

भारत सरकार  
केन्द्रीय विद्युत प्राधिकरण  
(विद्युत मंत्रालय)  
सेवा भवन (उत्तरी खंड) कक्ष सं. 622, छठा तल,  
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### सार्वजनिक नोटिस

विद्युत अधिनियम, 2003 की धारा 177 के अनुसरण में, केंद्रीय विद्युत प्राधिकरण (के.वि.प्रा.) द्वारा केंद्रीय विद्युत प्राधिकरण (सुरक्षा और विद्युत आपूर्ति से संबंधित उपाय) विनियम, 2010 को तारीख 24.09.2010 को अधिसूचित किये गये थे। अब उपर्युक्त विनियमों को **केंद्रीय विद्युत प्राधिकरण (सुरक्षा और विद्युत आपूर्ति से संबंधित उपाय) विनियम, 2022** द्वारा प्रतिस्थापित करना प्रस्तावित है। उक्त प्रारूप विनियम के.वि.प्रा. की वेबसाइट [www.cea.nic.in](http://www.cea.nic.in) पर उपलब्ध हैं। प्रारूप विनियमों का निरीक्षण **28 जुलाई, 2022** तक 11:00 बजे से 16:00 बजे तक किसी भी कार्य दिवस को मुख्य अभियंता (विधि), के.वि.प्रा, कमरा नं. 622, सेवा भवन (उत्तरी खंड), छठा तल, आर.के.पुरम, नई दिल्ली के कार्यालय में भी किया जा सकता है।

सभी हितधारकों एवं आम जनता से प्रारूप विनियमों पर अपनी टिप्पणियां डाक अथवा ई-मेल ([celegal-cea@gov.in](mailto:celegal-cea@gov.in)) के जरिए मुख्य अभियंता (विधि), कमरा नं. 622, सेवा भवन, (उत्तरी खंड), 6 वां तल, आर.के.पुरम, नई दिल्ली-110066 को **28 जुलाई, 2022** तक भेजने का अनुरोध किया जाता है।

(राकेश गोयल)  
सचिव, के.वि.प्रा.

**GOVERNMENT OF INDIA  
CENTRAL ELECTRICITY AUTHORITY  
(MINISTRY OF POWER)  
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**PUBLIC NOTICE**

In accordance with the Section 177 of the Electricity Act, 2003, the Central Electricity Authority (CEA) had notified the Regulations *namely* Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 on 24.09.2010. It is now proposed to replace the said regulations by the **Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2022**. The proposed draft regulations are available on the CEA Website [www.cea.nic.in](http://www.cea.nic.in). The Regulations can also be inspected in the office of Chief Engineer (Legal), Sewa Bhawan (North Wing), Room No. 622, 6th Floor, R. K. Puram, New Delhi on any working day till **28<sup>th</sup> July, 2022** between 1100 hrs to 1600 hrs.

All the Stakeholders including the public are requested to send their comments on the draft regulations to Chief Engineer (Legal), Sewa Bhawan (North Wing), Room No. 622, 6th Floor, R. K. Puram, New Delhi-110066 by post or through e-mail ([celegal-cea@gov.in](mailto:celegal-cea@gov.in)) latest by **28<sup>th</sup> July, 2022**.

**(Rakesh Goyal )  
Secretary, CEA**

**CEA (Measures Relating to Safety and Electric Supply)  
Regulations, 2022**

## NOTIFICATION

No. CEI/1/59/CEA/EI – In exercise of the powers conferred by sub-section (2) of 177 read with section 53 of the Electricity Act, 2003 (36 of 2003), the Central Electricity Authority hereby makes the following regulations for Measures relating to Safety and Electric Supply, namely: -

### Chapter I

**1. Short title and Commencement.** - (1) These regulations may be called the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2022.

(2) They shall come into force on the date of their final publication in the Official Gazette.

(3) **Scope and extent of application.** - These regulations are applicable to all electrical installation, including electrical plant and electric lines, and persons engaged in generation or transmission or distribution or trading or supply or use of electricity.

**2. Definitions.** - (a) In these regulations, unless the context otherwise requires,

- (1) “Act” means the Electricity Act, 2003;
- (2) “accessible” means within physical reach without the use of any appliance or special effort;
- (3) “Aerial Bunched Cable (ABC)” means a self-supporting assembly of XLPE (Cross Linked Polyethylene Insulation) insulated conductor(s) with or without a suitable metallic screen to eliminate any magnetic/induction field reaching the external surface and bundled together with an earthed bearer wire of suitable breaking strength;”
- (4) “ampere” means a SI unit of electric current and is equal to the direct current which, if maintained constant in two parallel straight conductors of infinite length of circular cross-section with negligible area, and placed 1 metre apart in vacuum, would produce between these conductors a force per length equal to  $2 \times 10^{-7}$  Newton per metre-
- (5) “apparatus” means electrical apparatus and includes all machines, fittings, accessories and appliances in which conductors are used;
- (6) “bare” means not covered with insulating materials;
- (7) “Bonding Conductor” are the inter connecting conductors for the purpose of equipotential bonding with the main earth.
- (8) “cable” means a length of insulated single conductor (solid or stranded) or of two or more such conductors each provided with its own insulation, which are laid up together. Such insulated conductor or conductors may or may not be provided with an overall mechanical protective covering;
- (9) “charging point” means a facility for recharging of batteries of electric vehicle for private or public non-commercial use, connected at 415/220 Volts;
- (10) “charging station” means a facility for recharging of batteries of electric vehicles for commercial use and shall also include multiple charging points for non-commercial public use and capable of transferring power from electric vehicle to the grid;’
- (11) Chartered Electrical Safety Engineer means a person authorised by the Appropriate Government as referred to in Regulation 6.

- (12) “circuit” means an arrangement of conductor or conductors for the purpose of conveying electricity and forming a system or a branch of a system and protected at the origin;
- (13) “circuit breaker” means a mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified duration and breaking currents under specified abnormal circuit condition such as those of short circuit.
- (14) “concentric cable” means a composite cable comprising an inner conductor which is insulated and one or more outer conductors which are insulated from one another and are disposed over the insulation of, and more or less around, the inner conductor;
- (15) “conductor” means any wire, unscreened cable, bar, tube, rail or plate used for conducting electricity and so arranged as to be electrically connected to a system;
- (16) “conduit” means rigid or flexible metallic tubing or mechanically strong and fire resisting non-metallic tubing into which a cable or cables may be drawn for the purpose of affording it or them mechanical protection;
- (17) “connected load” means the sum of the ratings of the electricity consuming apparatus connected to a consumer’s installation which can be connected simultaneously to the source;
- (18) “contact potential” means electric potential difference across the junction of two different objects in the absence of electric current.
- (19) “covered conductor” consists of a conductor surrounded by a covering made of insulating material as protection against accidental contacts with other conductors or with grounded parts such as tree branches etc. and is able to withstand the phase to earth voltage temporarily.
- (20) “covered with insulating material” means adequately covered with insulating material of such quality and thickness as to prevent danger;
- (21) “cut out” means any appliance for automatically interrupting the transmission of electricity through the conductor when the current rises above a pre-determined amount, and shall also include fusible cut-out;
- (22) “danger” means danger to health or danger to life or any part of body from shock, burn or other injury to persons, or property, or from fire or explosion, attendant upon the generation, transmission, transformation, conversion, distribution or use of electricity;
- (23) “dead” means at or about earth potential and disconnected from any live system. It is used only with reference to current carrying parts when these parts are not live.
- (24) “designated person” means a person whose name appears in the record maintained under regulation 3(2) by the supplier or consumer, or the owner, agent or manager of all electrical installations including mine, or the agent of any company operating in an oil-field or the owner of a drilled well in an oil field or a contractor.
- (25) “earth” make an electric connection between a given point in a system or in an installation or in equipment and a local earth.
- (26) “earthing” means connection of the exposed conductive and extraneous parts of an installation to the main earthing terminal of that installation or connection of neutral conductor of transformer/generator, equipment to general mass of earth or Earth bonded Bar (EBB) of that installation.
- (28) “earthing arrangement (earthing system)” means all the electric connections and devices involved in the earthing of a system, an installation and equipment.

- (29) “electric vehicle” means any vehicle propelled, partly or wholly, by an electric motor drawing current from a rechargeable storage battery, or from other portable energy storage devices or other self-generating electric source.
- (30) “electric vehicle supply equipment (EVSE)” means an element in electric vehicle (EV) charging infrastructure that supplies electric energy for recharging the battery of electric vehicles;
- (31) “Electrical-in-charge” means a person in charge of the electrical installation/plant/department/section/installation of mines and oil fields responsible for safe operation and maintenance of all electrical systems;
- (32) “Electrical Inspector of Mines” means a person appointed as such by the Appropriate Government under sub-section (1) of section 162 of Electricity Act 2003 for the purpose of electrical installations of mines and oil fields;
- (33) “enclosed sub-station” means any premises or enclosure or part thereof, being large enough to admit the entrance of a person after the apparatus therein is in position, containing apparatus for transforming or converting electricity to or from a voltage at or exceeding 1000V (other than transforming or converting solely for the operation of switch gear or instruments) with or without any other apparatus for switching, controlling or otherwise regulating the electricity, and includes the apparatus therein;
- (34) “enclosed switch-station” means any premises or enclosure or part thereof, being large enough to admit the entrance of a person after the apparatus therein is in position, containing apparatus for switching, controlling or otherwise regulating electricity at or exceeding 1000V but not for transforming or converting electricity (other than for transforming or converting solely for the operation of switchgear or instruments) and includes the apparatus therein,
- (35) “equipotential bonding” means an electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential  
Note: In a building installation equipotential bonding conductor shall interconnect the following conductive parts:
- a. protective conductor;
  - b. Earth continuity conductor;
  - c. Risers of air-conditioning system and heating systems, if any.
- (36) “exposed conductive part” means a conductive part which can readily be touched and which is not normally alive, but which may become alive under fault conditions
- (37) “extraneous conductive part” means a conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the electric potential of a local earth.
- (38) “flameproof enclosure” means an enclosure in which the parts which can ignite an explosive atmosphere are placed and which can withstand the pressure developed during an internal explosion of an explosive mixture and which prevents the transmission of explosion to the explosive atmosphere surrounding the enclosure;
- (39) “flexible cable” means a cable consisting of one or more cores each formed of a group of wires, the diameter and the physical properties of the wires and insulating material being such as to afford flexibility.
- (40) “guarded” means covered, shielded, fenced or otherwise protected by means of suitable casings, barrier, rails or metal screens to remove the possibility of dangerous contact or approach by persons or objects to a point of danger;

- (41) “hand-held portable apparatus” means an apparatus which is so designed as to be capable of being held in the hands and moved while connected to a supply of electricity;
- (42) “High Voltage Direct Current (HVDC)” means Direct Current (DC) voltage above 100000 Volts used for transmission of power.
- (43) “inspector of mines” means an Inspector appointed under the Mines Act,1952 (35 of 1952);
- (44) “installation” means any composite electrical unit used for the purpose of generating, transforming, transmitting, converting, distributing or utilizing electricity;
- (45) “Installation Manager” has the same meaning as defined in the Oil Mines Regulations, 2017
- (46) “intrinsically safe circuit” shall denote any circuit operating under its normal operation and specified fault condition as specified in the Bureau of Indian Standards, which when exposed to any spark, ignition, or any thermal effect whilst operating under the above said conditions, is not capable of causing ignition of a given explosive gas atmosphere;
- (47) “intrinsically safe apparatus” shall denote electrical apparatus in which all the circuits are intrinsically safe circuits;
- (48) “increased safety type ‘e’” means a method of protection by which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of occurrence of arcs and sparks in apparatus which does not produce arcs or sparks in normal service;
- (49) International Standard” means IEC/IEEE/EN standard unless otherwise stated
- (50) “lightning arrester” means a device which has the property of diverting to earth any electrical surge of excessively high amplitude applied to its terminals and is capable of interrupting follow on current if present and restoring itself thereafter to its original operating conditions;
- (51) “linked switch” means a switch with all the poles mechanically linked so as to operate simultaneously;
- (52) “live” means electrically charged;
- (53) local earth: part of the Earth which is in electric contact with an earth electrode and the electric potential of which is not necessarily equal to zero.
- (54) “main earthing terminal” means the terminal or bar which is the equipotential bonding conductor of protective conductors, and conductors for functional earthing, if any.
- (55) “metallic covering” means mechanically strong metal covering surrounding one or more conductors;
- (56) “meter” has the meaning assigned to in clause (p) of sub-regulation (1) of regulation 2 of the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 (as amended)
- (57) “mine” has the same meaning as defined in the Mines Act, 1952 (35 of 1952);
- (58) “Modulus of Rupture” means stress in a material just before it yields in a flexure test.
- (59) “neutral conductor” means that conductor of a multi-wire system, the voltage of which is normally intermediate between the voltages of the other conductors of the system and shall also include return wire of the single phase system;
- (60) “neutral point” common point of a star-connected poly-phase system or earthed mid-point of a single-phase system or earthed point of a single-phase system or earthed mid-point of a three-wire direct current circuit or the earthed point of a two wire earthed direct current;

- (61) “nominal voltage (of an electrical installation)” means value of the voltage by which the electrical installation or part of the electrical installation is designated and identified;
- (62) “notified voltage” means a voltage notified by the Appropriate Government under intimation to the Authority for the purpose of specifying the voltage level upto which self-certification is to be carried out under regulation 32 and regulation 45;
- (63) “occupier” means the owner or person in occupation of the premises where electricity is used or proposed to be used;
- (64) “ohm” means a unit of electrical resistance and is the electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points produces a current of one ampere in the conductor, provided no electromotive force is generated in the conductor;
- (65) “open sparking” means sparking which owing to the lack of adequate provisions for preventing the ignition of inflammable gas external to the apparatus would ignite such inflammable gas;
- (66) “overhead line” means any electric supply line which is placed above ground and in the open air but excluding live rails of a traction system;
- (67) "owner" means the company or body corporate or association or body of individuals, whether incorporated or not or artificial juridical person which owns or operates or maintains Electric Plants and Lines;
- (68) “owner”, “agent” and “manager” of a mine have the same meanings as are assigned to them in the Mines Act, 1952 (35 of 1952);
- (69) “point of commencement of supply of electricity” means the point at the incoming terminal of the switchgear installed at the consumer’s premises;
- (70) “poles” means the phase, neutral terminals of a Switch;
- (71) “portable apparatus” means an apparatus which is so designed as to be capable of being moved while in operation;
- (72) “portable hand lamp” means a portable light-fitting provided with suitable handle, guard and flexible cord connected to a plug;
- (73) “Prosumer” has the meaning assigned to in clause (ja) of sub-regulation (1) of regulation 2 of the Central Electricity Authority (Technical Standard for Connectivity of the Distributed Generation Resources) Regulations, 2013 (as amended)
- (74) “protective conductor” means a conductor used for protection against electric shock and intended for connecting together any of the following parts: -
- a) exposed conductive parts,
  - b) extraneous conductive parts,
  - c) the main earthing terminal, and
  - d) the earthed point of the source, or an artificial neutral
- (75) “Schedule” means a schedule to these regulations;
- (76) “section” means a Section of the Act;
- (77) “self-certification” means a certification by a supplier or owner or consumer in the prescribed format as required under regulation 32 and regulation 45;
- (78) “socket-outlet” means an electrical device that is for fixing at a point where fixed wiring terminates, and provides a detachable connection with the pins of a plug, and has two or more contacts and includes a cord extension socket attached to a flexible cord that is permanently connected to installation wiring;
- (79) “solar park” means a concentrated zone of development of solar power generation projects and provides developers an area that is well characterized, with proper



infrastructure and access to amenities and where the risk of the projects can be minimized.

- (80) “span” means the horizontal distance between two adjacent supporting points of an overhead conductor;
- (81) “step voltage” means the potential difference between two points on the earth’s surface, separated by distance of one pace, that will be assumed to be one metre in the direction of maximum potential gradient.
- (82) “street box” means a totally enclosed structure, either above or below ground containing apparatus for transforming, switching, controlling or otherwise regulating electricity;
- (83) “supplier” means any generating company or licensee from whose system electricity flows into the system of another generating company or licensee or consumer;
- (84) “supply lead” means a piece of equipment used to establish the connection between the electric vehicle and either a socket-outlet or a charging point;
- (85) “switch” means a manually operated device for opening and closing or for changing the connection of a circuit;
- (86) “switchboard” means an assembly including the switchgear for the control of electrical circuits, electric connections and the supporting frame;
- (87) “switchgear” shall denote switches, circuit breakers, cut-outs and other apparatus used for the operation, regulation and control of circuits;
- (88) “system” means an electrical system in which all the conductors and apparatus are electrically connected to a common source of electric supply;
- (89) “touch voltage” means the potential difference between the ground potential rise of a grounded metallic structure and the surface potential at the point where a person could be standing while at the same time having a hand in contact with the grounded metallic structure.
- (90) “transportable apparatus” means apparatus which is operated in a fixed position but which is so designed as to be capable of being moved readily from one place to another;
- (91) “volt” means a unit of potential difference of electro-motive force and is the difference of electric potential which exists between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is one watt;
- (92) “voltage” means the difference of electric potential measured in Volts between any two conductors or between any part of either conductor and the earth as measured by a voltmeter meeting Indian Standards;

Voltage Level	Voltage level (r.m.s.) value ( $U_n$ ) (under normal condition)
Low Voltage (LV)	$U_n \leq 1 \text{ kV}$ and $\leq 1500 \text{ VDC}$
Medium Voltage (MV)	$1 \text{ kV} < U_n \leq 33 \text{ kV}$
High Voltage (HV)	$33 < U_n \leq 150 \text{ kV}$
Extra High Voltage (EHV)	$150 \text{ kV} < U_n$

- (93) “watt” is a unit of active power and “MW” means megawatt and is equal to  $10^6$  watts.

2 (b) Words and expressions used and not defined in these regulations but defined in the Act or any other rules or regulations made there under or any other relevant Indian Standards shall have the meaning assigned to them.

## **Chapter II Preliminary**

**3. Designating person(s) to operate and carry out the work on electrical lines and apparatus.-** (1) A supplier or a consumer, or owner of electrical installation, agent or manager of a mine, or agent of any company operating in an oil-field or owner of a drilled well in an oil field or a contractor who has entered into a contract with a supplier or a consumer, or owner of electrical installation, or agent or manager of a mine, or agent of any company operating in an oil-field or owner of a drilled well in an oil field to carry out duties incidental to the generation, transformation, transmission, conversion, distribution or use of electricity shall designate person(s) for the purpose to operate and carry out the work on electrical lines and apparatus.

(2) Supplier or consumer, or owner, agent or manager of a mine, or agent of any company operating in an oil-field or the owner of a drilled well in an oil field or a contractor referred to in sub-regulation (1) shall maintain a record, in paper or electronic form, wherein the names of the designated person(s) and the purpose for which they are designated, shall be entered.

(3) No person shall be designated under sub-regulation (1) unless,-

(i) he possesses a certificate of competency or electrical work permit, issued by the Appropriate Government.

(ii) his name is entered in the register referred to in sub-regulation (2).

**4. Inspection of record of designated person(s) -** (1) The record maintained under sub-regulation (2) of regulation 3 shall be produced before the Electrical Inspector when required by him.

(2) If on inspection, the Electrical Inspector finds that the designated person does not comply with sub-regulation (3) of regulation 3, he shall recommend the removal of the name of such persons from the record.

**5. Electrical Safety Officer(s). -** (1) All suppliers of electricity including generating companies, transmission companies and distribution companies shall designate Electrical Safety Officer(s) for ensuring observance of safety measures specified under these regulations in their organisation, for construction, operation and maintenance of electric system of all generating stations, transmission lines, substations, distribution systems and supply lines.

