

Environmental and Social Review (ESR)

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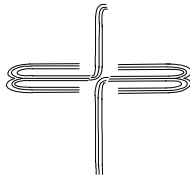
HIGH VOLTAGE DISTRIBUTION PROJECT

FOR

AGRICULTURE CONSUMERS IN THE STATE OF

PUNJAB

Prepared By



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PATIALA

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CHAPTER- 1

INTRODUCTION OF THE PROJECT &

ACTIVITIES INVOLVED

As it is clear from the name, High Voltage Distribution System is a project related to conversion of existing Low Voltage Distribution Lines i.e. 415 Volts feeding to various agricultural Tube well consumers to High Voltage System i.e 11000 Volts. By converting these lines to HVDS, the current flowing through the lines shall reduce by 28 times. Further the line losses ($I^2 R$) will reduce approximately by 800 times.

In order to reduce AT&C (aggregated Transmission and Commercial Losses) Losses, a proposal was framed to convert existing LVDS System feeding AP Consumers on 3 Phase 3 Wire Feeders to HVDS. Accordingly 46 Nos. Detailed Project Reports (DPR's) covering 5, 24,856 No. AP Connections in the first phase were got sanctioned from REC for financing the Project. However finally out of these 46 no. DPR's 6 No. DPR's covering 81251 number connections have been selected covering each Zone (PSEB is divided into five Zones). The Work Orders for the execution of the work for these Schemes have been issued and the completion period is targeted as May 2008. For the remaining 40 nos. schemes Expression of interest (EOI) for getting the execution of these scheme was published in the paper. A pre-bid meeting was held on 21-12-2007 and the applicants were asked to submit their Expressions of Interest by 4.1.2008. The EOI is under process regarding finalization of pre qualification criterion. Thereafter NIT for execution of works relating to these 40 nos. schemes shall be floated.

The works for converting the remaining 4.25 lacs tube well connections presently being fed through 3 phase 4 wire feeders to HVDS has also been undertaken. DPR's are under preparation and shall be submitted to Rural Electrification Corporation (REC) during March 2008 for sanctioning of the same.

The completion of total project has been targeted within three years i.e. upto May, 2010.

1.1 The major activities involved in this Project are listed as under: -

(a) The conversion from LVDS to HVDS shall be carried out by using the existing poles and conductor. Additional Poles shall only be erected wherever, utmost necessary such as on road crossings etc.

(b) The ACSR Conductor of the existing LV System shall be used only with a changed configuration. The D-Shackles provided to hold these wires with the poles shall be removed and a V-shape cross-arm shall be provided with three insulators upon which these wires will be re-laid in a delta configuration. Each pole shall be earthed through the earth rod to provide safety to the human being/animals etc. as per the requirement of Indian Electricity Rules.

(c) The pole upon which service cable is laid to provide power to the AP consumer shall be used for erecting 11 KV Sub Station for providing dedicated DT of small ratings (6.3,10/16/25 KVA). However, the existing service cable shall be retained and connected to the LT side of the dedicated transformer through LT Fuse Unit.

(d) From the above, it can be very well seen that this Project does not involve the acquisition of any additional land and as such, there will not be any depletion of cultivable/forest land, as the conversion is being done on the existing poles. Therefore, there is no requirement of any Right of Way for erection of lines. By way of this project, each AP consumer shall be fed through a dedicated transformer.

1.2 **Benefits:**

The benefits and the well being which this project will bring to the particularly to the agricultural consumers and in general to the people of Punjab are as under: -

a) Improved voltage profile to every AP Consumer.

Presently due to lengthy LT line and voltage drop the voltage received at the consumer end drops down. With the provision of DT's at the consumer premises (Zero LT system) there will not be any voltage drop therefore due to improved voltage profile, efficiency of the motor will also increase.

b) Theft of energy will be practically zero.

The unauthorized consumers at present are stealing energy by hooking or tapping LT lines feeding to various authorized consumers. After conversion of all LT lines in to HT lines hooking/tapping or theft of energy shall not be possible.

c) Failure of Distribution Transformers will almost be negligible.

In the present system one bigger transformer is feeding to various consumers and due to theft of energy load increases which causes damage to the distribution transformer. After conversion a dedicated transformer will be provided for each agriculture consumer thus chances of damage due to unauthorized increased load shall be eliminated

d) Drastic reduction in Line losses.

After conversion virtually all consumers 'shall be fed through high voltage distribution system viz voltage shall increase (from 400 volt to 11000 volt) and current shall decrease accordingly. Hence there shall be considerable reduction in Line Losses (I^2R)

e) Chances of adding illegal motors are completely eliminated.

As explained above after conversion chances of running illegal motors shall be eliminated as no LT line shall be available to the un-authorized consumers.

f) Due to reduction in KVA capacity and better voltage profile, the peak power losses shall also reduce considerably.

g) Consumers shall be involved in safety and upkeep of Distribution Transformers due to installation of dedicated Transformers for each consumer

Every consumer shall have the ownership feeling regarding dedicated transformers and knowing very well that in case of failure of Distribution Transformers, he shall be the only sufferer.

h) Overall system efficiency will be improved.

Due to increase in voltage profile and decreased losses system efficiency will improve.

i) More, volume of water shall be pumped out with the same capacity of the motor due to improved voltage.

Due to improved voltage profile, motors will pump more water and the life of the motor running the Tube well shall increase due to less drawl of current and over-heating. In the existing system, number of consumers are being fed from the same transformer which leads to blowing of the LT /HT fuse interrupting the supply to all the consumers. Thus in the HVDS system, AP consumer shall get interruption free supply.

In view of the said benefits, the agricultural consumers are co- operating with the PSEB for the execution of this project as has been seen in case of pilot feeders already undertaken by the PSEB.

The proposed project area for these 6 No. DPR's fall within the Jurisdiction of 14 nos. Operation Divisions namely Dhuri, Sirhind, Amlloh, Samana, Patran, Muktsar, Malout, Gidderbaha, Abohar, Badal, Fazilka, Suburban Nakodar, City Taran Tarn and Bhikhiwind falling under, Sangrur, Fatehgarh Sahib, Patiala, Mukatsar, Faridkot, Kapurthala and Taran Tarn, Districts of Punjab State. However the sketch showing the location of this project is enclosed as Annexure-"A'.

Environmental and Social Review: -

PSEB being state utility always take notice of the Environmental aspects and its impact on the people of State before taking any project in to hand. So before the conception of this project also this idea was kept in mind. As explained in foregoing paras, this project shall not in any way harm the environment rather it shall contribute in improving the quality of power supply & this help in enhancement of food production and contribute towards well being of the people besides considerable economic benefits to the utility on account of reduction in AT & C losses.

CHAPTER- 2

IMPACTS OF THE PROJECT

As stated under Chapter-I, a dedicated transformer shall be installed for each Tube well consumer. Hence many more number of new Distribution Transformers shall be installed. The position in respect of DT's to be dismantled and the new ones to be installed against 46 nos. schemes is as under: -

Name of the Zone	Transformers to be installed (Nos.)				Transformers to be dismantled (Nos.)				
	6.3 KVA	10 KVA	16 KVA	25 KVA	25 KVA	50 KVA	63 KVA	100 KVA	200 KVA
Border	86256	22367	742	130	6316	0	7176	2873	0
North	60510	29869	2110	162	6229	9	6187	2010	0
Central	33172	18884	2741	486	3453	0	3671	1534	0
South	34779	87086	19139	1717	14646	4	11603	5777	1
West	65877	51616	6495	718	14140	6	8401	3182	0
Total Number s of DT's	280594	209822	31227	3213	44784	39	37038	15376	1
Total KVA Capacity	1767742	2098220	499632	80325	1119600	1950	2333394	1537600	200

Total KVA to be installed = 4445919 KVA
 Total KVA to be dismantled = 4992744 KVA

The Transformers to be spared shall be re-used by the PSEB for other Distribution works.

So far as the presence of PCB's in the Distribution Transformers to be dismantled is concerned, Guidelines for Identification of PCB's and Material Containing PCB's prepared by United Nations Environment Programme (UNEP) Chemicals has been referred to.

After going through these guidelines, it is intimated as under: -

- i) The Distribution transformers to be removed/installed are not fire resistant and are installed in the open.
- ii) As explained in these guidelines, simple tests such as Density Test and Chlorine Presence tests were conducted in Punjab State Electricity Board's Oil testing lab situated at Sirhind. The test results (Annexure-"B') reveal that no PCB's was found in the Transformer Oils.

The new-dedicated small rating Transformers (81251 nos.), which shall be installed under this project, shall be Copper wound whereas the higher capacity Transformers, which are to be dismantled, are Aluminium wound. Therefore the total Copper losses of the DT's shall reduce and hence the generation of heat (by way of Copper losses) shall also be reduced.

The other positive impacts of this project has also been enlisted under Chapter-1.

CHAPTER- 3

OCCUPATIONAL SAFETY DURING EXECUTION OF THE

PROJECT

The Work Orders cum Contract Agreement issued to the contractors for the execution of HVDS works specifically contain the required instructions about the occupational safety of the workers. The Contractors are required to obtain A-Class License from CEI, Punjab. As per the requirement of this License, the Contractor has to employ a qualified/Licensed Supervisor who is well versed and duty bound to take care of the occupational safety of the workers engaged for the execution of the works.

PSEB also has its own Safety Code (Annexure-'e') on the safety precautions to be taken for execution/ maintenance of various electrical works/ installations. These instructions contain the procedures to be adopted during execution of the work for proper safety of the workers. These also include the handling of the Tools and Plants (T&P), earthing of the System, precautions to be taken during erection of the electric lines, shock treatment, first aid etc. A copy of these instructions have already been supplied to the Contractors who have specifically asked to follow these instructions in a letter and spirit to avoid any miss- happening.

The Contractors are also required to supply the labour License to be obtained from the Labour Department of the Punjab State before the commencement of the work. As such, the Contractor shall be responsible to comply with all the labour Laws/Regulations involved from time to time by the Appropriate Authorities. The Contractors have specifically been asked that before commencement of any work, they shall associate the local Distribution Officials of PSEB for taking shut down etc. so as to avoid any miss-happening.

Transfer of any fluids is not required in this project. However the black spot seen in the CD might be some water pond in the village.

However as explained in Chapter-I, the execution of the project being confined to the conversion of the system on the existing poles and do not involve use of heavy machinery emitting pollutants. Thus there is no damage to the surrounding fields from pollution etc.

As stated above all type of safety precautions are required to be taken by the Contractors responsible for the execution of the Project. So far as awareness of general public is concerned, the people of the area where the works shall be undertaken shall be made aware about the conversion of LT Line to HT Line through announcements from religious places which is the most effective communication source in the villages of Punjab. The Contractors have specifically been asked to get these announcements made before the execution of the work.

The inter-action with the farmers about this project is to be made while making the survey of the line/their installations before the execution of the work. The Farmers are being informed about conversion of LT Line to HT Line during the said inter-action. The other measures such as earthing of poles and Sub Stations as per the REC

Standards and fixing of danger plates on the Pole Mounted Sub Station etc. shall be taken as incorporated in the Work Orders cum Contract Agreement. It is however, further brought out that the farmers of Punjab are very well aware about the implications of LT /HT System.

CHAPTER- 4
ENTITIES RESPONSIBLE FOR VARIOUS
ACTIVITIES

The various entities involved in this project are as under: -

(A) Distribution Organisation:

46 No. DPR's in the first phase involving all agricultural tube well being fed through 3 phase 3 wire agricultural feeders in the State were initially formulated by Dy. CE/SE's/Distribution. This Organization is also involved during final survey of the area along with Contractors and RE Organisation before the execution of the work. Finally the converted feeders on HVDS shall also be handed over to this Organisation.

(B) RE & APDRP Organisaion:

This Organisation is involved for sanctioning of the DPR's from REC, financing the Project, framing of the Specification, floating NIT, processing of the Tenders and 'award of the Contracts besides monitoring during execution of the Project, payments and issue of required instructions to the field etc.

