.

6.15 WORK ON BUS BARS

1. A permit-to-work shall be obtained for all work on H.T and E.H.T. Bus Bars.

2. In isolating the point of work from supply care shall be taken to disconnect right points in case of sectionalized ring and mesh schemes of Bus Bars.

3. Isolators/Switches closing on the section Bus Bars on which work is to be carried out shall be locked in open position and the closing mechanism rendered inoperative.

6.16 WORK ON METAL CLAD SWITCHGEAR SPOUTS

1. A permit-to-work shall be obtained for all work on Bus Bar spouts and feeder and voltage transformer spouts.

2. The isolating arrangements and the shutters of live spouts shall be locked so that they cannot be operated. In the case of Bus Bar spouts, where duplicate switches in one tank of on load bus bar isolators are installed and it is not possible to isolate a Bus bar fed from different sources of supply, all the switches that can be closed to the gear involved shall have their mechanism locked in the open position and the closing mechanism made-in-operative.

3. Approved appliances shall be used for earthing. The insertion of the hand or any other tools in the Bus Bar, feeder or transformer spouts for this purpose is strictly forbidden.

4. On feeder or voltage transformer spouts the earths may be replaced, if necessary, by temporary earths and these earths shall be removed one phase at a time from the point of work. Each phase earth shall be replaced before a second phase earth is removed.

6.17 WORK ON INSTRUMENT TRANSFORMERS

1. A permit-to-work shall be obtained for all work on instrument transformers.

2. The cases of all instrument transformers shall be earthed. In handling instrument circuits the secondary of a current transformer shall not be opened while it is live.

3. Before any work is carried out on an instrument or other device in a current transformer secondary circuit the device shall be bridged with jumpers, so that the circuit cannot be opened at the device. The circuit shall never be opened at meter connections until it has been bridged elsewhere.

4. Potential transformer secondary shall never be short-circuited.

5. Low voltage windings of potential transformers shall always have one side permanently and effectively earthed.

6. The spare core terminals of secondary of CT shall not be kept open while working on these types of transformers or during replacement.

6.18 WORK ON LIGHTENING ARRESTERS

1. No work shall be done on a lightening arrester including in earth wire unless it is disconnected from the live circuit and earthed at both the line and Earth terminals.
2. Tanks of electrolyte or shields of oxide film lightening arresters must never be touched while arresters are energized.
3. H.V. and E.H.V. lightening arresters where accessible shall be provided with suitable screens or fences against possible contact while the arresters are live. The gate of the screens shall be kept locked and the keys under safe custody with the operator on duty.

6.19 WORK ON CAPACITORS

1. A permit-to-work shall be obtained for all work on capacitors.
2. For isolation of capacitors first open all cutouts or disconnecting device of the capacitors, then wait for at least 5 minutes for the internal resistor to reduce the voltage. Next using an isolating rod short circuit and earth all terminals of the capacitors. The short, circuiting earthing jumpers shall be left attached while work is being done on the capacitors.
3. In short circuiting and earthing any capacitor or bank of capacitor no reliance shall be placed on any internal discharging circuit, but all individual capacitor terminals are to be connected to earth using the special leads where these are provided.
4. Special precautions shall be taken when working on capacitors and their associated equipment when connected to transmission lines, e.g. coupling capacitors, capacitor potential devices, capacitors for power factor correction.
5. In case of star connected bank of capacitors, neutral point shall be earthed before taking the work in hand.
6. The H.V and E.H.V cables shall be treated as stored capacitor and after making cable circuit dead, wait for at least 5 minutes before connecting to earth.

6.20 SAFETY PRECAUTIONS FOR WORK ON STORAGE BATTERIES

1. Only authorized personnel who have been familiarized with battery installation, charging and maintenance procedures should be permitted access to the battery area
2. Battery rooms should be well ventilated and should be provided with exhaust fans enough to ensure that pockets of trapped hydrogen gases do not occur particularly of the ceiling.
3. Smoking, open flames or the use of tools or any other devices that are liable to cause sparks, should be avoided in storage Battery rooms since in the operation of a battery (Refer figure 6.4), hydrogen gas is formed which may be explosive, if ignited.
4. When mixing electrolyte, always add acid to water and not water to acid. Pour slowly and stir constantly to avoid excessive heat.
5. While handling sulfuric acid electrolyte, always goggles and acid/alkali proof apron and gloves. Avoid spilling electrolyte. If electrolyte comes in contact with the skin, rinse with water immediately.
6. To reduce the shock hazard due to short-circuit, insulate the handles of all tools used for lightening connector volts. Also, remove the jewellery that could produce short-circuit.

Fig. 6.4 : Safety precautions for work on Storage Batteries

Un-insulated/unprotected tools, lamps are prohibited, Art Silk, Fur clothing creates static electricity. Hence prohibited.

7. Electric storage battery jars and cells, unless composed of glass, hard rubber or the insulating material, should be mounted on insulation supports.

8. All battery connection shall be kept clean and tight so that sparking is avoided because of loose/cored connections.

9. The paint used on the Battery room walls should be fire retardant epoxy paint.

6.21 Work on Communication Apparatus

1. A permit to work or sanction for test shall be obtained for all work communication apparatus operating at voltages over 250 volts (carrier systems radio etc.).

2. When an insulating transformer is provided, no employee shall work on any apparatus on the line side of the insulating transformer unless the apparatus has been isolated from line and earthed. The line isolating switch shall only be operated with an isolating rod.

3. When it has been considered necessary to provide insulated steel, this shall always be used when operating on the line side of the insulating transformer unless the apparatus has been isolated from line and earthed. The line isolating switch shall only be operated with isolating rod.

4. When it has been considered necessary to provide insulated steel, this shall already be used when operating on the line side of the transformer of when using the telephone itself.

6.22 WORK ON CABLES

1. A permit-to-work shall be obtained before start of the work.

2. For isolation of cables open at least one set of disconnecting switches or remove fuses in every source though which the cable can be made alive including leads to the cable potential transformers. Then discharge the cable to earth (Refer figure 6.5).

3. Before digging out the point of cable fault, the authorized person shall determine the particulars of all cables in the vicinity of faulty cable.

Fig. 6.5 : Work on Cables

4. All cables in the vicinity of the fault point shall be exposed and identified to establish the identity of the faulty cable.

5. Before a high or extra high voltage cable is cut the Authorized Persons shall made definite checks to identify the cable and to ensure, that the cable has been made dead and earthed. He shall then spike the cable in an approved manner at the point where the cut is to be made.

6. Before any high voltage joint or chamber is to be opened in circumstances where it is not desirable to spike the cable entering the joint or chamber, the Authorized Person shall satisfy from cable route record and if necessary by approved tests, that the joint or chamber is associated with the particular cable which has been made dead and on which it is safe to work.

7. After completion of work, the cable shall be properly tagged and its position entered in appropriate drawing.

8. Employees shall not step on live cables even though they are insulated and enclosed in a dead sheath. Tools and material shall not be rested against the sheath of the cable.

6.23 TESTING OF HIGH VOLTAGE APPARATUS

1. Permit-to-work should be obtained for all tests, and the Shift in charge should ensure that the apparatus, where reasonably practicable, is adequately guarded or the boundary limits of the Test area is clearly marked. Danger notices should be attached in conspicuous positions, during the test period, on all apparatus that may be subjected to Voltage.

2. The test area should be isolated from all supplies other that those necessary to allow the testing to take place

3. No switch of isolator connecting the isolated section to the main supply system, with the exception of those for the agreed testing supplies, should be operated without the sanction of the authorized person.

4. When a section of equipment has been isolated from the main supply for testing, the Shift in charge may, to enable testing to be done, give on the Sanction for test, a general sanction for the operation of switches, isolators, earthing switches and earth connections, within the test area and only for the application of test supplies of the isolated apparatus. The authorized person in charge of the testing shall then become wholly responsible for safety within the isolated section.

5. Connections used for test purposes should be of adequate size for the purpose and easily distinguishable and visible when in the test position.

6. The application of test supplies should be done only under the supervision of the person who has received the sanction for test.

7. Where the apparatus is to have a test voltage applied to it and that apparatus has a remote end that may be made alive by the test voltage, then the remote end of that apparatus should be safe guarded so as to “prevent danger and ‘No Back feed’ certificate to be taken from remote end.

8. If the remote end of the apparatus which may become live by the test voltage is readily accessible from the ground level or on a structure or tower, then it is the responsibility of the person who received the P.T.W. to obtain confirmation that it is under the control of authorize person before a test voltage is applied. It is the responsibility of that authorize person to ensure that any person, including himself, does not approach the apparatus unless instructed to do so for any work by the person in charge of the testing.

6.24 SAFETY PRECAUTIONS FOR WORK ON HV & EHV EQUIPMENTS:

1. Before any person is allowed to carry out any work or repairs or modifications of any High or Extra High Voltage apparatus, a permit-to-work should be obtained.

2. All electrical apparatus should be considered as live unless it is positively known to be dead. Approved indicators should be used to verify that the circuit is not live, and the indicator itself should be tested before and after the use.

3. No person should touch the insulation, which covers or supports any conductor subject to High or Extra Voltage, unless the conductor is dead and earthed.

4. Working spaces adjacent to exposed live parts should not be used as passageways.

5. Only authorized person to climb structures or apparatus, which bring them at reduced distance to live parts. The senior authorized person should be present at the point of work and supervise directly.

6. New electrical apparatus should not be placed in service without the approval of the Executive Engineer (O&M) and until the same has been thoroughly examined and where necessary tested by Executive Engineer (T&C).

7. When testing, switching or doing other work in a particular location of the working zone is likely to affect the operation of the working zone is likely to affect the operation in any other location, the authorized person should inform all the concerned before the work is started and after the work is completed.

8. Danger notice, barriers and screens should be fixed and moved under the supervision of the senior authorized person.

6.25 ISOLATOR AND EARTH SWITCH OPERATION

(i) The isolators (Refer figure 6.6) should not be operated (open or close) on load in any case.

(ii) The isolators should not be operated (open or close) on charged line / transformer.

(iii) After opening isolator, make sure that there is no pole stuck and all three poles of the isolators have been opened fully.

(iv) After closing isolator make sure that all three poles of the isolators have been closed.

(v) The isolator should be locked with pad lock and key after opening and should be closed when PTW is returned properly.

(vi) When PTW is given for work on line the Earthing switch is closed after opening the isolator and both should be locked in position till returned of PTW properly.

Fig. 6.6 : Isolator and Earth Switch Operation

Power Transmission Corporation of Uttarakhand Limited

SECTION 7

EARTHING

7.1 TERMINOLOGY

DEAD - The term used to describe a device or circuit to indicate that a voltage is not applied.

EARTH - The conductive mass of the earth, whose electric potential at any point is conventionally taken as zero.

EARTH ELECTRODE - A conductor or group of conductors in intimate contact with and providing an electrical connection to earth.

EARTH LEAKAGE CURRENT - A current, which flows to earth or to extraneous conductive parts in a circuit, which is electrically sound.

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

LIVE PART - A conductor or conductive part intended to be energized in normal use including a neutral conductor but, by convention, not a protective earth conductor.

NEUTRAL CONDUCTOR - A conductor connected to the neutral point of a system and capable of contributing to the transmission of electrical energy.

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

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

EARTH GRID - A system of grounding electrodes consisting of inter-connected connectors buried in the earth to provide a common ground for electrical devices and metallic structures.

EARTH MAT - A grounding system formed by a grid of horizontally buried conductors and which serves to dissipate the earth fault current to earth and also as an equi-potential bonding conductor system.

7.2 STATUTORY PROVISIONS FOR EARTHING

1. All medium voltage equipment shall be earthed by two separate and distinct connections with earth. In the case of high and extra high voltages, the neutral points shall be earthed by not less than two separate and distinct connections with earth, each having its own electrodes at substation.

2. All earth connections shall be visible for inspection.

3. All connections shall be carefully made; if they are poorly made or inadequate, for the purpose for which they are intended, loss of life or serious personal injury may result.

4. Each earth system shall be so devised that the testing of individual earth electrode is possible. It is recommended that the value of any earth system resistance shall be such as to confirm with the degree of shock protection desired. Values preferably should be less than 1.0 ohms.

5. No cut-out, link or switch other than a linked switch arranged to operate simultaneously on the earthed or earthed neutral conductor and the live conductors, shall be inserted on any supply system.

6. The basic requirements are:

   (a) A contact potential of 65 volt is within the tolerable limits of human body for 10 seconds. Hence protective relays or device characteristic should be such that this 65 volt contact potential should be eliminated within 10 seconds and higher voltage with shorter times.

   (b) A voltage of 250 volts can be withstood by a human body for about 100 milliseconds which requires instantaneous disconnection of such faults, giving rise to potential rise of 250 volts or more above the ground potential.

7.3 EARTHING PRACTICES

Provision of adequate earthing in a sub-station (Refer figure 7.1) is extremely important for the safety of the operating personnel as well as proper operation of the system and protective devices. The primary requirements of a good earthing system in a sub-station are:

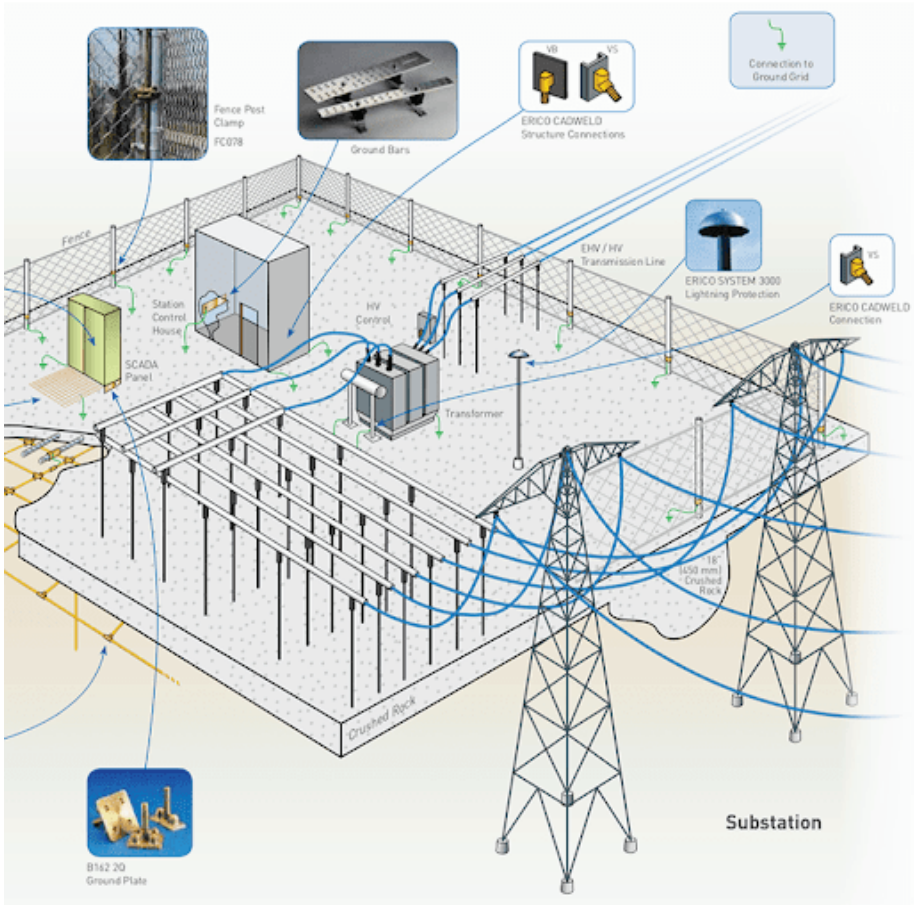

Fig. 7.1 : Earthing Practice

(a) The resistance to ground should be as low as possible in large sub-stations- it should not exceed 1 ohms and in exceptional cases to 2 ohms for small sub-station.

(b) The step and touch potentials should be within safe limits.

To meet these requirements an earthing network is made by connecting all the earthing in a mesh. All the non-current carrying parts of the equipments in the sub-station are connected to this mesh so as to ensure that under-fault conditions; none of these parts are at a higher potential than the grounding mesh.

In the sub-stations provisions for earthing for following are made:

(a) The neutral point of each system (transformers, capacitor bank, V.T. etc.) should have two independent earths which in turn should be interconnected with each other as well as other earthings.

(b) Equipment metal framework and other non-current carrying parts.

(c) All other metallic frame work not associated with, equipment, like fencing wire mesh, fencing poles (if metallic).

(d) Lightning arresters should have one dedicated earth electrode, which in turn should be connected to grounding mesh.

(e) All special structures on which switches, transformers, fuses, etc. are mounted should be earthed.

(f) The supports on either side of the road, railway or river crossing should be earthed.

In special locations, railway and telegraph lines crossings, special structures, etc., pipe/rod earthing should be done.

At other locations the coil earthing may be adopted. The coil earthing consists of 10m length of 8 SWG. G.I. wire compressed into a coil 450 mm length and 50 mm diameter and buried 1500 mm deep.

Earthing in a sub-station must confirm to the requirements of Indian Electricity Rules and relevant Indian Standard. The earthing system has to be designed to have low overall impedance and a current carrying capacity consistent with fault current. The factors, which influence the design, are:

1. Duration of fault.
2. Magnitude of fault current.
3. Resistivity of the underlying strata.
4. Resistivity of surface material.
5. Material of the earth electrodes.

The joints in earthing system should be riveted, brazed, bolted or welded. For protection against rust, welded joints should be painted with red oxide and aluminium paint and then coated with bitumen. Joints between switchgear units, cable sheaths, etc. that require opening should be bolted. All joints in the interconnecting grounding mesh should be welded.

Bare or stranded copper conductor or copper strips were extensively used in part for earthing. Due to high cost now, copper is not used and ACSR conductor, G.I. Wires etc. are used instead.

7.4 TEMPORARY EARTH

Temporary earths are those applied at the actualization of the work during repair or construction of installations for the protection of workman and property. They are coordinated with permanent earths but are distinct from them.

The following features of temporary earthing equipment shall be kept in view:

(a) Earthing devices shall be approved type (comprising properly designed line clamps attached to insulating sticks of sufficient length to enable the clamps to be securely clamped to the conductors being earthed without an employee's hands approaching closer than the minimum safe working distances. Each such line clamp is to be connected by a flexible capper earthed lead to an adequate earth clamp or other device for attaching to a permanent connection or to a temporary earthing spike).