(2) The Electrical Safety Officer shall possess a degree in Electrical Engineering with at least five years experience in operation and maintenance of electrical installations or a diploma in Electrical Engineering with at least ten years experience in operation and maintenance of electrical installations.

Provided that the Electrical Safety Officer designated for mines shall possess educational qualification as mentioned in sub regulation (2) with at least five years of experience in operation and maintenance of electrical installations relevant to mines as applicable.

(3) For every electrical installation including factory registered under the Factories Act, 1948 (63 of 1948) and mines and oil field as defined in the Mines Act, 1952 (35 of 1952), where more than 2000 kW of electrical load is connected, the owner of the installation or the management of the factory or mines, as the case may be, shall designate Electrical Safety Officer under sub regulation (1) and having qualification and experience specified in sub-regulation (2), for ensuring the observance of the safety provisions laid under the Act and the regulations made thereunder, who shall carryout recommended periodic tests as per the relevant standards, and inspect such installation at intervals not exceeding one year, and keep a record thereof in Form I or Form II or Form III or Form-IV, as the case may be, of Schedule IV to these regulations; test reports and a register of recommendations in regard with safety duly acknowledged by owner; compliances made thereafter; and such records shall be made available to the Electrical Inspector, as and when required.

**6 Chartered Electrical Safety Engineer.-** (1) The Appropriate Government shall authorise Chartered Electrical Safety Engineers from amongst persons having the qualification and experience as specified in schedule -XIV to assist the owner or supplier or consumer of electrical installations for the purpose of self-certification under regulation 32 and regulation 45.

(2) The Appropriate Government shall upload the name of the Chartered Electrical Safety Engineers, as soon as any person(s) is authorized as Chartered Electrical Safety Engineer, on the web portal of the Government or Department dealing with matters of inspection of electrical installations for the information of the owner or supplier or consumer.

**7. Safety measures for operation and maintenance of electric plants. -** (1) Engineers and Supervisors engaged or appointed to operate or undertake maintenance of any part or whole of an electrical plant shall hold degree or diploma in Engineering relevant to the electrical installations from a recognized institute or university.

(2) Engineers and Supervisors engaged or appointed for operation and maintenance of electrical plants should have successfully undergone the type of training as specified by Central Electricity Authority in its guidelines issued from time to time, within two years from the date of engagement or appointment.

(3) (a) The technicians to assist Engineers or Supervisors shall possess a certificate in appropriate trade, preferably with a two years course from an Industrial Training Institute recognized by the Central Government or the State Government and should have successfully undergone the type of training as specified in sub-regulation (2), within two years from the date of engagement or appointment.

Provided that the existing employees, who do not have requisite qualification as mentioned above shall have to undergo the training either from Power Sector Skill Council or from

Central Electricity Authority recognised training institute carrying out trade specific course for the purpose of getting equivalent certificate as mentioned above.

Provided further that the duration of the trade specific course as indicated above shall not be less than as indicated below:

- (i) 80 hours Module- for the employees who are having experience in desired field for five years or more
- (ii) 350 hours Module- for the employees who are having experience in desired field less than five years subject to minimum of 2 years of experience.

3 (b) based on the equivalent certificate issued by the power Sector Skill Council or Central Electricity Authority recognised training institute, certificate to work as technicians may be issued by appropriate Government.

(4) The owner of every electrical plant shall arrange for training of personnel engaged or appointed to operate and undertake maintenance of the electrical plant its own institute or any other institute recognized by Central Electricity Authority or State Government as per the guidelines framed by the Authority and shall maintain records of the assessment of these personnel issued by the training institute in the format prescribed in guidelines as per sub regulation (2) and such records shall be made available to the Electrical Inspector, as and when required.

(5) The certificate of recognition of the training institute under these regulations shall be displayed by the Institute in its website.

(6) Notwithstanding anything contained in sub-regulation (2), the training syllabus may be customized by the owner of the electrical plant of capacity below 100 MW owning the training institute for the purpose of imparting training to its employees.

Provided that the customized training duration shall not be less than 8 weeks.

**8. Safety measures for operation and maintenance of transmission, distribution systems.-**

(1) Engineers or supervisors engaged or appointed to operate or undertake maintenance of transmission and distribution systems shall hold degree or diploma in Appropriate trade of Engineering from a recognized institute or university.

(2) Engineers and supervisors engaged or appointed to operate or undertake maintenance of transmission and distribution systems should have successfully undergone the type of training as specified in guidelines as per sub regulation (2) of Regulation 7, within two years from the date of engagement or appointment.

(3) The technicians to assist engineers or supervisors shall possess a certificate in appropriate trade, preferably with a two years course from an Industrial Training Institute recognized by the Central Government or State Government and should have successfully undergone the type of training as specified in guidelines as per sub regulation (2) of Regulation 7, within two years from the date of engagement or appointment.

Provided that the existing employees, who do not have requisite qualification as mentioned above shall have to undergo the training either from Power Sector Skill Council or from

Central Electricity Authority (CEA) recognised training institute carrying out trade specific course for the purpose of getting a certificate as mentioned above,

Provided that the duration of the trade specific course as indicated above shall not be less than as indicated below:

- (i) 80 hours Module- for the employees who are having experience in desired field for five years or more
- (ii) 350 hours Module- for the employees who are having experience in desired field less than five years subject to minimum of 2 years of experience.

3 (b) based on the certificate issued by the power Sector Skill Council or Central Electricity Authority (CEA) recognised training institute, certificate to work as technicians may be issued by appropriate Government.

(4) Owner of every transmission or distribution system shall arrange for training of their personnel engaged or appointed to operate and undertake maintenance of transmission and distribution system, in his own institute or any other institute recognized by the Central Electricity Authority or State Government as per the guidelines framed under sub regulation (4) of Regulation 7 and shall maintain records of the assessment of these personnel issued by the training institute in the format prescribed in guidelines as per sub regulation (2) of Regulation 7 and such records shall be made available to the Electrical Inspector, as and when required.

#### **9. Safety measures for operation and maintenance of Load Despatch Centres**

(1) Engineers or supervisors engaged or appointed to operate or undertake maintenance of Load Despatch Centre(s) shall hold degree or diploma in appropriate trade of Engineering or in other relevant disciplines from a recognized institute or university.

(2) Load Despatch Centre(s) shall arrange for training and certification of their personnel, as specified by Central Electricity Authority(CEA) in its guidelines issued from time to time and by certification authority/training institute recognized by the Central Electricity Authority. The said training institute shall maintain record of the assessment forms of these personnel (in electronic form) in the format prescribed and such records shall be made available to the Electrical Inspector, as and when required.

(3)The certification authority shall be notified by Central Electricity Authority once every five years.

Provided that till such time a certification authority is notified, National Power Training Institute (NPTI) shall be the certification authority.

(4) Engineers and supervisors engaged or appointed to operate or undertake maintenance of Load Despatch Centre(s) should have successfully undergone the type of training and certification conducted by the certification authority as specified in sub regulation (2) of regulation 7 within two years from the date of engagement or appointment. Only the personnel with at least basic level certification shall be posted in the control room of load dispatch centres. The specialist certificate shall also be obtained within one year to continue his posting in the control room.

(5) The duration and content of certification/training course shall be as per guideline in sub regulation (2) of regulation 7. The course content shall be reviewed by CEA every three years in consultation with National Load Despatch Centre. and Certification Authority.

(6) In case the personnel is not certified, then after identification of the personnel to be posted in the control room of the load dispatch centre, He/she must undertake the training in basic course and obtain the certificate within 6 months and then only posted in the control room of the Load Despatch Centres.

(7) Other personnel posted in the LDC shall also be required to be certified in the area of their related work in the LDC within 6 months.

(8) The certificate should be renewed every 3 years.

(9) Roles and responsibilities of the Certification Authority

a. Conduct the online certification examination

b. Maintain records of validity of certification with appropriate credential verification mechanism in place

c. Any other function to be notified by CEA in consultation with National Load Despatch Centre

(10) The respective Load Despatch Centres shall submit annual statement of certified operators to CEA.

**10. Keeping of records and inspection thereof** (1) The generating company or licensee shall maintain records of the maps, plans and sections relating to supply or transmission of electricity and submit the same to the Electrical Inspector for inspection as and when required by him and the licensee shall also be required to submit the records of consumers to the Electrical Inspector.

(2) The Electrical Inspector shall supply a copy of the report of inspection referred to in sub-regulation (1), to the generating company or licensee, as the case may be.

**11. Deposit of maps.** – When a license has been granted, two sets of maps showing, as regards such licensee, the particulars specified in application for license shall be signed and dated to correspond with the date of notification of the grant of the license by an officer designated by the Appropriate Commission in this behalf, one set of such maps shall be retained by the said officer and the other one shall be furnished to the licensee.

**12. Deposit of printed copies.** - (1) Every person who is granted a license, shall, within thirty days of the grant thereof, have copies of the license and maps, showing the area of supply as specified in the license to exhibit the same for public inspection at all reasonable times at his head office, his local offices, if any, and at the office of every local authority within the area of supply.

(2) Every such licensee shall, within the aforesaid period of thirty days, supply free of charge one copy of the license along with the relevant maps to every local authority within the area of supply and shall also make necessary arrangement for the sale of printed copies of the

license and maps to all persons applying for the same, at a price to be notified by the Appropriate Government from time to time.

**13. Plan for area of supply to be made and kept open for inspection.-** (1) The licensee shall, after commencing to supply electricity, forthwith cause a plan, to be made in electronic form, of the area of supply, and shall cause to be marked thereon the alignment and in the case of underground works, the approximate depth below the surface of all the existing electric supply lines, street distribution boxes and other works, and shall once in every year cause that plan to be duly corrected so as to show the electric supply lines, street distribution boxes and other works for the time being in position and shall also, made sections showing the approximate level of all his existing underground works other than service lines.

(2) Every plan shall be drawn to such horizontal and vertical scale as the Appropriate Commission may require.

Provided that no scale shall be required unless maps of the locality on that scale are for the time being available to the public.

(3) Every plan and section so made or corrected, or a copy thereof, marked with the date when it was made or corrected, shall be kept by the licensee at his principal office or place of business within the area of supply, and shall at all reasonable times be open to the inspection of all applicants, and copies thereof shall be supplied.

(4) The licensee shall ensure that all new and old plans and sections shall be compatible to the Global Positioning System mapping or mapping through any other latest technology.

(5) The licensee shall, if required by an Electrical Inspector, and, where the licensee is not a local authority, by the local authority, if any, concerned, supply free of charge to such Electrical Inspector or local authority a duplicate copy of every such plan or section or a part of the same duly corrected.

(6) The copies of plans and sections under this regulation shall be supplied by the licensee to every applicant on the payment of such fee as the Appropriate Commission may, by regulation, specify.

## **Chapter III**

### **General safety requirements**

**14. General safety requirements pertaining to construction, installation, protection, operation and maintenance of electric supply lines and apparatus** (1) All electric supply lines and apparatus shall be of sufficient rating for power, insulation and estimated fault current and of sufficient mechanical strength, for the duty cycle which they may be required to perform under the environmental conditions of installation, and shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of human beings, animals and property.

(2) Save as otherwise provided in these regulations, the relevant Indian Standards or National Electrical Code or National building code, shall be followed to carry out the purposes of these regulations and where relevant Indian Standards are not available, International Standard shall be followed and in the event of any inconsistency, the provisions of these regulations shall prevail.

(3) The material and apparatus used shall conform to the relevant specifications of the Indian Standards or National Electrical Code or International Standards where relevant Indian Standards are not available.

(4) All electrical equipment shall be installed above Highest Flood Level (HFL) and where such equipment is not possible to be installed above HFL, it shall be ensured that there is no seepage or leakage or logging of water.

**15. Service lines and apparatus on consumer's premises.** - (1) The supplier shall ensure that all electric supply lines, wires, fittings and apparatus belonging to him or under his control, upto the point of commencement of supply, which are on a consumer's premises, are in a safe-condition and in all respects fit for supplying electricity and the supplier shall take precautions to avoid danger arising on such premises from such supply lines, wires, fittings and apparatus.

(2) Service lines placed by the supplier on the premises of a consumer which are underground or which are accessible shall be so insulated and protected by the supplier as to be secured under all ordinary conditions against electrical, mechanical, chemical or other injury to the insulation.

(3)The consumer shall, as far as circumstances permit, take precautions for the safe custody of the equipment on his premises belonging to the supplier.

(4)The consumer shall also ensure that the installation of the licensee under his control is kept in a safe condition.

**16. Switchgear on consumer's premises** - (1) The supplier shall provide a suitable switchgear in each conductor of every service line other than an earthed or earthed neutral conductor or the earthed external conductor of a concentric cable within a consumer's premises, in an



accessible position and such switchgear shall be contained within an adequately enclosed fireproof receptacle.

Provided that where more than one consumer is supplied through a common service line, each such consumer shall be provided with an independent switchgear at the point of rigid junction to the common service.

(2) Every electric supply line other than the earthed or earthed neutral conductor of any system or the earthed external conductor of a concentric cable shall be protected by a suitable switchgear by its owner.

**17. Identification of earthed and earthed neutral conductors and position of switches and switchgear therein.** - Where the conductors include an earthed conductor of a two-wire system or an earthed neutral conductor of a multi-wire system or a conductor which is to be connected thereto, the following conditions shall be complied with: -

(i) an indication of a permanent nature shall be provided by the owner of the earthed or earthed neutral conductor, or the conductor which is to be connected thereto, to enable such conductor to be distinguished from any live conductor and such indication shall be provided as per IS 3043

(a) where the earthed or earthed neutral conductor is the property of the supplier, at or near the point of commencement of supply;

(b) where a conductor forming part of a consumer's system is to be connected to the supplier's earthed or earthed neutral conductor, at the point where such connection is to be made;

(c) in all other cases, at a point corresponding to the point of commencement of supply or

(ii) no cut-out, link, switch or circuit breaker other than a linked switch arranged to operate simultaneously on the earthed or earthed neutral conductor and live conductors shall be inserted or remain inserted in any earthed or earthed neutral conductor of a two wire-system or in any earthed or earthed neutral conductor of a multi-wire system or in any conductor connected thereto.

Provided that the above requirement shall not apply in case of-

(a) a link for testing purposes, or

(b) a switch for use in controlling a generator or transformer.

**18. Earthed terminal on consumer's premises. –**

(1) The supplier shall provide and maintain on the consumer's premises for the consumer's use, a suitable earthed terminal in an accessible position at or near the point of commencement of supply as per IS 3043

Provided that in the case of installation of voltage exceeding 250 V the consumer shall, in addition to the aforementioned earthing arrangement, provide his own earthing system

with an independent electrode and same shall be interlinked with the earthed terminal mentioned in sub regulation (1) through a suitable link.

Provided further that the supplier may not provide any earthed terminal in the case of installations already connected to his system on or before the date to be specified by the State Government in this behalf if he is satisfied that the consumer's earthing arrangement is efficient.

(2) The consumer shall take all reasonable precautions to prevent mechanical damage to the earthed terminal and its lead belonging to the supplier.

(3) The supplier may recover from the consumer the cost of installation on the basis of schedule of charges published by him in advance and where such schedule of charges is not published, the procedure laid down, in regulation 65 shall apply.

**19. Accessibility of bare conductors.** - Where bare conductors are used in a building, the owner of such conductors shall, -

- (a) ensure that they are inaccessible for general public;
- (b) provide in readily accessible position switches for rendering them dead whenever necessary; and
- (c) take such other safety measures as are specified in the relevant Indian Standards.

**20. Danger Notices.** - The owner of every installation of voltage exceeding 250 V shall affix permanently in a conspicuous position a danger notice in Hindi or English and the local language of the district, with a sign of skull and bones of a design as per IS -2551 on-

- (a) every motor, generator, transformer and other electrical plant and equipment together with apparatus used for controlling or regulating the same;
- (b) all supports of overhead lines of voltage exceeding 1000V which can be easily climbed upon without the aid of ladder or special appliances;
- (c) luminous tube sign requiring supply, X-ray and similar high frequency installations of voltage exceeding 1000 V but not exceeding 33 kV:

Provided that where it is not possible to affix such notices on any generator, motor, transformer or other apparatus, they shall be affixed as near as possible thereto, or the word 'danger' and the voltage of the apparatus concerned shall be permanently painted on it:

Provided further that where the generator, motor, transformer or other apparatus is within an enclosure one notice affixed to the said enclosure shall be sufficient for the purposes of this regulation.

*Explanation-* For the purpose of clause (b) rails, tubular poles, wooden supports, reinforced cement concrete poles and pre stressed cement concrete poles without steps, I-sections and channels, shall be deemed as supports which cannot be easily climbed upon

**21. Handling of electric supply lines and apparatus.** -(1) Before any conductor or apparatus is handled, adequate precautions shall be taken, by earthing or other suitable means, to discharge electrically such conductor or apparatus, and any adjacent conductor or apparatus if there is danger therefrom, and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon shall be followed as per relevant Indian Standards or International Standards (where relevant IS are not available).

(2) (a) Every person who is working on an electric supply line or apparatus or both shall be provided with personal protective equipment (PPE), tools and devices such as rubber gloves and safety footwear suitable for working voltage, safety belts for working at height, nonconductive ladder, earthing devices of Appropriate class, helmet, line tester, hand lines, voltage detector and hand tools as per relevant Indian Standards specified in schedule –XV or International Standards where relevant Indian Standards are not available.

(b) Any other device for protecting him from mechanical and electrical injury due to arc flash and such PPE, tools and devices shall conform to Indian Standards and where relevant Indian Standards are not available, International Standard IEEE 1584 /IEC 60255 shall be followed and shall always be maintained in sound and efficient working condition.

(3) (a) No person shall operate and undertake maintenance work on any part or whole of an electrical plant or electric supply line or apparatus and no person shall assist such person on such work, unless he is designated in that behalf under regulation 3(1) or engaged or appointed under regulation 7(1) or regulation 8(1) or permitted under regulation 31(1) or under Reg-117 (1) (ii) &(iii) and takes the safety precautions given in Part-I, Part-II, Part-III and Part-IV of Schedule-I.

(b) Violation of the sub-section (a) will be treated as an act of criminal negligence under appropriate section/s of the Indian Penal Code.

(4) Every telecommunication line on supports carrying a line of voltage exceeding - 1000 V but not exceeding 33 kV shall, for the purpose of working thereon, be deemed to be a line of voltage exceeding - 1000V.

Provided that prior permission shall be taken from concerned licensee before laying telecommunication lines on electric supports.

(5) For the safety of operating personnel, all non-current carrying metal parts of switchgear and control panels shall be properly earthed and insulating floors or mat conforming to IS 15652, of Appropriate voltage level shall be provided in front and rear of the panels where such personnel are required to carry out operation, maintenance or testing work.

(6) All panels shall be painted with the description of its identification at front and at the rear.

**22. Supply to vehicles and cranes.** - Every person owning a vehicle, travelling crane, or the like to which electricity is supplied from an external source shall ensure that it is efficiently controlled by a suitable switch enabling all voltage to be cut off in one operation and, where such vehicle, travelling crane or the like runs on metal rails, the owner shall ensure that the rails are electrically continuous and earthed.

**23. Cables for portable or transportable apparatus.**- (1) Flexible cables shall not be used for portable or transportable motors, generators, transformers, rectifiers, electric drills, electric sprayers, welding sets or any other portable or transportable apparatus unless they are insulated for required voltage as per relevant Indian Standards and adequately protected from mechanical damage.

(2) Where the protection is by means of metallic covering, the covering shall be in metallic connection with the frame of any such apparatus and earthed.

(3) The cables shall be three core type and four core type for portable and transportable apparatus working on single phase and three phase supply respectively and the wire meant to be used for **earth** connection shall be easily identifiable.