(C) Contractors:

As per the Work Orders, the Contractors are responsible for final survey, supply of material, its erection, testing & commissioning, approval of lines and Sub Stations from Chief Electrical Inspector and handing over the completed works.

(D) Stores Organisation:

The dismantled material shall be returned to this Organisation by Distribution Organisation for further issuing the same to Distribution Works/disposal, as the case may be.

CHAPTER- 5

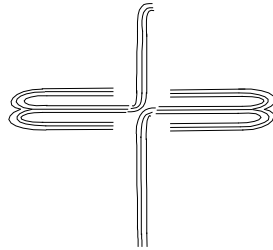
CONCLUSION

As brought out in the earlier chapters, all aspects relating to safety of personals engaged in the execution of this project have been well taken care of viz contractors are bound by way of work order cum contract agreement placed upon them to adhere to all safety precautions required to be taken as per the statutory requirements. PSEB of its own also very well thought of all the environmental aspects before taking into hand this' project. As explained in the earlier chapters all out efforts has been made/are being made to adopt all possible measures that will in no way lead to any harm to the environment rather this project shall lead to better environment due to reduction of green house gases and help in providing quality power supply.

Chief Engineer/RE & APDRP,

PSEB, Patiala.

PUNJAB STATE ELECTRICITY BOARD



SAFETY CODE

FOR

ENGINEERING OFFICERS & TECHNICAL STAFF

CONTENTS

The following Chapters related to HVDS are being attached:

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PART- 'A'
CHAPTER-1
Definitions

1. (a) 'Pressure' means the difference of electrical potential between any two conductors or between a conductor and earth, as read by a hot wire or Electrostatic Voltmeter.
- (b) 'Low Pressure', means a pressure in a system normally not exceeding 250 volts where the electrical energy is used.
- (c) 'Medium Pressure' means a pressure in a system normally above 250 volts, but not exceeding 650 volts, where the electrical energy is used.
- (d) 'High Pressure' means a pressure in a system normally above 650 volts but not exceeding 33,000 volts where the electrical energy is used or supplied.
- (e) 'Extra High Pressure' means in a system normally exceeding 33,000 volts where the electrical energy is used or supplied.
- (f) Punjab State Electricity Board has adopted alternating current, three phase system at 50 cycles per second at the following pressures:

Pressure	Delivery Voltage	Station Voltage	Remarks
1	2	3	4
	Volts	Volts	
Low	230	250	Phase to Neutral
Medium	400	440	Between phases
High	3000	3300	-do-
High	6000	6600	-do-
High	10000	11000	-do-
High	30000	33000	-do-
Extra High	60000	66000	-do-
Extra High	120000	132000	-do-
Extra High	200000	220000	-do-
Extra High	380000	400000	-do-

Note: The above station voltage are approximate and shall be delivered in each case by the addition to the delivered voltage, the voltage lost in transmission.

2. '**System**' means an electrical system in which all the conductors and apparatus are electrically connected to a common source of pressure.
3. '**Apparatus**' means all electrical apparatus including machines, static condensers, transformers, switchgear, electrical power transmission and distribution lines, underground cables and fittings, in which conductors are used or of which they form a part, which are used for the generation, transformation or utilization of electrical energy.

4. **'Conductor'** means a body or substance, which offers a low resistance to the passage of an electric current and is arranged to be electrically, connected to a system.
5. **'Covered with Insulating Material'** means adequately covered with insulating material of such quality and thickness that there is no danger.
6. **'Bare'** means not covered with insulating material.
7. **'Circuit'** means an electrical circuit forming a system or a branch of system.
8. **'Live'** means electrically charged. A conductor is live when a difference of electrical potential exists between it and earth or when it is connected to another conductor or circuit in which such a potential difference exists. Electrical Apparatus is live when its conductors are live.
9. **'Dead'** means at or about earth potential and disconnected from any live system, provided that electrical apparatus; whose conductors are separated from a live conductor by a spark gap, shall not be considered dead.
10. **'Earth'** means the conducting mass of the earth or of any conductor in direct electrical connection therewith.
11. **'Earthed'** means connected to earth in such a manner as will ensure at all times an immediate discharge of electrical energy without danger.
12. **'Earth System'** means an electrical system in which all the conductors are earthed.
13. 'Danger' means danger to health or danger to life or limb from shock, burn or other injury to persons employed or from fire attendant upon the generation, transformation, transmission, distribution or use of electrical energy.
14. **'Earthing connection'** means a metallic conductor for connecting electrical equipment to earth.
15. **'Employee'** means an authorized person of either Gazetted or Non-Gazetted rank who is in receipt of wages, salary or pay in return for services rendered to the Punjab State Electricity Board.
16. **'Power Controller'** means for the purpose of Safety Code, an authorized person in charge of all switching operations on the 400 KV, 220 KV, 132 KV and 66 KV Trunk and Branch transmission system in Power Stations and Grid Sub Stations.
17. **'Load Dispatcher'** means for the purpose of Safety Code an authorized person in-charge of all loading instructions, control of generating units connected to the inter-linked power system maintenance of voltage regulation and frequency.

18. **'Assistant Power Controller'** means for the purpose of Safety Code an authorized person to assist the Power Controller in the performance of his duties and to issue switching instructions in defined areas.
19. **'Resident Engineer'** means for the purpose of safety code an authorized person in-charge of operation and maintenance of Power House, Sub Station, Trunk and branch transmission lines, local distribution system allotted to his charge.
20. **'Assistant Resident Engineer'** means for the purpose of Safety Code an authorized person to assist the Resident Engineer in the performance of his duties.
21. **'Sub Station Engineer'** means for the purpose of Safety Code an authorized person in charge of operation and maintenance of Grid Sub Station and other ancillary works allotted to his charge.
22. **'Shift Engineer'** means an authorized person in-charge for the running of Power House and Sub Station during a shift.
23. **'Sub Divisional Officer'** means for the purpose of this Safety Code, an authorized person in-charge, under the instructions of an Executive Engineer, of the operation and maintenance of the Trunk and Branch transmission and local distribution system allotted to his charge, excluding only the switching operations duly carried out under the instructions of the Power Controller.
24. **'Control Room Operator and Sub Station Operator'** means an authorized person in-charge of the operation of Switch Gear at a Sub Station or Power Station.
25. **'Line Superintendent'** means an authorized person in-charge 'of operation, maintenance and construction of electric supply lines and local distribution system placed under his charge.
26. **'Linesman'** means an employee authorized to inspect and work on electric supply lines and switches connected thereto and to patrol electric supply lines.
27. **'Assistant Linesman'** means an employee authorized to assist Linesman in the discharger of his duties.
28. **'Permit to work'** means a form of declaration signed and given by one . authorized person to another in-charge of work to be carried out on any electric apparatus or electric supply lines for the purpose of making known to such latter person exactly what apparatus or electric supply lines are made dead and earthed at the Sub Station.

29. **'Authorized Person'** means a person who is duly authorized to perform the duties appertaining to his employment, the authorization being by an officer of the Punjab State Electricity Board empowered for that purpose.

30. **'Use of energy'** means the conversion of electric energy into mechanical or chemical energy, heat or light for the purpose of providing mechanical energy, electrolysis, heat or light.

31. **'Electric Supply Lines'** means electric supply or overhead electric power transmission and distribution lines, including any underground cables connected thereto. Electric supply lines are included in the expression 'Apparatus' (Paragraph 3).

32. **'Caution Notice'** means a notice attached to dead electrical apparatus to convey a warning against such equipment being made live.

33. **'Danger Notice'** means a notice attached to live electrical apparatus calling attention to the danger of touching or interfering with such apparatus.

34. **'Executive Engineer'** means for the purpose of this Safety Code, an authorized person in-charge of the operation and maintenance of the Trunk and Branch transmission and local distribution system allotted to his charge.

35. **'Superintending Engineer'** means for the purpose of this Safety Code an authorized person who is responsible to the Chief Engineer for the general professional control of the power stations and trunk and Branch transmission and local distribution system allotted to the charge of departmental officers within his circle of superintendence.

36. **'Chief Engineer'** means the Chief Engineer Punjab State Electricity Board.

37. **'Contractor's Engineer'** means for the purpose of this safety Code, a duly authorized representative, approved by the Chief Engineer in writing, of a firm who having applied and erected apparatus has to carry out work upon such apparatus under the terms of the contract with that firm.

PART - 'A'
CHAPTER-2
General Instructions for Safety.

G-1 Responsibility of Supervisors

All Sub Station Engineers/Sub Divisional Officers/Junior Engineers/Line Superintendents/Overseers /Operators and other supervisors have the definite responsibility of ensuring the following: -

- (a) To impart Clear instructions to the workers about the work to be done and hazards that can possibly befall.
- (b) Safe working conditions.
- (c) Necessary protective equipment and its use.
- (d) Properly maintained tools and equipment.
- (e) Properly planned work in a safe manner.
- (f) Application of the general and special safety instructions by their workmen.
- (g) Assignment to employees of jobs, which they are capable of doing safely.
- (h) Immediate steps to correct any violation of safety rules observed or reported to them.
- (i) Frequent inspections of construction, Operation and maintenance of electrical equipment and other apparatus.

G-2 Responsibility of Workers

All workers have the definite responsibility to carry out their duties/work in accordance with the instructions imparted to them, after observing full safety precautions. Failure to know the safety precautions by the workers will not be acceptable as an excuse for violation. Each permanent employee shall be provided with a copy of 'Safety Code' to be retained by him until he retires or leaves the service. Each employee must carefully study and comply with these rules and recommendations concerning his duties. Willful violation will be considered sufficient cause for dismissal.

G-3 Responsibility of Individuals

(a) Your definite responsibility is to act so as to provide:

- i) Safety to your self.
- ii) Safety to your fellow employees.
- iii) Protection to the public.
- iv) Protection to the Board's property.

(b) Every employee is expected to study the Safety Code, familiarize himself with its contents and apply them to his work, ignorance of rules and regulations will result in accident to you and your co-workers.

(c) Whenever any doubt arises regarding any rule and regulation you should consult your supervisor or the person in-charge of the work.

(d) Before attempting any work under condition, which you consider to be unsafe, you are required to bring these conditions to the notice of person in-charge of work and seek his advice.

(e) It will be the duty of the every employee to report promptly to his superior or supervisor any dangerous or improper conditions of Board's apparatus or equipment, which comes to his notice.

G-4 Personal Conduct

(a) Use of intoxicating liquor and smoking while on job is strictly prohibited. No employee under the influence of liquor should be allowed to go on work.

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

(c) No employee shall distract the attention of another worker from his job when the worker is doing something which is dangerous either to his person or equipment.

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

G-5 Personal Caution

(a) In climbing, say transmission towers and poles and setting about any work, employees should not waste time, but concentrate on the work in hand. When working near electric supply lines and other apparatus one should consider the effect of each act and do nothing which may endanger him or others. Employees must be careful always to place themselves in a safe and secure position to avoid slipping, stumbling or moving backwards against live conductors. The care assumed to be exercised by others must not be relied upon for protection.

(b) Before commencing the work, one should examine all the required safety equipment like ladders, gloves, safety belts etc.

G-6 Physical Fitness

(a) Any employee who is unable to perform his duties due to illness or other disability shall promptly report his condition to his immediate supervisor, otherwise it will be taken as neglect of duty.

(b) After absence from work due to illness or injury, an employee may be required to pass a physical examination to determine his fitness for duty. If a person is unable to carry out any order, he should report to his supervisor immediately.

G-7 Fundamentals of Safety

The majority of accidents which occur are preventable, if proper precautions are taken. Accidents occur due to unsafe working, lack of proper supervision and workman's carelessness. A capable and mentally alert employee will avoid accidents, but an unsafe person is a liability to Board.