(b) Earthing connection shall be continuous. All joints & terminals should be bolted, riveted or welded properly cramped.

(c) Electrodes for installation of temporary earths shall be of iron or steel rods at least 2 cm dia. and 1.5 meters in length. These shall have clear metal surfaces free from rust or any eating of paint or any other poor conducting material and be driven to a depth of at least one meter to provide good earth. The spacing between the electrodes shall not be less than the depth of the electrodes.

(d) Chains shall not be used far earthing, because they cannot with stand the fault current. Conductive flexible straps of adequate current carrying capacity shall be used.

(e) All earthing equipment shall be examined by employees every time before use and by the JE in charge periodically.

(f) Far earthing .of circuit through metal clad switchgear only approved appliances shall be used. Employees shall not insert their hands or any other tool in contact spouts.

7.4.1 General precautions for the application of temporary earths are as follows:

(a) No electric apparatus of line shall be earthed until all reasonable precautions have been taken to ensure that is has been disconnected from all sources of supply.

(b) Connections for earthing of apparatus of lines shall be applied or removed only by competent persons.

(c) Before any circuit or apparatus is earthed for work it shall be ensured that it is disconnected from supply mains. It shall then be discharged with the help of approved discharge rod, which is efficiently connected with earth. The workman shall use rubber gloves and keep his body at least 60 cm. away from the earthing wire.

(d) Approved earthing devices only shall be used and these shall be so applied that the apparatus or line being earthed is effectively short-circuited as well as earthed.

(e) In case where earthing is done through the station ground wire existing on the pole, it shall be examined to ensure that there is no cut or break on it.

(f) When steel tower or structure is used for earthing the lines, prior to connecting conductors there too, one leg of the tower/structure shall be earthed with approved earthing device.

(g) Earthing leads shall be connected to the earth system before being secured to the conductors.

(h) Earthing leads shall not be applied in any cell or compartment in which there is any exposed live conductor.

(i) When it is necessary to cut a line Bus bar or loop or to repair a broken conductor or damaged loop, earths shall be placed on both sides of the work.

(j) If there are any isolator/C.B. between the work, the earthed point, earth shall also be applied on the side of the isolator C.B. adjacent to the work unless such switches are securely locked in the closed position and danger tag attached thereon.

(k) If work is being done on de-energized equipment on both sides of an air break switch, earths shall be placed on the circuit on both side of the switch or the switch shall be designated as a temporary earthing switch. The switch shall be properly tagged in the closed position. An oil circuit breaker shall not be used for this purpose.

(l) When work is to be done inside oil circuit breaker or on oil circuit breaker bushings, or on the upper portion of the operating mechanism of oil circuit breakers where there is the slightest chance of contact being made with the live conductors, all terminals of the switch shall be securely earthed even if the work pertains only to bushing or tank of the switch.

(m) For work on transformers, earths must be placed on each terminal or each winding.

(n) Before working on capacitors or underground cables, they shall be disconnected from the source of energy, discharged after delay of 5 minutes and then earthed. To discharge them, through earth and make contact with it to each terminal in turn repeatedly heavy sparks shall be drawn from them if they are discharged.

(o) Where a neon lamp, potential light voltmeter phasing sticks, or other device is employed for testing of live circuit, the device shall be tested before and after use to ascertain that the device is in working order.

(p) While working overhead transmission lines, earths" shal1 be placed on both sides of the tower on which work is being done as far as possible.

(q) While applying earths to overhead transmission lines place the earth wire on the lowest conductor first.

(r) When removing earthing leads, they shall be disconnected from the phases first and the earth system last. The removal shall be carried out in reverse order than that adopted for connection of the various phases to earth.

(s) The receiving stations/Sub-station operator shall keep a record of the time of application and of removal of the earths in the sub-station log book in case of works inside the sub-station.

(t) Before starting work on the telephone lines, signal or relay circuits running parallel to overhead lines or on the same lines or on the same poles or towers of the power lines, earth shall be applied or safeguard against dangerous voltages likely to be induced due to opening or closing of power circuits or by accidental contact between the communication line or power line.

(u) Earths shall never be attached or removed with bare hands. Rubber gloves or approved protective equipment shall always be used.

(v) In so far as practicable, the person applying the earths on poles and structures shall maintain the position below the level of conductors to be earthed in order to keep the body away from any arc that may occur when the earthing device is applied.

(x) If there are more than one working parities in different sections, each working party shall have precautionary earths of its own. As far as practicable, no man shall work at a point where he is out of sight of earths, which protects him.

7.4.2 When earthing underground cables, the following additional points shall be born in mind:

(a) Each core shall be discharged to earth repeatedly until drawing of arc to earth stops.

(b) The cable shall be earthed at both ends and earthing switches, wherever installed, shall be locked up.

(c) The dead cable shall be distinctively marked with a tag.

7.4.3 The following additional precautions shall be taken on lines for protection against lightening:

(a) During construction of an E.H.T (Refer figure 7.2). line, after the conductor has been pulled in place and sagged, one or more earths shall be placed on the tower nearest to the point of temporary dead end or the point of snub and allowed to remain until conduct ahead has been pulled in and sagged. New earths shall be put on or the old earth moved forwards as the sagging is completed. Always keep an earth between men working and the completely erected conductors.

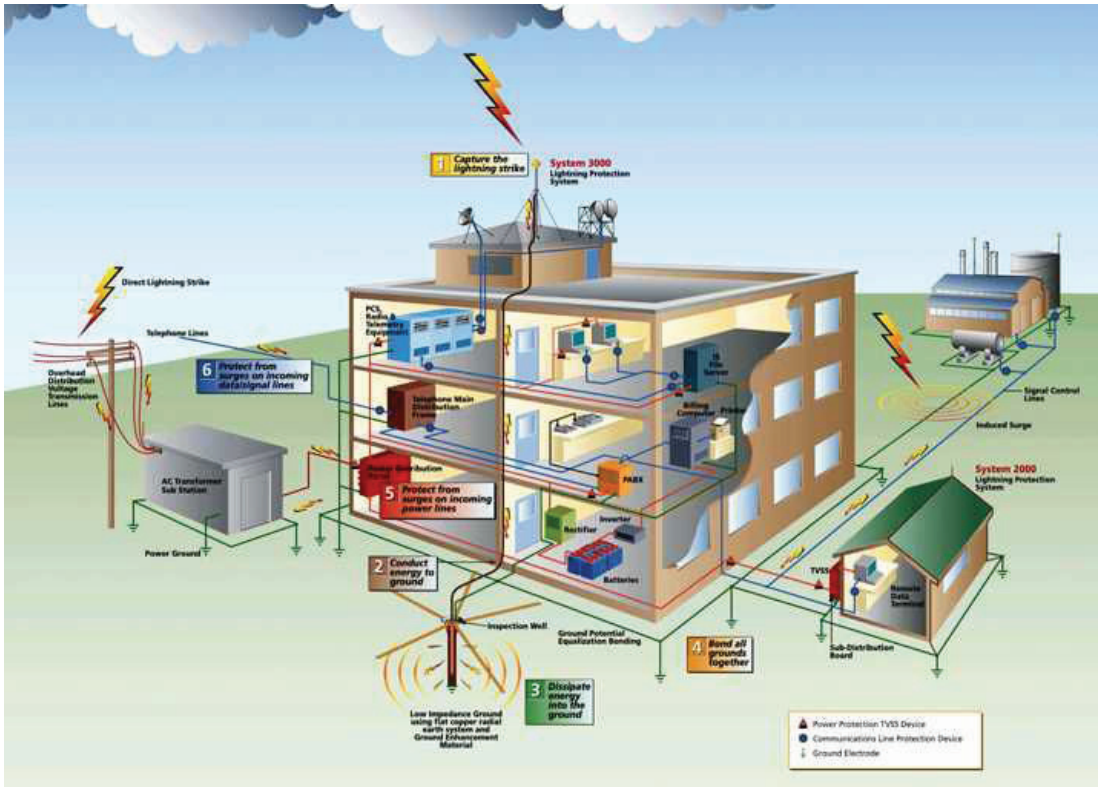

Fig. 7.2 : Lines for Protection Against Lightening

(b) If during work on electric line, an electrical storm should approach so close that there appears a likelihood of a direct lightening stroke to the line the employees concerned shall descend from the towers or poles and shall keep clear of them until the danger has passed.

7.4.4 The following general safety precautions shall be observed by all the employees:

(a) When any apparatus is not known to be adequately earthed, it shall be treated alive,

(b) Short circuiting of a circuit by a strap alone is not a safeguard until the short-circuiting strap is properly earthed.

(c) Even though lines or other electrical equipment may have been isolated, they may be rendered dangerous due to induced voltage from neighboring circuits and therefore, they shall not be touched until the regular earthing procedure has been carried out.

(d) Earthing of one conductor does not render the other conductors safe for work. All phases shall be earthed even if the work is to be carried out only on the one phase.

(e) Never, assume, because a circuit has been made dead, isolated and earthed on poles or towers with more than one circuit upon which work is being carried out, that any other circuit on the same pole or tower must necessarily be dead also.

(f) No earthing switch on high or extra high voltage apparatus shall be operated or temporary earth connections to such apparatus detached or removed except under the instruction of the authorized persons.

(g) Employee shall not touch any conductor from which protective earths have been removed.

(h) While shifting the ladder in the switchyard special care shall be taken and the same should be shifted horizontally to avoid any contact with the live part.

(i) Earthing rods should be of adequate current and voltage withstanding capacity as per the requirement of the system.

(j) The point of connection of earthing rod should be tightly fixed with the solid earthing ground.

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SECTION 8

HANDLING AND STORAGE OF MATERIAL AND EQUIPMENT

8.1 HOUSE KEEPING

Workmen are frequently injured by tripping, stumbling, stepping on, or bumping into tools, material and other objects left lying around, or by carelessly placed objects falling from above.

To ensure good housekeeping (Refer figure 8.1) following precautions should be observed:

(a) Walks, aisles, stairways, fire escape and all other passageways shall be kept clear of all obstructions.

(b) Tools and materials should not be placed where they may cause tripping stumbling hazards or where they may fall and strike anyone below.

(c) Puddles of oil and water create a slipping hazard and should be cleaned up promptly.

(d) Nails in boards, such as those removed from scaffolds, frames and packing boxes constitute a hazard and should be removed. The boards should be carefully stacked or stored.

(e) Dirty and oily waste rages should be deposited in approved containers and disposed off as soon as possible to avoid fire hazards.

(f) Broken light bulbs, glass metal and scrap and other sharp objects should be dumped in places on containers provided specially for them.

(g) Discarded fluorescent and other gas filled tubes should be disposed off safely.

Fig. 8.1 : House Keeping

8.2 MANUAL HANDLING, CARRYING, PILING ETC.

The workmen shall be trained in safe methods of handling. They shall avoid:

(a) Lifting with back

(b) Lifting too quickly or with a jerk

(c) Lifting while in a awkward position or with a poor footing

(d) Handling loads which are too heavy or loads which obstruct vision

(e) Handling loads with sharp edges or corrosive material without the use of protective clothing and equipment.

8.2.2 (a) Material stored in quantity should be arranged so that the weight is evenly distributed and not too heavy.

(b) All stacks and piles should be protected against overturning or other movements.

(c) Lime, Cement and other heavy material required supports of unusual strength and shall not be stored in buildings unless the supports are designed for additional weight.

(d) Barrels, drums and keys should be stored on end or securely blocked to prevent rolling.

(e) Gas cylinders should be properly piled. One type of cylinders should be separated from another type. These should be always handled with safety cap mounted on the valve. Unloading should be done one by one and not dropped in any case.

(f) Transport contractors should also be made to abide by these rules.

8.3 MECHANICAL HANDLING OF MATERIAL AND EQUIPMENT

8.3.1 Suitable hoisting apparatus shall be employed for lifting and handling of loads (Refer figure 8.2).

Fig. 8.2 : Mechanical Handling Equipment

8.3.2 Slings for hoisting and other purposes may be made of chains, wire ropes, or fibre ropes of sufficient strength to carry the loads, Fibre rope slings, especially if of relatively larger diameter, may contain invisible internal defects. More-over fibre rope cannot withstand the rough usage and the abuse to which the sling are often subjected. Chain slings may have invisible fractures or internal defects resulting in sudden failure without warning. Incipient failure of wire rope is easily detected by broken wires. As such, wire rope strings are preferable to fibre rope or chain slings.

8.3.3 All slings except endless slings, shall be provided with rings, shackles, links, hooks or eyes of proper size so that they can be safely suspended.

8.3.4 JE shall ensure that the workmen are trained in the fundamentals of handling rigging equipment (e.g. proper use of knots, ties and hitches. safe methods of hooking and slinging) and informed of the common faults connected therewith.

8.3.5 Hoisting or sling chains are liable to break suddenly without warning. These shall be withdrawn from use whenever:

(a) The chains are reported/considered as unsafe due to overloading or through faulty or improper annealing.

(b) The chains have stretched more than 5 percent of their original length.

8.3.6 Wire ropes shall be removed from service whenever their strength is effected by marked corrosion or by broken wires and wear as follow:

(a) 6 by 7 wire rope: 12 percent on a length of 50 cm

(b) 6 by 19 wire rope: 20 percent on a length of 50 cm.

(c) 6 by 37 wire rope: 25 percent on a length of 50 cm.

(d) 6 by 61 wire rope: 25 percent on a length of 50 cm.

(e) Cables with strands of triangular sections: 15 percent on a length of one meter.

8.3.7 Stress bearing parts of the hoisting apparatus shall be:

(a) Examined and tested by an Authorized person before item is put to service.

(b) Examined for loose parts or defects by the operators each day on which they are in use.

(c) Examined once a week by the JE in charge.

(d) Inspected by an Authorized person at least once every twelve months (in the case of chains, ropes and lifting tackle once in every six months). Results of such inspections shall be recorded in a register to be maintained for this purpose.

8.3.8 Following general precautions shall be observed:

(a) Only Authorized Persons shall operate power-operated cranes.

(b) A permit to work shall be obtained before doing any work on power-operated cranes, lifting tackle on or near overhead crane tracks.

(c) Riding on hoist, hooks loads etc. shall not be permitted. No employees shall climb on to any crane rail or on to and crane which is under operation, without the knowledge of crane driver.

(d) Hoisting of leads at an angle shall not be permitted. Loads shall not, as far as far as possible, be carried over persons or moving machinery. No employee shall unnecessarily go under or remain under any load, which is under suspension form a crane or a hoist. Specifically care shall be taken by the operator to avoid swinging of load during long travel and cross travel motion of the crane with the hoisted load.

(e) Operators shall not leave the hoisting apparatus with load suspended.

(f) In case the power goes off, the crane driver shall immediately switch all controllers in off position until the power is available again.

(g) When work is to be done on a crane track effective measures shall be taken to ensure that the crane doe not approach within six meter of the place where work is being done.

(h) Chains shall be free from kinks, knots and twists, when in use.

(i) Rope used in blocks and tackle shall be of the type and size of which is sheaves are designed.

(j) Wire rope slings when hooked by a spliced eye shall not be used singly, as the rope is likely to untwist thus allowing the splices to open and slip. Wire rope slings shall always be used double and where sharp corners or rough castings exist the strings shall be protected by pads.

(k) Wire ropes shall be treated periodically with suitable lubricants free from acids or alkalis.

(l) Heat shall not be applied to fibre ropes as this dries out the internal oil and thus shortens the life of the rope.

(m) Fiber rope shall not be allowed to come in contact with acids, acid fumes, oil or other destructive chemicals.

(n) All legs of a multi-leg sling shall be loaded evenly.

(o) Splicing broken chain by wiring links together by inserting bolts between links or passing one link through another and by inserting a nail or bolt shall be prohibited.

8.4 HANDLING AND STORAGE OF POLES

8.4.1 General precautions-The following general precautions shall be observed:-

(a) Only methods, tools and equipments approved by the Control Engineer shall be used in pole handling operations.

(b) When pole are handled mechanically:-

(i) Hoisting equipment operators shall accept signals only from employees specifically designated and/or authorized therefore:

(ii) Employees and equipment shall be placed so as to minimize the danger of injury or damage, should a pole or poles get out of control:

(iii) Employees shall not stand nor pass under a suspended load, and

(iv) Employees shall not ride pole trailers.

(c) Poles shall be stored on elevated ways, using sleepers between each layer, where necessary to make the pile stable, having each layer securely chocked or tied.

8.4.2 Loading and Transporting poles on Trucks, Trailers and the following precautions shall be observed:

(a) Trailer and wheels shall be securely braked and/or blocked before loading.

(b) While loading a pole, employees shall not stand between the pole pile and the loading or transporting equipment.

(c) When a pole is being rolled from the pile or from the ground to trailer or it shall be done with a line and can"t hook.

(d) When poles are loaded on a flat bed battens, bolsters or sleepers shall be used beneath the bottom layer.

(e) Bolster type loads shall be loaded in pyramidal fashion, each succeeding layer containing one less pole until pay load or a peak of one pole is reached. Each layer shall be securely nested on the one below.

(f) When using bolsters with hocks, each layer above the bottom layer shall be secured with straps, tie wire or other approved means, except the top pole which shall be held in place by the overall tie chain.

(g) When loading a delly, the first pole in the load shall be loaded with the tope in the direction of the tongue and shall extend for enough ahead of the rest of the load to permit the lashing of the tongue and attachment of the towing device to it.

(h) Where necessary, approved type binders and boisler strakes shall be used in securing a load to a pole dolly.

(i) Towing devices and chains used with pole dollies shall be of approved type.

(j) Pole dollies shall not be loaded in excess of registered allowable weight.

(k) When hauling poles of over (15.24 meters) in length, a second bolster shall not be used on top of the first layer of poles.

(l) Trucks shall be loaded in such a manner that there are no dangerous projections and the load shall be firmly secured to make it safe for transport.

8.4.3 Unloading poles from trucks, trailers and dollies-The following precautions shall be observed for unloading poles from trucks, trailers and dollies:-

(a) Poles shall be unloaded from trucks, trailers and dollies by the following methods as circumstances and traffic conditions may permit.

  (i) By means of a book, mobile-type crane or skids;

  (ii) By snaking poles from the end of a load;

  (iii) By lowering of poles with lines only where conditions require this method.