**Provided that the power supply to such apparatus shall be controlled by as per Regulation 44.**

**24. Cables protected by bituminous materials.** - (1) Where the supplier or the owner has brought into use an electric supply line, other than an overhead line, which is not completely enclosed in a continuous metallic covering connected with earth and is insulated or protected *in situ* by composition or material of a bituminous character -

(i) any pipe, conduit, or the like into which such electric supply line may have been drawn or placed shall, unless other arrangements are approved by the Electrical Inspector in any particular case, be effectively sealed at its point of entry into any street box so as to prevent any flow of gas to or from the street box, and;

(ii) such electric supply line shall be periodically inspected and tested where accessible, and the result of each such inspection and test shall be duly recorded by the supplier or the owner.

(2) The supplier or the owner after the coming into force of these regulations, shall not bring into use any further electric supply line as aforesaid which is insulated or protected *in situ* by any composition or material known to be liable to produce noxious or explosive gases on excessive heating.

**25. Street boxes.** - (1) Street boxes shall not contain gas pipes, and precautions shall be taken to prevent, as far as reasonably possible, any influx of water or gas.

(2) Where electric supply lines forming part of different systems pass through the same street box, they shall be readily distinguishable from one another and all electric supply lines of voltage exceeding - 1000V at or in street boxes shall be adequately supported and protected so as to prevent risk of damage to or danger from adjacent electric supply lines.

(3) All street boxes shall be regularly inspected for the purpose of detecting the presence of gas and if any influx or accumulation is discovered, the owner shall give immediate notice to any authority or company who have gas mains in the neighborhood of the street box and in cases where a street box is large enough to admit the entrance of a person after the electric supply lines or apparatus therein have been placed in position, ample provision shall be made-

(i) to ensure that any gas which may by accident have obtained access to the box shall escape before a person is allowed to enter and the box shall have provision for sufficient cross ventilation; and

(ii) for the prevention of danger from sparking.

(4) The owners of all street boxes or pillar boxes containing circuits or apparatus shall ensure that their covers and doors are kept closed and locked and are so provided that they can be opened only by means of a key or a special appliance.

(5) The street/Pillar boxes shall be erected with the live parts at least 2 feet above the ground level or above the flood level of the local site condition, whichever is higher.

**26. Distinction of different circuits.-** The owner of every generating station, sub-station, junction-box or pillar box in which there are any circuits or apparatus, whether intended for operation at different voltages or at the same voltage, shall ensure by means of indication of a permanent nature that the respective circuits are readily distinguishable from one another.

**27. Distinction of the installations having more than one feed. -** The owner of every installation including sub-station, double pole structure, four pole structure or any other structure having more than one feed, shall ensure by means of indication of a permanent nature, that the installation is readily distinguishable from other installations.

**28. Accidental charging.-** (1) The owners of all circuits and apparatus shall so arrange them that there shall be no danger of any part thereof becoming accidentally charged to any voltage beyond the limits of voltage for which they are intended.

(2) Where alternating current and direct current circuits are installed on the same box or support, they shall be so arranged and protected that they shall not come into contact with each other .

**29. Provisions applicable to protective equipment. -** (1) Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires, in addition to fire extinguishers suitable for dealing with fires, shall be conspicuously marked and kept in all generating stations, enclosed sub-stations and enclosed switching-stations in convenient location.

(2) Appropriate type of fire extinguisher conforming to relevant Indian Standards, shall be installed, maintained and periodically inspected and tested as per IS 2190 for extinguishing and controlling fire and record of such tests shall be maintained.

(3) Sufficient number of first-aid boxes or cupboards conspicuously marked and equipped with such contents as the State Government may specify or as per IS 13115, shall be provided and maintained at Appropriate locations in every generating station, enclosed sub-station, enclosed switching station and in vehicles used for maintenance of lines so as to be readily available and accessible at all the times and all such boxes and cupboards shall, except in the case of unattended sub-stations and switching stations, be kept in charge of responsible persons who are trained in first-aid treatment and one of such persons shall be available during working hours.

(4) Two or more gas masks shall be provided conspicuously and installed and maintained at accessible places in every generating station with capacity of 5 MW and above and enclosed sub-station with transformation capacity of 5 MVA and above for use in the event of fire or smoke:

Provided that where more than one generator with capacity of 5 MW and above is installed in a power station, each generator shall be provided with at least two separate gas masks in an accessible and conspicuous place.

(5) In every generating station, sub-station or switching station, an artificial respirator, fire extinguishers, first-aid boxes and gas masks shall be provided and kept in good working condition and locations of the same shall be displayed in the control room and operator cabin.

(6) Address and contact number of the nearest Doctor, hospital with a facility for first-aid treatment for electric shock and burns, ambulance service and fire service shall be prominently displayed near the electric shock treatment chart in control room and operator cabin.

**30. Display of instructions for resuscitation of persons suffering from electric shock.-** (1) Instructions, in English or Hindi and the local language of the District and where Hindi is the local language, in English and Hindi for the resuscitation of persons suffering from electric shock, shall be affixed by the owner in a conspicuous place in every generating station, enclosed sub-station, enclosed switching station, mines and in every factory as defined in clause (m) of section 2 of the Factory Act, 1948 (63 of 1948) in which electricity is used and in such other premises where electricity is used as the Electrical Inspector may, by notice in writing served on the owner, direct.

(2) The owner of every generating station, enclosed sub-station, enclosed switching station and every factory or other premises to which these regulations apply, shall ensure that all designated persons/persons engaged or appointed to operate and maintain electrical plants or transmission or distribution systems are acquainted with and are competent to apply the instructions referred to in sub-regulation (1).

**31. Precautions to be adopted by consumers, owners, occupiers, electrical contractors, electrical workmen and suppliers.-** (1) No electrical installation work, including additions, alterations, repairs and adjustments to existing installations, except such replacement of lamps, fans, fuses, switches, domestic appliances of voltage not exceeding 250V and fittings as in no way alters its capacity or character, shall be carried out upon the premises of or on behalf of any consumer, supplier, owner or occupier for the purpose of supply to such

consumer, supplier, owner or occupier except by an electrical contractor licensed in this behalf by the State Government and under the direct supervision of a person holding a certificate of competency and by a person holding a permit issued or recognized by the State Government.

Provided that in the case of works executed for or on behalf of the Central Government and in the case of installations in mines, oil fields and railways, the Central Government and in other cases the State Government, may, by notification in the Official Gazette, exempt on such conditions as it may impose, any such work described therein either generally or in the case of any specified class of consumers, suppliers, owners or occupiers.

Provided further that, in the case of works executed for or on behalf of the Central Government and in the case of installations in mines, oil fields and railways, an electrical contractor having licence issued by any State Government or UT shall not require licence from other State Government in which the works are to be executed.

(2) No electrical installation work which has been carried out in contravention of sub-regulation (1) shall either be energized or connected to the works of any supplier.

**32. Periodic inspection and testing of installations.-** (1) Where an installation is already connected to the supply system of the supplier or trader, every such installation shall be periodically inspected, and tested at intervals not exceeding five years either by the Electrical Inspector or by the supplier, as may be directed by the State Government in this behalf or in the case of installations belonging to, or under the control of the Central Government, and in the case of installation in mines, oilfields and railways, by the Central Government.

(2) The periodic inspection and testing of installation of voltage equal to or below the notified voltage belonging to the owner or supplier or consumer, as the case may be, shall be carried out by the owner or supplier or consumer and shall be self-certified for ensuring observance of safety measures specified under these regulations and the owner or supplier or consumer, as the case may be, shall submit the report of self-certification to the Electrical Inspector in the format as specified by the Authority;

Provided that the electrical installation so self-certified shall be considered as duly inspected and tested only after the report of self-certification is duly received by the office of Electrical Inspector;

Provided further that the owner or supplier or consumer has the option to get his installation inspected and tested by the Electrical Inspector of the Appropriate Government.

(3) Notwithstanding anything contained in sub-regulation (2), every electrical installation covered under section 54 of the Act including every electrical installation of mines, oil fields and railways shall be periodically inspected and tested at intervals not exceeding five years by the Electrical Inspector of the Appropriate Government.

(4) The Electrical Inspector shall, on receipt of the report of self-certification of electrical installation referred in sub-regulation (2), verify the report submitted by the owner or

supplier or consumer, as the case may be, and record variation, if any, in accordance with these regulations.

(5) The Electrical Inspector in case of variations, which require rectification, direct the owner or supplier or consumer, as the case may be, to rectify the same within a period of fifteen days and the owner or supplier or consumer, as the case may be, shall send a report of compliance to the Electrical Inspector.

(6) The Electrical Inspector, in case not satisfied with the compliance report submitted under sub-regulation (5), shall inspect the electrical installation within a period of one-month from the date of submission of compliance report and intimate the owner or supplier or consumer of the installation the defects, if any, for rectification within fifteen days.

(7) If the owner or supplier or consumer, as the case may be, fails to comply with the directions as given under sub-regulation (6), such installation shall be liable to be disconnected under the directions of the Electrical Inspector after serving the owner or supplier or consumer or, as the case may be, of such installation with a notice for a period not less than forty-eight hours.

(8) The periodical inspection and testing of installation of voltage above the notified voltage belonging to the owner or supplier or consumer shall be carried out by the Electrical Inspector.

(9) Where the supplier is directed by the Central Government or the State Government, as the case may be, to inspect and test the installation, such supplier shall report on the condition of the installation to the consumer concerned in the Forms I, II and III as specified in **Schedule II** and shall submit a copy of such report to the Electrical Inspector.

(10) The Electrical Inspector may, on receipt of such report, accept the report submitted by the supplier or record variations as the circumstances of each case may require and may recommend that the defects may be rectified as per report.

(11) In the event of the failure of the owner of any installation to rectify the defects in his installation pointed out by the Electrical Inspector in his report and within the time indicated therein, such installation shall be liable to be disconnected under the directions of the Electrical Inspector after serving the owner of such installation with a notice for a period not less than forty-eight hours:

Provided that the installation shall not be disconnected in case an appeal is made under sub section (2) of section 162 of the Act and the appellate authority has stayed the orders of disconnection.

(12) It shall be the responsibility of the owner of all installations to maintain and operate the installations in a condition free from danger and as recommended by the manufacturer or by the relevant codes of practice of the Bureau of Indian Standards.

**33. Testing of consumer's installation.-** (1) (a) Upon receipt of an application for a new or additional supply of electricity and before commencement of supply or recommencement of



supply after the supply has been disconnected for a period of six months, the supplier (electrical power supplying company) shall either test the installation himself or accept the test results submitted by the consumer when same has been duly signed by the licensed electrical contractor/ chartered electrical safety engineer.

Provided that recommended testing and verifications as per IS 732 / National electrical code wherever applicable shall be carried out.

(b) The testing equipment shall be calibrated through a Government authorized or NABL accredited laboratory at periodical interval as recommended by NABL.

(2) The supplier shall maintain a record of test results obtained at each supply point to a consumer, in a Schedule--III.

(3) If as a result of such inspection and test, the supplier is satisfied that the installation is likely to be dangerous, he shall serve on the applicant a notice in writing requiring him to make such modifications as are necessary to render the installation safe and may refuse to connect or reconnect the supply until the required modifications have been completed.

**34. Generating units required to be inspected by Electrical Inspector.-** The capacity above which generating units including generating units producing electricity from renewable sources of energy shall be required to be inspected by the Electrical Inspector before commissioning, shall be as per the notification issued by the Appropriate Government in this regard.

## Chapter IV

### General conditions relating to supply and use of electricity

**35. Precautions against leakage before connection.** -(1) The supplier shall not connect his works with the apparatus in the premises of any applicant seeking supply unless he is reasonably satisfied that the connection will not at the time of making the connection cause a leakage from that installation or apparatus of a magnitude detrimental to safety which shall be checked by measuring the installation or apparatus insulation resistance as under, -

(i) all apparatus shall have the insulation resistance (IR) value as stipulated in the relevant Indian Standards;

(ii) on application of 500 V DC between each conductor to be charged and earth for a period of one minute the insulation resistance of installation and apparatus of voltage not exceeding - 1000 V shall be at least 1 MEGA OHM or as specified in the relevant Indian Standard;

(iii) on application of 2.5 kV DC between each conductor to be charged and earth for a period of one minute, the insulation resistance of installation and apparatus of voltage exceeding - 1000 V but not exceeding 33 kV shall be at least 5 MEGA OHM or as specified in the relevant Indian Standard.

(iv) on applying 5 kV or 10 kV DC between each conductor to be charged and earth for a period of one minute, the insulation resistance of installation and apparatus of voltage exceeding 33 kV shall be at least 500 MEGA OHM or as specified in the relevant Indian Standard.

(v) on applying 5 kV or 10 kV DC between pin and cap of clean and dry insulator for a period of one minute, the insulation resistance of insulator shall be at least 2000 MEGA OHM or as specified in the relevant Indian Standard.

(vi) for rotating machinery minimum insulation resistance at 40 degrees centigrade shall be  $(n+1)$  MEGA OHM, where n is the operating voltage in kV;

(2) If the supplier declines to make a connection under the provisions of sub-regulation (1) he shall convey to the applicant the reasons thereof, in writing for so declining.

**36. Leakage on consumer's premises.** -(1) If the Electrical Inspector or the supplier has reasons to believe that there is leakage in the system of a consumer which is likely to affect injuriously the use of electricity by the supplier or by other persons, or which is likely to cause danger, he may give the consumer notice in writing that he desires to inspect and test the consumer's installation.

(2) If on such notice being given the consumer does not give all reasonable facilities for inspection and testing of his installation, or when an insulation resistance of the consumer's installation is so low as to prevent safe use of electricity, the supplier may, and if directed so to do by the Electrical Inspector shall discontinue the supply of electricity to the installation but

only after giving to the consumer forty eight hours' notice in writing of disconnection of supply and shall not recommence the supply until he or the Electrical Inspector is satisfied that the cause of the leakage has been removed.

**37. Supply and use of electricity.** - (1) The electricity shall not be supplied, transformed, converted, inverted or used or continued to be supplied, transformed, converted, inverted or used unless the conditions contained in sub-regulations (2) to (8) are complied with.

(2) The following controls of requisite capacity to carry and break the current shall be placed as near as possible after the point of commencement of supply so as to be readily accessible and capable of completely isolating the supply to the installation, such equipment being in addition to any control switch installed for controlling individual circuits or apparatus, namely: -

Supplied at voltage	Control
Up to 11 kV	Switch fuse unit or a circuit breaker by consumers
Above 11 kV and not exceeding 33 kV	A linked switch with fuse or a circuit breaker by consumers
Exceeding 33 kV	A circuit breaker by consumers

Provided that where the point of commencement of supply and the consumer apparatus are separated by a distance less than 15 meter, only one controlling device as specified above near the point of commencement of supply as required by this clause shall be considered sufficient.

(3) For given HV and LV side voltages following type of protection of requisite capacity shall be provided: -

HV side voltages	LV side voltages	Type of Protection	
		HV Side	LV side
Above 650V and up to 11 kV	Less than 650 V (400V, 415V and 430 V)	<b>For transformer rated below 100 kVA</b>	
		Horn gap fuse/Drop out fuse with air break switch. Or Gang operated 3-pole isolator with expulsion type dropout fuse	Switch fuse unit or wire fuse or MCCB
		<b>For transformer rated 100 kVA up to 1MVA</b>	
		Drop out expulsion type fuses with air break switch or circuit breaker or HT isolator with HRC type fuse	High rupturing capacity cartridge fuses or moulded case circuit breakers (MCCB) or miniature circuit breakers (MCB) or air circuit breaker of suitable capacity
		<b>For transformer rated 1MVA and above:</b>	
		Circuit breaker of suitable capacity	Fuse or MCCB or ACB
11 kV	Less than 650 V (400 V, 415 V and 430 V)	<b>For transformer of below 100 kVA:</b>	
		Horn gap fuse with air break switch	switch fuse unit or wire fuse
		<b>For transformer of 100 kVA and above:</b>	

		drop out expulsion type fuses or circuit breaker	high rupturing capacity cartridge fuses or moulded case circuit breakers (MCCB) or miniature circuit breakers (MCB) or air break switch
22 kV or 33 kV	Less than 650 V	circuit breakers or drop out fuses	high rupturing capacity cartridge fuse or moulded case circuit breakers (MCCB) or miniature circuit breakers (MCB) or air circuit break switch (ACB)
Exceeding 11 kV	Exceeding 650 V	Circuit breaker	Circuit breaker

Provided that the fuse or circuit breaker on the primary side of the transformer shall not be required for the unit auxiliary transformer and generator transformer;

(4) Except in the case of composite control gear designed as a unit each distinct circuit is to be protected against excess energy by means of suitable fuse link or a circuit breaker of adequate breaking capacity suitably located and so constructed as to prevent danger from overheating, arcing or scattering of hot metal when it comes into operation and to permit for ready renewal of the fusible metal of the cut-out without danger.

(5) The supply of electricity to each motor or a group of motors or other apparatus meant for operating one particular machine shall be controlled by a suitable linked switch or a circuit breaker or an emergency tripping device with manual reset of requisite capacity placed in such a position as to be adjacent to the motor or a group of motors or other apparatus readily accessible to and easily operated by the person incharge and so connected in the circuit that by its means all supply of electricity can be cut off from the motor or group of motors or apparatus from any regulating switch, resistance of other device associated therewith.

(6) All insulating materials shall be chosen with special regard to the circumstances of their proposed use and their mechanical strength shall be sufficient for their purpose and so far as is practicable of such a character or so protected as to maintain adequately their insulating property under all working conditions in respect of temperature, moisture and dust; and

(7) Adequate precautions shall be taken to ensure that no live parts are so exposed as to cause danger.

(8) Every consumer shall use all reasonable means to ensure that where electricity is supplied by a supplier no person other than the supplier shall interfere with service lines and apparatus placed by the supplier on the premises of the consumer.

**38. Provisions for supply and use of electricity in multi-storeyed building more than 15 metres in height. - (1) The connected load and voltage of supply above which inspection is**

to be carried out by an Electrical Inspector for a multi-storeyed building of more than fifteen meters height shall be notified by the Appropriate Government.

(2) Before making an application for commencement of supply or recommencement of supply after an installation has been disconnected for a period of six months or more, the owner or occupier of a multi-storeyed building shall give not less than thirty days notice in writing to the Electrical Inspector specifying therein the particulars of installation and the supply of electricity shall not be commenced or recommenced within this period, without the approval in writing of the Electrical Inspector.

(3) The supplier or owner of the installation shall provide at the point of commencement of supply a suitable isolating device with cut-out or breaker to operate on all phases except neutral in the 3-phase, 4-wire circuit and fixed in a conspicuous position at not more than 1.70 metres above the ground so as to completely isolate the supply to the building in case of emergency.

(4) The owner or occupier of a multi-storeyed building shall ensure that electrical installations and works inside the building are carried out and maintained in such a manner as to prevent danger due to shock and fire hazards, and the installation is carried out in accordance with IS732 and National electrical code (SP30).

Provided that hospitals and medical establishments shall have safety measures as per National Electrical Code irrespective of height.

(5) No other service pipes and cables shall be taken through the ducts provided for laying power cables and all ducts provided for power cables and other services shall be provided with fire barrier at each floor crossing.

(6) (a) Only Fire Retardant Low Smoke and Low Halogen (FRLSH) power cables shall be used as per relevant IS.

Provided Halogen Free Flame Retardant (HFFR) as per IS 17048 power cables shall be used in airports, hospitals and hotels irrespective of height.

(6) (b) Distribution of electricity to the floors shall be done using bus bar trunking system.

Provided for airports, hospitals and hotels, distribution of electricity to the floors shall be done using bus bar trunking system irrespective of height.

(7) Lightning protection of the building shall be as per IS/IEC 62305.

Provided Lightning protection of Hotels/Airports shall be provided irrespective of height.

(8) Electrical Safety Verification of the installation shall be done as per IS 732.