(a) Unsafe acts which may cause accidents include the following: -

(i) Operating without authority or warning, such as closing switches without authority, operating cranes and trucks without warning.

(ii) Making safety devices inoperative such as using oversize fuses, blocking safety valves, etc.

- (iii) Operating or working unsafely -such as driving too fast, throwing material or tools to another worker, jumping from vehicles or platforms and unnecessary haste.
- (iv) Using unsafe, improper and substandard tools and equipments or using equipment improperly such' as using dull cutting tools, defective chisels, defective wrenches, using hands instead of hand tools, etc.
- (v) Unsafe loading, over loading of vehicles, carrying too heavy a load, leaving objects where they are likely to fall and improper packing.
- (vi) Working on dangerous equipment such as cleaning, oiling or adjusting moving machinery.
- (vii) Practical joking, horseplay quarrelling and teasing.
- (viii) Failure to use safe clothing or protective equipment such as wearing loose sleeves, neckties or jewellery near moving machinery.
- (ix) Failure to use rubber gloves on live equipment, helmets, gas masks, safety belts, ladders and goggles during welding.
- (b) The accidents which occur due to lack of proper supervision or workman's carelessness may be attributed to: -
 - (i) Class of work beyond mental or physical ability of the employee.
 - (ii) Lack of proper instruction.
 - (iii) Improper use of safety devices and tools.
 - (iv) Methods pursued not suitable for work.
 - (v) Protective devices not used.
 - (vi) Rules or instructions not observed.
 - (vii) Lack of proper inspection and maintenance.
 - (viii) Mental condition of employee.
 - (ix) Failure to think.
 - (x) Mechanical manner of doing work.
 - (xi) Haste and over boldness.
 - (xii) Intemperance.

G-8 Reporting Hazardous Conditions.

- (i) All hazardous conditions should be reported to the supervisor.
- (ii) Hazardous conditions should be eliminated as soon as they are discovered. Where a hazard cannot be removed accident can be prevented by taking reasonable and proper precautions.

G-9 Accident Report, Records and investigation

(a) Accident Reports:

(i) If any accident occurs in connection with the generation, transmission and distribution of supply or use of energy in or in connection with any part of an electric supply line or other electrical apparatus, it shall be immediately brought to the notice of the authorized person in direct charge of the apparatus, who shall give notice of the accident in writing to the Secretary concerned Chief Engineer and Superintending Engineer, P.S.E.B. within 48 hours of the occurrence thereof. A copy of the notice shall also be sent to his immediate superior for information. In case where the accident results or is likely to result in loss of life or personal injury the authorized person in direct charge of apparatus, shall also give notice of the accident in writing to the Chief Electrical Inspector to Government Punjab within 48 hours of the occurrence thereof if the accident has occurred in the Punjab State. In case an accident has resulted in loss of life, notice shall be given as stated above to the Electrical Inspector Punjab and also to the Chief Engineer and Superintending Engineer concerned on the date of the accident by express telegram to be confirmed by post within 48 hours of the occurrence of the accident.

N.B. The falling of a tree, which results in damage to an electric supply line, is an 'accident' and must be reported as such.

(i) Neglect to report accident is punishable by fine under section 47 of the Indian Electricity Act, 1910.

(ii) In case of fatal accidents to persons immediate report shall also be made to the nearest police station and the body should not be allowed to be removed until the police enquiry is completed.

(iii) Every accident should be investigated to determine the cause and steps needed to prevent its re-occurrence. It shall be the responsibility of the person incharge of the job to get a complete detailed history of the accident as soon as possible after it occurs.

(v) All accidents involving motor vehicles shall be investigated to determine responsibility and to suggest remedial measures.

b) "Fallen Wires"

i) It shall be the duty of all employees to watch for fallen electric supply line conductors and other wires belonging to the Board. When an employee finds a fallen wire, he shall stand by it to protect all street and highway traffic from it. He shall as soon as possible instruct someone from those available- in the neighborhood to telephone or otherwise inform the nearest headquarters either to have the wire made dead and earthed or to have it raised from the ground. This employee shall not leave the fallen wire until he has been requested to do so by the authorized person in direct charge of the electric supply line.

ii) All fallen wires should be considered live unless proved to be dead. When suspected to be live they should, after taking proper precautions with a dry pole, be moved aside.

G-10 Safeguarding the Public

i) Every effort should be made to protect the Public at all times when Board's work is in progress, by the use of signs" barricades or personal warning. When working on consumer's premises or public property, every effort should be made to avoid hazards to persons and damage to the property. When work is being carried out along public streets or highways, Pedestrians and vehicular traffic should be warned by signs and flags during the day and by red lights during the night.

Suitable barriers shall be placed around all open man-holes, exposed open ditches and excavations.

PART-'A'
CHAPTER-3
Safety Devices and tools

SD-1 Safety Devices and their Use

- (a) Board shall provide adequate and approved type of protective aids and tools for use by the employees.
- (b) All safety devices and tools shall be inspected by: -
 - (i) Supervisors like Line Superintendents, Sub Station Operators etc. once a month.
 - (ii) Sub Station Engineer, Sub Divisional Officer, Junior Engineer, etc. once in six months.

All items found defective shall be. Withdrawn and replenished with new ones. Records of all such inspections shall be maintained.

- (c) Board shall provide storage racks, bags and bins for safe storage and carriage of protective equipments and tools
- (d) Protective devices are issued to the employees in order to protect themselves against electric shock and arcs.

SD-2 Use of Rubber Gloves, Gauntlets and Other Devices

- (a) Rubber Gauntlets, gloves, mats, boots, galoshes, insulated platforms and stools, safety belts, hand-lines and other special insulated devices shall be used, as required, by employees during working on electrical apparatus and electric supply lines, as precautions against accidental electric shock.
- (b) Rubber gloves and gauntlets shall be used when:-
 - (i) Working on or near live lines and apparatus not exceeding medium voltage.
 - (ii) Using operating rods and handles of switches and isolators.

- (iii) Attaching or detaching leads when using a telephone set.
- (iv) Cutting primary and common neutral earth wires to install n earthing plates.
- (v) The right hand gauntlet or glove wears out more quickly. Under no circumstances a left hand gauntlet should be allowed to be used on the right hand. It is cumbersome to work, the workman is likely to discard it and meet with an accident.

SD-3 Testing of Rubber Gloves and Gauntlets.

- (a) Upon each occasion before an employee puts on his rubber gauntlets or gloves to start work on a new job, he must test each one mechanically for cuts, scratches, cracks and weak spots by rolling it up tightly, beginning at the gauntlets end and notice if any air escapes. This is usually called an 'air' test. Gauntlets or gloves, which show visible cuts, cracks or weak spots or air leakage in this test, shall not be used for protection and must be returned to and a new pair obtained from stock.
- (b) Every pair of rubber gauntlets and every pair of rubber gloves shall be carefully examined at least once a month by an authorized person and be passed for or rejected from further use by him.

SD-4 Storage of Rubber Protective Devices

- (a) Rubber equipment shall not be folded or distorted or allowed to come in contact with sharp objects.
- (b) Rubber equipment shall not be exposed to oil, grease or sun when not in use.
- (c) Rubber deteriorates rapidly in hot climate of Punjab. Therefore these items should be stores in cooler places.
- (d) French chalk shall be used as preservative for storage of gloves and gauntlets.

SD-5 Leather protective Gloves.

Protective leather gloves may be worn over rubber gauntlets, when wires are being spliced, when solder is being handled and when it is necessary to move about a lot during working to avoid injury to gauntlets and consequent danger to the wearer.

SD-6 Periodical Inspection of Safety Devices

(a) Insulated platforms and stools, rubber mats and other safety devices(except rubber gauntlets, gloves ,boots and galoshes) shall be inspected and tested by an authorized person at least once every six months.

(b) Rubber gauntlets, gloves ,boots and galoshes shall be inspected and tested by an authorized person at least once every month and also be inspected immediately after use.

(c) Safety devices found defective upon inspection shall be repaired immediately,. If it is not possible to effect repairs satisfactorily, the defective devices shall be destroyed at once.

50-7 Responsibility in using safety Devices.

(a) It shall be the duty of the supervisor to explain the proper use of such devices and tools to the workmen concerned.

(b) Employees shall use proper protective equipment and tools intended for each job. Each piece of equipment shall be examined by the employee before and after its use. If any item is found defective, the supervisor shall be informed and its use shall be abandoned.

(c) The employee working on electrical apparatus and electric supply lines shall be held responsible for using in proper manner the safety devices provided.

SD-8 Measuring tapes and Rules

Metal rules, metal measuring tape, cloth rules or cloth measuring tapes with metal strands, or wood rules with metal fittings and ferrules shall not be used near energized equipment. 'Suitable rules and types containing no metal parts will be provided or dry hand and approved sticks may be used and then measured by tape on the ground.

SD-9 Use of Goggles and Eye Shields

(a) Employees' shall wear approved types of goggles or eye shields whenever there is danger from harmful radiations, fumes and flying splinters. These may be used while performing the following operations:-

- (i) Welding or cutting
- (ii) Chipping & Grinding.
- (iii) Drilling, cutting or breaking masonry.
- (iv) Cleaning with compressed air, sand blasting
- (v) Handling hazardous chemicals.
- (vi) Handling molten metals.
- (vii) Operating cut-outs and fuses.
- (viii) Scrapping and painting

SD-10 B Provisions may be amended to the effect, that metal ladder shall not be used while working on live lines/equipment unless specifically authorized.

5D-10 Ladders.

- (a) All wood ladders shall be inspected at regular intervals and maintained properly
- (b) Portable metal ladders shall not be used unless specifically authorized.
- (c) Wood ladders for outdoor use should be given a suitable coating such as clear varnish or linseed oil, metallic paint shall not be used on wood ladders.

(d) When a ladder has fallen or been struck, it should be carefully inspected for possible damage before use.

(e) Defective ladders should be destroyed immediately.

(f) A ladder shall not be placed on slanting, oily, slippery or on vibrating footings, unless the ladder is held by another person or securely fastened to prevent it from slipping or twisting.

(g) The base of the ladder should not be placed less than quarter of the length of the ladder from a wall or supporting surface and not more than half the length of the ladder.

(h) The overlap of section for extension ladders should be sufficient to prevent collapse of extension.

(i) Ladders placed near doors or in passage ways should be protected against being struck by doors or traffic.

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

(k) Several workmen should not climb at the same time. The bottom man shall not start climbing until the top man has reached the top and is in safe position. Similarly, the top man shall not start descending until the bottom man has reached the ground.

(l) Ladders must not be used on walk-ways or road-ways exposed to the traffic unless there is a guard stationed at a small distance from the ladder to guard the traffic.

(m) Whenever possible the ladder shall be held by one person when another is climbing up or descending.

(n) During working on the ladder, workman should not try to reach side- ways so as to create unbalance.

(o) Ladders should be securely positioned before using. No one should remain on the ladder when it is being shifted to another position.

SD-11 Hand Tools.

(a) Many accidents result from improper use of tools and use of defective tools and equipment. Employees should use only those tools and equipments which are in good condition and only for the purpose for which they are designed.

(b) Tools which develop defects while in use should be removed from service.

(c) Impact tools such as chisels drills, hammers and wedges with mushroomed heads should not be used until they have been reconditioned.

(d) Hammers, axes shovels and similar tools should not be used if handles are loose, cracked and splintered.

(e) Defective wrenches such as opened and adjustable wrenches with spread jaws, or pipe wrenches with dull teeth, should not be used as they are likely to slip.

(f) Pipe or other extensions should not be used on a wrench handle to increase the leverage unless the wrench is specifically designed for such an extension.

(g) Metal rules and metallic tapes shall not be used around electric) conductors or equipment.

(h) All tools carried on trucks should be inspected monthly and defective tools repaired or replaced.

(i) Portable electric tools should be provided with a cable having earth wire permanently connected to the tool frame and approved socket at the other end.