(b) When unloading poles which have been secured with the tie wire or straps, only the binding for the laying being unloaded shall be removed.

(c) When rolling a pole from a load, a bull line or lines shall be used to control its descent. Dropping poles over the side of a truck, trailer or dolly shall be prohibited.

(d) When unloading poles with skids or lines, the load binders and bolster stakes shall not be removed until the skids or lines are in place, and the load binders shall be removed from the side opposite the unloading side when possible.

(e) Dumping an entire load from a dolly or trailer shall be prohibited.

(f) Employees shall not stand on the unloading side of transporting equipment while unloading a pole.

8.5 HANDLING & STORAGE OF CHEMICALS

8.5.1 Persons authorized to handle chemicals & gases shall have a reasonable knowledge of the properties of the same, the possible hazards preventive and the first aid treatment connected therewith.

8.5.2 All employees handling chemicals (Refer figure 8.3) shall be provided with suitable protective clothing, eye shields and safe handling equipment and the officer-incharge of the work shall ensure that

(a) These are stored in the vicinity of areas where chemicals are stores/or used.

(b) These are used by the person engaged on handling of chemicals.

Fig. 8.3 : Handling & Storage of Chemicals

8.5.3 Repairs and examination of plant connected with utilization of chemicals shall be done under a permit to work.

8.5.4 No food, drink, tobacco, pan or similar article shall be stores or consumed in or consumed in or around the area where chemicals are stored or used. Workmen shall be instructed on the dangers arising from testing of chemicals or of the use of any vessel connected therewith for drinking purposes.

8.5.5 All chemical processes shall be carried out in well ventilated locations.

8.5.6 Acids are liable to cause irritation of the throat and burning of skin and are good conductors or electricity.

Essential precautions connected with the chemicals are:-

(a) Storage under air tight conditions.

(b) Extra caution in their use near live apparatus.

(c) Prohibition of smoking and open flames in the vicinity of these chemicals, (some acids when in contact with metals create explosive mixtures).

(d) Availability of plentiful supply of water and arrangements for treatment of chemical burns at the site of their use.

(e) For making solutions, slowly addition of acid to distilled water (never add water to acid).

(f) Prohibition of absorbing spilled acid with saw dust waste cloth or other organic material, it shall always be flushed out with water or neutralized with chalk or lime.

8.5.7 Volatile solvents & Naphtha etc are generally flammable and give out dangerous fumes. Essential precautions connected with these are:-

(a) Smoking or use of open flamer shall be prohibited in the vicinity of their storage and use.

(b) Use of portable electric hand lamps and tools unless of intrinsically safe type, shall be prohibited in the vicinity of their storage and use.

(c) Use of cleaning solvents in the form of jet or spray shall be undertaken only when absolutely necessary. This operation shall be carried out only under a Permit to work.

8.6 STORAGE AND HANDLING OF EXPLOSIVES

8.6.1 All persons concerned with storage and handling of explosives (Refer figure 8.4) shall have a thorough knowledge of Indian Explosives Act 1884 and there rules made there under for sale working.

Fig. 8.4 : Handling of Explosion

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SECTION 9

TRANSPORTATION AND AUTOMOTIVE EQUIPMENT

9.1 GENERAL PRECAUTION

These General instructions pertaining to Transport vehicles are subject to statutory provisions of Traffic Rules.

9.1.1 No person shall drive a vehicle belonging to the PTCUL unless he has a proper license and is duly authorized.

9.1.2 Every driver of a vehicle shall familiarize himself and comply with the traffic and other relevant laws prevailing in the area, where he operates. He shall be liable to the disciplinary action for any willful violation thereof.

9.1.3 Before operating any vehicle, the driver shall make sure that it is in a proper operating condition as follows:

(a) Test brakes, steering gear, clutch, tie rod, horn and lights.

(b) See that stepney and the tyres are in good condition and properly inflated.

(c) Check emergency equipment, e.g. First Aid Kit, Jack and tools.

(d) Ensure that requisite quantities of Petrol, lubricating oil and water are available in

(e) Check the electrolyte level in battery cells and add distilled water to make up, if necessary.

9.1.4 Drivers shall test the head and tail lights before undertaking night driving. They shall not undertake driving until these are in order.

9.1.5 The tyres of a vehicle shall be periodically interchanged to ensure uniform wear.

9.1.6 All vehicles shall be inspected by an authorized person at least every six months and the reports of such inspections shall be entered in a register to be maintained for this purpose.

9.1.7 If any defect is found by the Inspecting officer, it shall be reported to the officer-in-charge immediately, and the vehicle shall not be operated until the defect has been set right.

9.1.8 Before filling the petrol tank, the engine shall be shut off. The hose nozzle shall be kept in contact with the tank to avoid static sparks.

9.1.9 Smoking and use of open flames, while filling petrol tanks of the vehicles shall not be permitted near the vehicle.

9.1.10 “Left-hand-drive‟ vehicles shall have these words written and displayed conspicuously on the back.

9.1.11 All loaded trucks, or trucks towing trailers carrying loads projecting beyond the rear end of the body shall carry red flags of approved type and size when driving during day time and red lights placed at extreme ends of the loads or trailers at night.

9.1.12 Whenever a cable reel trailer is hauled by the truck, the brake cable shall be used. Care shall be taken to see that the cable plug is properly inserted with relation to contact position and depth.

9.1.13 While driving the vehicle, the driver shall be attentive to any extraneous sounds or noises in the vehicle. He shall stop the vehicle and investigate the cause for any such sounds before he proceeds further.

9.1.14 Drivers shall not drive vehicles while feeling fatigued, exhausted, ill, and sleepy or while in a drunken state.

9.1.15 All drivers should be medically examined periodically and they should be trained in first aid.

9.2 OPERATION OF AUTOMOTIVE EQUIPMENT

9.2.1 When loading or unloading vehicles, the emergency brakes shall be set and the wheels blocked.

9.2.2 Equipment materials and tools carried on vehicles shall be properly secured and arranged so as not to obstruct the view of the driver or to interfere with his giving traffic signals.

9.2.3 Vehicle shall be operated within prescribed speed limits. The speed shall be reasonably reduced, where necessary, due to bad weather, poor visibility, heavy traffic and the conditions of the road and the driver.

9.2.4 Drivers shall keep at a safe distance from vehicles in front. They shall not attempt to overtake any vehicle unless they can see far enough to be sure of passing safely and until the horn signal given for this purpose has been accepted by driver of the vehicle in front.

9.2.5 Drivers shall not attempt to pass other vehicles on curves, grades, street intersections or such other places where tile view of other vehicle is obstructed.

9.2.6 No vehicle shall be driven past school buses that are loading or disembarking children.

9.2.7 Drivers shall dim lights when meeting other vehicles when blinded by glaring headlights they shall slow down and, if necessary, stop until the vehicle has crossed.

9.2.8 When fire department vehicles/ambulances/police patrols are heard/observed coming from any direction, vehicles shall be stopped at a safe place until these vehicles have passed.

9.2.9 When proceeding down grade the clutch shall not be disengaged. The engine shall be throttled.

9.2.10 When approaching railway crossing and road intersections, drivers shall slow down speed and see that no train/vehicle is approaching, and if approaching be prepared to stop.

9.2.11 On slippery road, drivers shall keep a safe distance from vehicles in front to enable them to make a stop within safe limits, leaving the vehicle in gear and applying the brakes until speed has been retarded sufficiently to disengage the clutch without danger of skidding.

9.2.12 Driver shall anticipate the intentions of other drivers and pedestrians and shall give clear signal of their intentions regarding stopping or turning. He will make allowance for lack of skill/improper attitude on the part of other drivers, pedestrians, children and animals.

9.2.13 When moving vehicles in reverse direction under poor visibility or on hilly or congested roads, drivers shall employ a signalman.

9.2.14 Horns shall be used only when necessary. Use of horn just near the object is dangerous and shall be avoided.

9.2.15 Doors, tailgates, or parts of load of a vehicle shall not be kept dangling when the vehicle in motion.

9.2.16 Number of persons in a vehicle shall not exceed the number of seats actually provided.

9.2.17 The movement of vehicles should be avoided / restricted over cable trenches.

9.3 OPERATION OF TOWER WAGONS, VEHICLES BOOMS LADDERS AND LIFTS

9.3.1 Drivers of vehicles equipped with booms used for setting or removing poles, truck mounted ladders, mechanical or hydraulic lifts, hole diggers or similar equipment shall not drive with such equipment in an elevated or partially elevated position:

9.3.2 Proper precautions shall be taken at all times to prevent contact with overhead lines, trees or structures.

9.3.3 “Men at work” signs shall be placed around the tower wagon at a safe distance (Refer figure 9.1).

Fig. 9.1 : Men at Work

9.4 TRANSPORTATION OF MATERIAL

9.4.1 In transporting material, particular care shall be exercised to see that material will not shift or fall off the vehicle and loading of the vehicle shall not exceed the prescribed limit. .

9.4.2 Live line equipments shall be transported and remain in special portable containers designed for their transportation in a manner, which prevents mechanical damage and provides protection from the weather.

9.5 TRANSPORTATION OF PERSONNEL

9.5.1 Number of employees carried in a vehicle shall not exceed the prescribed limit. Persons, other than the employees shall not be allowed to use the PTCUL’s vehicle.

9.5.2 The employees shall keep their body parts inside the vehicle and shall not sit on the outside projections of the vehicle when in motion.

9.5.3 The employees shall not enter or leave the vehicle when it is in motion.

9.5.4 The employee shall not ride on a load of poles or pole trailers or on vehicles along with material if the same creates hazard to the employee.

9.5.5 Vehicle fully loaded with personnel shall not be started or stopped suddenly with a jerk except under emergency conditions.

9.6 PARKING

9.6.1 Vehicles shall be parked on proper side of the street (Refer figure 9.2), highway so as not to interfere with traffic, bridges, road curves, culverts and intersections shall be avoided for parking.

Fig. 9.2 : Parking

9.6.2 When parking on a grade, place vehicle in gear, Set hand brakes, turn wheel to curb, and block the vehicle so that it cannot accidentally roll. Leave the gears in reverse for downgrade and in the first for upgrade.

9.6.3 When parking along a highway at night lights shall be left on, but dimmed, if any work is to be done, flares shall be set at opposite ends to warn drivers so as to be visible from minimum 150 meters.

9.6.4 When parking on the highway near another vehicle on the opposite side of the road, sufficient clearance shall be kept between the two vehicles.

9.6.5 Before leaving a parked vehicle drivers shall remove the ignition key to prevent theft or authorized starting of the same.

9.6.6 Before changing tyres or making any other repairs along the highway, the drivers shall put off the vehicle to the side of the road at a safe distance from the running traffic.

9.6.7 Trailers shall not be left parked alongside the road.

9.6.8 When leaving or entering parked vehicles, curb side doors shall be used. If using the doors open on road side, care shall be taken to ensure that no vehicles are in the rear.

9.6.9 Before starting a parked vehicle, the driver shall observe the front and the rear to ensure that there are not persons or objects in the way.

9.7 MAINTENANCE OF AUTOMOTIVE EQUIPMENT

9.7.1 Repair garages shall be maintained according to the provisions of Section 10 of this manual.

9.7.2 Each vehicle shall be equipped with an approved set of tools and first aid kit and the driver shall be trained for their use.

9.7.3 When vehicles are raised for working underneath, they shall be held by sufficiently strong fixed supports, or when jacks are used, sufficient wooden packing/blocks shall be used.

9.8 PROCEDURE IN TRAFFIC ACCIDENT

9.8.1 Drivers shall not get involved in an argument as to who was responsible for the accident but endeavor to get all the facts in the case.

9.8.2 The following instructions shall be observed by drivers in the case of accidents:

(a) Stop the vehicle.

(b) Do hot leave the scene of accident without stopping to identify yourself and render such assistance as may be possible.

(c) Render first aid and send for the doctor and ambulance, if necessary.

(d) When requested, give your name/address and show your driving License to other party.

(e) Secure name, address and License number of the other driver, vehicle license number and names and address of the vehicle owner, witnesses and the insurance company.

(f) Unless some police officer is available at the scene of accident, notify police station having jurisdiction in the territory.

(g) Sketch the location showing position of vehicles or pedestrians involved and any special condition such as obstructions, parked cars, skid marks.

(h) Record date, time, weather and road conditions and any other information, which you may consider useful

(i) Submit a detailed report to your superior.

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SECTION 10

WORKSHOPS AND GARRAGES

10.1 GENERAL PRECAUTIONS

10.1.1 Workshops and garages shall be properly ventilated and have adequate natural or artificial lighting or both suitable for the operations and type of the work performed.

10.1.2 All machines driven by individual motors shall be grounded. Suitable guards shall be provided at the point of operations on all tools. Guards shall not be removed except when the machine is stationary for the purpose of repairs or adjustments. On completion of repairs, adjustments, the guards shall be immediately replaced.

10.1.3 Electrically drive portable tool shall have 3 wire extensions and 3 ways plugs and outlets, one of which shall connect the non-current carrying parts of the tools to earth. Tools provided with 2 way outlets shall be appropriately earthed before use.

10.1.4 Every machine shall have a brush conveniently placed for the operator to brush shavings or bits of metal etc. from the machine.

10.1.5 Chain hoists and other power lifting devices shall be provided to lift heavy objects to the operating tables of the machine.

10.1.6 Only competent person shall operate/repair any machine.

10.1.7 Generally remember the following “Don’ts”.

(a) Don’t attend to machines or fans when in motion.

(b) Don’t use wrenches, which do not fit the nuts or bolts heads properly.

(c) Don’t clean hands with cutting oil or compound.

(d) Don’t use blowtorches in pits in the garages.

(e) Don’t use compressed air to clean clothing.

(f) Don’t compressed air against any person for any reason.

10.1.8 Operators shall check the machines and tools before use to ensure that the same are without any defect.

10.1.9 All machines and equipment shall be inspected by an Authorized person periodically, at least once in six months. Reports of all such inspections shall be maintained in a register.

10.2 GRINDER WHEELS

10.2.1 Suitable protection hood shall be provided on all grinders and the operators shall wear suitable eye protection when performing grinding operations.

10.2.2 Wheels used in wet grinding shall not be left standing in water - the water soaked portion may throw the wheels out of balance.

10.2.3 When changing grinding stones check that the rated speed or the stone is suited to the speed of the motor

10.3 TOOLS

10.3.1 All tools and accessories shall be properly kept arranged near respective machines to ensure ready availability.

10.3.2 Employee shall use proper tools suitable for each job.

10.3.3 Tools shall be kept in good order and machine tools shall be kept properly sharpened.

10.3.4 All files shall be fitted with proper handles. The file shall never be used as a prey or as drift pin or as a hammer.

10.4 WELDING BURNING AND CUTTING.

10.4.1 The following general precautions shall be taken in all welding, burning and cutting operations (Refer Figure 10.1).

(a) All places where welding, cutting or burning operations are carried out shall be well-ventilated. Where considerable work is involved exhaust system shall be installed to carry away harmful toxic gases. If brass, bronze, zinc or galvanized or lead coated material is to be welded, brazed out a suitable respirator shall be worn particularly if the exhaust system is not installed.

(b) Welding or cutting or burning shall not be done in the immediate proximity of transformer rooms, inflammable material or explosive gases or dusty atmospheres, When the work cannot be moved suitable barriers shall be erected and a suitable fire extinguisher should be in place.

(c) Welders and their helpers shall wear suitable goggles or helmets and gauntlets and use suitable shields during welding, burning or cutting operations.

(d) Welders and their helpers shall wear clothing free from grease, oil petroleum or any other inflammable material.

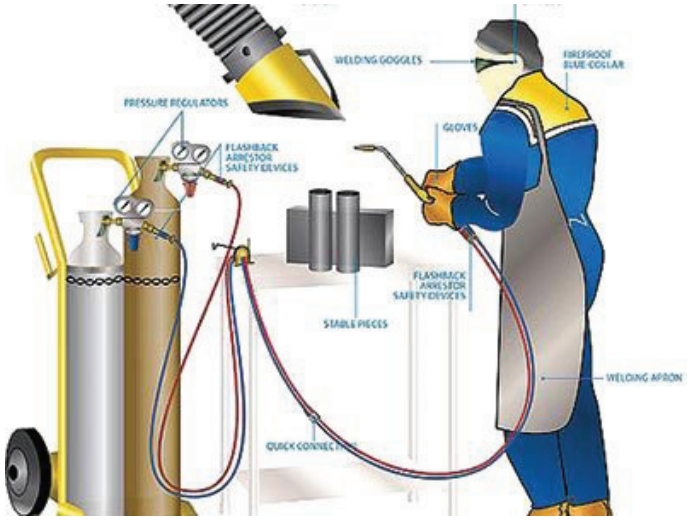

Fig. 10.1 : Welding Burning and Cutting

(e) When welding, cutting or burning at an elevation, suitable precautions shall be taken to safeguard persons properly at lower levels from rays, welding flames, sparks etc.

(f) Before welding containers used for storage of flammable material, the same shall be washed with hot water and soda and thoroughly ventilated.

10.4.2 The following additional precautions shall be taken in the electrical welding operations:

(a) All connections shall be waterproof and shall be checked before welding is started and frequent inspections shall be made during welding operations.

(b) Goggles suitable for gas welding are not a sufficient protection for electric welding. Operators shall use the goggles recommended by manufacturers for the work in hand.

(c) When the welding operations are not in progress, the main circuit switch shall be kept open.

(d) Alternating current is dangerous even at low voltage therefore:

(i) Avoid personal contact with the electrode or live parts of the electric welding equipments.

(ii) Prevent accidental contact of the electrode with ground or the near by metallic objects.

(iii) When passing the electrode through doors, etc., the main switch shall be kept open.

(e) After the valve cap has been removed and before the regulator is attached. The operator shall see that the adjusting screw of the regulator is released. Oxygen shall not be permitted to enter the regulator suddenly. The cylinder valve shall be opened slowly.

(f) In case pressure in the oxygen cylinder is so low as to create likelihood of the acetylene gas flowing back into the oxygen cylinder, it shall not be used.

(g) All painted surfaces shall be properly scrapped before using the torch.

(h) Always use gas lighter to light the torch.

(i) Acetylene gas at pressure above 1.054 Kg/cm² shall not be used and it shall not be transferred from one container to another.

(j) The special wrench provided by the manufacturer must be in position on the valve steam while the cylinder is in use so that the gas may be turned off quickly in case of an emergency.