(9) Meter shall not be installed in stair case.

(10) Electrical safety verification of the installation at the time of construction shall be done as per relevant IS.

**39. Conditions applicable to installations of voltage exceeding 250 Volts.** - The following conditions shall be complied with where electricity of voltage above 250 V is supplied, converted, transformed or used; namely: -

(i) all conductors, other than those of overhead lines, shall be completely enclosed in mechanically strong metal casing or metallic covering which is electrically and mechanically continuous and adequately protected against mechanical damage unless the said conductors are accessible only to a designated person or are installed and protected so as to prevent danger:

Provided that non-metallic conduits conforming to the relevant Indian Standard Specifications may be used for installations of voltage not exceeding - 1000 V;

(ii) all metal works, enclosing, supporting or associated with the installation, other than that designed to serve as a conductor shall be connected with an earthing system as per standards laid down in the Indian Standards in this regard and the provisions of regulation 43.

(iii) Every switchboard shall comply with the following, -

(a) have a clear space of not less than one metre in width shall be provided in front of the switchboard;

(b) if there are any attachments or bare connections at the back of the switchboard, the space, if any, behind the switchboard shall be either less than twenty centimetres or more than seventy-five centimetres in width, measured from the farthest protruding part of any attachment or conductor;

(c) if the space behind the switchboard exceeds seventy five centimetres in width, there shall be a passage way from either end of the switchboard, clear to a height of 1.8 metres.

(iv) In case of installations provided in premises where inflammable materials including gases and chemicals are produced, handled or stored, the electrical installations, equipment and apparatus shall comply with the requirements of flame proof, dust tight, totally enclosed or any other suitable type of electrical fittings depending upon the hazardous zones as per the relevant Indian Standard Specifications.

(v) Where an application has been made to a supplier for supply of electricity to any installation, he shall not commence the supply or where the supply has been discontinued for a period of six months and above, recommence the supply unless the consumer has complied with, in all respects the conditions of supply set out in these regulations.

(vi) Where a supplier proposes to supply or use electricity at or to recommence supply of voltage exceeding 250 V but not exceeding - 1000 V after it has been discontinued for a period of six months, he shall, before connecting or reconnecting the supply, give notice in writing of such intention to the Electrical Inspector.

(vii) If at any time after connecting the supply, the supplier is satisfied that any provision of these regulations are not being observed he shall give notice of the same in writing to the consumer and the Electrical Inspector, specifying how the provisions have not been observed and to rectify such defects in a reasonable time and if the consumer fails to rectify such defects pointed out, he may discontinue the supply after giving the consumer a reasonable opportunity of being heard and recording reasons in writing and the supply shall be discontinued only on written orders of an officer duly notified by the supplier in this behalf and shall be restored with all possible speed after such defects are rectified by the consumer to the satisfaction of the supplier.

**40. Appeal to Electrical Inspector in regard to defects.-** (1) If any applicant for a supply or a consumer is dissatisfied with the action of the supplier in declining to commence, to continue or to recommence the supply of electricity to his premises on the grounds that the installation is defective or is likely to be dangerous, he may appeal to the Electrical Inspector to test the installation and the supplier shall not, if the Electrical Inspector intimates that the installation is free from the defect or danger complained of, refuse supply to the consumer on the grounds aforesaid, and shall, within twenty four hours after the receipt of such intimation from the Electrical Inspector, commence, continue or recommence the supply of electricity.

(2) Any test for which application has been made under sub regulation (1), shall be carried out within seven days after the receipt of such application.

**41. Precautions against failure of supply and notice of failures. -** (1) The layout of the electric supply lines of the supplier for the supply of electricity throughout his area of supply shall under normal working conditions be sectionalized and so arranged, and provided with switchgear or circuit-breakers, so located, as to restrict within reasonable limits the extent of the portion of the system affected by any failure of supply.

(2) The supplier shall take all reasonable precautions to avoid any accidental interruptions of supply, and also to avoid danger to the public or to any employee or designated person when engaged on any operation during and in connection with the installation, extension, replacement, repair and maintenance of any works.

(3) The supplier shall send to the Electrical Inspector a notice of failure of supply of such kind as the Electrical Inspector may from time to time require to be notified to him, and such notice shall be sent by the earliest mode of communication after the failure occurs or after the failure becomes known to the supplier and shall be in the Form given in **Schedule-IV**.

(4) For the purpose of testing or for any other purpose connected with the efficient working of the supplier's installations, the supply of electricity may be discontinued by the supplier for such period as may be necessary, subject to not less than twenty-four hours' notice being given by the supplier to all consumers likely to be affected by such discontinuance:

Provided that no such notice shall be given in cases of emergency.

## Chapter V

### Safety provisions for electrical installations and apparatus of voltage not exceeding 1000 Volts AC & 1500 V DC :

**42. Test of insulation.-** Where any electric supply line for use at voltages not exceeding 1000 V AC or 1500 V DC is new or has been disconnected from a system for the purpose of addition, alteration or repair, such electric supply line shall not be reconnected to the system until the supplier or the owner has applied the test as per IS 732-6.

**43. Connection with earth.-** The following conditions shall apply to the connection with earth of systems at voltage normally exceeding 40 V but not exceeding 1000 V AC or 1500 V DC, namely:-

- (i) neutral conductor of a 3-phase, 4-wire system and the middle conductor of a 2-phase, 3-wire system shall be earthed as per IS:3043.
- (ii) neutral conductor shall also be earthed at one or more points along the distribution system or service line in addition to any connection with earth which shall be at the consumer's premises.
- (iii) in the case of a system comprising electric supply lines having concentric cables, the external conductor of such cables shall be earthed by two separate and distinct connections with earth.
- (iv) in a direct current system, earthing and safety measures shall be as per IS 732.
- (v) every building shall have protective equipotential bonding by interconnecting exposed and extraneous conductive parts as per IS 3043 & IS 732.
- (vi) alternating current systems which are connected with earth as aforesaid shall be electrically interconnected:  
Provided that each connection with earth is bonded to the metal sheathing and metallic armouring, if any, of the electric supply lines concerned.
- (vii) the frame of every generator, stationary motor, portable motor, and the metallic parts, not intended as conductors, of all transformers and any other apparatus used for regulating or controlling electricity, and all electricity consuming apparatus, of voltage exceeding 250 V but not exceeding 1000 V shall be earthed by the owner as specified in IS 3043 and IS 732.
- (viii) all metal casing or metallic coverings containing or protecting any electric supply line or apparatus shall be connected with earth and shall be so joined and connected across all junction boxes and other openings as to make good mechanical and electrical connection throughout their whole length:

Provided that conditions mentioned in this regulation shall not apply, where the supply voltage does not exceed 250 V and the apparatus consists of wall tubes or brackets, electroliers, switches, ceiling fans or other fittings, other than portable hand lamps and



portable and transportable apparatus, unless provided with earth terminal and to class-II apparatus and appliances:

Provided further that where the supply voltage is not exceeding 250 V and where the installations are either new or renovated, all plug sockets shall be of the three pin type, and the third pin shall be permanently and efficiently earthed.

- (ix) All earthing systems shall, -
  - (a) consist of equipotential bonding conductors capable of carrying the prospective earth fault current without exceeding the allowable temperature limits as per IS: 3043 in order to maintain all non-current carrying metal works reasonably at earth potential and to avoid dangerous contact potentials being developed on such metal works;
  - (b) maintain Earth fault loop impedance shall be maintained sufficiently low to permit adequate fault current for the operation of protective device within the time stipulated in IS: 3043
  - (c) be mechanically strong, withstand corrosion and retain electrical continuity during the life of the installation and all earthing systems shall be tested to ensure efficient earth bonding as per relevant IS, before the electric supply lines or apparatus are energised.
- (x) all earthing systems belonging to the supplier shall in addition, be tested for resistance on dry day during the dry season at least once a year.
- (xi) Earth fault loop impedance shall be tested to ensure the automatic disconnection of the protective device and a record of every earth test made and the result thereof shall be kept by the supplier for a period of not less than two years after the day of testing and shall be available to the Electrical Inspector when required.
- (xii) Earth fault loop impedance of each circuit shall be limited to a value determined by the type and current rating of the protective device used such that, on the occurrence of an earth fault, disconnection of the supply shall occur before the prospective touch voltage reaches a harmful value.
- (xiii) Where multiple sources are used in the same installation (e.g. Transformer and DG with changeover facility), fault loop impedance shall be tested for both the sources and automatic disconnection of supply shall be ensured.

*Explanation:-* The expression “Class-II apparatus and appliance” shall have the same meaning as is assigned to it in the relevant Indian Standards.

- 44. Residual Current Device.** - The use of electricity to every electrical installation, shall be controlled by a Residual Current Device as per IS 12640(part-1)/IEC 61008-1 or IS 12640(Part-2)/IEC 61009-1 or IEC 62423 whichever is applicable. whose rated residual operating current shall not exceed 30 milliampere so as to disconnect the supply instantly on the occurrence of earth fault or leakage current.

Provided further that such protective device shall not be required for overhead supply lines having protective devices which are effectively bonded to the neutral of supply transformers and conforming to regulation 76.

## Chapter VI

### Safety provisions for electrical installations and apparatus of voltage exceeding 1000 volts

**45. Approval by Electrical Inspector and self-certification.** – (1) (a) Every electrical installation of notified voltage and below shall be inspected, tested and self-certified by the owner or supplier or consumer, as the case may be, of the installation before commencement of supply or recommencement after shutdown for six months and above for ensuring observance of safety measures specified under these regulations and such owner or supplier or consumer, as the case may be, shall submit the report of self-certification to the Electrical Inspector in the formats as framed and issued by the Authority:

Provided that the electrical installation so self-certified shall be considered fit for the commencement of supply or recommencement after shutdown for six months only after the report of self-certification is duly received by the office of Electrical Inspector.

Provided further that the owner or supplier or consumer, as the case may be, has the option to get his installation inspected and tested by the Electrical Inspector of the Appropriate Government.

(b) Notwithstanding anything contained in clause (a), every electrical installation covered under section 54 of the Act including every electrical installations of mines, oil fields and railways shall be inspected and tested by the Electrical Inspector of the Appropriate Government as specified in sub-regulation (3);

(2) The voltage above which inspection and testing of electrical installations including installations of supplier or consumer shall be carried out by the Electrical Inspector shall be notified by the Appropriate Government.

(3) Every electrical installation of voltage above the notified voltage and all the apparatus of the generating stations and above the capacity specified under regulation 34, shall be inspected and tested by the Electrical Inspector before commencement of supply or recommencement after shutdown for six months and above for ensuring observance of safety measures specified under these regulations;

(4)(a) The Electrical Inspector shall, on receipt of the report of self-certification of electrical installation referred in sub-regulation (1), examine the report submitted by the owner or supplier or consumer, as the case may be, and record variation, if any, in accordance with these regulations;

(b) The Electrical Inspector in case of variations which require rectification, direct the owner or supplier or consumer to rectify the same within a period of fifteen days from the date of recording of the variations and the owner or supplier or consumer, as the case may be, shall send a report of compliance to the Electrical Inspector;

(c) If the Electrical Inspector, is not satisfied with the compliance report submitted under clause (b), shall inspect the electrical installation within a period of ninety days from the date of submission of the compliance report and intimate the owner or supplier or consumer of the installation the defects, if any, for rectification within fifteen days;

(d) If the owner or supplier or consumer, as the case may be, fails to comply the directions as given under clause (c), such installation shall be liable to be disconnected under the directions of the Electrical Inspector after serving the owner or supplier or consumer, as the case may be, of such installation with a notice for a period not less than forty-eight hours.

(5) Before making an application to the Electrical Inspector for permission to commence or recommence supply in installations above the notified voltage after an installation has been disconnected for six months, the supplier shall ensure that electric supply lines or apparatus of more than notified voltage belonging to him are placed in position, properly joined, and duly completed and examined, and the supply of electricity shall not be commenced by the supplier for installations of voltage needing inspection under these regulations unless the provisions of regulations 14 to 31, regulations 35 to 37, regulations 46 to 53 and regulations 57 to 80 have been complied with and the approval in writing of the Electrical Inspector has been obtained by him:

Provided that the supplier may energize the aforesaid electric supply lines or apparatus for the purpose of tests specified in regulation 48 and after successful testing, the owner may energize the section of a line to prevent theft of conductors or towers, subject to compliance of all the provisions of these regulations.

(6) The owner of any installations of voltage above the notified voltage shall, before making application to the Electrical Inspector for approval of his installation or additions thereto, test every circuit or additions thereto, other than an overhead line, and satisfy himself that they withstand the application of the testing voltage set out in sub-regulation (1) of regulation 48 and shall duly record the results of such tests and forward them to the Electrical Inspector:

Provided that an Electrical Inspector may direct such owner to carry out such tests, as he deems necessary or accept the certified tests of the manufacturer in respect of any particular apparatus in place of the tests required by this regulation.

(7) The owner of any installation who makes any addition or alteration to his installation shall not connect to the supply his apparatus or electric supply lines, comprising the said alterations or additions, unless and until such alteration or addition has been approved in writing by the Electrical Inspector or self-certified by the owner of the installation, as the case may be.

(8) In case of installations of mines and oil fields, the electrical installations of voltage 650 V and above shall not be connected to supply, unless and until such installation work including alterations or additions or recommencement after shutdown for six months are approved in writing by the Electrical Inspector of Mines.

Provided that the electrical installations of voltage below 650 V in mines and oil fields are to be self-certified by the Owner/Agent/Manager of the mine before commencement of supply or recommencement after shutdown for six months in the manner specified in sub regulation (1).

**46. Use of electricity at voltage exceeding 1000 V** The Electrical Inspector where the supply voltage exceeds the notified voltage shall not authorise the supplier to commence supply or recommence the supply, where the supply has been discontinued for a period of six months and

above, or the supplier, where the supply voltage is equal to or below the notified voltage but exceeds 1000 V , shall not commence supply or recommence the supply where supply has been discontinued for a period of six months and above, to any consumer unless-

(a) all conductors and apparatus situated on the premises of the consumer are so placed as to be inaccessible except to the person(s) designated under regulation 3(1) or engaged or appointed under regulation 7(1) or regulation 8(1) or permitted under regulation 31(1) or under Reg-117 (1) (ii) &(iii) and all operations in connection with the said conductors and apparatus are carried out by the person(s) designated under regulation 3(1) or engaged or appointed under regulation 7(1) or regulation 8(1) or permitted under regulation 31(1) or under Reg-117 (1) (ii) &(iii) ;

(b) the consumer has provided and agrees to maintain a separate building or a locked weather proof and fire proof enclosure of agreed design and location, to which the supplier at all times shall have access for the purpose of housing his apparatus and metering equipment, or where the provision for a separate building or enclosure is impracticable, the consumer has segregated the aforesaid apparatus of the supplier from any other part of his own apparatus:

Provided that such segregation shall be by the provision of fire proof walls, if the Electrical Inspector considers it to be necessary:

Provided further that in the case of an outdoor installation the consumer shall suitably segregate the aforesaid apparatus belonging to the supplier from his own;

(c)all pole type sub-stations are constructed and maintained in accordance with regulation 50.

(2)Where electricity at voltage exceeding 1000V is supplied, converted, transformed or used, owner shall :

(i) maintain safety clearances for electrical apparatus as per Bureau of Indian Standard specification so that sufficient space is available for easy operation and maintenance without any hazard to the operating and maintenance personnel working near the equipment and for ensuring adequate ventilation;

Provided that in case of mines, safety clearances for electrical apparatus to be as per relevant mining regulation (Coal Mining Regulation(CMR)/Mineral Mining Regulation (MMR)/ Oil Mining Regulation (OMR))

(ii) not allow any encroachment below such installation:

Provided that where the Electrical Inspector comes across any such encroachment, he shall direct the owner to remove such encroachments;

(iii) maintain minimum safety working clearances specified in Schedule- V for the bare conductors or live parts of any apparatus in outdoor sub-stations excluding overhead lines of installations of voltage exceeding 1000 V;

(iv) ensure that the live parts of all apparatus within reach from any position in which a person may require to be, are suitably protected to prevent danger;

- (v) ensure that where a transformer or transformers are used, suitable provision shall be made, either by connecting with earth, a point of the circuit at the lower voltage or otherwise, to guard against danger by reason of the said circuit becoming accidentally charged above its normal voltage by leakage from or contact with the circuit at the higher voltage;
- (vi) not install a sub-station or a switching station with apparatus having more than 2000 litres of oil in the basement where proper oil draining arrangement cannot be provided;
- (vii) take the following measures, where a sub-station or a switching station with oil-filled apparatus, such as transformer, static condenser, switchgear or oil circuit breaker having more than 2000 litres of oil is installed, whether indoor or outdoors,:-
  - (a) the separation wall or fire barrier walls of thickness and dimensions as specified in IS:1646 shall be provided between the apparatuses and between the apparatus & adjacent building if building wall adjacent to the apparatuses is not rated for four hours fire withstand rating-
    - (i) on the consumer premises;
    - (ii) where adequate clearance between the apparatuses and between the apparatus and the adjacent building wall as per IS:1646 for O-class oil or as per IEC 61936-1 for K-class oil is not available.
  - (b) provisions shall be made for suitable oil soakpit and where use of more than 9000 litres of oil in any one oil tank, receptacle or chamber is involved, provision shall be made for the draining away or removal of any oil which may leak or escape from the tank, receptacle or chamber containing the same, and special precautions shall be taken to prevent the spread of any fire resulting from the ignition of the oil from any cause and adequate provision shall be made for extinguishing any fire which may occur;
  - (c) spare oil shall not be stored in the vicinity of any oil filled equipment in any such sub-station or switching station;
  - (d) all the transformers and switchgears shall be maintained in accordance with the maintenance schedules prepared in accordance with the relevant codes of practice of Bureau of Indian Standards;
- (viii) take adequate fire detection and protection arrangement for quenching the fire in the apparatus, without prejudice to the above measures;
- (ix) ensure that every transformer of 10MVA or reactors of 10 MVAR and above rating shall be provided with automatic High Velocity Water Spray System as per IS 15325 or High Pressure Water Mist System as per IS 15519 or compressed air-foam system as per NFPA 11 or Nitrogen injection & drain method system;
- (x) take the following measures, namely, where it is necessary to locate the sub-station, or switching station in the basement,:-
  - (a) the room shall necessarily be in the first basement at the periphery of the basement;

- (b) the entrances to the room shall be provided with fire resisting doors of 2 hour fire rating and the door shall always be kept closed and a notice of this effect shall be affixed on outer side of the door;
  - (c) a curb (sill) of a suitable height shall be provided at the entrance in order to prevent the flow of oil from a ruptured transformer into other parts of the basement;
  - (d) direct access to the transformer room shall be provided from outside and the surrounding walls of four hours fire withstand rating shall be provided as per IS: 1642;
  - (e) the cables to primary side and secondary side shall have sealing at all floors and wall opening of atleast two hours fire withstand rating;
  - (f) Fire Retardant Low Smoke Low Halogen cable shall be used.
- (xi) ensure that oil filled transformers installed indoors in other than residential or commercial buildings are placed on the ground floor or not below the first basement: Provided that, in the event of no possibility for accomodating any future expansion on the ground floor or in the first basement, the transformer can be accomadeted on the first floor, provided that there is adequate oil drainage facility, the building structure is sufficiently strong, transformer is placed in separate room with direct access, no flammable material is stored in the room and on the floors above.
- (xii) he shall ensure that
- (a) cable trenches inside the sub-stations and switching stations containing cables are filled with sand, pebbles or similar non-inflammable materials or cables having fire proof paint of 2 hours rating or fire bandage of 4 hrs rating or completely covered with non-inflammable slabs;
  - (b) control room shall be provided with as per National Building Code or other IS/international standards.
- (xiii) ensure that unless the conditions are such that all the conductors and apparatus may be made dead at the same time for the purpose of cleaning or for other work, the said conductors and apparatus shall be so arranged that these may be made dead in sections, and that work on any such section may be carried on by the person(s) designated under regulation 3(1) or engaged or appointed under regulation 7(1) or regulation 8(1) or permitted under regulation 31(1) or under Reg-117 (1) (ii) &(iii) without danger;
- (xiv) Lightning protection;
- a) The surge arrester (SA) which responds to over-voltages without any time delay shall be installed for protection of 11 kV and above switchgear, transformers, associated equipment and lines.
  - b) Surge arresters as per requirement and conforming to relevant IS shall be provided
  - c) Surge arresters shall be connected to two independent earthing connections.