(j) Screw drivers with full-length metal tong or shank through handle must not be used for electric work.

SD-12 Earthing Devices for Electric Supply Lines

(a) The following is the standard earthing equipment required by each party of men working on high and extra high pressure electric supply lines carried on lattice towers: -

(i) Two sets of three earthing sticks, fitted with metal heads designed for attaching to the line conductors, and each set .connected by three specifically insulated flexible earthing wires (Min. size 19/.052",0.04 square inch annealed copper or 50 mm Aluminium) of not less than 21 feet in length, to a special earthing clamp designed for clamping and earthing the flexible wires to a leg member of the steel tower structure. The earthing stick must be made of impregnated wood not less than 4"2" in length and dia 1-1/2" or of bamboo in two parts of 5'-0 and 5'-2"

length, respectively to be coupled together for use and must not be less than 1-1/8 inch dia.

- (ii) Two extensions of specially insulated flexible earthing wire (minimum size 19/.052", 0.04 square inch annealed copper or 50m.m. Aluminum of not less than 30 feet in length and fitted at each end with an earthing clamp.
 - (iii) Two pointed metal earthing rods, fitted with clamps to take the earthing wires, for driving into the ground to obtain an independent earth, where necessary.
 - (iv) Strong, light hand lines and safety belts hand lines should always be dry.
- (b) The following is the standard earthing equipment required by each party of men for working on high and extra high pressure electric supply lines carried on poles with a ground wire.

Two sets of three earthing sticks, fitted with metal heads designed for attaching to the line conductor and each set connected by specially insulated, flexible earthing wires (minimum size 19/.052", 0.04 sq. inch annealed copper or 5 m.m. Aluminum) of not less than 6 feet in length to a fourth stick of similar earthing design for attaching to the ground wire. The details of these earthing sticks are shown in Board's drawing No.HW/IT-137).

SD-13 Lines-Men's Clothing

- (a) Linemen should avoid the use of overalls, dungarees, loose dhotis, neckties and coats having metal buttons, metal straps and similar metal fitting. Plastic buttons should be used in every case. Loose clothing should not be worn.
- (b) Linemen, in working among live. conductors, should not roll up their sleeves, as dry clothes give some protection against electric shock.
- (c) Linemen should not wear caps with covered metal buttons or any metal adornment.
- (d) Linemen should not wear shoes with nailed soles. Shoes should have sewn soles.
- (e) Linemen should not wear suspenders and arm bands with metal parts.

(f) Linemen should not wear rings of any kind while working on a pole, line or apparatus which may be live.

(g) Metal keys, chains or metal keepers for key rings or watch chains should not be worn on the outside of the clothing. There is always a possibility that they may come in contact with live conductors or live apparatus.

(h) Linesmen exposed to the danger of falling materials should wear safety helmets and hats.

SD-14 Linemen's Safety Belts.

(a) Employees working on poles or structure shall use lineman's belt. It should be made of good quality leather with D-rings and buckles of galvanized solid steel. It may carry pockets for carriage of tools. Safety straps, when in use, shall be passed around the pole and not around the cross arms, pins and braces.

(b) Inspection and Maintenance.

(i) Every day before using a belt, make sure that it shows no defect.

(ii) Never punch extra holes in a belt or strap.

(iii) Wipe off the belt with clean rag after work in rain and allow it to dry at room temperature.

(iv) Do not expose the safety belt to heat from furnace and other sources of heat.

(v) Belts should not be dropped or thrown from an elevation to the ground.

(vi) Belts should be stored in special compartments or bag or hung on a rack to avoid contact with hardware or sharp tools.

(vii) Belts should be given a periodical treatment of a penetrating oil suitable for the purpose.

(viii) Safety belts should be inspected periodically for the following: -

1. Leather near the holes.

2. Stitches

3. Rivets
 4. Buckles and Rings
- (c) Belt Tools

Belt tools should be well secured in belt. Only pliers, hammer, wrench and connectors should be carried. All other tools should remain below until needed and then hoisted with hand line.

SD-15 Hand lines and Canvas Bags

(a) All tools, protective equipment and light materials shall be raised or lowered by means of hand lines and canvas bags. No tool should be tossed up or down.

- (b) Hand lines shall be of fiber rope. It should not have wire reinforcement.
- (c) Hand lines shall not be left lying in street or road.
- (d) Hand lines should be kept dry, coiled and free from oil, kinks or knots.,

SD-16 Operating Rods

- (a) Only approved type of operating rods should be used.
- (b) Operating Rods shall be kept dry and under cover when not in use.
- (c) Operating Rods shall not be dropped from an elevation.
- (d) Charred operating rods and rods with deformed metal heads due to flash over should not be used.

SD-17 Torch Lights.

Torches used on poles near live wires and other line equipment should be insulated. They should be raised and lowered by hand lines.

PART - 'A'

CHAPTER-4

Permit System and Switching Operations

P-1 Perm it to work

(a) No person shall carry out any work in proximity of an equipment apparatus or line unless the man in direct and immediate charge of the work, has the necessary permit for work. Even when the person himself is competent to issue the permit for work, a permit shall be made out and issued to himself.

(b) Permit for work shall be taken only by authorized persons from authorized persons incharge of operation. The same person whop took the permit shall return it

(c) When written permits cannot be given and taken," Line Clear" should be given and taken on phone. In such cases, substance thereof shall be confirmed by the sender of the message to ensure that both the parties are quite clear as to its purport. These instructions shall be recorded in Permit-to-Work books at both the sending and receiving ends. The duplicate copies of "Line Clear" permits shall be sent by post as soon as possible for record at either end, after duly canceling the same.

(d) When work is done on remote controlled gear such as switchgear or tap changes or while testing relays, etc. The authorized person issuing permitwork will remove all fuses/links from control and trip circuit and will see that the mechanism is blocked where necessary to prevent accidents of mechanical nature. After completion of work, fuses/links will be replaced. Entry of removing the fuses/links and replacing the same will be made on permit-to-work. P-2 .

Caution Notices, Form E.Sc.

(a) After a circuit has been made dead and earthed, Caution Notices shall be placed on' all switch gear and control panels controlling electric supply lines or other electrical apparatus upon which men are about to work. These notices shall be placed by the authorized person issuing permit-to- work in the presence of the authorized persons in charge of the working parties e.g. in the presence of the Line Superintendent, in the case of work on an electric supply line and they shall not be

removed except in the presence of the authorized persons in-charge of the working parties.

(b) Electrical apparatus and Electric supply lines guarded by Caution Notices shall not be made live again until all the Caution Notices of the circuit have been duly removed in the presence of the authorized persons incharge of the parties who have been working on electric supply lines.

(c) To prevent their being torn or dropping off the apparatus guarded, Caution Notices must always be placed in the wooden holders provided for the purpose.

(d) When more than one party of men are working on a section of an electric supply line made dead for the purpose, each Line Superintendent incharge of each party shall have his own duly signed Caution Notices on all switchgear and control panels controlling the section and none shall be removed except in the presence of the Line Superintendent to whom the Caution Notices belongs, when it shall be duly completed and signed.

P-3 Sub Station Log Sheet

The Sub Station Operator shall strictly keep his Sub Station Log Sheet at the exact times through-out day and night recording therein all happenings, including all meter and instrument readings and switching operations. Similarly other log sheets will be kept up-to-date by other authorized employees.

P-4 Placing and Removal of Caution Notices.

Caution Notice shall be placed on and subsequently removed from all controlling switchgear and be duly filled in and signed, in accordance with the instructions given in paragraph "Permit System" in all cases where apparatus is made dead and earthed to enable men to work upon it.

P-5 Possession of Switch Gear Keys

(a) The authorized person incharge of work on electrical apparatus or electric supply lines shall keep in his possession the keys of the locked in earthing switches controlling the electrical apparatus or electric supply lines he is working on, until completion of the work.

(b) Where the geographical separation of the controlling sub-stations and electric supply lines makes this impracticable, the keys of the locked in earthing and locked out isolating switches controlling the electric supply line at the remote sub station shall be retained in the custody of the authorized person issuing permit-to work.

(c) When an electric supply line is controlled by switchgear equipped with Castel locks, an authorized person, before proceeding from the sub station with his men to work on the line, should padlock the Castel key lock covers on the isolating and earthing switches, after the line has been duly isolated and made dead by these switches, and take his padlock keys away with him, leaving the released Castel keys of these switches in the custody of the sub station operator. This will give security to the men working on the electric supply line, while enabling others to work at the same time on the isolated switchgear.

(d) Where the geographical separation of the controlling sub station and the site of work on an electric supply line makes this impracticable, the authorized person incharge of the controlling sub station should padlock the Castel key covers on the line isolating and earthing switches after the line has been duly isolated and made dead by these switches and take the padlock keys in his personal custody before any permit-to-work is issued by telephone. He shall duly record on Form CCSC that the padlock keys are in his personal custody.

(e) A set of numbered padlocks will be specially provided for locking off switches and those locks will be with non -interchangeable keys. Two keys for each padlock shall be provided, one to be the key for normal use and the other to be a spare key. The key for normal use shall have securely attached to it a round brass label with the number of padlock boldly stamped on it. The spare key shall have securely attached to it a square brass label also, boldly stamped with the number of padlock. The padlocks meant for switches together with the normal keys shall be kept on hooks in a cabinet to be installed in the control room. The spare keys will be kept in the possession of the Sub Divisional Officer, Sub Station Engineer or Resident -Engineer Incharge of the sub station and powerhouse, as the case may be. These must not be used except in emergency. The numbers 6 and 9 should not be used in this labeling as these lead to confusion.

PART - 'A'

CHAPTER-5

Knowledge of Safety Code and of the Indian Electricity Act and Rules

K-1 Working Class

(a) All employees of working class will be supplied each with a copy of 'Safety Code', for which they shall sign a receipt. Subsequent amendments will be issued to them from time to time, for which also they shall, sign receipts.

(b) Every employee of working class is expected to have a complete knowledge of this Safety Code in respect of chapters relating to his duties. Lack of such knowledge shall not be accepted as an excuse for permitting any infringement of them in the operation, maintenance, construction and up-keep of equipment in his charge.

K-2 Engineering Subordinates

(a) All, the employees of this category will be supplied each with copy of 'Safety Code', for which they shall sign a receipt. Subsequent amendments will be issued to them from time to time, for which also they shall, sign receipts.

(b) Every employee of this category is expected to have a complete knowledge of this Safety Code and lack of such knowledge shall not be accepted as an excuse for permitting any infringement of them in the operation, maintenance or construction of apparatus and works in his charge.

K-3 Employees of Gazetted Rank and Junior Engineer.

(a) All the employees of above category will be supplied each with copy of 'Safety Code' and a copy of the Indian Electricity Act and the Rules issued thereunder, as amendments to safety Code, to the Act and to Rules will be issued to them in like manner from time to time, for which also they shall sign receipts.

Every employee of above category is expected to have a complete knowledge of Safety Code, the Indian Electricity Act and the Rules, and lack of such knowledge shall not be accepted as an excuse for permitting any infringement of them in operation maintenance or construction of apparatus and works in his charge.

PART-B

CHAPTER-1

Transportation (Instructions For Drivers)

T -1 General Precautions.

(a) Vehicles should be kept in good operating condition, and driven in a safe manner so as to prevent injury to driver and others and save damage or loss of valuable equipment. Driving of Board's car or truck is a responsibility, not a privilege.

(b) No employee shall operate a Board's car or truck upon a public thorough fare unless he has the proper licence in his possession.

© Every driver of Board's car or truck shall be thoroughly familiar and comply with the State and city traffic law covering the territory where he operates.

(d) Before operating the vehicle.

(i) Test brakes, horns, lights etc .

(ii) See that stepney and tyres are properly inflated.

(iii) Ensure that sufficient petrol, lubricating oil, water and brake oil are available in the vehicle.