(k) Torches and tips of proper sizes for the work in hand shall always be used. For fixing of the tips and the pressure applicable under various conditions, reference shall be made to the tables published by the manufacturers.

(l) Only copper or brass wire shall be used to clean the tips.

(m) Oxygen and acetylene cylinders or containers shall not be permitted in small places or compartments were welding operations are in progress.

(n) Gas Cylinders shall be kept away from stoves, furnaces and other sources of heat. Smoking near the gas cylinders in prohibited.

(o) Flammable construction and/or material near the oxy-acetylene flames shall be adequately protected and a fire extinguisher shall be kept at hand when working in such situations.

(p) Hoses, cylinder valves, connections, gangs etc. shall be kept free from grease, oil, white load, graphite, dust or dirt. These shall not be handled with oily greasy hands or gloves.

(q) Cylinder valves shall be lubricated only with glycerin.

(r) Sparks and flames shall be kept away from the hose. Hoses shall be inspected frequently to ensure that these are not damaged in any way.

(s) When testing for leaks, only soap water shall be used.

(t) The gas cylinder shall not be allowed to be dropped or struck by other objects. Caps shall be screwed firmly on cylinder valves when the same are being moved or are not in use.

(u) Gas cylinders shall not be handled by cranes except in specially constructed cradles or containers.

(v) Leaking cylinders shall be moved to open air immediately and disposed off in a manner as to prevent any possibility of the gas getting ignited.

(w) When a welder is working in a place from which escape may be difficult, a helper shall always be at hand to shut off gas in case of an accident.

(x) Before the regulator is removed from the cylinder, ensure that all gas from the regulator is removed.

10.4.3 The following precautions shall be taken in respect of the gas welding equipment

(a) Cylinders containing oxygen and those containing acetylene shall be stored separately preferably in separate bui1dings or separated by fire resistant partitions) dry, well- ventilated places, away from oil, petroleum, grease or other flammable liquids, gases or material and where they can not fall or be otherwise damaged. The cylinders shall not be exposed to the heat of the stoves, radiators or furnaces or allowed to come into contact with electric wires or ground wires of electrical equipment. If not stored in buildings, the cylinders shall be protected from snow and ice and from direct rays of the sun, i.e. where high temperatures prevail.

(b) If a cylinder valve or any other part of the gas welding or cutting equipment should freeze, it should be thawed out with warm water having a temperature of 52ºC or less. Open flames shall never be used for this purpose.

(c) Cylinders shall be used in the order in which received. Discharged cylinders shall be marked empty and shall be handled with the same care as loaded cylinder. Loaded and empty cylinders shall be kept in separate places.

(d) All cylinders shall be fitted with pressure relief devices, high pressure gauge to indicate the pressure on the torch. The oxygen regulator connection shall have a right hand thread. The fuel gas regulator shall have a left hand thread so that they can not be interchanged.

(e) Each pressure regulator shall be equipped with a safety relief device which shall relieve the pressure from the low pressure gauges and the diaphragm, In case, the regulator seat shall develop a leak or an excess pressure is otherwise built up. In case safety device blow, these shall not be inserted by operator.

(f) The hose shall be specially designed for use on cutting or welding operations. Oxygen hose shall be of high pressure green rubber, and acetylene hose shall be of high pressure red rubber. Special care shall be taken to avoid interchange of oxygen and acetylene hoses. The hoses shall be taped or clamped together at 90 cm intervals

(g) New hose shall be thoroughly cleaned on the interior before attaching to torch. Since the manufacturers dust inside of the hose with fine talc, compressed air shall never be used to clean the hoses, as it may contain oil from the compressor. Oxygen shall be used to clean acetylene hoses.

(h) Armour covered or wires wrapped hose shall never be used to connect torches and tanks.

(i) Pressure from oxygen supply shall not be used for cleaning clogged oil lines.

10.5 PAINTING OF EQUIPMENT

10.5.1 The following precautions shall be observed while painting on or near electrical equipment:

(a) Only competent person shall be allowed to undertake painting work on or near electrical equipment.

(b) Only competent person shall be allowed to undertake painting under a permit to work.

10.5.2 Painting jobs near live electrical apparatus shall be carried out under a permit-to-work.

(a) All electrical apparatus which is likely to produce sparks in the vicinity of the place where painting is to be done shall be made dead.

(b) Smoking shall not be permitted within 7.5 meters in indoor spray painting operations.

(c) When spray painting is to be carried out in enclosed places, the workmen shall wear clothing which fit snugly at the ankles, neck and wrists and shall wear gloves, goggles and respirators.

10.5.3 Hints regarding painting of sub-station equipments.

(a) Aluminum paint has superior lasting quality for metal exposed to the sun and shall be preferably used on all painted metal surfaces on outdoor equipment of substation.

(b) Self-cooled transformers exposed to the sun shall preferably be painted aluminum. Other colours may be used where to fit into an established colour scheme.

(c) Water cooled or forced-oil-cooled transformers, where heat gets dissipated by convection, can be painted any colour that fits the colour scheme or general surroundings.

10.6 OIL TESTS & PURIFICATION:

10.6.1 Insulating oil used in transformers, oil circuit breakers and high voltage bushings are affected by moisture and oxidation. The maintenance thereof shall be carried out in accordance with I.S. 1866, Indian Standards Code of practice for maintenance of insulating oils. These oils shall be subjected to following periodic tests:

(a) Dielectric Test: The tests shall be performed at least once annually or more frequently as required, in accordance with the method described in Appendix E of I.S. 335, Specification for Insulation Oil for transformer, and switchgear (low viscosity type). Oil shall withstand a test voltage of at least 30KV for one minute without breakdown.

(b) Acidity Test: Acidity is proportional to the amount of oxygen absorbed by the oil and it is estimated that 0.0056 Cubic meters oxygen absorbed per 4.546 liters of oil will cause an acidity of about 0.5 milligram of KOH which is the approximate neutralization number at which slugging is assumed to start.

10.6.2 A representative sample shall be drawn according to the method described below:

(i) Samples of oil should be drawn from transformers while the oil is warm. In the absence of special sampling devices, such as are sometimes fitted to large transformers, a sample is usually taken from the drain cock as described below, and will, in general, be representative of the bulk, Sampling of oil from conservators of large transformers may also be necessary, since these containers are subject to water contamination.

(ii) Samples taken on site are frequently found to be contaminated owing to inadequate cleaning of the sampling cock. It is essential that the outlet be first thoroughly cleaned externally and

then wiped with a clean material reasonable free loose fiber (such as thin smooth paper) followed by a similar material soaked in clean oil. Finally the outlet should be flushed by drawing off a sufficient quantity of oil to ensure that the sample obtained is representative of the oil at the bottom of the tank. When a sample cannot be run direct into the sampling bottle, it is recommended that the oil should be run into a clean dry enameled jug. With outdoor transformers, care must be taken to avoid contamination of the sample by dust, rain or moisture, for example from thick mist. Care should also be taken to avoid, contamination by contact with the operator's hand. Touching the inside of a receptacle with a damp hand or wiping round with the apparently clean dry cloth can seriously reduce the breakdown figure of a sample of good oil.

(iii) Sampling tubes and bottles should be rinsed with clean oil after use, and stored in a suitable dust free container. When required for use the bottle or tube should be rinsed with the first sample drawn. When necessary, glass vessel should be cleaned by treatment with chromic acid solution, oily vessel being first cleaned with petroleum sprit a warm oven and cooled. The stopper of vessel should be washed with distilled water, drained sample bottles having once been placed in position should not be removed until the sample of oil are ready to be transferred into them. Any material liable to leave fibre in the sampling vessels should not be used for cleaning.

(iv) Stoppered glass bottles of one liter size are recommended for samples of oil for electric strength tests, but is satisfactory to use 250 ml. Samples jars fitted with suitable screw caps, preferably lined with metal foil for samples for acidity or flash point test. Tests should be carried out as soon as possible after drawing a sample. If the sample is kept for a considerable length of time, it should, during such storage, be protected from strong light.

10.6.3 The electrodes and the test cap shall be wiped clean with dry calandered (glossy) tissue paper or with a clean dry chamois skin and thoroughly rinsed with oil free dry benzene until they are entirely free from fibers.

10.7 AIR COMPRESSORS AND RECEIVERS:

10.7.1 The following precautions shall be observed in operation and maintenance of air compressors:

(a) Unloaders on air compressors shall be maintained in good condition.

(b) Air compressor cylinders shall be lubricated with approved type of oil and precautions shall be taken to avoid carryover of oil to intercoolers, after coolers, receivers and other parts of the system.

(c) Where air compressor cylinders are equipped with water-cooling jackets, a visible indication of water flow shall be provided.

(d) Air intake compressors shall be located at a place where the air is pure and clean. These shall not be located in 'the vicinity of flammable or toxic gases or fumes.

(e) Unless exemption is granted by the competent authority, an oil separator shall be installed at a convenient point between the compressor and the air receiver

(f) When starting an air compressor, the drain cocks on the compressor cylinders and the pipe leading to the air receiver shall be open.

(g) Compressor valves shall be inspected frequently and regularly and when air compressors are used regularly or frequently safety valves and oil separators shall be cleaned at least once a week.

(h) No cleaning agent other than that specified by the manufacturer of the compressors shall be introduced into cylinder and connected piping

10.7.2 The following precautions shall be observed in connection with air receiver:

(a) No receiver shall be installed without a pressure gauge and a relief or safety valve, so proportioned and adjusted that the pressure will never exceed the maximum allowable working pressure of the tank by more than 6%. The manufacturer"s test pressure and normal working pressure shall be clearly indicated by panting in bold letters on each side of the receiver.

(b) The air receiver shall be equipped at the lowest point possible with automatic drain taps or with valves which shall be opened daily for relieving the vessels of dirt moisture and oil accumulated at the bottom.

(c) The air receiver shall be cleaned of oil, carbon and other foreign substances periodically at least every two months.

(d) When operating under dusty conditions the relief valve shall be checked at least every month.

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SECTION 11

FIRE PREVENTION AND FIRE FIGHTING

11.1 FIRE FIGHTING SERVICES AND FIRE ESCAPES

These instructions pertaining to Fire Prevention and Fire Fighting are subject to statutory rules on the subject:

11.1.1 The Fire Officer shall carry out the following functions:

(a) Developing and executing, in collaboration with appropriate authorities, programme for maintenance of adequate fire services, training of personnel etc

(b) Inspection and testing of fire fighting equipment and furnishing technical guidance to the JEs and other personnel in the maintenance of such equipment.

(c) Technical guidance for installing fire protection system at the time of Erection/ Commissioning of new grids/Slab-stations and construction of multi storied buildings etc.

(d) Holding fire drills periodically.

(e) Supervising fire fighting in case of fires, where possible.

(f) Collection, analysis and presentation of reports on fire accidents.

(g) Will associate in all fire related jobs in the undertaking.

11.1.2 The fire officer shall maintain adequate fire fighting equipment and fire alarm system at important situations. Framed plans showing the position of fire fighting equipment, water supplies and hydrants, means of access and other useful information shall be displayed at suitable points.

11.1.3 The Fire Officer shall ensure that in all premises, where persons are required to work, adequate means of fire escape are available.

11.2 TRAINING IN FIRE FIGHTING

11.2.1 The Fire Officer shall arrange periodic classes to ensure that all its regular employees are trainees to be familiar with the following:

(a) Common fire hazards, techniques of fire prevention and fire fighting

(b) Use of various types of fire safety equipment.

(c) Location of exits and fire fighting equipment.

(d) Precautions against electric shock and inhalation of toxic gases.

(e) Operations to be carried out in case of fire involving electrical equipment or in the vicinity thereof.

(f) Observation of unusual suspicious conditions, e.g. overheating of apparatus.

11.2.2 Training in fire fighting may include class room lectures, group discussions; circulation of accident statistics, fire drills and demonstration of fire fighting appliances, reporting fire, operation of fire alarm, response to alarm etc.

11.2.3 The fire drills shall be held without notice under the supervision of an authorized person and all employees on the premises shall participate in the drill.

11.3 FIRE INSPECTIONS

11.3.1 The Fire Officer shall inspect:

(i) The fire fighting equipment to insure its adequacy and effectiveness;

(ii) Oil drains, gravel pits, etc to ensure that these are kept clean at all times;

(iii) Fire escapes to ensure that all fire doors and shutters and their hardware (including fusible links, if any) are kept in good condition;

(iv) Premises, stores, etc to ensure that the fire hazards due to bad housekeeping, improper storage of inflammable material are eliminated.

11.3.2 Fire fighting procedure

(i) As soon as a person discovers a fire he shall immediately turn the alarm and intimate the control room or the JE maintenance, as the case may be, giving exact information as to the location, type and event of fire. He shall then proceed to extinguish or control the fire with proper extinguishing apparatus until help arrives. If he is not certain as to the action to be taken, he shall just wait.

(ii) In case of a fire involving electrical apparatus, the first essential is to render till circuit dead. Where it is not possible to switch off the current the fire must be attacked in a way, which will not involve danger to the operator, i.e. by the use of non-conducting extinguishing material, i.e. carbon dioxide, Dry Chemical Powder, dry sand, ashes, etc. Water should not be used on fires involving electrical equipment.

(iii) When extinguishing a fire known to have been started through an electrical fault, the current most, in any event shall be switched off to avoid-ignition.

(iv) The operator in the control room after receiving the fire alarm shall inform immediately his immediate superior officer and the security officer, the nearest available fire fighting squad and the local fire brigade giving the exact information regarding the location type and extent of fire, it will, however be the endeavor of the station staff to control the fire.

(v) The following principles shall be kept in view, in fighting fire:

(a) To extinguish fire, it is necessary to eliminate one or more of the following three factors causing fire:

(i) **Heat** : is eliminated by cooling, water is a good heat absorber.

(ii) **Oxygen** : is eliminated by smothering and exclusion of air.

(iii) **Fuel** : is eliminated by segregation, cooling or smothering.

(b) The person in-charge shall size up, the situation, plan and direct the line of attack.

(c) Precautions shall be taken to prevent the spread of fire to adjoining buildings, plant and material not affected, by use of segregate on methods, water streams to break

that waves, etc. Tarpaulins shall be thrown on unaffected plants and material to prevent damage by water.

(d) Ventilation shall be arranged to let smoke out and fire fighters in.

(e) Extinguishers or hose line streams shall not be directed into the clouds of smoke. Base of the fire shall be located and attacked.

(f) In the events of the clothes of a fire catching fire" he shall cover his face with palms of the hands and roll himself on the ground or he shall lie down and cover himself with a blanket.

11.3.3 Fire fighters and rescue workers should use suitable protective equipment or gas masks, wet cloth, etc. They should crawl on their hands and knees to keep their faces close to the floor and they should move along the wall.

11.3.4 The first aid personnel shall be arranged to be available at site of fires for rescue and first aid work.

11.3.5 All fires shall be reported on prescribed form.

11.4 PRECAUTIONS FOR PREVENTION OF FIRE

11.4.1 Fires are broadly classified in the following categories, based on the kind of combustible involved (Refer figure 11.1).

(a) Class A: Ordinary material, e.g. wood, paper, textile and rubbish

(b) Class B: Flammable liquids, e.g. oils and greases.

(c) Class C: Live electrical equipment.

Fig. 11.1 : Precautions for prevention of Fire

11.4.2 Precautions relating to common type of class "A" fires are as follows:

(a) Glowing cigarette butts and matches shall not be thrown into waste buckets, oil regimes or other places of fires hazard.

(b) Smoking and use of open flames shall be prohibited in oil filtration and storage room storage battery rooms and places where combustible material is kept.

(c) High standard of cleanliness shall be maintained waste material, oily waste or rags, etc. shall be removed from the premises daily and suitable disposed of

(d) Trees and rank vegetation shall not be permitted to grow in the neighborhood of receiving stations/sub-stations, pole yards or other buildings, Roofs/buildings shall be kept clear of leaves, etc.

(e) Before starting welding and cutting operations, it shall be ensured that sparks arising there from do not lodge in woodwork or ignite other combustible material in the area.

(f) While installing heating devices, hot water pipes, suitable clearance from the combustible material shall be maintained.

11.4.3 Precautions relating to common type of class B fires are as follows:

(a) Cable trenches inside stations containing cables shall be filled with sand or pebbles or covered with non-inflammable slabs.

(b) Oil filled containers and equipment in Receiving stations, sub-stations, buildings, store rooms etc. shall be so located that fire and smoke from oil is not likely to do any damage.

(c) Concrete dikes, curbs or floor drains and loose rock filled pits shall be provided near oil storage rooms and oil filled equipment to prevent spread of spilled oil.

(d) Empty oil drums, boxes or other combustible material shall never be piled near storage oil tanks and oil filled equipment.

(e) Petroleum containers shall be labeled and kept securely stappered.

(f) When a vehicle is re-fuelled or petrol transferred from one container to another, no smoking or open flames shall be permitted in the vicinity.

(g) Places where paints, varnishes, lacquers, thinners, etc. are stored or used shall be kept scrupulously clean and well ventilated.

11.4.4 Precautions relating to common type of Class “C’ Fires are as follows:

(a) Electrical equipment shall be installed, operated and maintained properly and in a manner as to eliminate arcs due to poor contacts in switches and fittings, worn insulation, crossed wires, opening of switches carrying large current, etc.

(b) Leakage on and/or overloading of circuits with consequent heating up of wiring must be guarded against.

(c) Motors shall be equipped with over-current and under voltage protection to prevent excessive heating.

(d) Insulation strength of the equipment and cables shall be checked periodically.

(e) Temperature and loading conditions of the equipments shall be recorded and studied.

(f) Electric lamps shall not be surrounded by or laid on combustible material.

(g) Battery rooms shall have no loose connections and there shall be no sparking devices, e.g. bell, buzzers, relays, fuses or switches in the room. Smoking shall be prohibited and rubbish and other combustible shall not be permitted to accumulate in the battery room.

(h) Metal parts of oil tanks, electrical equipment and buildings shall be adequately bonded to prevent fires by lightning and static electricity. The earth resistance shall be checked periodically.

(i) Flammable gases or material shall not be stored near electrical equipment.