- d) The earthing lead for surge arrester shall not pass through any iron or steel pipe, and shall be taken as directly as possible from the surge arrester to a separate earth electrode or junction of the earth mat already provided for the sub-station.  
Provided that a down rod shall be provided at the node where surge arrester is connected with earth mat.

(3) All apparatus shall be protected against lightning as per IS/IEC 62305.

(4) The equipment used for protection and switching shall be adequately co-ordinated with the protected apparatus to ensure safe operation and to maintain the stability of the inter-connected units of the power system.

(5) The minimum clearances specified in Schedule- VI shall be maintained for bare conductors or live parts of any HVDC apparatus in outdoor sub-stations, excluding HVDC overhead lines -

(6) There shall not be tapping of another transmission line from the main line for 66 kV and above class of lines.

Provided that during natural calamities, tapping may be allowed to ensure emergency power supply to affected areas till normalcy is restored

(7) Fire Detection, Alarm and Protection System for Sub- station and Switchyard

- a) A comprehensive fire detection, alarm as well as fire protection system shall be installed in conformity with relevant IS.
- b) All buildings inside the substation or switchyard such as control room building, GIS hall, relay room etc., shall be provided with fire detection and alarm system based on smoke detectors and/or heat detectors. The fire alarm system shall conform to relevant IS or /IEC standards.
- c) In case of switchyard associated with generating stations, water supply system can be extended from the fire water pump house provided for the generating station.

(8) Notwithstanding anything contained in the Sub-Regulation (2), dry type of transformers only shall be used for installations inside the residential and commercial buildings;

- (i) The Switchgear unit and transformer cubicle shall be mechanically interlocked, so that the transformer chamber can be opened only when the switchgear is turned off.
- (ii) The transformer shall be installed on a platform at adequate height to avoid the danger from water logging on the roof.
- (iii) Transformer shall be protected by a suitable barrier to prevent unauthorized entry.

**47. Inter-locks and protection for use of electricity at voltage exceeding - 1000 Volts.- (1)**

The owner shall ensure the following, namely:-

(i)isolators and the controlling circuit breakers shall be inter-locked so that the isolators cannot be operated unless the corresponding breaker is in open position;

(ii)isolators and the corresponding earthing switches shall be inter-locked so that no earthing switch can be closed unless and until the corresponding isolator is in open position;

(iii) where two or more supplies are not intended to be operated in parallel, the respective circuit breakers or linked switches controlling the supplies shall be inter-locked to prevent possibility of any inadvertent paralleling or feedback;

(iv) when two or more transformers are operated in parallel, the system shall be so arranged as to trip the secondary breaker of a transformer in case the primary breaker of that transformer trips;

(v) all gates or doors which give access to live parts of an installation shall be inter-locked in such a way that these cannot be opened unless the live parts are made dead and proper discharging and earthing of these parts should be ensured before any person comes in close proximity of such parts;

(vi) where two or more generators operate in parallel and neutral switching is adopted, inter-lock shall be provided to ensure that generator breaker cannot be closed unless one of the neutrals is connected to the earthing system.

(2) The following protection shall be provided in all systems and circuits to automatically disconnect the supply under abnormal conditions, namely:-

- (i) over current protection to disconnect the supply automatically if the rated current of the equipment, cable or supply line is exceeded for a time which the equipment, cable or supply line is not designed to withstand;
- (ii) earth fault or earth leakage protection to disconnect the supply automatically if the earth fault current exceeds the limit of current for keeping the contact potential within the reasonable values;
- (iii) Buchholz relay, pressure relief device and winding and oil temperature protection with alarm and trip contacts shall be provided on all transformers of ratings above 1000 KVA and above
- (iv) transformers of capacity 10 MVA and above shall be protected against incipient faults by differential protection;
- (v) all generators with rating of 100 KVA and above shall be protected against earth fault or leakage;
- (vi) all generators of rating 1000 KVA and above shall be protected against faults within the generator winding using restricted earth fault protection or differential protection or by both;
- (vii) high speed bus bar differential protection along with local breaker back up protection shall be commissioned and shall always be available at all 132 kV and above voltage sub-stations and switching stations and generating stations connected with the grid:

Provided that in respect of existing 132 kV sub-stations and switching stations having more than one incoming feeders, the high speed bus bar differential protection along with local breaker back up protection, shall be commissioned and shall always be available;



(viii) In addition to above, all electrical protection system for Generating Stations, Substations and Transmission lines shall be as per CEA (Technical Standard for construction of Electrical plants and electric lines), Regulations 2010 (as amended from time to time).

**48. Testing, Operation and Maintenance.-** (1) Before approval is accorded by the Electrical Inspector under regulation 45 the manufacturer's test certificates shall, if required, be produced for all the type, acceptance & routine tests as required under the relevant Indian Standards or International Standards where relevant Indian Standards are not available.

(2) No new apparatus, cable or supply line of voltage exceeding - 1000 Volts shall be commissioned unless such apparatus, cable or supply line are subjected to site tests as per relevant Indian Standards or International Standards where relevant Indian Standards are not available.

(3) No apparatus, cable or supply line of voltage exceeding - 1000 V which has been kept disconnected, for a period of six months or more, from the system for alterations or repair, shall be connected to the system until such apparatus, cable or supply line are subjected to the to site tests as per relevant Indian Standards or International Standards where relevant Indian Standards are not available.

(4) Notwithstanding the provisions of this regulation, the Electrical Inspector may require certain tests to be carried out before or after charging the installations.

(5) All apparatus, cables and supply lines shall be maintained in healthy conditions and tests shall be carried out periodically as per the relevant code of practice of the Bureau of Indian Standards.

(6) Records of all tests, trippings, maintenance works and repairs of all equipment apparatus, cables and supply lines shall be duly kept in such a way that these records can be compared with earlier ones.

(7) It shall be the responsibility of the owner of all installations of voltage exceeding - 1000 V to maintain and operate the installations in a condition free from danger and as recommended by the manufacturer or by the relevant codes of practice of the Bureau of Indian Standards.

(8) Failures of any 220 kV and above voltage level substation equipment, transmission line towers and cables shall be reported by the owner of electrical installation, within forty eight hours of the occurrence of the failure, to the Central Electricity Authority and the reasons for failure and measures to be taken to avoid recurrence of failure shall be sent to the Central Electricity Authority within one month of the occurrence in the format given in Schedule-VII.

Provided that in case of mines and oil fields the failure of 10MVA and above transformers it shall be reported to CEI of mines

**49. Precautions to be taken against excess leakage in case of metal sheathed electric supply lines.-** The following precautions shall be taken in case of electric supply lines other than overhead lines, for use at voltage exceeding - 1000 V; namely:-

- (i) the conductors of the cable except the cable with thermoplastic or XLPE insulation without any metallic screen or armour shall be enclosed in metal sheathing which shall be electrically continuous and connected with earth, and the conductivity of the metal sheathing shall be maintained and reasonable precautions taken where necessary to avoid corrosion of the sheathing;
- (ii) the resistance of the earth connection with metallic sheath shall be kept low enough to permit the controlling circuit breaker or cut-out to operate in the event of any failure of insulation between the metallic sheath and the conductor.

*Explanation-* For the purpose of this regulation;

- (a) in the case of thermoplastic insulated and sheathed cables with metallic armour the metallic wire or tape armour, shall be considered as metal sheathing.
- (b) where an electric supply line as aforesaid has concentric cables and the external conductor is insulated from an outer metal sheathing and connected with earth, the external conductor may be regarded as the metal sheathing for the purposes of this regulation provided that the foregoing provisions as to conductivity are complied with.

**50. Connection with earth for apparatus exceeding - 1000V.-** (1) The entire switchyard / substation equipment and buildings including all non-current carrying metal parts associated with an installation shall be effectively earthed to a grounding system or mat which shall,-

- (i) limit the touch and step potential to tolerable values as per relevant IS / IEEE 80 standards;
- (ii) limit the ground potential rise to tolerable values so as to prevent danger due to transfer of potential through ground, earth wires, cable sheath, fences, pipe lines, etc.;
- (iii) maintain the resistance of the earth connection to such a value as to make operation of the protective device effective;

(2) In the case of star connected system with earthed neutrals or delta connected system with earthed artificial neutral point,-

- (i) the neutral point of every generator and transformer shall be earthed by connecting it to the earthing system not by less than two separate and distinct connections:

Provided that the neutral point of a generator may be connected to the earthing system through an impedance to limit the fault current to the earth:

Provided further that in the case of multi-machine systems neutral switching may be resorted to, for limiting the injurious effect of harmonic current circulation in the system;

Provided further that in case of Multi maximum power point inverters where DC+AC system earthing is technically not possible the complete system should use cables rated for maximum DC Voltage of connected system. In such case each inverter should be equipped to trip on first earth fault based upon insulation measurement in connected system.

(ii)the generator or transformer neutral shall be earthed through a suitable impedance where an appreciable harmonic current flowing in the neutral connection causes interference, with communication circuits;

(iii)in case of the delta connected system the neutral point shall be obtained by the insertion of a grounding transformer and current limiting resistance or impedance wherever considered necessary at the commencement of such a system.

(3) In case of generating stations, sub-stations and industrial installations of voltage exceeding 33 kV, the system neutral earthing and protective frame earthing may be, if system design so warrants, integrated into common earthing grid provided the resistance to earth of combined mat does not cause the step and touch potential to exceed its permissible values.

(4) Single phase systems of voltage exceeding - 1000V shall be effectively earthed.

(5) In the case of a system comprising electric supply lines having concentric cables, the external conductor shall be connected with earth.

(6) Where a supplier proposes to connect with earth an existing system for use at voltage exceeding 1000 V which has not hitherto been so connected with earth, he shall give not less than fourteen days notice in writing together with particulars of the proposed connection with earth to the telegraph-authority established under the Indian Telegraph Act, 1885 (13 of 1885).

(7) Where the earthing lead and earth connection are used only in connection with earthing guards erected under overhead lines of voltage exceeding – 1000 V where they cross a telecommunication line or a railway line, and where such lines are equipped with earth leakage protective device, the earth resistance shall not exceed twenty five ohms and the project authorities shall obtain No Objection Certificate (NOC) from Railway Authorities and Power and Telecommunication Co-ordination Committee before energisation of the facilities.

(8) Every earthing system belonging to either the supplier or the consumer shall be tested for its resistance to earth on a dry day during dry season not less than once a year and records of such tests shall be maintained and produced, if so required, before the Electrical Inspector.

**51. General conditions as to transformation and control of electricity.-** (1) Where electricity of voltage exceeding 1000 V is transformed, converted, regulated or otherwise controlled in sub-stations or switching stations (including outdoor sub-stations and outdoor switching stations) or in street boxes constructed underground, the following provisions shall be observed, namely:-

(i) sub-stations and switching stations shall preferably be erected above ground, but where necessarily constructed underground due provisions for ventilation and drainage shall be made and any space housing switchgear shall not be used for storage of any materials especially inflammable and combustible materials or refuse;

(ii) (a) outdoor sub-stations except pole type sub-stations and outdoor switching stations shall, unless the apparatus is completely enclosed in a metal covering connected with earth, the said apparatus also being connected with the system by armoured cables, be efficiently protected by fencing not less than 1.8 metres in height or other means so as to prevent access to the electric supply lines and apparatus therein by an undesignated person and the fencing of such area shall be earthed efficiently;

(ii) (b) Transformer Mounting Structure-

(I) The mounting of transformers shall be as per relevant Indian Standards.

(II) The structures shall be provided with

(a) anti-climbing devices and

(b) danger board.

(III) (a) The plinth shall be:

(i) higher than the surroundings.

(ii) made of Concrete/ Metal (properly earthed) or fire resistant fibre glass of adequate strength to withstand the load:

(b) the plinth can be pre-fabricated also:

(c) the plinth foundation shall be of concrete.

(IV) Plinth mounted distribution sub-stations shall be adequately protected by fencing so as to prevent access to the equipment by unauthorized persons, animals and shall be provided with standard danger boards.

(iii) underground street boxes, other than sub-stations, which contain transformers shall not contain switches or other apparatus, and switches, cut-outs or other apparatus required for controlling or other purposes shall be fixed in separate receptacle above ground wherever practicable.

**52. Pole type sub-stations.-** Where platform type construction is used for a pole type sub-station and sufficient space for a person to stand on the platform is provided, a substantial hand rail shall be built around the said platform and if the hand rail is of metal, it shall be connected with earth:

Provided that in the case of pole type sub-station on wooden supports and wooden platform the metal hand-rail shall not be connected with earth.

**53. Condensers.-** Suitable arrangement shall be made for immediate and automatic or manual discharge of every static condenser on disconnection of supply.

**54. Supply to luminous tube sign installations of voltage exceeding – 1000 Volts but not exceeding 33 kV.-** (1) Any person who proposes to use or who is using electricity for the purpose of operating a luminous tube sign installation, or who proposes to transform or is

transforming electricity to a voltage exceeding 1000 V but not exceeding 33 kV for any such purpose shall comply with the following conditions, namely:-.

(i)all live parts of the installation, including all apparatus and live conductors in the secondary circuit, but excluding the tubes except in the neighbourhood of their terminals, shall be inaccessible to undesignated persons and such parts shall be effectively screened;

(ii)irrespective of the method of obtaining the voltage of the circuit which feeds the luminous discharge tube sign, no part of any conductor of such circuit shall be in metallic connection, except in respect of its connection with earth, with any conductor of the supply system or with the primary winding of the transformer;

(iii)all live parts of an exterior installation shall be so disposed as to protect them against the effects of the weather and such installation shall be so arranged and separated from the surroundings as to limit, as far as possible, the spreading of fire;

(iv)the secondary circuit shall be permanently earthed at the transformer and the core of every transformer shall be earthed;

(v)where the conductors of the primary circuit are not in metallic connection with the supply conductors, one phase of such primary circuit shall be permanently earthed at the motor generator or convertor, or at the transformer and an earth leakage circuit breaker of sufficient rating shall be provided on the side of voltage not exceeding 250 V to detect the leakage in such luminous tube sign installations;

(vi)a sub-circuit which forms the primary circuit of a fixed luminous discharge tube sign installation shall be reserved solely for such purpose;

(vii)a separate primary final sub-circuit shall be provided for each transformer or each group of transformers having an aggregate input not exceeding 1,000 volt-amperes, of a fixed luminous discharge tube sign installation;

(viii)an interior installation shall be provided with suitable adjacent means for disconnecting all phases of the supply except the “neutral” in a 3-phase, 4-wire circuit;

(ix)for installations on the exterior of a building a suitable emergency fire-proof linked switch to operate on all phases except the neutral in a 3-phase, 4-wire circuit shall be provided and fixed in a conspicuous position at not more than 1.70 metres above the ground;

(x)a special “caution” notice shall be affixed in a conspicuous place on the door of every enclosure of voltage exceeding 1000 V but not exceeding 33 kV to the effect that the supply must be cut off before the enclosure is opened;

(xi) where static condensers are used, they shall be installed on the load side of the fuses and the primary side of the transformers where the voltage does not exceed 250 V;

(xii) where static condensers are used on primary side, provision shall be made for automatic or manual discharging of the condensers when the supply is cut off;

(xiii) before using the static condensers or any interrupting device on the voltage exceeding 1000 V, the executing agencies shall test and ensure that automatic discharging device is functional thereon.

(2) The owner or user of any luminous tube sign or similar installation of voltage exceeding 1000 V but not exceeding 33 kV shall not bring the same into use without giving to the Electrical Inspector not less than fourteen days notice in writing of his intention so to do.

**55. Supply to electrode boilers of voltage exceeding 1000 Volt but not exceeding 33 kV.-**

(1) Where a system having a point connected with earth is used for supply of electricity to an electrode boiler of voltage exceeding 1000 V which is also connected with earth, the owner or user of electrode boiler shall comply with the following conditions, namely:-

(i) the metal work of the electrode boiler shall be efficiently connected to the metal sheathing and metallic armouring, if any, of the electric supply line of voltage exceeding 1000 V but not exceeding 33 kV whereby electricity is supplied to the electrode boiler;

(ii) the supply of electricity at voltage exceeding 1000 V to the electrode boiler shall be controlled by a suitable circuit-breaker so set as to operate in the event of the phase currents becoming unbalanced to the extent of ten per cent of the rated current consumption of the electrode boiler under normal conditions of operation:

Provided that if in any case a higher setting is essential to ensure stability of operation of the electrode boiler, the setting may be increased so as not to exceed fifteen per cent of the rated current consumption of the electrode boiler under normal conditions of operation;

(iii) an inverse time element device may be used in conjunction with the aforesaid circuit breaker to prevent the operation thereof unnecessarily on the occurrence of unbalanced phase currents of momentary or short duration;

(iv) the supplier or owner shall serve a notice in writing on the telegraph-authority at least seven days prior to the date on which such supply of electricity is to be afforded specifying the location of every point, including the earth connection of the electrode boiler, at which the system is connected with earth.

(2) The owner or user of any electrode boiler of voltage exceeding 1000 V shall not bring the same into use without giving the Electrical Inspector not less than fourteen days notice in writing of his intention so to do.

**56. Supply to X-ray and high frequency installations.-** (1) Any person, who proposes to use or who is using electricity for the purpose of operating an X-ray or similar high-frequency installation, other than portable units or shock-proof self contained and stationary units shall comply the following conditions, namely:-

(i) mechanical barriers shall be provided to prevent too close an approach to any parts of the X-ray apparatus of voltage exceeding 1000 V but not exceeding 33 kV, except the X-ray tube and its leads, unless such parts of voltage exceeding 1000 V but not exceeding 33 kV have been rendered shock proof by being shielded by earthed metal or adequate insulating material;

(ii) where generators operating at 300 kV peak or more are used, such generators shall be installed in rooms separate from those containing the other equipment and any step-up transformer employed shall be so installed and protected as to prevent danger;

(iii) a suitable switch shall be provided to control the circuit supplying a generator, and shall be so arranged as to be open except while the door of the room housing the generator is locked from the outside;

(iv) X-ray tubes used in therapy shall be mounted in an earthed metal enclosure;

(v) every X-ray machine shall be provided with a milliammeter or other suitable measuring instrument, readily visible from the control position and connected, if practicable, in the earthed lead, but guarded if connected in the lead of voltage exceeding 1000 V but not exceeding 33 kV:

Provided that earth leakage circuit breaker of sufficient rating shall be provided on the side wherein voltage does not exceed 250 V to detect the leakage in such X-ray installations.

*Explanation:-* For the purpose of this regulation “shock proof”, as applied to X-ray and high-frequency equipment, shall mean that such equipment is guarded with earthed metal so that no person may come into contact with any live part.