(iv) Check emergency equipment i.e. first aid kit, jack and tools.

(e) Before filling the petrol tank, the motor should always be shut off. While filling the petrol tank, smoking or using an open flame near the vehicle should be avoided.

(f) Horn should be used only when necessary. Use of horn just near the object is very dangerous and shall be avoided. Use of horn near hospitals is prohibited. .

(g) Left hand drive vehicles shall have these words written, and displayed conspicuously on the back.

(h) Employees should ride with all parts of the body inside, should not attempt to get on or off a moving vehicle. Riding on trailers is prohibited.

(i) When loading or unloading vehicles, the emergency hand brakes shall be applied and the wheels blocked.

U) In transporting heavy materials like drums, transformers etc. particular care shall be exercised to see that material will not shift or fall off the vehicle,

T-2 **Driving**

- a) Most traffic accidents can be prevented by faithful observance of three things.
 - (i) "Control speed": Speeding is dangerous. A few minutes saved at the cost of safety is no bargain.
 - (ii) "Avoid Distractions": Give your undivided attention to the job of driving. Keep your eyes on the road.
 - (iii) "Drive defensively" It is the general law to give right of wayan intersection to approaching vehicles. Do not insist on your right of way. Try to anticipate the intension of other drivers and pedestrians. Their failure to observe traffic regulations does not justify your running into them.

- (b) Board's vehiCles shall be operated within the legal speed limit at all times and at lower speeds where conditions like bad road, poor visibility and weather conditions so warrant.

- © Keep a safe distance from vehicle in front to avoid collision. Drivers should be on the alert for any signal and for its sudden stopping.

- (d) Do not attempt to pass another vehicle going in the same direction, unless you can clearly see ahead to be sure that you can pass safely. Proper horn or signal should be given before passing.

- (e) Do not drive at high speed and to the right of road when approaching the crest of a hill, road crossing school and play grounds for children or curve where full view of the roadways ahead is obstructed.

- (f) Drivers shall not drive vehicles while feeling fatigued, ill, sleepy or in a drunken state.

- (g) When vehicle is being backed, the drive should be guided by a signalman.

- (h) If during driving, any extraneous noise becomes audible, vehicle may be stopped for investigation.

- (i) When emerging from or entering streets and alleys, drivers should use proper precautions to avoid accidents.

- (J) On wet, muddy or snowy, roads, sudden application of brakes shall be avoided. Anti-skid chains shall be used on snowy roads.

- (k) Drivers should use dipper at night when meeting other vehicles.

- (l) When proceeding down gradient, vehicles should not be brought to netural, neither clutch should be dis-engaged.

- (m) When fire-brigade, ambulance, police patrols or flag cars are pproaching, allow them to pass.

(n) Drivers should anticipate the intentions of other drivers, pedestrians, children and animals. They should also give clear signal regarding turning or stopping.

T-3 Parking

(a) Park on the proper side of the street close to the curb of the highway so as not to interfere with traffic.

(b) When parking along a highway at night, lights shall be left on but dimmed.

© When parking on a down gradient ,place vehicle in gear, set hand brake, turn. wheels to curb, or otherwise block the car so that it cannot accidentally roll.

(d) To change a tyre or make other necessary repairs along the highway, pull off to the side of the road as far as possible.

(e) Before leaving a parked vehicle, always remove the ignition key to prevent theft or unauthorized starting of car.

(f) Leave or enter parked vehicle on the curb side wherever possible. Use extreme care if doors are on road side to see that no other vehicles are near.

(g) Before starting a parked vehicle, observe front and rear to make sure that persons and objects are out of the way.

T -4 Operations of Trucks. Trailers and Tower Wagons

(a) In transporting heavy materials like drums, transformers and poles, particular care should be exercised to see that materials will not shift or fall off the vehicle. .

(b) Loading of vehicles should not exceed their rated capacity and objects should not be permitted to be extended beyond sides unless the necessary permit has been obtained from the authorities. Red flags during day and red lantern during night should be attached at the extreme ends of the long loads.

(c) The passengers carried in truck should not exceed the legally permitted number.

(d) In coupling trailers, be sure to place coupling pin or lock.

(e) Driver of tower wagon or other vehicle equipped with booms or mounted ladders shall not drive with such equipment in an elevated position~

(f) Proper precautions shall be taken at all times to prevent contact with overhead lines, trees or structures.

T-5 Procedure in Traffic Accidents

(a) Do not become involved in an argument as to who was responsible for accident, but endeavor to get all the facts in the case. Remember that accidents, which may appear trivial often, result in claim for personal injury or property damage.

(b) Do not lose your temper try to be courteous and helpful.

(c) Following instructions should be observed in the order given if possible when you are involved in a traffic accident.

(i) Stop the vehicle and don't leave the scene of accident, without completing usual formalities.

(ii) Assist injured persons and give immediate first -aid and send for doctor and ambulance if necessary.

(iii) When requested give your name, address and show driver's licence to the other party or Police.

(iv) Secure name, address and licence number of other driver, vehicle registration number and names and address of car owner and insurance company.

(v) Record names and addresses of witnesses.

(vi) Unless a policeman is present at the scene of the accident, notify police having jurisdictions in the territory.

(vii) Prepare rough sketch of the location showing position of vehicles or pedestrians involved and any special condition such as obstructions, parked cars skid marks. Show date, time, weather and road conditions and any other information which you consider useful.

(viii) Notify your supervisor and also submit written report with all useful information which you possess.

PART-B
CHAPTER-2
CONSTRUCTION

C-1 **Pole Erection**

(a) **Carting**

Where poles are carted so that one end of the pole projects beyond the vehicles an indicator should be placed at the rear end of the pole to warn traffic and pedestrians of the projection. In the day time the indicator should be a red flag or sign. At night a red lantern should be used as an indicator.

(b) **Temporary Storage**

When poles are stored temporarily in roadways before erection or removal, they should be placed as close as possible to the edge of roadway. They should not be stored at points in the road where there are sharp turns. Each pole should be placed so that its top faces the direction of traffic. Poles stores on highways should not have cross arms or steps attached. Poles temporarily stored in roadways should be protected from traffic at night by means of red lamps' or other means at the disposal of the workmen to avoid possible accidents.

(c) **Digging Holes**

The digging of pole -holes does not involve any great hazard but does contribute a number of minor injuries such as eye-injuries from flying splinters of rock and earth, blisters on hands from use of tools which can be partially eliminated by the use of gloves, foot and leg injuries due to falling tools etc., Whenever there is a possibility of people or animals falling into open holes, these holes must be covered if they are to be left open overnight.

(d) **Setting Poles**

Setting of poles is a hazardous job. When erecting poles across a highway, two flag-men should be deputed at least 50 metres away from the location of polesetting to guard traffic. Two legged "Dead Men" should invariably be used for erection of poles. Side -guy should never be wrapped around the bodies of the workmen but should be attached to the bars driven into the ground. Supervision should never assist the pole-setting but Goncentrate on supervision for safe-erection. During erection near live lines, care should betaken to prevent poles from coming in

contact with these lines. When poles are raised by means of derricks linemen and . ground men should avoid standing close to the derrick.

(e) **Back Filling**

After the pole is raised, the guys should be anchored so as to prevent it from falling. Back filling should then be done. Temporary guys should not be removed until the back filling is sufficient to hold the pole in position. After a pole has been set, all obstructions to traffic must be removed before the gang engaged in pole setting moves away.

C-2 **Pole Climbing**

(a) Before a linesman attempts to climb a pole, he should make sure by inspection or test that it is strong enough to carry his weight safely. Poles which are decayed or badly raked must be securely guyed, before a linesman attempts climbing.

(b) Linesman should concentrate his mind fully to preclude possible accidents.

(c) . In choosing the climbing side, every effort should be made to avoid nails and other metal obstructions.

(d) When a pole is leaning, the climber should use the upper side whenever possible.

(e) When two or more men are ascending a pole, the second man should not start climbing until the first man is in safe position or when descending until the first man is on the ground.

(f) While climbing, proper use of belt and safety strap should be made to make full use of hands. It should be ensured that a safety strap will not slip over the pole top.

(g) Hands and arms should be protected by wearing gloves and keeping the shirt sleeves down and buttoned when ascending or descending a pole.

(h) Sliding along the pole or guy wire is not allowed.

(i) Pins, cross- arms, braces and insulators may not be relied upon as safe supports for hands or safety straps.

j) While moving up or down a pole, one hand should 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 strap to shift higher or lower with the free hand.

(k) Before starting work aloft the pole, all unauthorized persons should be warned to keep clear from the falling tools, splinters etc.

C-3 Pole Dismantling

(a) Dismantling a pole is an equally hazardous job. The pole should be guyed at least three ways by means of guy ropes before the pole is climbed to clear all wires and cables.

(b) Guys shall not be removed until all the temporary supports have been securely located. All members of the crew who are actually not engaged in the removal of pole should stand clear to avoid possible injury in case the pole falls.

(c) All traffic should be stopped in both directions while the pole is being dismantled.

C-4 Cross Arms

(a) Hand lines should always be used to raise cross arms, the former should be lashed well to the latter and tested thoroughly by hand before the cross arms are raised from the ground.

(b) All men not engaged in actually raising cross arms should stand clear. Linemen and ground men on the ground who are engaged in raising a cross arm should keep their eyes on the cross arm from the time it leaves the ground until it is received aloft. Only one cross arm should be raised at a time.

(c) A lineman should not put his safety belt around a cross arm for support unless he is positive that the cross arm will support him. C-5 Insulators

(a) In carrying insulators to the job they should be packed carefully in a separate box. No other line material or tools should be packed in this box.

(b) Before insulators are raised aloft, they should be inspected. Only sound insulators should be installed.

C-5 Wires

(a) Inspection

Before a Lineman undertakes any work on a pole; tower or structure, he should first make a complete inspection from the ground of the position of all high voltage wires and find out the direction of feed in each case. He should determine the necessary amount and kind of portable protective device which is required and should take this item from the truck and inspect it carefully before he attempts to climb.

A lineman should test his rubber gloves using the 'air' test on each new job. The rubber gloves should not however be worn, while a lineman is climbing the lower part of a pole, tower or structure, as they might be injured or punctured by wood splinters, nails, etc.

(b) Stringing Wires.

(i) In stringing wires, care must be taken not to put kinks into any part, kinks reduce the strength of the wire and may result in fallen wires latter. In the handling and stringing of weatherproof covered wires, care must be taken not to injure the weatherproof covering. A lineman should not change the strain on a pole by adding wires until he is satisfied that the pole will safely stand the altered strains.

(ii) In stringing wires across railway lines, train schedules should be ascertained help may be sought from P.W.I. and all other precautions taken to avoid any serious accident.

(iii) While stringing wires across roadway, these should be strung clear of the roadway or gang man shall be stationed to guard traffic.

Every reasonable effort shall be made not to interfere with P& T lines and public property.

(c) Tying in Wires.

Wires should be tied at all the insulators securely so as to prevent the possibility of wires becoming loose at points of support and possibly falling to the ground. While tying in the parallel circuits, it should be ensured that phase wires of one circuit are connected to the corresponding phase wires of the other circuits.

(d) Cutting Wires

(i) Line support should be properly guyed before removal of wires.

(ii) Wires may be lowered with a hand line. Care should be taken to avoid contact with other wires.

(iii) Wires, which have been cut, should not be allowed to fall over roadways or all street and highway traffic should be guarded.

(iv) All employees, on the ground should be alerted before broken wires are allowed to fall.

(e) Ground Wires

Ground wires should be installed clear of line equipment which would ordinarily be considered as insulated from ground, such as cross arm, brace, through bolts, pole steps, street lighting fixtures etc.

C-6 Installation of Guy Wires

(a) When insulators are used they should be inserted into the guy wire line before the guy wire is set in place. In new works guy should generally be installed before live wires are strung.