11.5 FIRE FIGHTING APPLIANCES

11.5.1 Broadly, types of extinguishers suited for the three classes of fires are as follows (Refer figure 11.2).

Fig. 11.2 : Fire Fighting Appliances

11.5.2 In unattended sub-station, switch room etc., where occurrences of a fire way prevent access, it is essential that sufficient numbers of portable fire fighting appliances are provided outside the place, e.g., lobby"s instance cases.

11.5.3 Even if premises are equipped with an automatic sprinkler installation, it is also necessary to have portable fire extinguishers, as these may enable an outbreak to be extinguished before the automatic sprinkler comes into operation.

11.5.4 Portable foam, Co2 or water fire fighting equipment is intended for non-electrical fires and shall not be used on electrical apparatus fires unless such apparatus has been made dead.

11.5.5 The employees shall familiarize themselves with the fire fighting apparatus installed in the various sections of the receiving station sub-stations and their use.

11.5.6 Fire Officer shall ensure the refilling of Fire Extinguisher through the rate contract.

11.5.7 Fire Officer shall approve the design of fire safety system for new set up of grid sub-stations, office buildings, stores etc.

11.6 FIRE RISK AREAS

(a) Transformers

(b) Battery Room

(c) Cable Gallaries

(d) Control Room

(e) Store room

(f) Fuel Storage Room

11.7 FIRE HAZARDS AND THEIR CAUSES

(a) Electrical short circuit, earth fault, overheating in electrical circuits and electrical contact getting stack up.

(b) Smoking in No smoking area.

(c) Hot surface or excessive heating due to friction or lack of cooling.

(d) Gas cutting, welding, splatters.

(e) Bad housekeeping

(f) Leakage of inflammable gas or liquid.

(g) Accumulation of static charges.

(h) Open storage of combustible material or their storage near a heat source.

(i) Addition or modification to the plant and building.

(j) Addition or modification to the plant or building.

(k) Inaccessibility or obstruction of fire protection equipment.

(l) Poor standard or maintenance of fire protection system.

11.8 MAINTENANCE OF FIRE EXTINGUISHER:

1. Weigh the appliance and compare results with the previous reading (Refer figure 11.3).

Fig. 11.3 : Fire Extinguisher

2. Empty the extinguisher and dismantle it in accordance with the correct safety procedure and Examine contents.

3. Examine the inside of the extinguisher body and check for the absence of corrosion.

4. If tests gas cartridge operation, weigh the cartridge and check this against the weight marked on it, there is more than 10% difference, replace the cartridge.

5. Ensure that vent hole in the cap is clear.
6. Examine the nozzle and discharge tube. Don't grease or oil the operating mechanism, which should be freely operatable.
7. Rebuild the fire extinguisher using new component where necessary.
8. Refit the safety clip to prevent in advertent operation.
9. Record all dates and date of overhauling. This type of maintenance procedure will give maximum availability.

11.9 FIXED INSTALLATION:

This installation is provided where the fire risk is sufficiently high to warrant the cost of installation. Such equipment will always be supplemented by held portable gear and may, in many instances, come into operation automatically.

(a) **Hose Reels** : Possible with automatic action for use in offices and workshops.

(b) **Hydrant System** : For general use throughout plant area.

(c) **Sprinkler System** : Dry of wet for conveyor belts.

(d) **Mulsifire System** : Used for Transformers.

(e) CO2 installations used in closed areas, i.e. switchgear rooms, cable galleries and control room etc.

(f) Mechanical foam used in fuel oil storage protection.

(g) Halogen agent systems used in computer suites, control room, cable galleries and L.T. switchgear areas.

All such equipment needs regular checking and maintenance.

Type of Extinguisher	CLASS A	CLASS B	CLASS C
Carbon Di-Oxide	Suitable for small surface fires only	Suitable. Does not leave residue or affect equipment or food stuff	Suitable. Non conductor and does not damage Equipment
Dry Chemical	Suitable for small surface fires only	Suitable. Chemical releases smothering gas and fog and shields operating liquid	Suitable. Chemical is a non conductor Dry Chemical shields operator from heat
Water	Suitable. Water saturates material and prevents re-Kindling	Unsuitable. Water will spread and will not put it Out	Unsuitable. Water being conductor should not be used on live electrical equipments.
Vaporizing	Suitable for small surface fires only	Suitable. Releases heavy Smothering	Suitable. Non-conductor and will not damage.

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SECTION 12

FIRST AID

12.1 GENERAL

First aid means what one should do to reduce the suffering of the patient after an accident until the doctor arrives. It may give life to a dying person.

12.2 FIRST AID INSTRUCTIONS

1. Remove the patient from the source of accident or remove the cause of injury.
2. Keep the injured person lying down in a comfortable position, his head in level with his body. This is prevention against fainting. Never pick him up by head and heel.
3. Severe hemorrhage must received immediate attention, no matter what other injuries are present.
4. If the breathing has ceased, immediate measures must be taken to restore it. The patient should be in a position to breath freely.
5. If the patient has received burns attend to them.
6. When the patient has fractured a bone, no attempt must be made to move the patient until the bone has been rendered as much immovable as practicable unless life is in danger from some other cause.
7. Treat the patient for shock.
8. Send for medical help or ambulance immediately.

Fig. 12.1 : First Aid

9. Never given water or liquid to an unconscious patient.
10. Keep by standers away from the patient.
11. Don't let the patient see his own injury.
12. Keep the patient warm. Avid overzealous application of external application of external heat, but maintain normal body temperature.
13. Air should not be blocked in place where the patient has been kept.

12.3 EXTERNAL HAEMORRAHAGE (BLEEDING)

Bleeding wounds should be treated as follows:

1. Elevate the bleeding part except in the case of a fractured limb.
2. Immediately apply pressure with the thumb or fingers directly on the bleeding spot and if wound is large or a foreign body or a fracture is suspected, apply pressure on a "Pressure Point" as near as possible to the wound on the heart side where the artery can be pressed against the underlying bone.
3. Clean the wound and apply antiseptic all over the wound and the surrounding skin and cover with a dry dressing. Cover the dressing with cotton wool, lint, etc. and apply a bandage over the dressing.

12.4 PRESSURE POINTS

Six principal pressure points where hand or finger pressure against a bone may stop arterial bleeding are located as follows:

1. In the neck at the side of the windpipe against the backbone. Pressure in this area may produce unconsciousness or ever more serious effect. Hence it should be employed only as a last resort.
2. Just in front of the ear against the skull.
3. About an inch forward from the angle of the jaw where a large branch crosses the jawbone. The above three points control arteries to head and neck.
4. Behind the inner end of the collarbone down against the first rib.
5. One body side of the upper arm, half way between the shoulder & arms
6. In the mid groin, as it passes over the pelvic bone. This pressure point controls arteries to lower limbs.

12.5 INTERNAL HAMORRAGHGE:

12.5.1 Bleeding from lungs: Symptoms

(a) If the bleeding is from the lungs the blood will be bright red and frothy arid will be coughed out. (If the bleeding is from the stomach, the blood will be brownish and is vomited.

(b) Send for the doctor at once, if not possible to move the patient to the dispensary or hospital immediately.

(c) Keep the patient lying on this back as flat as possible. Turn the head to one side for vomiting and coughing.

(b) If the seat of the hemorrhage is known, apply an ice bag of a cold compress over the region.

(d) Give nothing by mount, except in case of hemorrhage from the lungs when ice may be given.

(e) Use encouraging words to the patient.

12.6 NOSE BLEEDING

(a) Have the patient sit up with his head thrown slightly back and breathing through the mouth. Loosen his collar and anything tight around his neck.

(b) Apply cold water over the nose and also the spine at the level of the collar.

(c) Warn the patient not to blow his nose.

(d) If these measures do not stop the bleeding in a few minutes, a doctor is needed at once. Meanwhile gently pack a narrow strip of sterilized gauze back into the nostril leaving the end outside so that it can be easily removed.

12.7 PHYSICAL SHOCK

12.7.1 Condition : Shock (Refer figure 12.2) is a condition of sudden depression of the nervous system resulting from and occurring after every case of accident or sudden illness. It may vary from the slight feeling of faintness to a condition of collapse in which the vital forces of body are so exhausted that death may result.

12.7.2 Symptoms : Symptoms of shock are pallow of face and lips, cold moist skin, rapid and weak pulse, shallow and irregular breathing, fall of the body temperature, nausea and vomiting may often occur.

Fig. 12.2 : Physical shock

12.7.3 Treatment (Immediate):

(a) Arrest severe hemorrhage, if present:

(b) Keep the patient lying on back with head low and turned to one side.

(c) Loosen clothing about the neck, chest and waist and ensure free circulation of air.

(d) Cover with rugs or coats.

(e) Raise well the lower limbs

(f) Apply smelling salts to the nose except on the case of head injury.

(g) Use encouraging words to the patient.

(h) Ensure freedom from excitement and worry and avoid unnecessary questioning of patient.

(i) Remove the patient to shelter in an airy place.

12.7.8 Treatment (on arrival at shelter)

1. Wrap the patient in blanket and apply hot water bottles to the sides of the body between the legs and to the feet. To much heat can be dangerous. Always test temperature of heated objects against your own face or wrist before you wrap them in cloth or a paper.

2. If the patient is able to swallow, give freely hot strong tea or coffee with plenty of sugar, except when injury to an internal organ is present or suspected. Do not pour fluids down the throat of unconscious person. Avoid alcoholic stimulants.

12.8 FAINTING

1. Lower patient's head between knees loosen tight clothing around neck. If impossible to lower victim's head, elevate his lower limbs and keep him lying down until recovery seems assured. If unconsciousness persists cover patient, call for a doctor.

2. Sprinkle the face with hot and cold water alternately, and apply warmth to the pit of the stomach and over heart. Vigorous rubbing of the limbs upwards has a stimulating effect. Smelling salts may be held to the nose.

12.9 SUN STROKE AND HEAT STROKE:

1. Sun stroke and heat stroke have the same symptoms but the cause may be slight;" different. Sun stroke results from excessive direct exposure to the sun's rays, while heat stroke results from excessive indoor such as in boiler rooms.

2. Symptoms : Red and flushed face, hot and dry skin, no sweating, rapid and strong pulse, very high temperature, headache and usually unconsciousness.

12.9.1 Treatment: Send for a doctor immediately, lay victim with head elevated. Sponge body with cold water continuously and apply ice bags to head and spine until symptoms subside. When consciousness returns, patient may be given Epsom or Glauber salt with water. Give cold water abundantly.

12.9.2 Heat exhaustion:

1. **Cause** : Heat exhaustion (Refer figure 12.3) is caused by direct exposure to sun's rays or by excessive in door heat.

2. **Symptoms** : Pale face, cool skin, profuse sweating, weak pulse, low temperature and fainting

3. **Treatment** : Keep patient's head low, give salt water, coffee or tea may also be given. External heat is required in severe cases.

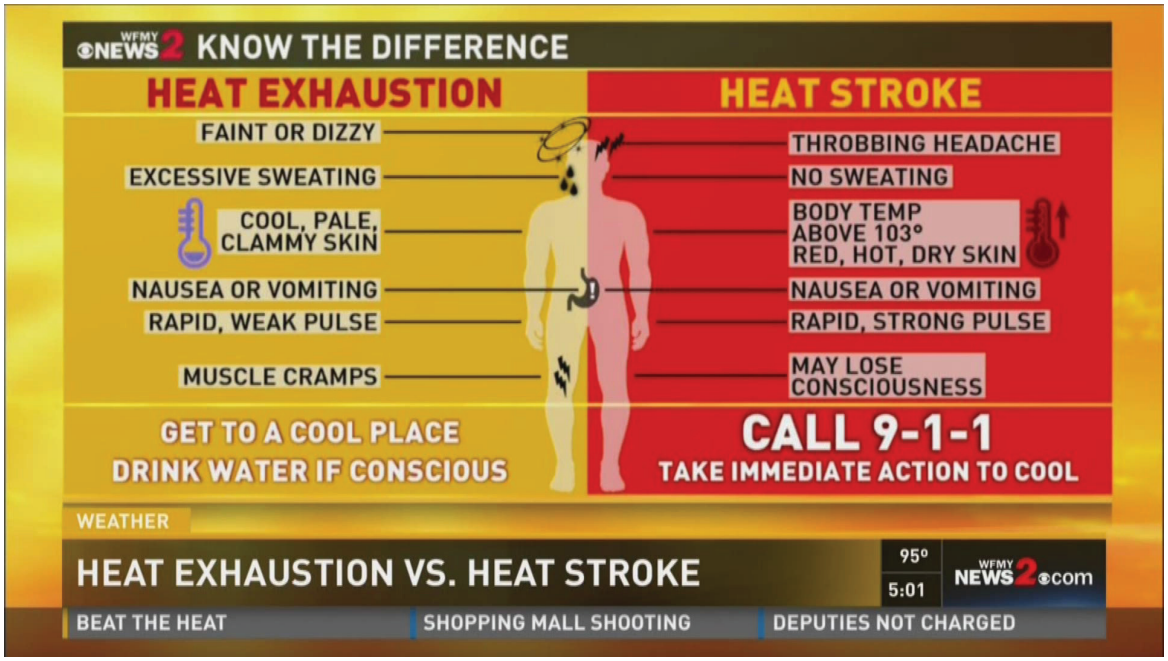


Fig. 12.3 : Heat Exhaustion

12.10 FRACTURES

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

12.11 TRANSPORTATION OF PATIENT

Don't hurry in moving a injured patient. Always be careful in handling and transporting an injured person. Improper or careless methods frequently increase the severity of injury and may even cause death. Acquaint yourselves with the various methods of carrying and transportation.

12.13 BURNS

Burns (Refer figure 12.4) are caused by heat of any kind, friction and chemicals such as acids and alkalis. Burns are classified according to degree as follows:

(a) First Degree: Skin reddened.

(b) Second Degree: Skin blistered.

(c) Third Degree: Deeper destruction of tissues such as charring.

12.14 ELECTRICAL BURNS

Two kinds of electrical burns occur:

(a) When current passes through the body burning or destroying of tissues as it goes, it makes a deep third degree burn which may be smaller on surface than below, and slow to heal.

(b) Flash burns of the skin are not usually and are first or second degree. Flash burns of the eye may not show up until sometime later. In first aid to flash burns of the eye, light should be excluded by using a moist compress held lightly instead of a bandage.

(c) Eye burn should get a doctor's attention as soon as possible.

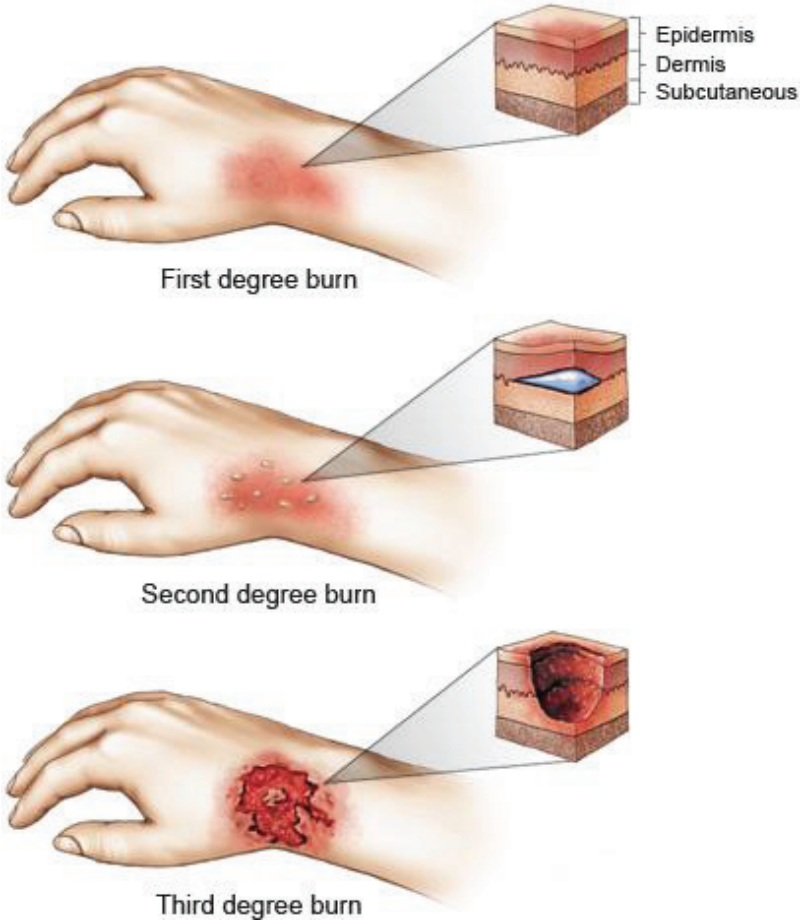


Fig. 12.4 : Hand Burn

(d) First-aider"s duties are to relieve pain, prevent infection and treat for shock. Death in a day or two, after a burn, is usually the result of shock. Death later is chiefly the result of infection.

(e) For burns of limited extent, apply Vaseline or burn ointment over the burnt area. Cover ointment with a layer or two, of fine mesh gauze and secure with a roller bandage. Take the patient to a doctor for further treatment.

(f) Extensive burns may be much more serious. Shock is always present. Keep victim laying down with his head low and avoid exposure or cold. Leave his clothing on, cover him with blankets and get him to a hospital as quickly as you can.

If hospital is not near by, remove all loose clothing from the burnt area unless it sticks to skin.

Cut the adhering cloth around the burn and leave the remaining for the doctor to remove.

Do not break blisters. Dip strips of clean freshly laundered sheeting into a solution of baking soda or salt in warm water, and apply to burnt area.

Chemical Burns: Burns caused by an acid or alkali should be washed immediately with large quantity of water until chemical is thoroughly washed away. Then apply an ointment dressing and send for medical help.

12.15 EYE INJURY

1. Loose particles may be removed using corner of clean bandage or handkerchief. If the particle can not be removed easily, relieve irritation with a few drops of olive oil/castor oil and consult a doctor immediately.

2. If a foreign particle is imbedded in the eye ball, do not try to remove it. Drop castor/medical paraffin oil over the eye ball, close the two eye lids, apply a soft pad of cotton wool and secure it by a bandage till the medical aid is made available.

3. When quick lime, acid or alkali falls into the eye, wash freely with the fresh water and consult a doctor immediately.

12.16 SPRAINS AND STRAINS:

SPRAINS: These are very common injuries caused by abnormal twisting of a joint or movement of a joint beyond range. It causes tearing or stretching of the tissues around the joint. It causes pain, swelling and discoloration of the joint.