(2) (i) in the case of nonshock proof equipment, overhead conductors of voltage exceeding 1000 V but not exceeding 33 kV, unless suitably guarded against personal contact, shall be adequately spaced and high voltage leads on tilting tables and fluoroscopes shall be adequately insulated or so surrounded by barriers as to prevent inadvertent contact;

(ii) the circuit of voltage not exceeding 250 V of the step up transformer shall contain a manually operated control device having overload protection, in addition to the over current device for circuit protection, and these devices shall have no exposed live parts and for diagnostic work there shall be an additional switch in the said circuit, which shall be of one of the following types:-

(a) a switch with a spring or other mechanism that will open automatically except while held close by the operator, or;

(b) a time switch which will open automatically after a definite period of time for which it has been set;

(iii) if more than one piece of apparatus be operated from the same source of voltage exceeding 1000 V, each shall be provided with a switch of voltage exceeding 1000 V to give independent control;

(iv) low frequency current-carrying parts of a machine of the quenched-gap or open gap type shall be so insulated or guarded that they cannot be touched during operation but the high frequency circuit-proper which delivers high-frequency current normally for the therapeutic purposes shall be exempt from such insulation;

(v) all X-ray generators having capacitors shall have suitable means for discharging the capacitors manually;

(vi) except in the case of self-contained units, all 200 kV peak or higher X-ray generators shall have a sphere gap installed in the system of voltage exceeding 1000 V but not exceeding 33 kV adjusted so that it will break down on over voltage surges.

(3) (i) all non-current carrying metal parts of tube stands, fluroscopes and other apparatus shall be properly earthed and insulating floors, mats or platforms shall be provided for operators in proximity to parts of voltage exceeding 1000 unless such parts have been rendered shock proof;

(ii) where short wave therapy machines are used, the treatment tables and examining chairs shall be wholly non-metallic.

(4) The owner of any X-ray installation or similar high frequency apparatus shall not bring the same into use without giving to the Electrical Inspector not less than fourteen days notice in writing of his intention to do so:

Provided that the aforesaid notice shall not be necessary in the case of shock-proof portable X-ray and high-frequency equipment which have been inspected before the commencement of their use and periodically thereafter.



## Chapter VII

### Safety requirements for overhead lines, underground cables, Sub stations and generating stations

**57. Material and strength.-** (1) All conductors of overhead lines other than those specified in regulation 70 shall have a breaking strength of not less than 350 kg.

(2) Where the voltage does not exceed 250 V and the span is of less than fifteen metres and is drawn through the owner's or consumer's premises, a conductor having an actual breaking strength of not less than 150 kg may be used.

**58. Joints.-** (1) There shall be no Joints on the Wires or Cables or lines taken for temporary purpose.

(2) The joint between conductors or earthwires of overhead lines shall be mechanically and electrically secure under the conditions of operation and the ultimate strength and the electrical conductivity of the joint shall be as per relevant Indian Standards or International Standards, where relevant Indian Standards are not available.

**59. Maximum stresses and factors of safety.-** (1) The load and permissible stresses on the structural members, conductors and earth wire of self supporting steel lattice towers or steel monopole towers for overhead transmission lines shall be as per relevant Indian Standards or International Standards, where relevant Indian Standards are not available.

(2) Overhead lines not covered in sub-regulation (1) shall have the following minimum factors of safety as per the table given below:-

<u>Description</u>	<u>minimum factors of safety</u>
metal supports	1.5
mechanically processed concrete supports	2.0
hand-moulded concrete supports	2.5
wood supports	3.0

(3) The minimum factors of safety shall be based on such load as may cause failure of the support to perform its function, assuming that the foundation and other components of the structure are intact.

(4) The load shall be equivalent to the yield point stress or the modulus of rupture, as the case may be, for supports subject to bending and vertical loads and the crippling load for supports used as strut.

(5) The strength of the supports of the overhead lines in the direction of the line shall not be less than one-fourth of the strength required in the direction transverse to the line.

(6) The minimum factor of safety for stay-wires, guard-wires or bearer-wires shall be 2.5 based on the ultimate tensile strength of the wire.

- (7) The tension limit for conductor and earth wire shall be ,as per IS 802,
- (8) For the purpose of calculating the factors of safety in sub-regulation (2), the following conditions shall be observed, namely:-
- (i) the maximum wind pressure shall be as specified in the relevant Indian Standards;
  - (ii) for cylindrical bodies the effective area shall be taken as full projected area exposed to wind pressure; and
  - (iii) the maximum and minimum temperatures shall be such as specified in the relevant Indian Standards.
- (9) Notwithstanding anything contained in sub-regulation (2) to (8) in localities where overhead lines are liable to accumulations of ice or snow, the load and permissible stresses on the structural members, conductors and earth wire of self supporting steel lattice towers and steel monopole towers for overhead transmission lines shall be as per relevant Indian Standards or International Standards, where relevant Indian Standards are not available and in accordance with the specifications laid down, from time to time, by the Appropriate Government, by order in writing.

**60. Clearance in air of the lowest conductor of overhead lines.-**

(1) The minimum clearance above ground and across road surface of National Highways or Expressway or State Highways or other road or highest traction conductor of railway corridors or navigational or non-navigational rivers of the lowest conductor of an alternating current overhead line, including service lines, of nominal voltage system shall have the values specified in Schedule-VIII-A. The minimum clearances regarding HVDC line shall be as per Schedule VIII-B.

(2) In case of electric lines of 33 kV and below passing through habitated urban or rural areas, any forest areas other than National Parks, Wildlife Sanctuaries, Conservation Reserves, Community Reserves, Eco-sensitive zones around the protected areas and Wildlife Corridors, underground cable or Aerial Bunched Cable or Covered Conductor shall be used.

Provided that in case of laying of electric lines of 33kV and below passing through protected area (National Parks, Wildlife Sanctuaries, Conservation Reserves, Community Reserves), Eco-Sensitive Zones around the protected areas and Wildlife Corridors, underground cable shall be used.

Provided further where protected areas are aquatic and marine in nature, Aerial Bunched Cable or Covered Conductor shall be used.

3 (a) Provided no conductor of an overhead line, including service lines, erected across the Right of Way (RoW) of a Petroleum/ Natural Gas Pipeline, shall at any part thereof be at a height of less than 8 Meters.

(b) Provided that no tower footing/ structure of an overhead line of voltage 33kV or above/ HVDC, shall be closer than 25 meters from the edge of the Right of Way (RoW) of a Petroleum/ Natural Gas Pipeline

(c) Provided that wherever overhead line of voltage 33 kV or above/ HVDC shall intend to cross the Right of Way (RoW) of a Petroleum/ Natural Gas Pipeline, the angle of crossing of the overhead line with respect to the pipelines shall preferably be right angles, but the crossing angle shall not be less than 75 degrees in any case.

**61. Clearance between conductors and trolley wires.-** (1) No conductor of an overhead line crossing a tramway or trolley bus route using trolley wires shall have less than the following clearances above any trolley wire-

- |       |  |   |            |
|-------|--|---|------------|
| (i)   | lines of voltage not exceeding - 1000 Volts  | - | 1.2 metres |
|       | Provided that where an insulated conductor suspended from a bearer wire crosses over a trolley wire the minimum clearance for such insulated conductor shall be 0.6 metre. |   |            |
| (ii)  | lines of voltage exceeding - 1000 Volts up to and including 11,000 Volts   | - | 1.8 metres |
| (iii) | lines of voltage exceeding 11,000 Volts but not exceeding 33,000 Volts   | - | 2.5 metres |
| (iv)  | lines of voltage exceeding 33 kV   | - | 3.0 metres |

(2) In any case of a crossing specified in sub-regulation (1), whoever lays his line later in time, shall provide the clearance between his own line and the line which will be crossed in accordance with the provisions of the said sub-regulation:

Provided that if the later entrant is the owner of the lower line and is not able to provide adequate clearance, he shall bear the cost for modification of the upper line so as to comply with this sub-regulation.

**62. Clearance from buildings of lines of voltage and service lines not exceeding – 1000 Volts.-** (1) An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.

(2) Where an overhead line of voltage not exceeding - 1000 V passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed, namely:-

- (i) for any flat roof, open balcony, varandah roof and lean-to-roof-
  - (a) when the line passes above the building a vertical clearance of 2.5 metres from the highest point, and
  - (b) when the line passes adjacent to the building a horizontal clearance of 1.2 metres from the nearest point, and
- (ii) for pitched roof-
  - (a) when the line passes above the building a vertical clearance of 2.5 metres immediately under the line, and
  - (b) when the line passes adjacent to the building a horizontal clearance of 1.2 metres.

(3) Any conductor so situated as to have a clearance less than that specified above shall be replaced with Aerial Bunched Cable or adequately insulated and shall be attached at suitable intervals to a bare earthed bearer wire having a breaking strength of not less than 350 kg.

(4)The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

(5)Vertical and horizontal clearances shall be as specified in schedule-VIII-C.

*Explanation:-* For the purpose of this regulation, the expression “building” shall be deemed to include any structure, whether permanent or temporary.

**63. Clearances from buildings of lines of voltage exceeding 1000V.-** (1) An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.

(2) Where an overhead line of voltage exceeding 1000V passes above or adjacent to any building or part of a building it shall have on the basis of maximum sag a vertical clearance above the highest part of the building immediately under such line, of not less than-

- (i) for lines of voltages exceeding 1000Volts upto and including 33,000 Volts - 3.7 metres
- (ii) for lines of voltages exceeding 33 kV - 3.7 metres plus 0.30 metre for every additional 33,000 Volts or part thereof.

(3) The horizontal clearance between the nearest conductor and any part of such building shall, on the basis of maximum deflection due to wind pressure, be not less than-

- (i) for lines of voltages exceeding - 1000 V upto and including 11,000 Volts - 1.2 metres
- (ii) for lines of voltages exceeding 11,000 V and up to and including 33,000 V - 2.0 metres
- (iii) for lines of voltages exceeding 33 kV - 2.0 metres plus 0.3 metre fore every additional 33kV or part thereof.

(4) For High Voltage Direct Current (HVDC) systems, vertical clearance and horizontal clearance, on the basis of maximum deflection due to wind pressure, from buildings shall be maintained as below:

Sl.No	DC Voltage (kV)	Vertical Clearance (mtrs.)	Horizontal Clearance (mtrs.)
1.	100 kV	4.6	2.9
2.	200 kV	5.8	4.1
3.	300 kV	7.0	5.3
4.	400 kV	7.9	6.2
5.	500 kV	9.1	7.4
6.	600 kV	10.3	8.6
7.	800 kV	12.4	10.7

(5) Vertical and horizontal clearances shall be as specified in schedule-VIII-C.

*Explanation:-* For the purpose of this regulation the expression “building” shall be deemed to include any structure, whether permanent or temporary.

**64. Conductors at different voltages on same supports.-** Where conductors forming parts of systems at different voltages are erected on the same supports, the owner shall make adequate provision to guard against danger to linemen and others, from the lower voltage system being charged above its normal working voltage, by leakage from or contact with the higher voltage system and the methods of construction and the applicable minimum clearances between the conductors of the two systems shall be as specified in regulation 71 for lines crossing each other.

**65. Erection or alteration of buildings, structures, flood banks and elevation of roads.-**

(1) If at any time subsequent to the erection of an overhead line, whether covered with insulating material or not or underground cable, any person proposes to erect a new building or structure or flood bank or to raise any road level or to carry out any other type of work whether permanent or temporary or to make in or upon any building, or structure or flood bank or road, any permanent or temporary addition or alteration, such person and the contractor whom he employs to carry out the erection, addition or alteration, shall, give intimation in writing of his intention to do so, to the supplier or owner and to the Electrical Inspector and shall furnish therewith a scale drawing showing the proposed building, structure, flood bank, road or any addition or alteration and scaffolding thereof required during the construction.

(2) On receipt of such intimation, the supplier or owner shall examine,-

(a) whether the line or underground cable under reference was laid in accordance with the provisions of these regulations and any other law for the time being in force;

(b) whether it is technically feasible;

(c) whether it meets the requirement of Right of Way (ROW);

(d) whether such person was liable to pay the cost of alteration of the overhead line or underground cable and if so, issue a notice within a period of thirty days, to such person together with an estimate of the cost of the expenditure likely to be incurred to so alter the overhead line or underground cable and require him to deposit, within thirty days of the receipt of the notice, with the supplier or owner, the amount of the estimated cost.

(3) If such person disputes the cost of alteration of the overhead line or underground cable estimated by the supplier or owner or even the responsibility to pay such cost, the dispute may be referred to the Electrical Inspector who shall after hearing both parties decide upon the issue in accordance with sub-regulation (4).

(4) The Electrical Inspector shall estimate the cost of alteration of overhead line or underground cable on the following basis, namely:-

(a) the cost of material used on the alteration after crediting the depreciated cost of the material which shall be available from the existing line or underground cable;

(b) the wages of labour employed in affecting the alteration;

(c) supervision charge to the extent of fifteen per cent of the wages mentioned in clause and charges incurred by the owner or supplier or consumer in complying with the provisions of section 67 of the Act, in respect of such alterations.

(5) Any addition or alteration to the building or structure shall be allowed only after the deposit of such estimated cost to the supplier or owner.

(6) No work upon such building, structure, flood bank, road and addition or alteration thereto shall be commenced or continued until the Electrical Inspector certifies that the provisions of regulations 60, 62, 63, 66 and regulation 79 have not been contravened either during or after the aforesaid construction:

Provided that the Electrical Inspector may, if he is satisfied that the overhead line or underground cable has been so guarded as to secure the protection of persons or property from injury, certify that the work may be executed prior to the alteration of the overhead line or underground cable or in the case of temporary addition or alteration, without alteration of the overhead line or underground cable.

(7) The supplier or owner shall, on receipt of such deposit, alter the overhead line or underground cable in such a way that it does not contravene the provisions regulations 60, 62, 63 and regulation 79 either during or after such construction within two months from the date of such deposit or within such longer period as the Electrical Inspector may permit for reasons to be recorded in writing.”.

Provided that the ongoing or completed construction or alteration as mentioned in sub regulation (1) without the intimation to the owner or supplier of the overhead line or underground cable is liable to be demolished by the owner or supplier of such lines or cable.

Provided further that the cost incurred in demolition shall be recovered from the owner of the such constructions.

**66. Transporting and storing of material near overhead lines.-** (1) No rods, pipes or similar materials shall be taken below, or in the vicinity of, any bare overhead conductors or lines if these contravene the provisions of regulations 62 and 63 unless such materials are transported under the direct supervision of a person designated under regulation 3(1) or engaged or appointed under regulation 7(1) or regulation 8(1) or permitted under regulation 31(1) or under Reg-117 (1) (ii) &(iii) in that behalf by the owner of such overhead conductors or lines.

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

(3) No material or earth work or agricultural produce shall be dumped or stored, no trees grown below or in the vicinity of, bare overhead conductors, or lines to contravene the provision of regulations 62 and 63.

(4) No flammable material shall be stored under the electric supply line.

(5) No fire shall be allowed above underground cables.

(6) Firing of any material below electric lines shall be prohibited.

**67. General clearances.-** (1) For the purpose of computing the vertical clearance of an overhead line, the maximum sag of any conductor shall be calculated on the basis of the maximum sag in still air and the maximum temperature as specified under regulations 59 and computing any horizontal clearance of an overhead line the maximum deflection of any conductor shall be calculated on the basis of the wind pressure specified under regulations 59.

(2) No blasting for any purpose shall be done within 300 metres from the boundary of a sub-station or from the electric supply lines of voltage exceeding - 1000 V or tower structure thereof without the written permission of the owner of such sub-station or electric supply lines or tower structures; and in case of mining lease hold area, without the written permission of the Inspector of Mines.”

(3) No cutting of soil within ten meters from the tower structure of 132 kV and above voltage level shall be permitted without the written permission of the owner of tower structure.

(4) No person shall construct brick kiln or other polluting units near the installations or transmission lines of 220 kV and above within a distance of 500 metres Without the written permission of the owner of the line.

**68. Routes proximity to aerodromes.-** Overhead lines shall not be erected in the vicinity of aerodromes unless the Airport Authorities or concerned defence authorities have approved in writing the route of the proposed lines as per relevant Indian Standards.

**69. Maximum interval between supports.-** All conductors shall be attached to supports at intervals not exceeding the safe limits based on the ultimate tensile strength of the conductor and the factor of safety specified under regulations 59.

Provided that in the case of overhead lines carrying conductors of voltage not exceeding 1000 V when erected in, over, along or across any street, the interval shall not, without the consent in writing of the Electrical Inspector, exceed 65 metres.

**70. Conditions to apply where telecommunication lines and power lines are carried on same supports.-** (1) Every overhead telecommunication line erected on supports carrying a power line shall consist of conductors each having a breaking strength of not less than 270 kg.

(2) Every telephone modem/ Set-top-box used on a telecommunication line/RF Coaxial line erected on supports carrying a power line shall be suitably guarded against lightning and shall be protected by cut-outs. Suitable Surge Protection Devices shall be used as per IS/IEC 62305-4 and tested as per IEC 61643 for equipotential bonding.

(3) Where a telecommunication line is erected on supports carrying a power line of voltage exceeding – 1000 V, arrangement shall be made to safeguard any person against injury resulting from contact, leakage or induction between such power and telecommunication/ RF Coaxial lines.

**71. Lines crossing or approaching each other and lines crossing street and road.-** Where an overhead line crosses or is in proximity to any telecommunication line, either the owner of the overhead line or the telecommunication line, whoever lays his line later, shall arrange to provide for protective devices or guarding arrangement in a manner laid down in code of practice or guidelines issued by Power and Telecommunication Coordination Committee and shall observe the following provisions, namely:-

- (i) when it is intended to erect a telecommunication line or an overhead line which will cross or be in proximity to an overhead line or a telecommunication line, as the case may be, the person proposing to erect such line shall give one month's notice of his intention so to do along with the relevant details of protection and drawings to the owner of the existing line;
- (ii) guarding shall be provided where lines of voltage not exceeding 33 kV cross a road or street or telecommunication line;
- (iii) where an overhead line crosses or is in proximity to another overhead line, guarding arrangements shall be provided so to guard against the possibility of their coming into contact with each other;
- (iv) where an overhead line crosses another overhead line, clearances shall be as under:-

**(Minimum clearances in metres between lines crossing each other)**

Sl. No.	Nominal System Voltage (kV)	11-66 kV	110-132 kV	220 kV	400 kV	765kV	1200 KV
1.	Low and Medium	2.44	3.05	4.58	5.49	7.94	10.44
2.	11-66	2.44	3.05	4.58	5.49	7.94	10.44
3.	110-132	3.05	3.05	4.58	5.49	7.94	10.44
4.	220	4.58	4.58	4.58	5.49	7.94	10.44
5.	400	5.49	5.49	5.49	5.49	7.94	10.44
6.	765	7.94	7.94	7.94	7.94	7.94	10.44
7	1200	10.44	10.44	10.44	10.44	10.44	10.44

Provided that no guardings are required when line of voltage exceeding 33 kV crosses over another line of 250 V and above voltage or a road or a tram subject to the condition that adequate clearances are provided between the lowest conductor of the line of voltage exceeding 33 kV and the top most conductor of the overhead line crossing underneath the line of voltage exceeding 33 kV and the clearances as stipulated in regulation 60 from the topmost surface of the road maintained;



(v) where an overhead direct current (DC) line crosses another overhead line, clearances shall be as under:-

**(Minimum clearances in metres between AC and DC lines crossing each other)**

Sl. No.	Sysytem Voltage AC/DC	100 kV DC	200 kV DC	300 kV DC	400 kV DC	500 kV DC	600 kV DC	800KV DC
1.	Low and Medium AC	3.05	4.71	5.32	6.04	6.79	7.54	9.04
2.	11-66 kV AC	3.05	4.71	5.32	6.04	6.79	7.54	9.04
3.	110-132 kV AC	3.05	4.71	5.32	6.04	6.79	7.54	9.04
4.	220 kV AC	4.58	4.71	5.32	6.04	6.79	7.54	9.04
5.	200 kV DC	4.71	4.71	5.32	6.04	6.79	7.54	9.04
6.	300 kV AC	5.32	5.32	5.32	6.04	6.79	7.54	9.04
7.	400 kV AC	5.49	5.49	5.49	6.04	6.79	7.54	9.04
8.	400 kV DC	6.04	6.04	6.04	6.04	6.79	7.54	9.04
9.	500 kV DC	6.79	6.79	6.79	6.79	6.79	7.54	9.04
10.	600 kV DC	7.54	7.54	7.54	7.54	7.54	7.54	9.04
11.	765 KV AC	7.94	7.94	7.94	7.94	7.94	7.94	9.04
12.	800 kV DC	7.94	7.94	7.94	7.94	7.94	9.04	9.04
13.	1200 KV AC	10.44	10.44	10.44	10.44	10.44	10.44	10.44

(vi) a person erecting or proposing to erect a line which may cross or be in proximity with an existing line, shall provide arrangements on his own line or require the owner of the other overhead line to provide guarding arrangements as referred to in clause (iii) and (iv).