(b) Guys should be so installed as not to interfere any more than 'necessary with the climbing space and should clear all high tension wires as far as practicable, otherwise rubber protective sheath, should be used.

(c) Guy strain insulators should be provided wherever necessary to secure the required amount of insulation. Guys should be carefully installed on poles to prevent them from becoming loose. Guy wires should not interfere with street highway traffic, otherwise stub-stayed guys may be installed.

(d) Guy wires should be installed not to rub against power cables.

(e) Guy wires may not be attached to trees

C-7 WORK EXECUTED BY CONTRACTOR'S ENGINEERS.

When it is necessary for a contractor's engineer to work on apparatus, he shall request the Executive Engineer (or the Sub Divisional Officer) to arrange to isolate and make the apparatus dead, The permit-to-work and release switch gear keys and other keys of the locked -in earthing switches and locked out isolating switches and circuit breakers shall under these circumstances be issued by the Sub Station Operator or the Sub Divisional Officer, as the case may be, direct to the Contractor's Engineer who will follow the same procedure when executing the work and sign the clearance certificate, upon its completion, returning the switch gear keys as laid in this Safety Code for a duly authorized employee of the Electricity Board in charge of a working party,

PART-B

CHAPTER-3

Handling and Storage of Material and Equipment

S-1 Storage of Material and Equipment

- (a) The storage of material and equipment should be on a planned basis and the following precautions may be taken.
 - (i) Indenting of materials should be in relation to consumption to avoid over crowding.
 - (ii) A notice showing maximum safe loading capacity of every room shall be displaced therein to avoid over loading and materials shall be distributed evenly.
 - (iii) The layout shall provide maximum use of lines and racks.
 - (iv) Material piles shall be on firm foundations, not liable to settle.
 - (v) The piles shall not interfere with adequate distribution of light, passageways or functioning of fire fighting equipment.
 - (vi) Material shall not be piled against partitions or walls of . buildings, unless it is known that the partition wall is of sufficient strength to with stand the pressure.
- (b) Wood poles and lumber shall be piled on support above ground with horizontal or slightly inclined layers separated by tie pieces, the end of which shall not project into walkways.
- (c) Storage of transformer oil and lubricating oil shall be at a safe distance from switch yards and other valuable properties. With a view to restricting damage in the case of tank ruptures, loose rock or ballast and proper drainage shall be provided.

S-2 Manual Handling, carrying, piling etc;

- (a) Where practicable, mechanical appliances (ropes, jacks, rollers and planks for sliding, wheelbarrows, handcarts etc.) may be provided.
- (b) The workmen shall be trained in safe methods of handling. They should avoid:
 - (i). Lifting with back.
 - (ii) Lifting too quickly or with a jerk.
 - (iii) Lifting while in an awkward position, or with a poor footing.
 - (iv) Handling loads which are unwieldy or too heavy ,or loads which obstruct vision.
 - (v) Handling loads with sharp edges or corrosive materials without the use of suitable protective clothing and equipment.
- (c) Raising or lowering of heavy objects by two or more workmen shall be governed by a well understood code of signal to ensure unity of action.
- (d) Chain Hoists will not be used until their condition is known to be satisfactory. Care should be taken to avoid over-straining hoisting equipment. Chains should be inspected before use and even at intervals during work to avoid failure of weakened links, hooks, and other parts.
- (e) Only safe loads should be lifted with various sizes of Manila and sisal ropes. These ropes should not be used over sharp metal edges.
- (f) Bulk of loads should be carried in such a way so that the front view is not obstructed.
- (g) Pipes, conduits, rounds and other conducting material should not be carried in close proximity of exposed live electrical equipment or conductors.

S-3 Mechanical Handling of Material and Equipment.

- (a) The Boards shall provide suitable hoisting apparatus ,for hauling and carriage of loads above 500 Kg.
- (b) Slings for hoisting and other purposes may be made of chains, wire ropes or fibre ropes of sufficient strength to carry the loads.
- (c) All slings should be provided with rings, shackles, links, hooks or eye of proper size so that they could be safely suspended.
- (d) Supervisors shall ensure that the workmen are trained in the proper use of knots, ties and hitches safe methods of hooking and slinging. They should know the common faults connected therein.
- (e) Following general precautions shall be observed.
 - (i) Power operated cranes should be operated only by authorized persons.
 - (ii) Riding on hC?ists hooks loads, etc is prohibited.
 - (iii) No employee shall unnecessarily remain below any load under suspension from a crane.
 - (iv) Operators shall not leave the hoisting apparatus with the load suspended.
 - (v) In case the power supply to the crane is interrupted the driver shall immediately switch all controls in off position until the power is available again.
 - (vi) Chains shall be free from kinks, knots and twists, when in use.
 - (vii) Wire ropes shall be treated periodically with suitable lubricants free from acids or alkalies.
 - (viii) Fibre -rope shall not come in contact with acids, oil and other destructive chemicals.

S-4 Handling and Storage of Poles

(Additional Provision Relating to Distribution).

(a) General precautions.

The following precautions shall be observed: -

- (i) Only approved methods, tools and equipment should be used in pole- handling operations.

- (ii) When handling treated wood poles, precautions should be taken to avoid skin contact, particular care being taken not, to rub the eyes nor wipe perspiration from them with the hands or with shirt sleeves which have been exposed to wood preservative. The employee engaged on such type of work shall use protective clothing, protective ointment, leather gloves etc.
 - (iii) When poles are handled mechanically, hoisting equipment operators shall accept signals only from an employee specifically detailed for the purpose.
 - (iv) Poles should be stored in elevated way with sleepers between each layer. Each layer may be securely tied.
- (b) Loading and transporting poles on trucks and trailers.
- (i) Trailer wheels shall be securely braked or blocked before loading.
 - (ii) While loading a pole, employee shall not stand between the pole pile and the loading or transporting equipment.
 - (iii) When a pole is being rolled from the pile or from the ground to trailer, it shall be done with a line or crow bar.
 - (iv) When poles are loaded on flat bed bidders sleepers shall be used beneath the bottom layer.
 - (v) Towing devices and chains used with pole trailer shall be of an approved type.
 - (vi) Pole trailers shall not be loaded in excess of registered allowable weight.
 - (vii) Trucks shall be loaded in such a manner that there are no dangerous projections and the poles are firmly secured for safe transportation.
 - (viii) Unloading poles from trucks and trailers. The following precautions shall be observed for unloading poles from trucks and trailers:
 - (i) Poles shall be unloaded from trucks and trailers by the following methods, as circumstances and traffic conditions may permit:
 - (a) By means of a boom, mobile -type crane or skids.

- (b) By shaking poles from the end of a load.
- (c) By lowering poles with lines only where conditions require this method.
- (ii) When unloading poles, which have been secured with the tie wire or strap, only the binding for the layer being unloaded shall be removed.
- (iii) When rolling a pole from a load, a bull line or line shall be used to control its decent. Dropping poles over the side of a truck or trailer shall be prohibited.
- (iv) Dumping an entire load from a trailer shall be prohibited.

S-5 Handling and Storage of Chemicals and Explosives.

(a) Chemicals

- (i) Persons handling chemicals should have reasonable knowledge of their properties, possible hazard that can be fall and manufacturer's instructions.
- (ii) Suitable protective clothing, eye shields etc. should be used while handling chemicals.
- (iii) No edible shall be stored or consumed in the area where chemicals are stored.
- (iv) Use of open flame or smoking should not be allowed in the vicinity of chemicals.

(b) Explosives

- (i) Smoking and open flames are strictly prohibited within 50 feet of explosives'.
- (ii) Only qualified, experienced and trained persons should be permitted to handle, use and transport explosives.
- (iii) Dynamite and blasting caps should be stored in separate magazines.

- (iv) Don't expose explosives to direct rays of the sun for a long time.
- (v) With the approach of lightning storm, all blasting work should be stopped and all person should move to a place of safety.
- (vi) Vehicles carrying explosives should not be driven at speed more than 40 Kilometers, per hour only the driver should remain in the vehicle when in motion.
- (vii) Containers of explosives should only be opened by means of non sparking tools like screw drivers etc.
- viii) Deteriorated explosives, empty containers and packing materials shall be disposed of in accordance with the manufacturer's instructions.

S-6 Handling and Storage of oil grease and paints.

- (a) All sources of ignition shall be prohibited in areas where flammable ' liquids are stored and handled. 'No smoking' warnings shall be exhibited conspicuously.
- (b) Oil storage tanks of the plants shall be at a safe distance from the plant and outside the building.
- (c) Empty oil drums, boxes or other combustable material shall never be piled near storage oil tanks and oil filled equipment.
- (d) Places where paints, varnishes, lacquers, thinners etc. are stored or used shall be kept scrupulously clean and will be ventilated.
- (e) Containers of petroleum shall be labeled and kept securely stoppered while in store. Only flame proof lamp may be taken inside such storage rooms.

S-7 Sanitation and House Keeping

Workmen are frequently injured by slipping, stumbling, stepping on or jumping into tools, material and other objects, left lying around or by carelessly placed objects falling from above. To ensure good house keeping following precautions should be observed: -

- (a) Stairways, fire escapes and all other passageways shall be kept clear of all obstructions.
- (b) Tools and materials should not be placed where they may cause tripping or stumbling hazards or where they, may fall and strike anyone below.
- (c) Spilt oil and water create a slipping hazard and should be cleaned up promptly.
- (d) Nails in boards, such as those removed from scaffolds and packing boxes, constitute a hazard and should be removed. The Boards should be carefully stacked or stored.
- (e) Dirty and oily wastes should be deposited in approved containers and disposed off as soon as practicable to avoid fire hazard.
- (f) Broken bulbs, glass, porcelain and other scrap objects should be dumped in placed or containers provided specially for the purpose.
- (g) Discarded florescent and other gas filled tubes shall be disposed off safety.

PART (C)
CHAPTER-1

Fire Prevention and Fire Fighting

EF-1 Fire Fighting Service and Fire Escapes.

- (a) Adequate fire fighting equipment should be maintained at all power houses, indoor Sub Stations both attended and un-attended and store god owns and other important buildings.
- (b) Firer extinguishers shall be suitably placed and accessibility to them shall not be obstructed. A framed plan showing the position of fire fighting equipment, water supplies and hydrants, means of access etc. should be displayed at suitable points.
- (c) Important buildings and installations may be got inspected and familiarized by the personnel of the local fire brigade.
- (d) In all premises where persons are required to work adequate means of fire escapes shall be provided.

These escapes should be kept free from any obstruction.

FF-2 Fire Alarm Devices

- (a) A siren, telephone system or other alarm arrangements should be provided.
- (b) Fire alarm system shall be installed at readily accessible places and in the fire exists.

FF-3 Fire Fighting Training

- a) Demonstration and training in fire fighting shall be conducted at sufficient intervals to familiarize the operating persons with the following:-
 - (i) Common fire hazards, techniques of fire prevention and fire fighting.
 - (ii) Use of various type of fire fighting devices.

- (iii) Locations of exits and fire fighting equipments.
- (iv) Precautions against electric shock and inhalation of toxic gases.

FF-4 Fire Inspections

Periodic inspections of extinguishers should be arranged:

- (a) To ensure that the fire fighting equipment is services and maintained effectively and in according with the manufacturer's instructions.
- (b) To ensure that all fire doors, shutters, oil drains and pits are kept in good condition.
- (c) To ensure that fire hazards due to bad house keeping and improper storage of inflammable material are eliminated.

FF-5 Fire Fighting Procedure

- (a) As soon as a person discovers a fire, he shall immediately turn the alarm and intimate the control room or his supervisor. He shall then proceed to . extinguish or control the fire with proper extinguishing apparatus until help arrives.
- (b) In case of fire involving electrical apparatus the first essential is to render the circuit dead. In case, 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 e.g. carbon dioxide, carbon tetra chloride, dry sand etc. Water must not be used on fire involving electrical equipment.
- (c) The operators in the control room after receiving the fire alarm shall Immediately inform his superior officer and the nearest local fire brigade giving the exact information regarding location, type and extent of fire.
- (d) The first-aid personnel shall be arranged to be available at site of fires for rescue and first aid work.