Treatment:

(a) Place the limb in the most comfortable position and prevent any movement.

(b) Apply a firm and approved bandage for the limb.

(c) Wet the bandage with cold water and consult a doctor.

12.17 STRAINS

These are the injuries to muscles or tendons caused by overstretching or overexertion.

Treatment :

(a) Advice the patient to take complete rest in a comfortable position.

(b) Apply heat and massage gently.

12.18 BRUISHES

A bruise is caused by a blow which breaks the small block vessel in the tissue under the skin. Ice or cloth wrung out of very cold water should be applied immediately. It helps to prevent discoloration, keeps down swelling and relieves pain.

12.19 TREATMENT OF ELECTRIC SHOCK

12.19.1 General

1. Act at once -delay is Fatal

2. Death from Electric shock is rarely instantaneous.

3. Heat Fibrillations (Heart Muscle Tremors) persist as long as 30 minutes after an Electric Shock. Therefore life can be saved by immediate Artificial Respiration.

4. Send for but never wait for a doctor.

5. Continue Artificial Respiration for four hours after apparent death.

12.19.2 Release from contact:

Switch off current immediately or send someone to do so. Do not attempt to remove a person

from contact with high voltage unless suitable articles insulated for the system voltage are used for this purpose. When attempting to force a person from contact with low or medium voltage, use rubber gloves, boots, mat or insulated stick, but if these are not available, use a loop of rope, cap or coat to drag the person free. Whatever is used should be dry and non-conducting.

After Release:

As soon as the victim is clear of the conductor, rapidly feel with your finger in his mouth and throat, and remove any foreign matter (tobacco, false teeth etc.). Then bring artificial respiration. Do not stop to loosen the victim's clothing, as every moment of delay is serious.

"KEEP PATIENT WARM"

Artificial Respiration

The various methods of artificial respiration usually adopted is a arm left back pressure method which is considered to be the best, being the most effective, easy to teach and fairly easy to perform

(a) **Arm Left Back Pressure Method**

The victim lies prone with both arms folded and hand resting, one on the other, under his head. The arms are grasped above the elbow and lifted until firm resistance is met. This above the elbow and lifted until firm resistance is met. This induces active inspiration. Then they are let down and pressure applied on the back to cause active expiration. The movement in this method follows the sequence given below:

Position 1 : Place victim prone (i.e. face down) with his arms folded with one palm on the other and cheek resting on them. Kneel on one or both knees at victim"s head. Place your hands on the victim's back beyond the line of armpits, with your fingers the spread outwards and downwards, the thumb just touching each other.

Position 2 : Then gently rock forward keeping arms straight until they re nearly vertical thus steadily pressing the victim's back. This completes expiration.

Position 3 : Synchronizing the above movement, rock backwards, releasing pressure and slide your hands, downwards along the victim's arms and grasp his upper arms just above the elbows. Continue to rock backwards.

Position 4 : As your rock back, gently raise and pull the victim's arms and move your hands up for initial position.

(b) **Pole-Top Method;**

When a person received electric shock it is most important that the artificial respiration is started without any loss of time. The victim of the shock will be hanging by his safety belt and the rescuer ascends the pole, support the victim astride his own safety belt and rhythmically compresses the victim"s abdomen with both hands while he is being lowered to the ground. He is then changed on to one of the more effective methods. Several case of successful operation of this method has reported. The need for not waiting any time whatsoever in starting artificial respiration cannot, therefore, be over emphasized.

(c) **Mouth To Mouth Method** :

1. Place victim on his back. Place his head slightly downhill, if possible. A folded coat under victim"s shoulders will help maintain proper position. Tilt head back, so that the chin points straight upward

2. Grasp victim's jaw and raise it upward until lower teeth are higher than upper teeth, or place fingers on both sides of jaw near ear lobes and pull upward. Maintain jaw position throughout resuscitation period to prevent tongue from blocking air passage.

3. Take a deep breath and place your mouth over victim’s mouth making airtight contact. Pinch the victim’s nose, shut, with thumb and forefinger or close nostrils by pressing your cheek against them.

THINGS TO REMEMBER:

(A) If air can not be blown in, check position of victim‟s head and jaw and recheck mouth for obstructions, then try again more forcefully. If chest still does not rise turn victim‟s face down and strike sharply to dislodge obstructions.

(B) Sometimes air enters victim‟s stomach, evidenced by swelling of stomach. Expel air by gently pressing down on stomach during exhalation period.

Fig. 12.5 : Fire Fighting

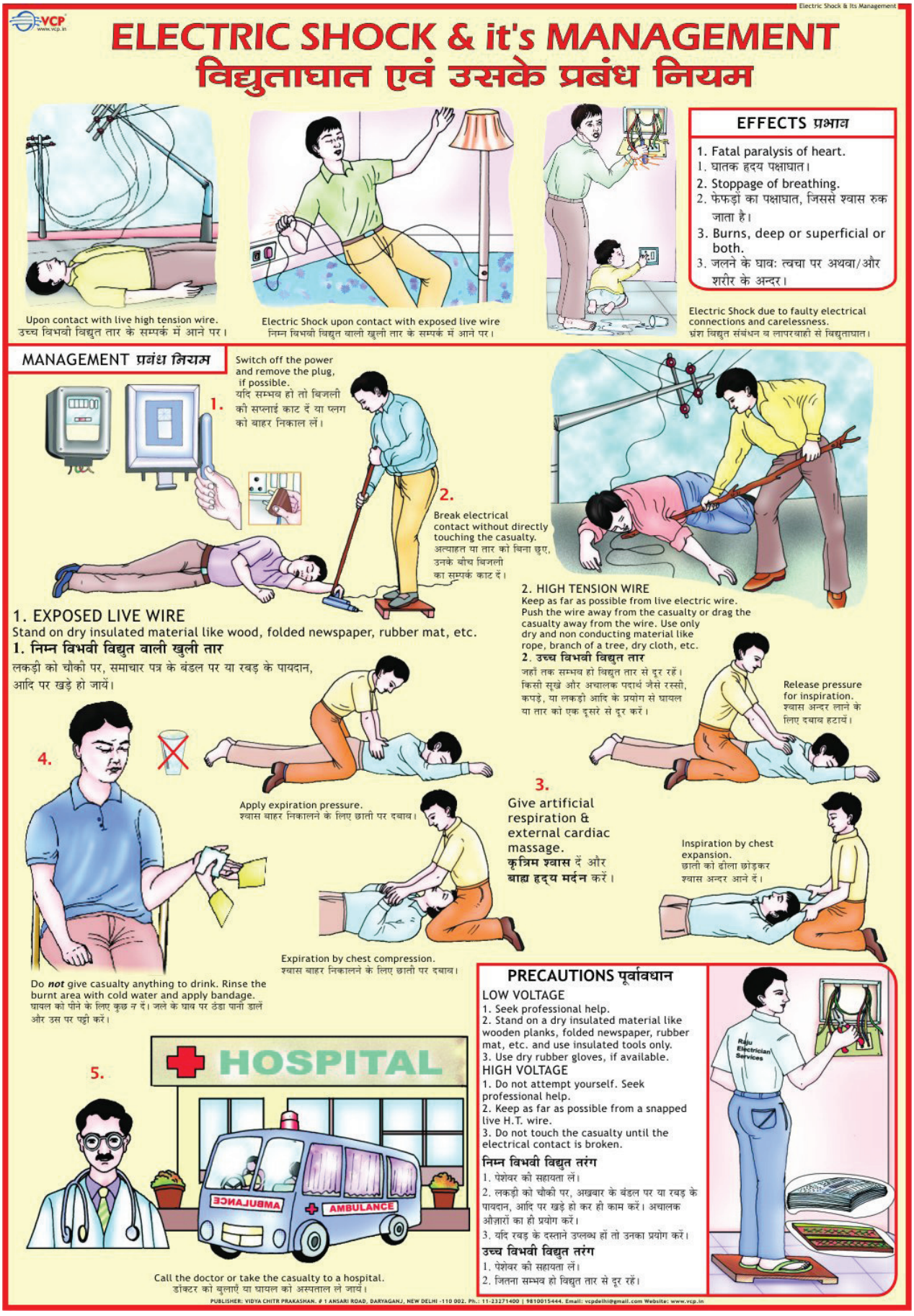
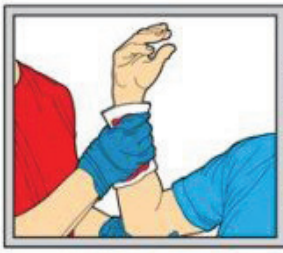


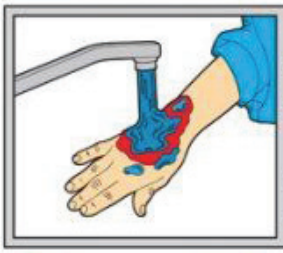
Fig. 12.6 : Electric Shocks & Its Management

FIRST AID



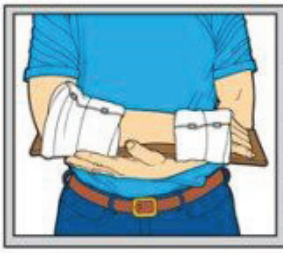
BLEEDING

- **Apply direct pressure** to the wound using a sterile gauze pad or clean cloth.
- **Elevate the injured area** above the level of the heart if there is no fracture.
- **Cover the dressing with a pressure bandage**. If bleeding does not stop apply additional dressings.
- If necessary, apply pressure to the artery with your hand.



BURNS

- **Stop the burning**. Remove the person from the source of the burn.
- **Cool the burn**. Hold burned area under cool (not cold or icy) running water or immerse for 10 to 15 minutes. Use cool compresses if water is unavailable.
- **Cover the burn**. Cover burn with non-adhesive sterile bandage or clean cloth.
- **Prevent shock**. Lay the person down and elevate the legs.

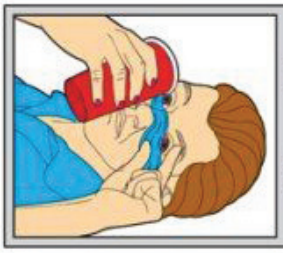


FRACTURES

- **Help the person support the injured area**. Stop any bleeding by applying pressure with sterile bandage or clean cloth.
- Check for feeling, warmth and color below fracture.
- **Immobilize the injured area**. Apply a soft or hard splint above and below the fracture.
- **Apply ice or cold packs** and elevate.
- **Treat for shock**. Lay the person down and elevate the legs.

SPRAINS

- **Rest the ankle or injured area.**
- **Apply ice or cold packs** (wrap in cloth or put cloth under to protect the skin).
- **Compress by lightly wrapping an elastic bandage** around the injured area.
- **Elevate the injured area** above heart level to reduce swelling.

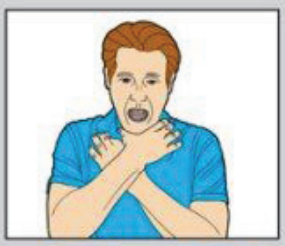


EYE INJURIES

- **Don't rub the eye.**
- For a foreign particle such as dirt, sand, or sliver of wood or metal have the person **pull the upper lid down and blink repeatedly**.
- **Flush the eye with water.**
- For any chemicals in the eyes immediately **wash the eyes with lots of water.**

SHOCK

- **Help the person lie down** on his or her back.
- **Elevate the feet about 12 inches.** If raising the feet causes pain or further injury, keep him or her flat.
- **Check for signs of breathing, coughing, or movement**, and if absent begin CPR.
- **Keep the person warm and comfortable.**
- Turn the person on his or her side to prevent choking if the person vomits or bleeds from the mouth.



CHOKING

Signs of choking

- The person has hands clutching his or her throat, unable to breathe or talk; or skin, lips, and nails are turning blue.

Perform abdominal thrusts (Heimlich maneuver)

- Stand behind the person. Wrap your arms around the waist.
- Make a fist with one hand. Position it slightly above the person's navel.
- Grab the fist with the other hand. Press hard into the abdomen with a quick inward and upward thrust.
- Perform 5 abdominal thrusts. (Heimlich maneuver)
- If you are alone, perform abdominal thrusts before calling 911. If two people are available, one can call for help while the other performs first aid.
- If the person becomes unconscious, perform CPR.

Clear the airway of obese person or pregnant woman

- Place your hands a little higher than normal.
- Proceed as with the Heimlich maneuver, shoving your fist inward and upward quickly
- Repeat abdominal thrusts until the blockage is dislodged. If the person becomes unconscious, perform CPR.

CPR

- Check to see if the person is conscious or unconscious.
- If the person doesn't respond and you are alone first call 911, then begin CPR. I two people are available, one should call 911 and the other begin CPR.

Compressions - Begin compressions

- If face down, put the person on his or her back while supporting the head, neck, and back.
- Place the heel of one hand over the person's breastbone. Place the other hand on top of the first hand. Keep your elbows straight.
- Using your upper body push straight down compressing the chest to about 2 inches. Push hard at a rate of 100 compressions per minute.

Airway - Clear the airway

- If trained for CPR, after 30 compressions, open the person's airway your by placing your palm on the person's forehead and gently tilt the head back. With the other hand gently lift the chin forward to open the airway.
- Check for normal breathing, chest motion, and listen for normal breathe sounds.

Breathing - Breathe for the person

- Pinch the nostrils and cover the person's mouth with yours.
- Give the first rescue breath and watch to see if the chest rises.If it does rise give the second breath . If the chest doesn't rise, repeat the head tilt, chin-tilt. and give the second breath.
- Resume chest compressions.
- Continue CPR until there are signs of movement or emergency personnel take over.

Fig. 12.7 : Fire Aid Tips

Power Transmission Corporation of Uttarakhand Limited

SECTION 13

FORESTRY WORK

13.1 GENERAL PRECAUTIONS

13.1.1 Before cutting any tree or large branches, the owner of the tree/trees connected, shall be notified to enable him to take charge of the cuttings.

13.1.2 Before any forestry work, requiring erection for barriers and danger notice on the roads is undertaken on the trees growing on the side of a highway or public road, the person in-charge of roads shall be notified in advance.

13.1.3 To enable removal of all branches or trees which are likely to interfere with the lines, the periodical inspection of these trees and installations shall be carried out.

13.1.4 The public shall be protected against hazards of tree trimming along public, street and highways by placing danger signs and signals at proper places in the streets and highways, where conditions warrant a Flagman shall be stationed.

13.1.5 When working in trees, an employee shall not work alone unless he is in sight off or within easy calling distance of another member of the working party.

13.2 TOOLS AND EQUIPMENT

13.2.1 The following precautions shall be observed in the use of ladders on trees:

(a) Sectional ladders consisting of more than 3 sections shall not be permitted.

(b) Ladders placed on the ground shall be tied at the top whenever any work is to done from them.

(c) When working on a ladder it shall not be placed on trucks or other moveable objects.

(d) Place a ladder so that both rails are supported on the top not just on rung.

13.2.2 The following precautions shall be observed in the use of insulated pole-prunners:

(a) Pole-prunners shall not be used in the proximity of live conductors having a voltage of more than 11 KV.

(b) Pole-prunners, while wet or moist, shall not be used in the dangerous proximity of live circuits.

(c) While working in the proximity of live conductors, the pole-prunners shall not be grasped by hand closer than 1.25 meters from the metal heads.

(d) Pole-prunners shall not be left lying on the ground lest they absorb moisture.

13.2.3 The following precautions shall be observed in the use of power chains saws.

(a) Only authorised persons shall be permitted to operate power chain saws.

(b) Operators shall assure that they have a secure footing particularly the man on engine and of the saw.

(c) The engine shall not be shut off when moving the saw from one tree to another.

(d) The engine shall not be started until the saw is in the working position exceeds when a warm up period is required, at which time, it shall not be left unattended.

(e) The blade shall be turned to the bucking position (vertical) when carrying saw.

(f) Cutting chains shall not be turned to the inserted in the guide rail grove while the motor running even when the clutch is disengaged.

(g) The clutch shall be disengaged while starting the motor.

(h) The transmission horn shall be held against the log during all cutting operations.

13.2.4 An approved safety rope shall be used for all tree work. The safety rope shall not be used for lowering branches or guying trees.

13.2.5 Saws, prunners and other sharp tools shall not be carried or attached to the workman's body when climbing previous to crouching the safety rope. At all times a hand in shall be used for passing tools to and from workman in tree and in no case shall they be thrown.

13.2.6 When there is no further use of the tools, these shall be lowered to the ground at once.

13.2.7 When chains or wire ropes are used to make attachments to live trees, a pad of burlap or similar material shall be placed between the chain and the tree to protect the bark of the tree.

13.3 TREE FALLING

13.3.1 All links that might contact the line or cause damage to other trees or property shall be removed and the tree shall be roped to guide its fall clear of all objects as above.

13.3.2 In locations where ordinary felling operations might cause damage to property, tree shall be suitably dismembered and handled by the use of block and tackle.

13.3.3 All employees shall keep clear of the area of possible fall and ample warning shall be given to all employees in the vicinity before the tree is expected to fall.

13.3.4 Partially cut trees shall not be left standing during lunch hours or overnight.

13.4 LOWERING SEVERED BRANCHES FROM TREES.

13.4.1 Branches that have to be cut from above a live line shall be lowered by means of at least two ropes, one for lowering' and one attached to the butt for guiding.

13.4.2 Branches shall not be dropped on fences, etc. where these can do damage.

13.4.3 No severed branches shall be allowed to remain on a tree overnight or after the workmen have left the tree.

13.4.4 The severed branches shall either be handed over to the owner of the tree or removed from public roads, footpaths where these might constitute the fire hazard.

13.5 WORKING NEAR LIVE LINES.

13.5.1 If there is a possibility of personal contact with live conductors above and including 11000 volts phase to phase, a permit-to-work shall be obtained and the standard earthing practice followed.

13.5.2 If there is a possibility of personal contact with live conductors up to 11000 volts, phase to phase rubber gloves and other protective equipment shall be used or a shut down obtained and standard earthing procedure followed provided that:

(i) The work shall be entrusted to a competent person.

(ii) Under no circumstances shall an employee climb between live conductors.

13.5.3 Should a link be found to be in actual contact with a live conductor or so close to a conductor that it is likely to be brought into contact either by a slight gust of wind or by movements of the climber, the tree shall not be climbed until the branch has been cleared. The operation shall be carried out from the' ground with insulated pole-pruners or a pole saw and rubber gloves shall be worn. If the line voltage is 11000 volts or above, a permit-to-work shall be obtained.