(vii) in all cases referred to in this regulation the expenses of providing the guarding arrangements or protective devices shall be borne by the person whose line was last erected;

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

(ix) the guarding arrangements shall ordinarily be carried out by the owner of the supports on which it is made and he shall be responsible for its efficient maintenance.

**72. Guarding.-** (1) Where guarding is required under these regulations the following shall be observed , namely:-

(i) every guard-wire shall be connected with earth at each point at which its electrical continuity is broken;

(ii) every guard-wire shall have an actual breaking strength of not less than 635 kg and if made of iron or steel , shall be galvanised;

(iii) every guard-wire or cross-connected systems of guard-wires shall have sufficient current-carrying capacity to ensure them rendering dead, without risk of fusing of the guard-wire or wires, till the contact of any live wire has been removed.

(2) In the case of a line crossing over a trolley-wire the guarding shall be subjected to the following conditions, namely:-.

(i) where there is only one trolley-wire, two guard-wires shall be erected as in DIAGRAM-A;

(ii) where there are two trolley –wires and the distance between them does not exceed 40 cms, two guard-wires shall be erected as in DIAGRAM-B;

(iii) where there are two trolley wires and the distance between them exceeds 40 cms but does not exceed 1.2 metres, three guard-wires shall be erected as in DIAGRAM-C;

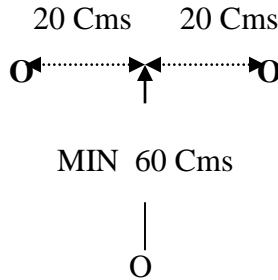
(iv) where there are two trolley-wires and the distance between them exceeds 1.2 metres, each trolley-wire shall be separately guarded as in DIAGRAM-D;

(v) the rise of trolley boom shall be so limited that when the trolley leaves the trolley-wire, it shall not foul the guard-wires; and

(vi) where a telegraph-line is liable to fall or be blown down upon an arm, stay-wire or span-wire and so slide-down upon a trolley-wire, guard hooks shall be provided to prevent such sliding.

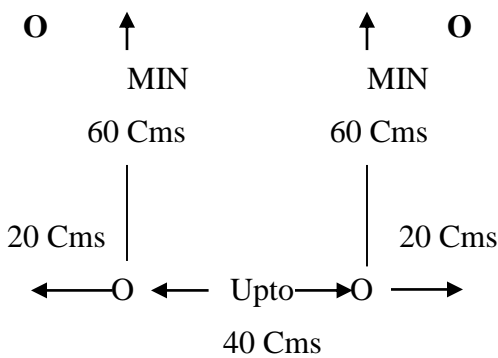
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**DIAGRAM-A**

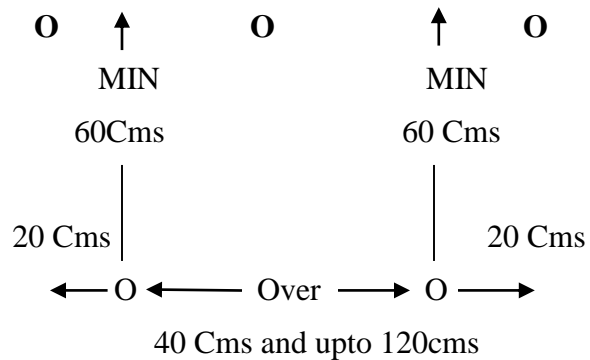


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**DIAGRAM-B**

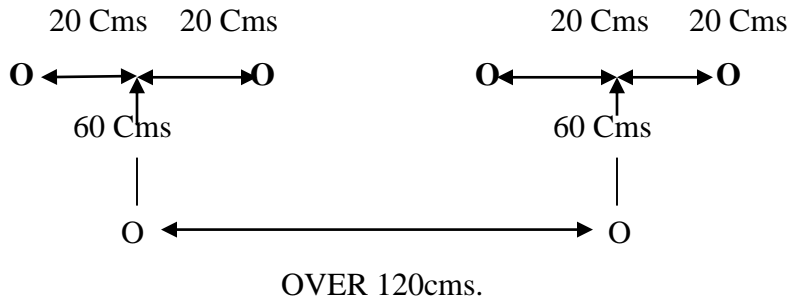


**DIAGRAM-C**



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**DIAGRAM-D**



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**73. Service lines from overhead lines.-** No service-line or tapping shall be taken off an overhead line except at a point of support.

**74. Earthing-**

(1) Earthing of 33 kV and below overhead line supports

(a) All metal supports and all reinforced and prestressed cement concrete supports of overhead lines and metallic fittings attached thereto, shall be either permanently and efficiently earthed by providing a continuous earth wire and securely fastening to

- each pole and connecting with earth ordinarily at every third support or each support and the metallic fitting attached thereto shall be permanently and effectively earthed.
- (b) Metal cross arms and insulator pins for Plain cement Concrete (PCC) and Pre-Stressed Cement Concrete (PSCC) poles shall be bonded together and normally earthed at every pole above 1000 V lines and at every 3<sup>rd</sup> pole for lines below 1000 volts.
  - (c) Normally coil earthing shall be provided except for locations involving railways, telegraph line, power line crossings and special structures where pipe/rod type earthing shall be provided.:
  - (d) Whenever the electric lines pass close to a well or a permanently moist place, an earth should be provided in the well or the marshy place and connected to the electric line pole.
  - (e) All steel poles on which switches, transformers, fuses etc. are mounted shall be earthed.
  - (f) For poles below 1000 V guarding with continuous earth wire (messenger wire in case of aerial bunched cable) shall be provided and shall be connected to earth at three equidistant points in one km.
  - (g) Each stay-wire shall be similarly earthed unless insulator has been placed in it at a height not less than 3.0 metres from the ground.

2) For 66 kV and above overhead line, earthing and requirement of earth wire shall be as per Central Electricity Authority ( Technical Standard for construction of Electrical Plants and electric line) Regulations.

**75 Anti Climbing Devices-**Barbed wires conforming to relevant IS for a vertical distance of 30 to 40 cm, at a height of 3.5 to 4 meters from ground level or clamps with protruding spikes at a height of 3 to 4 meter shall be provided on the pole/tower of above 11 kV line.

**76.Safety and protective devices.-** (1) Every overhead line which is not being suspended from a dead bearer wire, not being covered with insulating material and not being a trolley-wire, is erected over any part of a street or other public place or in any factory or mine or on any consumer's premises shall be protected with earth guarding for rendering the line electrically harmless in case it breaks.

(2) An Electrical Inspector may, by notice in writing, require the owner of any such overhead line, wherever it may be erected, to protect it in the manner specified in sub-regulation (1).

(3) The owner of every overhead line of voltage exceeding - 1000 V shall make adequate arrangements as per relevant Indian Standards to prevent undesigned persons from ascending any of the supports of such overhead lines which can be easily climbed upon without the help of a ladder or special appliances.

(4) To prevent birds perching immediately above the suspension insulator strings and fouling the insulators with bird dropping, suitable bird guards as per IS 5613, shall be provided on cross arms of suspension tower or suspension pole structures, over the suspension insulator strings.

*Explanation.-* For the purpose of this regulation, rails, reinforced cement concrete poles and pre-stressed cement concrete poles without steps, tubular poles, wooden supports without

steps, I-sections and channels' shall be deemed as supports which cannot be easily climbed upon.

**77. Protection against lightning.-** (1)The owner of every overhead line, sub-station or generating station which is exposed to lightning shall adopt efficient means for diverting to earth any electrical surges due to lightning which may result into injuries.

(2) The earthing lead for any lightning arrester shall be as short as possible and shall not pass through any iron or steel pipe, but shall be taken as directly as possible from the lightning arrester without touching any metal part to a separate vertical ground electrode or junction of the earth mat already provided for the substation of voltage exceeding 1000 V subject to the avoidance of bends wherever practicable.

**78. Unused overhead lines.-** Where an overhead line ceases to be used as an electric supply line:

(i) the owner shall maintain it in a safe mechanical condition in accordance with regulation 59 or remove it.

(ii) the Electrical Inspector shall, by a notice in writing served on the owner, require him to maintain it in a safe mechanical condition or to remove it within thirty days of the receipt of the notice.

**79. Laying of cables.-** (1) No underground power cable shall be laid without a minimum underground depth (from ground surface to top of the cable) as given below:

Voltage level	Minimum Depth (in meters)
Up to 1 kV	0.75
3.3 kV to 11 kV	0.9
22kV & 33 kV	1.05
Exceeding 33 kV	1.2

(2) No underground telecommunication cable shall be laid without a minimum separation distance of 0.3 meters and 0.6 meters to the underground power cable of voltage up to 33kV and exceeding 33 kV, respectively.

**80. Protection against electromagnetic interference. -** The owner of every overhead power line of voltage level 11 kV or higher shall obtain Power Telecommunication Co-ordination Committee clearance to ensure safety of the personnel and telecom equipment.

## **Chapter VIII**

### **Additional Safety requirements for Electric Traction**

- 81. Application of chapter.** - (1) The regulations in this chapter shall apply only where electricity is used for the purposes of traction:

Provided that nothing in this chapter shall apply to electricity used for the public carriage of passengers, animals or goods on, or for the lighting or ventilation of the rolling stock of any railway or tramway subject to the provisions of the Railways Act, 1989 (24 of 1989).

(2) In this chapter the conductor used for transmitting electricity to a vehicle is referred to as the “line” and the other conductor as the “return”.

(3) The owner of the line, return, rails or trolley wire, as the case may be, shall be responsible for the observance of regulations 82 to 95.

(4) Before an application is made by the owner of an installation of voltage exceeding 1000V to the Electrical Inspector for permission to commence or recommence supply after such installation has been disconnected for six months and above, the supplier shall ensure that the electric supply lines or apparatus at voltage exceeding 1000 V belonging to him are placed in position, properly connected and duly completed.

(5) The supply of electricity shall not be commenced by the supplier unless and until the Electrical Inspector is satisfied that the provisions of regulations 46 to 52 and regulation 82 to 95 have been complied with and the approval in writing of the Electrical Inspector has been obtained by him.

- 82. Voltage of supply to vehicle.**- No person shall supply electricity to any trolley wire or other conductor at voltage exceeding - 1000 V used in direct electrical and mechanical connection with any vehicle, except with the written approval of the Central Government or the State Government, as the case may be, and subject to such conditions as the State Government may think reasonable to impose.

- 83. Insulation of lines.**- (1) Every line shall be insulated throughout and a line may consist of either bare conductors supported on structures through insulators or insulated cable-;

- 84. Insulation of returns.**- (1) Where any rails on which cars run, or any conductors laid between or within 0.9 metre of such rails, form any part of a return, such part may be un-insulated and all other returns or parts of a return, shall be insulated, unless they are of such conductivity as to secure the conditions required by sub-regulations (2) and (3) of regulation 85.

(2) Where any part of a return is un-insulated, it shall be connected with the negative or neutral of the system.

- 85. Proximity to metallic pipes.**- (1) Where an un-insulated return is in proximity to any metallic pipe, structure or substance not belonging to the owner of the return, the owner of un-insulated return shall, if so required by the owner of such pipe, structure or substance, connect his return therewith at his own expense.

(2) Where the return is partly or entirely un-insulated, the owner shall, in the construction and maintenance of his system, adopt such means for reducing the difference produced by the current between the potential of the un-insulated return at any one point and the potential of the un-insulated return at any other point as to ensure that the difference of potential between the un-insulated return and any metallic pipe, structure or substance in the vicinity shall not exceed four volts where the return is relatively positive, or one and one-third volts where the return is relatively negative.

(3) The owner of any such pipe, structure or substance in respect of it require the owner of the un-insulated return at reasonable times and intervals to ascertain by test in his presence or in the presence of his representative, whether the condition specified in sub-regulation (2) is fulfilled, and, if such condition is found to be fulfilled, all reasonable expenses of, and incidental to, carrying out of the test shall be borne by the owner of the pipe, structure or substance.

(4) The potential of un-insulated return with respect to earth at any point shall not exceed fifty volt under normal conditions.

(5) The petroleum sidings installation earth shall be connected to the un-insulated return to make it equi-potential and pipelines in the vicinity of the track should be properly earthed.

**86. Difference of potential on return.-** Where the return is partly or entirely un-insulated, the owner shall keep a continuous record of the difference of potential, during the working of his system, between every junction of an insulated return with an un-insulated return and the point on the route most distant from that junction, and the difference of potential shall not, under normal running conditions, exceed a mean value of seven volts between the highest momentary peak and the average for the hour of maximum load.

**87. Leakage on conduit system. -** Where both the line and the return are placed within a conduit, the following conditions shall be fulfilled in the construction and maintenance of the system, namely: -

(i) where the rails are used to form any part of the return, they shall be electrically connected at distances not exceeding 30 metres apart, with the conduit by means of copper strips having a cross-sectional area of at least 0.40 sq. cm. or by other means of equal conductivity and where the return is wholly insulated and contained within the conduit, the latter shall be connected with earth at the generating station or sub-station through an instrument suitable for the indication of any contact or partial contact of either the line or the return with the conduit; and

(ii) the leakage-current shall be ascertained daily, before or after the hours of running, when the line is fully charged and if at any time it is found to exceed 0.6 ampere per km. of single tramway track, the transmission and use of electricity shall be suspended unless the leakage is stopped within twenty-four hours.

**88. Leakage on system other than conduit system. -** Where both the line and the return are not placed within a conduit, the leakage current shall be ascertained daily before or after the hours of running, when the line is fully charged and if at any time it is found to exceed 0.3

ampere per km. of single tramway track, the transmission and use of electricity shall be suspended unless the leakage is stopped within twenty-four hours.

**89. Passengers not to have access to electric circuit.** - Precautions to the satisfaction of an Electrical Inspector shall be taken by the owner of every vehicle to prevent,-

- (i) the access of passengers to any portion of the electric circuit where there is danger from electric shock;
- (ii) any metal, hand-rail or other metallic substance liable to be handled by passengers, becoming charged.

**90. Isolation of sections.**- Every trolley wire shall be constructed in sections not exceeding 1.6 km. in length, and means shall be provided for isolating each section.

**91. Minimum size and strength of trolley wire.**- No trolley-wire shall be of less cross-sectional area than 0.5 sq. cm. or shall have an actual breaking load of less than 2000 kg.

**92. Height of trolley wire and length of span.**- A trolley wire or a traction feeder on the same supports as a trolley wire shall, at no place be, at a height from the surface of the street of less than 5.2 metres except, where it passes under a bridge or other fixed structure, or through or along a tunnel or mineshaft or the like in which case it shall be suspended to the satisfaction of an Electrical Inspector.

**93. Earthing of guard wires.** - Every guard wire shall be connected with earth at each point at which its electrical continuity is broken and shall also be connected with the rails at intervals of not more than five spans;

**94. Proximity to magnetic observatories and laboratories.**- Traction works shall not be carried out in the vicinity of geomagnetic observatories and laboratories without the concurrence of the Central Government or of any officer authorised by it in this behalf.

**95. Records.** - (1) The owner shall keep the following records, namely : -

- (i) daily records showing –
  - (a) the maximum working current from the source of supply;
  - (b) the maximum working voltage at the source of supply;
  - (c) the difference of potential, as required under regulation 86; and
  - (d) the leakage current, if any, as required under regulation 87 and 88.
- (ii) occasional records showing –
  - (a) every test made under sub-regulation (2) and (3) of regulation 85
  - (b) every stoppage of leakage, together with the time occupied; and
  - (c) particulars of any abnormal occurrence affecting the electrical working of the system.

(2) The records so kept under sub-regulation (1) shall be open to examination by Electrical Inspector.



## Chapter IX

### Additional Safety requirements for mines and oil fields

**96. Application of chapter.-** The regulation in this chapter shall apply only where electricity is used in mines as defined in the Mines Act, 1952 (35 of 1952) and oil fields.

**97. Responsibility for observance.-** (1) It shall be the duty of every person in charge of and responsible to the mine including the owner, agent, manager, engineer and installation manager and Engineer of mine and oil field to comply with and enforce the regulations and it shall be the duty of all persons employed to conduct their work in accordance with the regulations.

Provided that in case of power stations, transformer substations, converter substations, rectifier substations and accumulator, storage stations for supplying electricity to solely and mainly for the purpose of working of the mine or number of mines and which do not fall in the precincts of a mine, Engineer holding a degree in electrical engineering from university with adequate experience may be appointed as manager of that installations.

*Explanation* – For the purposes of this regulation, the word “Engineer” shall

- (i) in the case of a coal mine, have the same meaning as assigned to it in the Coal Mines Regulations, 2017 as amended from time to time;
- (ii) in the case of a metalliferous mine, have the same meaning as assigned to it in the Metalliferous Mines Regulations, 1961, as amended from time to time; and
- (iii) in the case of an oil field, means the Installation Manager’ under the Oil Mines Regulations, 2017.

**98. Notices.-** (1) On or before the first day of February in every year, in respect of every mine or oil-field, returns giving the size and type of apparatus, together with such particulars in regard to circumstances of its use as may be required, shall be sent to the Electrical Inspector of Mines by the persons specified in regulation 97 in the Form provided in **Schedule- IX** or, as the case may be, Schedule-X, whichever is applicable.

(2) The persons specified in regulation 97, shall also give to the Electrical Inspector of Mines not less than seven days notice in writing of the intention to bring into use any new installation in a mine or oil-field giving details of apparatus installed and its location:

Provided that in case of any additions or alterations to an existing installation of voltage not exceeding 1000 V, immediate notice in writing shall be sent to the Electrical Inspector of Mines before such additions or alterations are brought into use:

Provided further that this regulation shall not apply to telecommunication or signalling apparatus.

Provided further that in case of emergency which may lead to loss of life or machinery and is detrimental to safety of mine, intimation shall be given within 24 hours to the Electrical Inspector of Mines giving the healthiness of the apparatus alongwith self certification report of such additions or alterations undertaken.

**99. Plans. -** (1) A correct plan, on the same scale as the plan kept at the mine in fulfillment of the requirements of the Mines Act, 1952 (35 of 1952), and Single Line Diagram of the

electrical installations from point of commencement of supply shall be available in the office at the mine showing the position of all fixed apparatus and conductors therein, other than lights, telecommunication or signaling apparatus, or cables for the same.

(2) A similar plan on the scale not less than 25 cm. to a km. (1:4000) shall be kept by the manager or owner of one or more wells in any oil-field.

(3) A similar plan and Single Line Diagram on such scale as the Central Government may direct, and Single Line Diagram showing the position of all electric supply lines, shall be kept in the office of any licensee. Owner and /OR other person transmitting or distributing electricity in a mine or oil-field.

(4) The plans specified under this regulation shall be examined and corrected as often as necessary to keep them up-to-date and the dates of such examinations shall be entered thereon by the manager or owner of the mine or wells and such plans shall be available to the Inspector, or inspector of mines, at any time. In case extent of hazardous area is revised, equipment covered under such area shall be reviewed as per IS-5571, IS-5572 and/or ATEX.