FF-6 Classification of Fires

Fires are classified as under:-

- (a) Class 'A': Ordinary material i.e. wood, paper, textile and rubbish.
- (b) Class 'B': Flammable liquids i.e. oils and greases.
- (c) Class 'C' Live electrical equipment.

FF-7 Causes and Precaution for Prevention of Fires.

(a) Class 'A' Fires involving ordinary combustible materials. Water in large quantity is of first importance for quenching such fires. The following precautions should be taken against 'A' Class fires:

- (i) Glowing cigarette butts and matches shall not be thrown. into waste baskets or other places of fire hazard.
- (ii) Smoking and use of open flames shall be prohibited in places where combustible material is kept.
- (iii) Waste materials or oily rags, etc. shall be removed from the premises daily and suitably disposed of.
- (iv) Trees and grassy vegetation shall not be allowed to grow in the vicinity of power houses, sub stations, store yards and other installations and buildings.
- (v) Open fires shall not be left unattended.
- (vi) Ashes shall be deposited in non-combustible, containers with lids.
- (vii) Fires, welding, flame cutting shall not be permitted in combustible areas like woodwork.

(B) Class 'B' Fires:

These are fires involving all types of flammable liquids such as transformer oil, petroleum and greases. The greatest hazard lies in oil filled equipments though the source of ignition is generally electrical. Blanketing is essential for extinguishing liquid fires. The following hazards are encountered on electrical equipments: -

Oil Filled equipment: -

Oil-filled equipment in power houses and sub stations shall be so located and sectionalized that burning oil may not engulf adjacent oil filled equipment. The oil used in a.C.Bs, transformers and other electrical equipments is ignited due to the following: -

(a) Oil Circuit Breaker.

- (i) Due to inadequate rupturing capacity of the circuit breaker to clear the fault. The metal tank of breaker bursts to emit the burning oil, which causes fire and personal injuries to the substation staff.
- (ii) Due to failure of spout insulators of the breaker during thunder storm and closing-in the breaker on account of switching surge. Due to flash, the ejected oil is ignited causing injuries to the operator.
- (iii) Due to bad maintenance of the breaker; both the male and female contacts are heavily pitted, fused and possibly welded together. It causes delayed opening of contacts during fault clearing, resulting into intense arcing in the oil tank. Under heavy pressure, the oil tank explodes to expel the burning oil. It causes damage to adjacent equipment and personal injuries.
- (iv) Explosion caused owing to failure of allied potential transformer possibly due to over-stressing of insulation and breakdown of windings of P.T.
- (v) Due to flashover of bakelite insulators of allied current transformers of the circuit breaker. It causes fire and damage to the breaker and adjacent equipment.
- (vi) Due to bursting of compound filled metal trunking cable box caused by presence of moisture or bad jointing technique.
- (vii) Due to violent internal flash-over inside circuit-breaker oil-chamber because of insufficient or no oil in the tank.
- (viii) Due to disruptive failure of air spaced bus-bar chamber of the breaker due to loose contacts or short circuit created by a reptile or rodent.

(b) Failure of Transformer.

- (i) Due to punctured insulation between adjacent turns or adjacent coil sections or between high voltage and low-voltage windings or between ends of windings and yoke. Such faults are accompanied with explosion inside the tank and emission of burning oil through relief valve or through bursting of transformer tank. The burning oil causes fire and personal injuries.
- (ii) Due to faulty operation of on-load tap-changing gear causing explosion and emission of gas and burning oil.
- (ii) Due to breakdown of insulating porcelain, burning of the transformer and faulting to earth.
- (iii) Due to bursting of cable-box installed near the bushing of the transformer. The flying splinters or cover of cable-box damage the bushings and injure the radiators and tank of the transformer. The intense flash-over sets the oil in the bushing or the tank on fire.
- (iv) Failure of Oil-Filled Cables and terminal Cable Boxes: Cable trenches inside power houses and sub station shall be filled with sand or pebbles or covered with non inflammable slabs.

(C) For Class 'C' Fires

These are fires involving electrical equipment Electricity may become a fire hazard due to fuse blowing, loose connections, short circuit and consequent arcing.

Non -conducting extinguishing agent is of first importance for dealing with such fires. The following are the Precautions to guard against such hazards.

- (a) Electrical equipment shall be installed, operated and maintained properly and in a manner so as to eliminate arcs due to poor contacts, in switches and fittings, worn out insulation, deteriorated and bunched wires, opening of switches carrying large currents etc.
- (b) Leakage of current and 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) Battery rooms shall have no loose connections. Smoking shall be prohibited and rubbish and other combustibles shall not be permitted to accumulate in the battery room.

(f) Metal parts of oil tanks, electrical equipment and buildings shall be adequately bonded and earthed to prevent fires by lightning and static electricity. The earth resistance shall be checked periodically.

(g) Flammable gases or material shall not be stored near electrical equipment.

F-8 Selection of Fire Fighting Appliances

Class 'A' Fires.

Water is by far the most effective agent. It can conveniently be provided in the following ways: -

- (a) Portable extinguishers from which the contents can be poured or thrown to the fire.
- (b) Portable extinguishers from which the water is expelled in the form of a jet or spray. These are two main types: -
 - (i) Soda Acid type in which a small quantity of sulphuric acid reacts with a weak solution of sodium-bicarbonate. This generates carbon dioxide, which builds up sufficient pressure to expel the liquids.
 - (ii) The gas pressure type in which compressed gas is used to expel the water.
- (c) Hose reels permanently connected to the main water supply and fitted with a small hand-controlled nozzle.
- (d) Automatic installation e.g. sprinklers.

Class 'B' Fires.

Here the smothering effect of the agent is most important. The following list covers that agents most widely used: -

- (a) Dry sand, kept in buckets, is not very effective as an extinguishing agent, but it can be usefully applied to limit the spread of burning liquids.
- (b) Asbestos blankets or other means of covering such as a lid on a fixed vessel.
- (c) Foam. There are two main types:-
 - (i) The chemical type, which is produced by chemical action.

(ii) The mechanical type, which is produced by aerating a foam solution.

N.B. Special foams must be used on liquids which mix with water e.g.alcohol, acetone, glycerine, glycols, etc.

(d) Carbon Dioxide: This is in liquid form under high pressure in an extinguisher. It should not be used if the risk of re-ignition is high.

(e) Dry Powder. This is a very effective agent when applied promptly, but it has limitations where the risk of re-ignition is high.

Class-'C' Fires

The following are non-conductors of electricity (for other characteristics. See Class'B' above).

(a) Dry Powder

(b) Carbon dioxide

(c) Vaporizing liquids.

PART (C)
CHAPTER-2
Treatment for Electric Shock.

ES-1 General Instructions

- (a) Act at once, delay is fatal. Every employee must be familiar with resuscitation drill.
- (b) Death from electric shock is rarely instantaneous.
- (c) Heart fibrillations (Heart Muscle Tremors), persist as long as 30 minutes after an electric shock. Therefore, life can be saved by immediate artificial respiration.
- (d) Send for, but never wait for a doctor.
- (e) Continue artificial respiration for four hours even after apparent death.

ES-2 Release From Contact.

- (a) Switch off current immediately or send some one to do so. If the controlling switch cannot be opened immediately it is frequently sufficient to earth the conductor or the equipment. The wire used to short or earth the conductor must first be connected to earth and then thrown across the line conductor to be earthed. 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 free a person from contact with low or medium voltage, use rubber gloves, boots, mat or insulated stick, but if these items are not available use a loop of rope, or coat to drag the person free. Whatever is used should be dry and non conductor.
- (b) In taking a man off a pole, carry a hand line up the pole, pass it over the first cross-arm above the man. Tie the end of the hand line round the man's body just under the arms. If the man has a belt, you may pass the line through two 'O' rings of the belt and tie it securely. Drop the other end of the line to those on the ground and have them pulled it taut. Clear the injured man's safety strap and have those on ground lower him as you guide him down the pole. Have some one there to catch him.
- (c) If you are alone with the injured man, instead of just looping the hand line over the cross arm above him, pass it completely around the arm so that there will be less strain on your end of the line as you lower him.
- (d) In doing this work rubber gloves should be worn. Try not to touch the injured man while he is in contact with the dangerous circuit. If you can throw the hand line around him, do not waste any time trying to get the line twice round his body. One wrap

will do. If you have to touch him, take hold of his dry clothing only. Look out for his shoes, the nails are conductors and you may get a shock through them.

(e) Usually you can most quickly clear the victim from the dangerous circuit by lifting him slightly above it while those on the ground hold the line taut. The man on the ground should then slowly lower him with the line while you guide him past the circuit. In some cases, however it may be possible to have the power shut off or cut the circuit. In these cases, be sure that the victim will not fall when the current is interrupted. This can be done.

(i) by having him attached to the hand line as just explained and by having the line held taut by those on the ground, before the current is interrupted.

(ii) by securing his safety belt before the current is interrupted as for example round the pole or over a cross arm.

(f) If you have to cut a live circuit, be sure that the live end in falling will not strike you or people on the ground and always turn your face away to protect your eyes from the flash.

(g) In case a victim is to be rescued from a manhole, overcome by gas, obtain a hand line, pass one end of the line twice around your own body under the arms and have it tied securely. Your fellow workers can then pull you out if you are overcome. Take the other end of the line down in the hole with you to secure it to the victim just as it secured to you and leave the loop on the ground.

(h) When a man has received electric shock or has been subjected to poisonous gases or has been removed from the water in drowning condition, his breathing is usually stopped. In accidents of this kind, speed may save the injured man's life, so do not waste a second. Send for a doctor at once, but do not neglect the patient in doing so.

ES-3 After Release

As soon as the victim is clear of the conductor, rapidly feel with your fingers in his mouth and throat and remove any foreign matter (Tobacco, chewing gum, false teeth, etc.) Then begin artificial respiration. Do not stop to loosen the victim's clothing, every moment's delay is serious. KEEP THE PATIENT WARM.

ES-4 Artificial respiration

Artificial respiration may only be applied when the victim does not breathe or breathes with difficulty at delayed intervals or convulsively as if sobbing. It may also be applied if breathing grows feebler gradually.

(A) Holger -Nielsen. Method (Standard Technique for Executing the Back Pressure-Arm Lift Method)

(a) Position

Place the patient face down-wards, with head turned to one side, with arms raised and bent, and the side of the head resting where the hands join Slap the patient between the shoulders smartly with the flat of the hand several times. Kneel on right knee opposite, the patient and place left foot by the patient's elbow.

(b) First Movement

Keep arms straight, palms of hands between and below shoulder blades and thumb on spine. Rock forwards with firm pressure taking 2% seconds for this movement.

(c) Second Movement

Release pressure quickly and gradually slide your hands out to the patient's elbows and then raise the patient's arms and pull slightly towards you taking 2~ seconds for this movement.

(d) Third Movement

(f) If there are chest injuries lay the patient face downwards, with arms raised and bent and the side of the head resting where the hands join. Grasp the patient's elbow and then pull slightly towards you, taking 2~ seconds for the movement. Return the arms to the first position and repeat the movements at the rate of 12 times per minute (in case of chest injuries, if possible, the Hip-Lift Back pressure should be given preference).

(g) If the arms are injured:

Lay the patient face downwards with his arms in such a position as to minimize the risk of increasing injury. Keep your arms straight with palms on patient's shoulder

blades and then on spine, rock forwards with firm pressure for 2½ seconds. Release pressure gradually and slide your hands to armpits and pull slightly towards you, taking 2~ seconds for this movement.

(i) In carrying out resuscitation, it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure, no confusion results at the time of change of operator and a regular rhythm is kept up.

(j) Send for medical assistance.