13.5.4 When working above conductors, the free end of the safety rope shall be passed over a limb on the side of the tree furthest from the live circuit.

13.5.5 Branches which are likely to broken and fall on the conductors and any branches which are likely to whip into the circuit-during the clearing operations shall, during removal, be roped and held away from the conductor by a man on the ground or shortened by means of insulated pruners.

13.5.6 In case of a tree branch falling on the line carrying the voltage above 11000 Volt, a permit to work shall be obtained and the work shall be done under a self-protection tag.

Power Transmission Corporation of Uttarakhand Limited

SECTION 14

HOT LINE TECHNIQUE

INTRODUCTION

Hot line tool is a Stick or pole, which clears the necessary degree of insulation and safe distance of operation from live equipment. The hot stick is made up of specially treated wood of selected quality. Recently developed is fiber glass stick of tubular section.

SPECIAL PRECAUTIONS FOT HOT LINE TOOLS

1. Hot line tools, as far as possible are to be kept in dry atmosphere.
2. They should be always kept neat and clean.
3. They should be tested quite often particularly before use.
4. Their insulation should be tested. The insulation of stick should be 75KV per foot run.
5. Hot line tools should not be place on the ground.
6. After the completion of work the tools should be kept in a canvas bag or weatherproof box provided for the purpose. Care should be exercised to ensure that tools are kept in these boxes or stored in dry and if possible, warm places.

14.1 GENERAL INSTRUCTIONS

1. Signal and member of a line crew who observes that a man on a pole has received an electric shock shall clearly and distinctly call out. This is to be followed by an immediate indication of where the victim is and the calling out of his name.
2. Precautions: Those, who go to the aid of an electric shock victim on a pole, shall take all precautions for their safety. Rescuers who are on poles shall descent carefully and artificial respiration started as quickly as possible. Undue haste, with the accompanying exhaustion of rescuer or operator may lessen his ability to do what is required when he reaches the victim portion of this body to contact with the victim's body or any nearby uncovered elements of the electrical system.
3. Protection: The rescuer shall wear rubber gloves and rubber sleeves and proceed to free the victim from contact. He must do it in a safe manner that does not expose any unprotected portion of his body in contact with the victim"s body or any nearby uncovered element of the electrical system.
4. Procedure: The rescuer shall examine surrounding conditions and if satisfied not artificial respiration can be safely given. He will not take time to place rubber protective equipment in proper position or restore anything that has become dislodged unless that is essential to the safe administering of resuscitation. If he should decide that it is not safe to attempt

resuscitation he shall proceed with arrangement for lowering the victim as quickly as can be safely done.

14.2 CLASSIFICATION OF SAFETY RULES

The safety precautions are classified as follows:

(a) General Rules and Precautions

(b) Safety rules for Junior Engineers.

(c) Safety Rules for Lineman.

(d) Instructions on Pole Climbing

14.2.1 General Rules and Precautions

1. Nothing in these rules for hot-line maintenance shall be construed as prohibiting any authorized lineman from performing routine opening and closing of manually operated hook disconnects and switches, or replacing of fuses on high voltage lines provided proper methods and approved tools are used.

2. Hotline maintenance cannot always be governed by firm and steadfast rules, and the JE must exercise a certain amount of ingenuity in following safe methods for accomplishing various jobs. However, this provision shall not permit any JE to violate any rules contained herein, but shall cover only situations not dealt with in these rules. The idea of safety is paramount from the beginning of the job up to its satisfactory and safe completion.

3. Hot-line maintenance shall not be carried out during unfavorable weather conditions such as Rain, snow, sleet, dampness, mist, high winds, etc.

4. Only crews selected and specially trained for such work in approved centers and have license from such approved centers shall be employed in hot-line maintenance. The selection of crew shall be based on the following factors:

   (a) Experience

   (b) Training

   (c) Temperament and general fitness

   (d) Habits and judgment

   (e) Mental and Physical fitness

   (f) Reputation for carefulness and

   (g) Alertness

5. A minimum hot line maintenance crew shall consist of four experienced lineman (a JE and three linemen).

6. Only approved hot-line maintenance tools and ropes shall be used and it shall be the duty of the officer in charge of the crew to ensure that these tools are in good condition. However, this provision shall not relieve the JE of his responsibility for inspecting the tools before starting the work.

7. Only one conductor or wire on the same structure shall be worked upon at any one time.

8. Wood structures and steel structures shall be considered alike and the insulating value of wood poles or structures shall not be depended upon for protection.

14.2.2 Safety rules for Junior Engineer

1. The JE shall designate th1e tools to be used and the tools to be used for each individual job, adhering to the safety rules specified herein. He shall be held directly responsible for the enforcement of all the safety rules.

2. It shall be the duty of the JE to see that he has sufficient experienced men, material and proper tools to do the job safely before start of work necessary for any reason for the JE to leave the job or devote his attention to another matter, he shall not do so until he has notified the lineman working who shall then cease all work until notified by the JE that he is back on the job.

3. While linemen are actually engaged in hot line maintenance work, the JE shall give their operations his undivided attention and shall direct their work from a location where he can be in a position to caution or warn them if necessary if it is necessary for any reason for the JE to leave the job or devote his attention to another matter, he shall not do so until he has notified the lineman working who shall then cease all work until notified by the JE that he is back on the job.

4. The JE shall not attempt any hot-line maintenance work, which, in his opinion, is beyond the ability of the men or the equipment, but shall notify his immediate superior officer that in his opinion the work would be unsafe.

5. A complete survey of the job shall be made by the JE and a definite plan to be followed must be decided on before the work is started.

6. It shall be the duty of the JE to see that the men doing the work understand thoroughly the procedures to be followed before any work is started.

7. No other work of any nature shall be performed on a pole or structure while hot line maintenance work is in progress.

8. Employees shall be cautioned against the danger of coming in contact with any guy wires attached to a structure upon which hot line maintenance is performed.

14.2.3 Safety Rules for Lineman.

1. No lineman shall start any hot line maintenance work without first assuring himself that he thoroughly understands the work to be done and the method of doing it. In case there is any doubt in his mind, he shall ask the JE for the requisite information.

2. The Lineman shall at all time keep parts of his body away as far as possible from the tool end of the stick (Refer figure 14.1). On poles with vertical formation with or without lapping, where there is abundance of hardware, rubber gloves shall be used when changing out dead end discs to eliminate the effect of static discharges.

3. Lineman shall ensure that their safety belts are properly fastened before starting the work.

4. When in doubt concerning the strength of a tool or piece of equipment. it shall not be used.

5. Hot line maintenance tools shall not be carried up the poles or towers in safety belts but tool bags of hand line shall be used for the purpose.

Fig. 14.1 : Safety rules for Lineman

6. The lineman must ensure before attempting any work, that his companions on the pole thoroughly understand the work to be done conversation shall be limited to those necessary concerning the work. No conversation, not pertinent to the work, shall be permitted.

7. The lineman shall not change position on the structure without first making certain that his new position will place him in the clear and without informing his fellow lineman as to what he intends to do.

8. Under no circumstances shall a lineman depend upon another lineman to hold a live conductor clear of him permanent anchors must be used. When blocks are under strain, the ropes must be securely snubbed. Ropes shall not be snubbed to a truck or to a trailer.

9. No knots of lesser security than “two half hitches” shall be used in tying of various lines.
   - When a line is to be subjected to a strain a “two half hitches” shall be taken around the snub and the completing knot shall be “two half hitches.
   - When joining two lines of the same size temporarily to take strain, a square knot shall be used.
   - When two lines are to be joined permanently, a spliced joint shall be made.
   - When a loop is to be made in the end of the line, a blow line knot shall be used.

10. When removing tie wires, these wires shall be rolled into a ball or cut short as soon as they are unwound so that under no circumstances shall they belong enough to reach a ground or another conductor and to endanger the lineman. During the installation or the removal of tie wires, a lineman shall steady the conductors on the insulator with a proper tool. The wires shall never be used a second time.

11. When moving a live conductor, the lineman shall not stay below the conductor that is being moved until it is thoroughly secured in a safe working position. Blocks shall be used on the end of the hot line tool so that the conductor may be moved slowly and carefully.
12. When working on lines paralleling or crossing roads or highways, special attention should be paid to securing adequate clearance for all moving vehicles.
13. Hot line tools shall never be placed directly on the ground, as it is possible that they might absorb moisture, which would reduce their dielectric strength.
14. Lineman must at all time use extreme care in transporting and using tools so as not to damage them.
15. All tools used on each job shall be carefully inspected before and after the work is done.
16. All tools when not in use must be kept in canvas bags or weatherproof boxes provided for that purpose. Care shall be exercised to ensure that tools kept in these bags or boxes are stored in a dry and; if possible, warm place. Wooden sticks shall be inspected regularly, dried out and thoroughly maintained at intervals, depending upon the extent of use and exposure.
17. Hot line maintenance work shall not be hurried. The job shall be done safely even though it takes more time.
18. Lineman shall avoid wearing rings, wristwatches, identification bracelets, etc. when engaged in hotline work.
19. Rubber gloves shall be worn when within reach of the live conductor.
20. Before climbing a pole for carrying out any work, the condition of adjacent poles shall be checked and, if required they shall be guyed or reinforced. The adjacent poles shall also be checked for loose or broken wires, broken insulators etc.
21. Ground wire shall either be covered by rubber goods or lowered down to a safe working distance, if lowered it shall be ensured that it does not contact any line below. Rubber gloves shall be worn when disconnection and connecting ground-wire.
22. Tools or materials to or from lineman or pole shall not be thrown.
23. Ground men shall maintain safe working distance from pole.
24. Safety hats shall be worn by all crews while engaged in the hot line work.
25. The following minimum clearance from the conductor or from the hot sticks to the lineman shall be maintained when working on hot lines.

LIVE VOLTAGE (VOLTS)		**MIN. CLEARANCE**
2,200 to 6,600 Volts	(01 ft)	0.3048 M
6,600 to 33,000 Volts	(02 ft)	0.6096 M
33,000 to 66,000 Volts	(03 ft)	0.9144 M
66,000 to 115,000 Volts	(05 ft)	1.5240 M

These clearances give the minimum safe working distances.

Note: It is a good practice to maintain a working position so that no conductor regardless of its voltage is within the reaching distance of a workman.

26. Stead pull without jerks shall be maintained on fall lines of hand line or set of classes.

27. Hand lines, fall lines, snub lines shall not be tied to trucks or other vehicles.

28. Rope shall not be used directly on conductors carrying over 5,000 volts without separating them from the conductors by a line stick.

29. Such temporary anchoring devices shall be used as would handle the strain placed on them.

30. Temporary line shall be tied securely to anchors and placed in such a position as to ensure that they will not interfere with the work in progress or be accidentally loosened.

14.2.4 Instructions on Pole Climbing

1. Climbing equipment is often used during the construction, operation, and maintenance of pole lines of various types.

   The following instructions shall be complied with to ensure safety and proper use of the equipment.

2. The Hazards of climbing can be reduced by ordinary precaution. Attention to the pole surface will help of avoid such accidents and the resultant injuries.

3. The belt and safety strap, which provides for security and allows full use of the hands when in working position, shall be properly used. It shall be ensured that the safety strap is on the „O"-rings. Safety strap shall be used even when the working position otherwise appears secure. It must be ensured that a safety strap does not slip over the top of a pole.

4. The rescue hitch used many times in practice from all possible pole positions, is usually available and is secure without risk of further injury to the man.

5. When the safety strap is not being used, it shall be with both snap hooks fastened to the O-ring work on the left side of the body belt if right handed and on the right side of the belt if left handed. The snap-hook on the double end should have the keeper facing outside. The other snap should have the keeper facing inside.

6. The hands and Arms shall be protected by the gloves. The shirt sleeves be kept down and buttoned when climbing or descending poles.

7. Before climbing, the pole shall be inspected, for any unsafe conditions such as cracks, nails, tacks, attachment rot; and loose pole steps. Any hazards shall be removed or reported. Rocks, planks or other objects, which are likely to cause injury at the foot of poles, shall be removed. Metal or wood signs etc. that may interfere the climbing operation shall be temporarily removed and replaced after completion of the job. The pole shall be inspected visually while ascending or descending to avoid placing the feet in hazardous spots.

8. Sliding down any portion of the pole or guy is not permissible.

9. Before starting work on hot line, all unauthorized persons, especially children, shall be warned to keep away from the pole to ensure against injury to such persons from dropping tools, splinters etc.

10. A second lineman shall not ascent until the first lineman has reached the ground or else has taken his position on the pole.

11. Pins, Cross arm, Braces, Insulators and Harrowers other than pole steps shall not be deemed as safe support as they are likely to pull loose or break and gloved hand cut on such fittings which may be rough or broken. Neither shall such fittings be used as support for hands or far attachments of safety straps.

12. While climbing leaning or crooked poles, care shall be taken to keep on top of or above the lean or bend of the poles.

13. Body belt and safety strap shall be worn when working loft as this allows the used of both hands for doing work while on the pole by giving support to the body without the use of the hands. Where the working position call standing or kneeling on a cross arm, the safety strap shall placed around another cross arm of the pole for support. Safety strap shall never be placed around the top of pole above the level of a top cross arm position for support.

14. The safety strap shall always have both ends fastened to one O-ring while climbing or descending a pole safety strap when hanging with one end loose, becomes a hazard particularly to fellow lineman.

15. In case work is performed near the top of a pole, with no top cross arm installed, a long machine bolt may be placed through the top gain hole temporarily to prevent the safety strap from sliding up end of the pole.

16. When moving up or down on pole end, hand shall be used around the pole for support and the tension from the safety strap released by moving the body slightly towards the pole. This will enable the safety strap being shifted higher or lower with the free hand. Body belt, shall always be worn on the outside of coats and other outer garments so that O-rings are in clear view.

    - Auto re-closing devices are made inoperative while doing the work.
    - Protective glasses and other protection clothes should be worn.
    - The normal voltage of the circuit is to be checked before work starts.
    - Protective clothing or conductive screens must be used when working on strong electric field in case of EHV lines.
    - Insulating rope must be clean.
    - Sticks must not be overloaded.
    - When returning to a metal structure from insulating ladder, workmen must drain the charge from his body.
    - Workmen shall see that their safety belts and hooks are properly fastened before they attempt work.
    - The workmen shall not change position on the structure without informing his fellow workman.
    - Check pole for buttrot cracks, nails and other hazards.
    - Pole climbing equipment consists of leather or fabric body belt and safety strap and a pair of climbers. The equipment allows a person to climb, stand or change position on a pole when no other suitable means of support is available.
    - The Safety Strap: It gives security and support to the body when working on a pole (Refer figure 14.2). Lengthen the strap when working on the pole of the large diameter and shorten it when working on a pole of smaller diameter.

- Place both feet at same level and both faces properly set. Hold on to the pole with right hand and reach for safety strap with the left hand.
- Under no circumstances shall a workman depend upon another workman.

Fig. 14.2 : Safety Strap

Power Transmission Corporation of Uttarakhand Limited

SECTION 15

ACCIDENTS

"ACCIDENTS BEGIN, WHERE SAFETY ENDS"

15.1 DEFINITION

An accident may be defined as a sudden mishap that interrupts the operation of an activity.

15.2 CLASSIFICATIONS

(a) Electrical: Generally Electrical accident may cause due to any of the following reasons;

(i) Any person or animal coming in accidental contact with snapped overhead conductor.

(ii) Any person or animal coming in contact with a metallic line support, stay wire, unauthorized energisation of fencing, frame of electrical apparatus, etc., through which there is leakage of current due to failure of insulation, damaged insulators, etc.,

(iii) Coming in contact with live overhead conductors during renewal of blown out fuses, replacing street lamps, cutting across live underground cable or touching live overhead conductors with metallic rods, etc.,

(iv) Climbing up poles or towers and coming in contact with live overhead electrical conductors, maliciously, out of ignorance or with the deliberate intention of committing suicide.

(b) Mechanical: Mechanical injury resulting from an electrical shock, such as person being thrown off line support due to electrical shock sustained.

(c) Non-electrical: Non-electrical injury due to reasons such as fall from a pole, structure, tower or roof trusses, etc., hurt caused while handling heavy machinery, while driving vehicles, etc.

(d) Miscellaneous: Other causes such as fuels, drowning, explosions, etc.

15.3 CAUSES OF ACCIDENTS

(a) Those over which we have limited control, like floods, landslides, earthquakes, fires, lightning and other acts of nature (Refer figure 15.1)

(b) Those due to improper or defective equipment and failure to provide adequate Protective devices

(c) The human elements or 'Human Factor' is by far the greatest cause of serious accidents. Statistics prove that more than ninety percent of Industrial accidents are not due to defective equipment but due to failure on the part of workman and those in authority to observe safety rules and adopt safety devices for accident prevention.

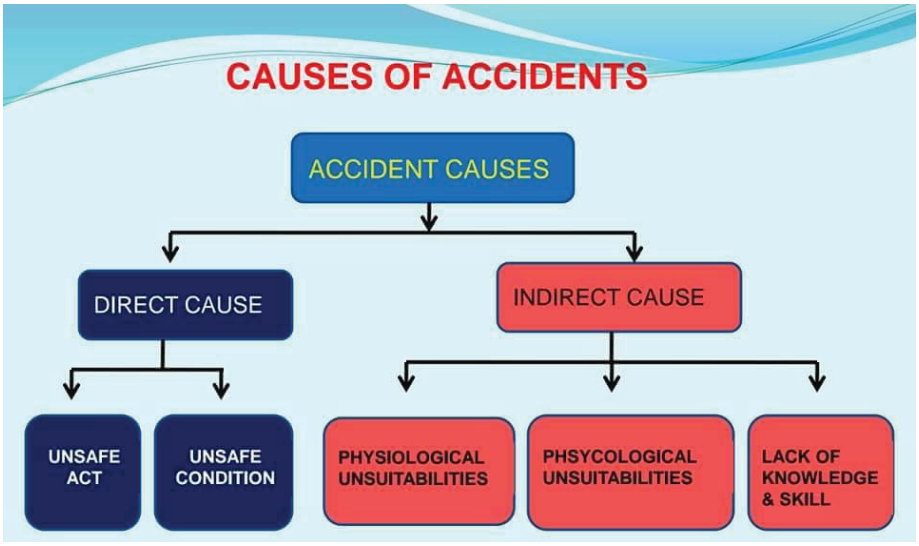


Fig. 15.1 : Causes of Accident

15.4 "FAILURE UNDER HUMAN FACTOR" CAN BE MORE CLEARLY DIVIDED INTO THE FOLLOWING CLASSIFICATIONS:

(a) Failure on the part of workmen to observe safety roles made for their protection.

(b) Failure on the part of Foremen or others having responsibility over workmen to properly instruct those under their supervision as to their duties and insistence upon workmen to observe safety rules.

15.5 ACCIDENT REPORTS, RECORDS AND INVESTIGATIONS

(a) Accident records (Refer figure 15.2) are essential aids to the prevention of future accidents. They show the type of accidents most frequently encountered, where they occur and their relative severity. A study of these records will emphasis common hazards and permits a better understanding of the causes of accidents and most effective methods of preventing them.

(b) All accidents, which result in injury or not, shall be promptly reported to the Foreman or JE. Many injury free accidents, which are not reported, recur with serious consequences.

(c) Every accident should be investigated to determine the cause and steps needed to prevent recurrence. It shall be the responsibility of the person in charge of the job to get a complete detailed cause of the accident as soon as possible after its occurrence.

Fig. 15.2 : Accident Records

15.6 REPORTING OF ACCIDENTS

(a) **Non-Electrical Accidents** : JE in charge of work should furnish immediate information to proper authorities on the occasion of every serious accident and in the case of death on the spot; they should not allow the body to be removed till an enquiry has been held. Fatal accidents to departmental workmen should be reported promptly by the Assistant Engineer concerned to the Executive Engineer & General Manager (O&M). Information should also be immediately furnished to concerned Police Station and UERC. Non-Fatal accidents should also be reported to the EE (O&M), GM (O&M) and UERC, duly indicating the circumstances leading to the accident.

(b) **Electrical Accidents** : Under Section 33 of the Indian Electricity (Amendment) Act, 1992, all electrical accidents including mechanical injury caused due to electrical shock should be reported by the AE concerned, within 24 hours to the Electrical Inspector & UERC and in case of death, the notice should be sent by telegram or telephone confirmed on the same day in writing. The telephone message should be in the standard form as per Annexure II & A detailed report shall be submitted to the Electrical Inspector as per Annexure III within 48 hours. Information should also be furnished to the Police.

(c) Failure to comply with the above instructions regarding accidents, electrical or non-electrical, fatal and non-fatal is an offence, punishable under the Indian Electricity Act of 1910 and workmen's Compensation Act and the Act makes no distinction between the Corporation and a Private Employer.

Power Transmission Corporation of Uttarakhand Limited

SECTION 16

SAFETY AUDIT

It is essential that the highest Safety Standards are maintained throughout the Corporation and that the quality of those standards is assured by audit. IS 18001:2007 Occupational Health and Safety Management System - Requirements with guidance for use. This recommends for Safety Audit & prescribes the means for monitoring and documentation process of the Safety and Occupational Health practices in the Organisation.

The audit is to be used solely as a means for establishing the quality of safety standards so that procedure can be reviewed documented and if necessary, improved to ensure that safety practices are satisfactory throughout the Corporation.

Safety Audit should not be seen as a means of judging an individual's performance.

Mainly there should be two types audits: (1) Internal Audit (2) External Audit

INTERNAL SAFETY AUDIT

The audit process will be in three stages:

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 of the Corporation & to the Circle Office for evaluation.

The Safety Officer of the Corporation will personally audit at least twenty four Substations & eight EHT Lines [minimum three S/S and one Line of each (O&M) Circle per annum basing upon some safety questioners (prepared by any reputed safety engineer)and the findings are to be reviewed by the corporate level Safety Committee for rectification of the deficiencies. The copy of reports is to be sent to the Circle with the instruction of the process for the remedies of the deficiencies. Corporate Safety Office will maintain a record of all the audit results and review the manually. Corporate Safety Office 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 the Competent Authority before implementation.

EXTERNAL SAFETY AUDIT

External safety audit is a process by which the necessary Safety Audit is to be done by any reputed and certified external agency having expertise on the matter.

The Agency may be selected through open tender observing the prevailing rules and procedures of PTCUL in force at the time of selection of the same.

Periodical External Safety Audit of all 400,220,132 Grids & Lines should be done and care should be taken for rectification of the deficiencies to ensure full proof Safety standard. The final External Safety Audit report should be put to the corporate level Safety Committee. It should be discussed/ analyzed for the discrepancies; remedial measures are to be finalized, being perused / approved by the Competent Authority, immediate instruction should be issued to the Zonal/Circle/Division of the concern Grid or Line for early compliance.

The compliance to the External Safety Audit report are to be furnished on regular basis, to the respective CE/SE and Corporate Safety officer for appraisal/evaluation of the Corporate level Safety Committee.

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SECTION 17

EMERGENCY MANAGEMENT PLAN

An on site emergency management plan shall be formulated for (a) Each electrical sub station (b) Group of electrical lines, for quickly & effectively dealing with probable emergencies like fire,explosion,gas leakage,land slides,flood etc. & for reducing response time.

Sub Station Incharge shall ensure that a mock drill of the on site emergency management plan is conducted atleast once every six month.

GUIDE LINES FOR MOCK SAFETY DRILLS

Mock safety drills and demo should be carried over in the Grids and work sites to enhance the safety knowledge and awareness among the workmen and engineers of the Corporation.

- MD, PTCUL directed that “Safety drills, First-aid and Fire-safety exercises shall be made mandatory at regular intervals in presence of the SDOs, Division Heads and a register to this effect shall be maintained capturing details of drills and exercises. This will be the responsibility of the respective Circle and Division Heads”.
- Conducting safety awareness meeting including the benefit of using PPEs.
- Demo on use of safety helmet (wearing properly)
- Demo on use of safety hand glove (wearing properly)
- Demo on use of safety belt (full body harness), how to wear itproperly.
- Demo on working with wearing safety belt
- Procedures for proper maintaining the PPEs, like proper storing and their condition monitoring
  - (a) Mock drill on line clear requisition/issue/return
  - (b) Discussion regarding the standard operating procedure (sop) for line clear requisition/issue/ return
  - (c) Requisition in proper format
- Requisition in proper manner
- Step by step procedure for issue ofl/c
  - (i) Verification of the l/c requisition format
  - (ii) Deciding the check list for issue of the particularl/c
  - (iii) Ensuring ‘No BACK FEED Certificate’ on the requisition from distcom requisitions
  - (iv) Adopting the proper, step by step procedure for issue of the l/c, suchas

- Intimation to the related other grid(s), if required and l/c from them are to be availed.
- Inside the controlroom:
  - Hand tripping of related breaker(s),
  - If isolators operate on remote, isolation of relatedisolators
  - Taking out of the relatedfuse(s)
  - Hanging the danger board on the specificpanel(s)
- In the switchyard:
  - Entering the switch yard with safety helmet, safety shoes & safety hand gloves
  - Verification of the related breaker for tripping of all the threephases
  - Isolation of relatedisolators
  - Connecting the related earthswitch
  - Hanging the danger board on the specificequipment(s)

(v) I**ssue of L/C format**

(d) **Availing the line clear and proceed to work by the site in-charge/work in- charge (executive)**

(i) Brief meeting with the working gang specifying about the work, working zone, nature of hazard/risk/danger involved.

(ii) Verification of the personal protective equipments regarding their condition

(iii) Proceeding to the specific work place with the working gang and all tools & tackles necessary for the work and with all personal protective equipments(ppe)

(iv) Checking the work place for complete isolation and earthing

(v) Barricading the work place by safety ribbon

(vi) Putting all temporary earthing

(vii) Completing the work in presence of the site/work in-charge(executive) (viii)Cleaning of the workplace

(ix) After completion of the work, thorough checking of the place for removal of waste, man, material and temporary earthing

(e) Returning the line clear in proper format

(f) After return of the line clear by the requisitioning officer

- Work place to be thoroughly checked for removal of man and material by operation in-charge
- Opening of earth switch
- Intimation to the nearby grid(s), If required
- After getting clearance from required nearby grid(s), restoration process may be completed.

Power Transmission Corporation of Uttarakhand Limited

SECTION 18

PROCEDURE FOR WORKING ON SF6 GAS FILLED EQUIPMENT

18.1 PURPOSE

To protect all personnel against inherent hazards / dangers while working on SF6 gas filled equipments.

18.2 SCOPE

These PTCUL Safety Instructions lay down procedures for working on SF6 gas filled equipments and to protect all personnel against inherent dangers / hazards of SF6 gas.

18.3 DEFINITIONS

Impurities: Impurities (toxic or non toxic) contained in SF6 gas filled in EHV equipments.

Decomposition products: Electrical discharge decomposes SF6 gas into SF4, SF2, etc. These are called decomposition products. In some cases, sulphur fluoride gas is also formed due to electric discharges.

18.4 EQUIPMENT IDENTIFICATION

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

18.5 DANGERS

Following are the dangers which the personnel may be subjected to while working on SF6 gas filled equipments: Since SF6 gas is heavier than air, there is danger of asphyxiation (suffocation) in :

- the storage / work area in the absence of proper ventilation. Decomposition products, e.g., sulphur fluorides and other toxic gases having
- pungent or unpleasant odour may cause irritation in nose, mouth and eyes.

18.6 WORKING PROCEDURES

(i) A Permit To Work must be issued before starting the work and the equipment on which work is to be done must be electrically isolated from other equipments.

(ii) The equipment must be earthed at two points.

(iii) Using gas evacuation trolley, SF6 gas should be taken out from the equipment and evacuation upto about 50 mbar should be achieved.

(iv) After ensuring that total gas has been evacuated / removed, then only the equipment should be opened / dismantled.

(v) In general, a mask or other protective measures are not necessary when no appreciable amount of dust (fluoride powder) or odour exists. However, during internal inspection of the interior path of apparatus, personnel should take precautions to avoid exposure to the break down products and suitable protective equipment like gas mask (preferably incorporating molecular filter, etc.), industrial type goggles (SF6 gas dust can some times attack the glass of goggles, spectacles, etc.) and rubber gloves shall be used.

(vi) After completing the work on the equipment, the equipment should be reassembled.

(vii) Before refilling SF6 gas, evacuation upto 5 m bar should be carried out for about two hours. Thereafter, SF6 gas should be filled in the equipment.

Annexure – I

PERMIT TO WORK

DEPARTMENT : .....

1. ISSUE

To ..... Employed By ..... Mob. No. .....

I hereby declare that it is safe to work on the following apparatus which is dead, isolated, connected to earth and caution notices pasted. .....

.....

The apparatus is isolated at the following points:

.....

.....

The apparatus is efficiently earthed at the following points:

.....

.....

(These earths shall not be removed till cancellation of this PTW)

"ALL OTHER APPARATUS IS DANGEROUS"

The following is the work to be carried out on the above apparatus:

.....

.....

Issued with the consent of .....

Signed ..... being an Authorized Person possessing Authority to issue this PTW.

Time ..... Date .....

2. RECEIPT

I hereby declare that I accept responsibility for carrying out the testing work on the apparatus detailed on this PTW and that no attempt will be made by me or but the men under my supervision to carry out work on any other apparatus.

Signed ..... being the authorized person in charge of the testing / work.

Time ..... Date .....

3. CLEARANCE

I hereby declare that the work for which this permit was issued is now suspended /completed, and that all men under my supervision have been withdrawn and warned that this PTW is no longer valid and that the equipment with the exception of the earths detailed above and the remarks noted below, is ready/ not ready for normal service.

Remarks .....

Signed ..... being the authorized person in charge of the testing/work

Time ..... Date .....

4. CANCELLATION

This PTW is hereby cancelled and I have informed the following Executive Engineer/Assistant Engineer . ..... (Name) Signed ..... being an Authorized Person possessing Authority to cancel this sanction.

Time ..... Date .....

Annexure – II

ACCIDENT REPORT
(TELEPHONE / TELEGRAM / FAX MESSAGE)

1. Name of the /Sub-Station: .....
2. Date and time of occurrence: .....
3. Name of the casualty, address, sex and age: .....
4. Fatal/non-fatal (if non-fatal state condition): .....
5. Departmental or non-departmental
   (If departmental, details of Emp. No. and
   Designation etc., to be furnished): .....
6. Voltage, name of the feeder and place of accident:

   .....
7. State the occurrence in brief: …….....
8. Date and time of reporting: …….....

Signature: ……...

Name: ……...

Designation: ……...

Address of the person reporting: …….

…….....

…….....

Annexure – III

FORM FOR REPORTING ELECTRICAL ACCIDENTS

1. Date and time of accident : .....
2. Place of accident: .....
3. System and voltage of supply, (Whether EHV/HV/LV line, Sub station): …….....

   .....
4. Designation of the Officer in charge whose jurisdiction the accident occurred: …….....
5. Details of Victim(s):

(a) Human:

The victim(s) name: .....

The victim address: .....

.....

Age: .....

Father's Name: …….....

Sex: …….....

Full Postal Address: …….....

…….....

Fatal/Non-fatal: ……....

(b) Animals

S. No.	Numbers	Description of animal(s)	Name(s) of Address (es) of owner(s)	Fatal / Non-fatal

In case the victim(s) is/are employee(s) of supplier

(a) Designation of such person(s): …….....

(b) Brief description of the job undertaken, if any: …….....

…….....

(c) Whether such person/persons was/were allowed to work on the job: …….....

In case the victim(s) is / are employee(s) of a licensed contractor:

(a) Did the victim(s) possess any electrical workmen's permit(s) JE's certificate of competency issued under rule 45? If yes give number and date of issue and the name of issuing authority.

.....

(b) Name and designation of the person who assigned the duties of the victim(s): ……..l

…….....

In case of accident in the supplier's system,

(1) Was the permit to work (PTW) taken? …….....

(2) (a) Describe fully the nature and extent of injuries, e.g., Fatal/ disablement (permanent or temporary) of any portion of the body or burns or other injuries.

(b) In case of fatal accident, was the post mortem performed? …….

(3) Detailed causes leading to the accident (to be given in a separate sheet annexed to this form).

(4) Action taken regarding first-aid, medical attendance etc, immediately after the occurrence of the accident (give details)

(5) Whether District Magistrate and police station concerned have been notified of the accident (if so, give details)

(6) Steps taken to preserve the evidence in connection with the accident to the extent possible.

(7) Name and designation(s) of the person(s) assisting, supervising the person(s) killed or injured.

(8) What safety equipment were given to and used by the person(s) who met with this accident (e.g. Rubber gloves, rubber mats, safety belts and ladders etc.)?

(9) Whether isolating switches and other sectionalizing devices were employed to deaden the sections for working on the same? Whether working section was earthed at the site of work?

(10) Whether the work on the live lines was undertaken by authorized person(s)? If so, the name and the designation of such person(s) may be given.

(11) Whether artificial resuscitation treatment was given to the person(s) who met with the electrical accident? If yes, how long was it continued before its abandonment?

(12) Name and designation of the persons present at and witnessed the accident.

(13) Any other informational remarks.

Signature: ……...……

Name: ……...……

Designation: ……...……

Address of the person reporting: ……

…….....……

…….....……

Place: ……

Time: ……

Date: ……

Annexure – IV

FIRE REPORT

GENERAL

1. Date. ……..
2. Location of fire …….....
3. Region …….....
4. Time discovered. …….....
5. Time Extinguished.…….....
6. Cause of fire. …… .....……
7. Fire discovered by …….....
8. AE- in-charge of the substation . …….....
9. Specific location from where fire started. …….....
10. Was fire confined to the starting point Yes/No
11. If No, state the extent of fire. …….....
12. Could fire have been prevented? Yes/No
13. If so, How? …….....
14. Estimated loss
    (a) Equipment Rs. .....
    (b) Building Rs. .....
    TOTAL Rs. .....
15. What fire protection has building and/or equipment? .....
16. By what mean was the fire extinguished? .....
17. List any extinguishing equipment found defective or unsuitable. .....
18. Was outside aid required? Yes/No
19. If Yes, when requested? .....
20. If No, what equipments used? .....
21. Class of fire .....

22. Portable extinguishers used

	Number	*Type size*	How soon: *By whomafter fire:*	Date *last*
A. (Wood)	…….	……..	.....……	
B. (Oils)	…….	……..	.....……	
C. Electrical	…….	……..	.....……	

23. Was any fixed extinguishing Eqpt. used?

24. Air or gas mask used (Length of time) .....……..……..……..……

25. By whom and how soon after fire started? .....……..……..……......

26. Was water spray used? Yes/No.

27. If Yes, Duration, Size and No. of nozzle .....……..……..……..……

STRUCTURE DATA

28. Kind of structure, i.e.

    (a) Wood/Brick/Stone/Concrete .....……..……..…… .....……..…….....

    (b) No. of storeys .....……..……..……..……..……..…….....

    (c) Structure No. .....……..……..……..……..……..……..…

    (d) Passing as .....……..……..……..……..……..……..……

29. Roof material

    (a) Slate/Wood/Shingle/Concrete .....……..……..……..……..…….....

    (b) Location .....……..……..……..……..……..……..……...

    (c) Householder's name .....……..……..……..……..……..……...

EQUIPMENT DATA

30. Type .....……..... 31. Rating .....……..……..... 32. Serial No. .....……..……..…….....

33. Manufacturer .....……..……..…… 34. Type of installation .....……..…….....

    Location .....……..……..…… Equipment No. .....……..……..……

INCIDENCE OF IMPORTANT

35. Prior to fire .....……..……..……..……..……..……..……..…….....

36. During fire .....……..……..……..……..……..……..……..…….....

37. After fire .....……..……..……..……..……..……..……..…….....

38. Casualities. .....……..……..……..……..……..……..……..…….....

39. List property of others involved. .....……..……..……..……..……..……..…..

40. Estimated period for which the Equipment will be out of service.

    .....……..……..……..……..……..……..……..…….....

41. Remarks and recommendation .....……..……..……..……..……

42. Written report to follow Yes/No

43. Report by

Name .....……..……..……

Signature .....……..……..……

Designation & Deptt. .....……..……..……

Note: 1. The station log should clearly sequence the events. Where applicable, show log times.

2. If more space is required, attach blank sheets showing designated item No.

Notes