(B) Mouth-to-Mouth Respiration

This method is neither difficult nor tiring. Only one person can maintain this breathing procedure for half an hour. To carry out this method,

(a) Insert your thumb into the mouth of the patient, pull his chin downward and pinch his nostrils.

(b) Take a deep breath, place your mouth firmly over the mouth of the victim and blow hard enough to make his chest rise.

(c) Watch for the patient's chest to expand in rhythm with the rate of respiration.

(d) Apply light pressure on his chesty to exhalation.

(e) When the victim resumes breathing, continue artificial respiration for sometime-until fully revives.

(C) Prone -Pressure Method

1. Best Method

(a) First Motion "Expiration"

(i) Kneel over the patient, rest the hands flat in the small of his back, let your thumb nearly touch, spread your fingers on each side over his lower ribs as shown in the figures.

(ii) Now lean firmly but gently forward over patient, exerting a steady pressure downwards.

(b) Second Motion

"Inspiration" Rock your self gently backwards, but do not remove your hands. Merely keep them in position for the next expiration pressure.

(c) Continue these two movements.

(d) The double movement should be gone through about fifteen per minute. The object is to keep expanding and contracting the patient's lungs so as to imitate slow breathing. If the operator himself breaths slowly, letting the air out as he presses forwards and drawing it in as he rocks backwards, he will naturally arrive at the proper rate, and will understand the reason of movements. In case of severe shock, respiration is seldom established before one hour while three hours may be necessary to restore normal breathing.

2. Alternative Method.

(a) Should it be expedient to place the patient on his back, first loosen the clothes around the chest and stomach. Then place a rolled up coat, or other improvised pillow beneath the shoulders, so that the head falls backwards. The tongue should be drawn forwards.

(b) First Motion

The Operator must kneel in a position to grasp the patient just below the elbows, and draw his arms over his head until horizontal, retaining them there for about two seconds.

(c) Second Motion

(i) Next bring the patient's arms down on each side of his chest and pressing inwards upon it, lean upon his arms so as to compress, his chest.

(ii) Remain thus for two seconds and thus keep repeating the motions at the same rate.

NOTE: - The lungs inflating effect is much assisted if the arms be swung outwards as they are lifted.

(d) If more than one person be present, the patient's tongue should also be drawn out during each outward or lung inflating stroke and released during each inward or lung deflating stroke.

3. **General**

Be careful to avoid violent operations as injury of the internal organs may result from excessive and sudden pressure.

PART (C)

CHAPTER-3

First Aid

F-1 General

First aid means what you should do to reduce the suffering of the patient until the doctor arrives. It may give life to a dying person.

Procedures outlined in this chapter are intended only to give a general knowledge of safe and effective method of applying first aid for certain type of injuries. More complete and detailed instructions are given in "First Aid to the injured" a test book issued by the St.John Ambulance Association.

F-2 First Aid Instructions

- (a) Remove the patient from the source of accident or remove the cause of injury.
- (b) Keep the injured person lying down in a comfortable position his headlevel with his body. This is prevention against fainting. Never pick him up by head and heel.
- (c) Severe hemorrhage must receive immediate attention no matter what other injuries are present.
- (d) If the breathing has ceased, immediate measure must be taken to restore it. The patient should be in a position to breathe freely.
- (e) Poisons swallowed should be got rid of neutralized.
- (f) If the patient has received burns attend to them.
- (g) When the patient .has fractured a bone no attempt may be made to move the patient until the bone has been rendered as much immovable as practicable or unless life is in danger from some other cause.
- (h) Treat the patient for shock.
- (i) Send for medical help or ambulance whenever possible.
- (j) Never give water or liquid to an unconscious patient.

When the patient returns to consciousness and is able to swallow, stimulants may be given.

- (k) Keep by standers away from the patient.
- (l) Don't let the patient see his own injury.

- (m) Keep the patient warm. Avoid overzealous application of external heat, but maintain normal body temperature.
- (n) The first aider must on no account take upon himself the duties and responsibilities of a doctor.

F-3 External Hemorrhage (Bleeding)

(1) Bleeding wounds should be treated as follows:-

- (a) Elevate the bleeding part, in the case of a fractured limb.
- (b) 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.
- (c) 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.

(2) Pressure Points

Six Principal pressure points where hand or finger pressure against a bone may stop arterial bleeding are located as follows:-

- (a) In the neck at the side of the wind pipe against the back bone. Pressure in this' area may produce unconsciousness or even more serious effect. Hence it should be employed only as a last resort.
- (b) Just in front of the ear against the skull.
- (c) About an inch forward from the angle of the jaw where a large branch crosses this jaw bone. The above three pressure points control arteries to head and neck.
- (d) Behind the inner end of the collar bone, down against the first rib.
- (e) On body side of the upper arm, half way between the shoulder and elbow. These two pressure points control arteries to shoulders and arms.
- (f) In the mid groin, as it passed over the pelvic bone. The pressure point controls arteries to lower limbs.

F-4 Internal Hemorrhage

a. Bleeding from lungs

SYMPTOMS:-

- (a) If the bleeding is from the lungs, the blood will be bright red and frothy and 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 it is not possible to move the patient to the dispensary or hospital immediately.
- (c) Keep the patient lying on his back as flat as possible. Turn the head to one side for vomiting and coughing.
- (d) If the seat of the hemorrhage is known, apply an ice bag or a cold compress over the region.
- (e) Give nothing by mouth, except in hemorrhage from the lungs when ice . may be given
- (f) Use encouraging words to the patient.

2. 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 compress over the nose and also the spine at the level onhe collar, place the feet in hot water.
- (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.

F-5 Physical Shock

1. Condition

Shock is a condition of sudden depression of the nervous system resulting from and ,occurring after every case of accident or sudden illness. It may vary from the slight feeling of faintness to a condition of collapse in which the vital forces of body ate so exhausted that death may result.

2. Symptoms:

Symptoms of shock are pallor of face and lips, cold moist skin, rapid and weak pulse, shallow and irregular breathing, fall of the body temperature, dilated pupils. Nausea and vomiting may often occur.

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 circulation of air.
- (d) Cover with rugs or coats.
- (e) Raise well the lower limbs.
- (f) Apply smelling salts to the nose except in 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.

4. On Arrival at Shelter

- (a) Wrap the patient in blankets and apply hot water bottles to the sides of body between the legs and to the feet. Too much heat can be dangerous. Always test temperature of heated objects against your own face or wrist before you wrap them in a cloth or a paper.
- (b) If the patient is able to swallow, give freely 1:1 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 persons. Avoid alcoholic stimulants.

F-6 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 in patient, call for a physician.
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.

F-7 Sun Stroke and Heat Stroke

1. Cause:

Sunstroke and heat stroke have the same symptoms but the cause may be slightly different. Sunstroke results from excessive direct exposure to the sun's rays, while heatstroke results from excessive indoor heat such as in boiler rooms.

2. Symptoms

Red and flushed face, hot and dry skin, no sweating rapid and strong pulse, very high temperature, headache and usually unconsciousness.

3. Treatment:

Send for a doctor immediately, lay victim with head elevated. Sponge body with coldwater 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 freely.

F-8 Heat Exhaustion

(1) Cause:

Heat exhaustion is caused by direct exposure of sun's rays, or by excessive indoor heat.

(2) Symptoms:

Pale face, cool skin, profuse sweating, weak pulse, low temperature and fainting.

3. Treatment:

Keep patient's head low give salt, Coffee or tea External heat is required in severe cases,

F-9 Fractures

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

F-10 Transportation

Do not be hurried into moving an injured person. Always be careful in handling and transporting an injured person. Improper or careless methods frequently increase severity of injury and may even cause death. Acquaint yourself, with the various methods of the patients transportations of the patients.

F-11 Animal Bites

Special danger from bite of an animal such as dog, jackal, fox or wolf suffering from rabies is of Hydrophobia.

- (a) Arrange for medical help immediately.
- (b) After a person has been bitten by a rabid animal, every effort should be made to promote bleeding, so as to wash the wound from within outwards.
- (c) Give alcohol such as brandy or whisky or hot black coffee.
- (d) If it is not possible to obtain the services of a doctor within a few minutes of the person being bitten, the wound should be cauterised. This is best done by applying a fluid caustic, such as carbolic or nitric acid on a match stick or a piece of wood cut to a pointy. To be effective every tooth mark must be probed and cauterised separately, as only by so doing can the virus be destroyed.

F-12 Snake Bites

In case of poisonous snake bites, immediate treatment is necessary to prevent the poison spreading through out the body. If a person is bitten by a poisonous snake, two small punctured wounds (fang marks) about 1/2 inch apart will be seen. These marks will be shown by two tiny drops of blood. If there are more scratches, the snake is most likely to be non poisonous.

TREATMENT

- (a) Send for the doctor.
- (b) If the bite is on a limb, immediately stop circulation of blood by means of a constriction on the upper arm or thigh. The constriction may be by a handkerchief, necktie, shoe-string, or bandage. It should be tight enough to prevent the return of blood in the surface vessels to heart but not tight enough to effect the deeper arteries and veins. The construction should be kept in position for twenty minutes then relaxed for one minute or until the skin becomes pink and again tightened. Repeat this procedure until the arrival of the doctor.
- (c) Make parallel one inch long $\frac{1}{4}$ inch deep incision with a clean knife or blade at the site of the wound should be allowed to bleed freely.
- (d) Keep the patient absolutely at rest.
- (e) If the patient is able to swallow, give hot drinks as strong coffee, tea or milk. Avoid alcohol.
- (f) Wash the wound preferably with light solution of potassium permanganate.
- (g) If breathing is failing, apply artificial respiration.

F-13 Burns

1. Burns are caused by heat of any kind, friction and chemicals such as acid 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

2. Electrical Burns

Two kinds of Electrical burns occur.

- (a) When current passes through the body burning or destroying 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 deep and are first or second degree. Flash burns of the eye may not show up until some time later. In first aid for flash burns of the eye, light should be excluded by using a moist compress held lightly in place with a bandage.

3. Eye burns should have a doctor's attention as soon as possible.

4. First aider's duties are to relieve pain, prevent infection and treat for shock. Death in a day or two after a burn is usually the result of shock. Death later is chiefly the result of infection.

5. For burns of limited extent, apply Vaseline or burn ointment cover ointment with a layer or two of fine mesh gauze and secure with a roller bandage. Take the patient to a doctor for further treatment.

6. Extensive burns may be much more serious. 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, then remove all loose clothing from the burned area unless it sticks to skin. Cut the adhering cloth around the burn and leave the remainder for the doctor to remove.

Do not break blisters. Dip strips of clean freshly laundered sheeting into a solution of baking soda or Epsom salt in warm tap water.

7. **Chemical Burns**

Burns caused by an acid or an alkali should be washed immediately with large quantities of water until chemical is thoroughly washed away. Then apply an ointment dressing and send for medical help.

F-14 Eye Injuries.

(a) Loose particles may be removed with the corner of clean bandage or handkerchief. If the particle cannot be removed easily relieve irritation with a few drops of olive/mineral oil and consult a doctor immediately.

(b) If a foreign particle is embedded in the eye-ball, don't try to remove it. Drop castor/mineral 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.

(c) When quicklime or acid or alkali falls into the eye, wash the eye freely with fresh water.

F-15 Sprains and Strains

(A) Sprains

There are very common injuries caused by abnormal twisting of a joint or movement of a joint beyond its normal range. It causes tearing or stretching of 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.

(B) Strain

These are the injuries to muscles or tendon caused by over-stretching or over-exertion.

TREATMENT

(a) Advise the patient complete rest in a comfortable position.

(b) Apply heat and massage gently.

F-16 Bruises.

A bruise is caused by a blow which breaks the small blood vessels in the tissue under the skin. Ice or cloth wrung out of very cold water should be applied immediately. It helps to prevent discoloration, keep down swelling and relieves pain.