#### **100. Lighting, overhead lines, communication and fire precautions. -**

(1) Adequate illumination by electricity as per relevant IS shall be provided in the mines.

Provided that in a belowground coalmine, such lighting fixtures shall be of a type approved by the Chief Inspector of mines.

Provided that one or more flame safety lamps or such lighting system approved by the Chief Inspector of mines shall be maintained in all places where failure of the electric light at any time shall be prejudicial to safety.

Provided that in a belowground metalliferous mine or any open cast mine or oil fields, such lighting fixtures shall be suitable for the type of application conforming to the relevant IS or harmonized standards, and adequate emergency lighting system shall be maintained in all places where failure of the electric light at any time shall be prejudicial to safety.

(2) Efficient means of communication shall be provided in every mine between the point where the switchgear under sub-regulation (1) of regulation 107 is erected, the shaft bottom and other distributing centres in the mines.

(3) Fire extinguishing appliances of adequate capacity and of an approved type as per IS 15683 as amended from time to time shall be installed and properly maintained in every place in a mine containing apparatus, other than cables, telecommunication and signalling apparatus.

(4) In case of mines, minimum clearance above ground of the lowest conductor of overhead lines or overhead cables where dumpers or trackless vehicles are being operated, shall not be less than twelve meters in height from the ground across the road where dumpers or trackless vehicles cross.

Provided where dumper bucket in raised position, the clearance between the top of dumper body and to the lowest conductor of overhead lines or overhead cables shall not be less than 1.00 metre.

**101. Isolation and fixing of transformer and switchgear.** - (1) Transformers and switchgear shall be placed in a separate room, compartment or box where necessary or in a manner to prevent danger of mechanical damage and spread of fire.

(2) Unless the apparatus is so constructed, protected and worked as to obviate the risk of fire, no inflammable material shall be used in the construction of any room, compartment or box containing apparatus, or in the construction of any of the fittings therein and each such room, compartment or box shall be substantially constructed and shall be kept dry and illuminated and efficient ventilation shall be provided for all apparatus installed therein.

(3) All apparatus that has to be worked or attended to and all handles intended to be operated shall be placed at a spacious working place which is accessible, clear of obstruction and free from danger, so far as circumstances permit.

**102. Method of earthing.**- (1) Where earthing is necessary in a mine, it shall be carried out by connection to an earthing system at the surface substation of the mine .

(2) All metallic sheaths, coverings, handles, joint boxes, switchgear frames, instrument covers, switch and fuse covers of boxes, all lamp holders, unless efficiently protected by an insulated covering made of fire resisting material, and the frames and bedplates of generators, transformers and motors, including portable motors, shall be earthed by connection to an earthing system in the manner specified in sub-regulation (1).

(3) Where cables are provided with a metallic covering constructed and installed in accordance with clause (iv) (d) of regulation 108, such metallic covering may be used as a means of connection to the earthing system.

(4) All conductors of an earthing system shall have conductivity, at all parts and all joints, at least equal to fifty per cent of that of the largest conductor used solely to supply the apparatus, a part of which desired to be earthed:

Provided that no conductor of an earthing system shall have a cross-sectional area less than 0.15 sq. cm. except in the case of the earth conductor of a flexible cable used with portable apparatus where the voltage does not exceed 125 Volts, and the cross-sectional area and conductance of the earthcore is not less than that of the largest of the live conductors in the cable.

(5) All joints in earth conductors and all joints in the metallic covering of cables shall be properly soldered or otherwise effectively made.

(6) No switch, fuse or circuit-breaker shall be inserted in any earth conductor.

(7) This regulation shall not apply, except in the case of portable apparatus, to any system in a mine in which the voltage does not exceed 30 V.

**103. Protective equipment.- Protective equipment.**- (1) In the interest of safety, the earth fault current shall not be more than 750 milliampere in installations of voltage exceeding 250 V and upto 1100V for below ground mines and oil fields, and 50 amperes in installations of voltage

exceeding 1100V and up to 11KV in open cast mines . The magnitude of the earth fault current shall be limited to these specified values by employing suitably designed, restricted neutral system of power supply including neutral-ground monitoring protection system.

Provided further that all electrical installations in or after notification of the CEA regulation 2021, of voltage exceeding 1100V and up to 11KV for belowground mines, open cast mines and oil mines or oil fields, the magnitude of the earth fault current shall be limited upto 10A by employing suitably designed, restricted neutral system of power supply including neutral-ground monitoring protection system.

Provided that the settings of protective relays thereof shall be set between 200 to 400 milliampere for individual apparatus of voltage upto 1100V with suitable time delay protection.

(2) The operation of the switchgear and the relays shall be recorded daily at the generating station, sub-station or switch station in a register kept for the purpose and in electronic form also.

(3) The effectiveness of switchgear and protective system shall always be kept in working order and shall be checked by calibrating and testing at least once in a year and the result thereof shall be recorded in separate register kept for the purpose and in electronic form.

Provided that wherever numerical relays are being used they shall be checked by testing procedure as per guidelines of OEM/Indian standard/IEC and periodicity of such checking shall be at least once in a year.

#### **104. Voltage limits.-**

Electricity shall not be transmitted into a belowground mine at a voltage exceeding 11000 Volts and shall not be used therein at a voltage exceeding 6600 Volts.

Provided that-

(i) where hand-held portable apparatus is used, the voltage shall not exceed 125 V;

(ii) where electric lighting is used –

(a) in belowground mines, the lighting system shall have a mid or neutral point connected with earth and the voltage shall not exceed 125 V between phases;

(b) on the surface of a mine or in an open cast mine or oil mines or oil fields, the voltage may be raised to 250 V, if the neutral or the mid-point of the system is connected with earth and the voltage between the phases does not exceed 250 V;

(iii) where portable hand-lamps are used in belowground mines and hazardous area of oil mines or oil fields, the voltage shall not exceed 30 V;

(iv)(a) where any circuit is used for the remote control or electric inter-locking of apparatus, the circuit voltage shall not exceed 30 V for below ground mine or hazardous area of oil fields.

Provided that in hazardous areas of oil mines or oil fields, the said voltage can be up to 250 volts if the on-off control push-button stations (PBS) or remote controls are housed in an Appropriate enclosure like:

i. Flameproof enclosure type ‘d’

- ii. Pressurized enclosure type 'p'
- iii. Sand filled apparatus type 'q'
- iv. Increased safety enclosure type 'e', 'n', and 'o'

Provided further that the control circuit shall have suitable protection against shock hazards, and the trippings due to faults do not adversely affect the operational safety.

(b) In fixed plants on surface of the mines or opencast mines, the said voltage for the remote control or electric inter-locking may be permitted up to 250V.

**105. Transformers.** - In mines or oil fields, the transformers used for providing voltages to control circuits or remote control or interlocking or for hand held apparatus, shall have suitable provision to guard against danger by reason of the lower voltage apparatus becoming accidentally charged above its normal voltage by leakage from or contact with the higher voltage apparatus.

**106. Switchgear and terminals.**- Switchgear and all terminals, cable-ends, cable-joints and connections to apparatus shall be totally enclosed and shall be constructed, installed and maintained as to comply with the following requirements, namely:-

- (i) all parts shall be of mechanical strength sufficient to resist rough usage;
- (ii) all conductors and contact areas shall be of adequate current-carrying capacity and all joints in conductors shall be properly soldered or otherwise efficiently made;
- (iii) the lodgement of any matter likely to diminish the insulation or affect the working of any switchgear shall be prevented;
- (iv) all live parts shall be so protected or enclosed as to prevent persons accidentally coming into contact with them and to prevent danger from arcs, short-circuits, fire, water, gas or oil;
- (v) where there may be risk of igniting gas, coal-dust, oil or other inflammable material, all parts shall be so protected as to prevent open sparking; and
- (vi) every switch or circuit-breaker shall be so constructed as to be capable of opening the circuit it controls and dealing with any short-circuit without danger.

**107. Disconnection of supply.**- (1) Properly constructed switchgear for disconnecting the supply of electricity to a mine or oil-field shall be provided at a point recommended by the Electrical Inspector of Mines.

(2) At any time, when any cable or overhead line supplying electricity to the mine from the aforesaid switchgear is live, a person designated to operate the said switchgears shall be available within easy reach thereof:

Provided that in the case of gassy coal seam of second degree and third degree gassiness, the main mechanical ventilator operated by electricity shall be interlocked with the switchgear

so as to automatically disconnect the power supply in the event of stoppage of main mechanical ventilator.

(3) When necessary in the interest of safety, any apparatus suitably placed, shall be provided for disconnecting the supply from every part of a system.

(4) If the Electrical Inspector of Mines, in the interest of safety considered it necessary, he may direct that the apparatus specified in sub-regulation (3) shall be so arranged as to disconnect automatically, from the supply, any section of the system subjected to a fault.

(5) Every motor shall be controlled by switchgear which shall be so arranged as to disconnect the supply from the motor and from all apparatus connected thereto and such switchgear shall be so placed as to be easily operated by the person designated to operate the motor.

(6) a suitably rated switchgear incorporated with protective mechanism to disconnect automatically the supply in the event of conditions of over-current, earth fault/leakage, under voltage/no voltage and single phasing.

(7) Auxiliary fan shall be interlocked with the switchgear controlling power supply to the in-bye face equipment of below ground coal mine for automatic disconnection of power supply in the event of the stoppage of the auxiliary fan.

(8) Every feeder of the mine shall be controlled by a suitably rated switchgear incorporated with protective mechanism in a manner so as to disconnect the supply automatically in the event of conditions of over-current, short circuit, single phasing, under-voltage and earth fault/leakage as relevant.

**108. Cables.-** All cables, other than flexible cables for portable or transportable apparatus, shall fulfill the following requirements, namely:-

(i) all such cables, other than the outer conductor of a concentric cable, shall be covered with insulating material and shall be efficiently protected from mechanical damage and supported at sufficiently frequent intervals and in such a manner as to prevent damage to such cables;

(ii) (a) except as provided in clause (iii) no cables other than concentric cables or single core or two core or multi core cables protected by a metallic covering and which contain all the conductors of a circuit shall be used where the voltage exceeds 125 V or when an Inspector considers that there is risk of igniting gas or coal dust or other inflammable material, and so directs;

(b) the sheath of metal-sheathed cables and the metallic armouring of armoured cables shall be of a thickness not less than that recommended from time to time in the relevant standard of the Bureau of Indian Standards;

(iii) where a voltage exceeding 250 V but not exceeding - 1000 V direct current system is used, two single core cables may be used for any circuit provided that their metallic

coverings are bonded together by earth conductors so placed that the distance between any two consecutive bonds is not greater than thirty metres measured along either cable;

(iv) The metallic covering of every cable shall be -

- (a) electrically and mechanically continuous throughout;
- (b) earthed, if it is required, to be earthed by a connection to the earthing system of conductivity ;
- (c) efficiently protected against corrosion where necessary;
- (d) of a conductivity at all parts and at all joints at least equal to fifty per cent of the conductivity of the largest conductor enclosed by the said metallic covering; and
- (e) where there may be risk of igniting gas, coal-dust, or other inflammable material, so constructed as to prevent, as far as practicable, the occurrence of open sparking as the result of any fault or leakage from live conductors.

(v) cables and conductors where connected to motors, transformers, switchgear and other apparatus, shall be installed so that,-

- (a) they are mechanically protected by securely attaching the metallic covering to the apparatus; and
- (b) the insulating material at each cable end is efficiently sealed so as to prevent the diminution of its insulating properties;

(vi) where necessary to prevent abrasion or to secure gas-tightness, properly constructed glands or bushes shall be provided;

(vii) unarmored cables or conductors shall be conveyed either in metallic pipes or metal casings or suspended from efficient insulators by means of non-conducting materials which will not cut the covering and which will prevent contact with any timbering or metal work and if separate insulated conductors are used, they shall be installed at least 3.75 cm. apart and shall not be brought together except at lamps, switches and fittings.

**109.Flexible cables.-** (1) Flexible cables for portable or transportable apparatus shall be two core or multi core, unless required for electric welding, and shall be covered with insulating material which shall be efficiently protected from mechanical injury.

(2) If flexible metallic covering is used either as the outer conductor of a concentric cable or as a means of protection from mechanical injury, it shall not be used by itself to form an earth conductor for such apparatus, but it may be used for that purpose in conjunction with an earthing core.

(3) Every flexible cable intended for use with portable or transportable apparatus shall be connected to the system and to such apparatus by properly constructed connectors:

Provided that for machines of voltage exceeding 1000 V but not exceeding 11KV a bolted type connector shall be used and the trailing cable shall be suitably anchored at the machine end.

(4) At every point where flexible cables are joined to main cables, a circuit breaker shall be provided which is capable of automatically disconnecting the supply from such flexible cables.

(5) Every flexible cable attached to a portable or transportable machine shall be examined periodically by the person designated to operate the machine, and if such cable is used underground, it shall be examined at least once in each shift by such person and if such cable is found to be damaged or defective, it shall forthwith be replaced by a cable in good condition.

(6) If the voltage of the circuit exceeds 250 V, all flexible cables attached to any transportable apparatus shall be provided with flexible metallic screening or pliable armouring and cables of portable apparatus shall be provided with flexible metallic screening on all the power and pilot cores.

Provided that the provision of this regulation shall not apply to flexible cables attached to any transportable or portable apparatus used in open cast mines or below ground mines where reeling and unreeling of such cables is necessary as per design features of the equipment.

(7) All flexible metallic screening or armouring specified in sub-regulation (6) shall fulfill the requirement specified in clause (iv) of regulation 108 .

Provided that in the case of separately screened flexible cables the conductance of each such screen shall not be less than twenty five per cent of that of the power conductor and the combined conductance of all such screens shall in no case be less than that of 0.15 sq. cm. copper conductor.

(8) Flexible cable exceeding hundred metres in length shall not be used with any portable or transportable apparatus:

Provided that such flexible cable when used with coal cutting machines or cutter or loader or armoured face conveyor for long wall operation, or with shuttle cars or load haul dumper or cutter loader or all alike equipment for development and de-pillaring operation shall not exceed two hundred fifty metres in length:

Provided further that the aforesaid cable in case of an open cast mine when used with electrically operated heavy earth moving machinery shall not exceed six hundred metres in length and for bucked wheel excavator at 11 kV shall not exceed one thousand metres in length.

Provided further that in case of Dragline or 42 CuM capacity Shovel, flexible cable length may be raised up to 600M



(9) Flexible cable, when installed in a mine, shall be efficiently supported and protected from mechanical injury.

(10) Flexible cables shall not be used with apparatus other than portable or transportable apparatus.

(11) Where flexible cables are used they shall be detached or otherwise isolated from the source of supply when not in use, and arrangements shall be made to prevent the energising of such cables by undesignated persons.

**110. Portable and transportable machines.-** The person designated to operate an electrically driven coal-cutter, or other portable or transportable machine, shall not leave the machine while it is in operation and shall, before leaving the area in which such machine is operating, ensure that the supply is disconnected from the flexible cable which supplies electricity to the machine and when any such machine is in operation, steps shall be taken to ensure that the flexible cable is not dragged along by the machine:

Provided that all portable and transportable machines used in underground mines shall operate on remote control from the concerned switchgear with pilot core protection.

Provided further that the portable and transportable machines used in open cast mines shall have the provision such that the power supply to the machine from concerned switchgear is remotely controlled from the machine.

Provided further that the portable or transportable machines used in open cast mine, provision of tripping device/ switch device from the operator's cabin shall be provided to disconnect power supply to such machine from the Field Switchgear

**111. Sundry precautions.-** (1) All apparatus shall be maintained reasonably free from dust, dirt and moisture, and shall be kept clear of obstruction.

(2) All apparatus other than portable and transportable apparatus shall be housed in a room, compartment or box so constructed as to protect the contents from damage occasioned by falling material or passing traffic.

(3) Inflammable or explosive material shall not be stored in any room, compartment or box containing apparatus, or in the vicinity of any apparatus.

(4) In case of a fault in any circuit, the part affected shall be made dead without delay and shall remain so until the fault has been remedied.

(5) While lamps are being changed the supply shall be disconnected.

(6) No lampholder shall have metallic connection with the guard or other metal work of a portable hand lamp.

(7) The following notices in Hindi and local language of the district, so designed and protected as to be easily legible at all times, shall be exhibited at the following places, namely:-

(i) where electrical apparatus is in use, a notice forbidding undesigned persons to operate or otherwise interfere with such apparatus;

(ii) in the interior or at the surface of the mine where a telephone or other means of communication is provided, a notice giving full instructions to person, at the surface of the mine, designated to effect the disconnection of the supply of electricity to the mine.

(8) All apparatus, including portable and transportable apparatus, shall be operated only by those persons who are designated for the purpose.

(9) Where a plug-and-socket-coupling other than of bolted type is used with flexible cables, an electrical inter-lock or other approved device shall be provided to prevent the opening of the coupling while the conductors are live.

## **112. Precautions where gas exists.**

(1) In any part of a coal-seam of the first degree gassiness –

(i) all cables shall be constructed, installed, protected, operated and maintained in such a manner as to prevent risk of open sparking;

(ii) all signaling, telecommunication, remote control and insulation tester circuits shall be so constructed, installed, protected, operated and maintained as to be intrinsically safe;

(iii) all apparatus including portable and transportable apparatus including lighting fittings used at any place which lies in-by of the last ventilation connection shall be flame-proof:

Provided that electrically operated or battery operated portable or transportable apparatus such as shuttle car, men or material transporting equipment of increased safety type “e” shall be permitted at any place with suitable monitoring devices for detection of gases, if any;

(iv) all electric lamps at any place which lie in-by of the last ventilation connection and return airways shall be in flame proof enclosure and at other places these shall be in increased safety enclosure type ‘e’.

(2) At any place which lies in any part of a coal-seam of second and third degree gassiness

(i) all signaling, telecommunication, remote control and insulation tester circuits shall be so constructed, installed, protected, operated and maintained as to be intrinsically safe;

- (ii) all cables shall be constructed, installed, protected, operated and maintained in such a manner as to prevent risk of open sparking;
  - (iii) all apparatus, including portable and transportable apparatus used at any place within ninety metres of any working face or goaf in case of a second degree gassy mine and within two hundred seventy metres of any working face or goaf in case of third degree gassy mine or at any place which lies in-between of the last ventilation connection or in any return airways shall be flame-proof;
  - (iv) all electric lamps shall be enclosed in flame-proof enclosures.
- (3) In any oil mine or oil-field, at any place within the zone-2 hazardous areas-
- (i) all signaling and telecommunication, remote control and insulation tester circuits shall be so constructed, installed, operated, protected and maintained as to be intrinsically safe;
  - (ii) all cables shall be so constructed, installed, operated and maintained as to prevent risk of open sparking;
  - (iii) all apparatus including portable and transportable apparatus shall have the following types of enclosures conforming to the relevant Indian Standards, namely:-
    - (a) flame-proof enclosure type 'd' or
    - (b) pressurized enclosure type 'p' or
    - (c) sand filled apparatus type 'q' or
    - (d) increased safety enclosure type 'e', 'n' and 'o'
  - (iv) all electric lamps shall be enclosed in increased safety enclosure type 'e'.
- (4) In oil mine or oil fields at any place within the zone-1 hazardous areas-
- (i) all signaling and telecommunication, remote control and insulation tester circuits shall be so constructed, installed, operated, protected and maintained as to be intrinsically safe;
  - (ii) all cables shall be so constructed, installed, operated and maintained as to prevent risk of open sparking;
  - (iii) all apparatus including portable and transportable apparatus shall have the following types of enclosures conforming to the relevant Indian Standards, namely:-
    - (a) flame-proof enclosure type 'd' or
    - (b) pressurized enclosure type 'p' or
    - (c) sand filled apparatus type 'q'
  - (iv) all electric lamps shall be enclosed in flame-proof enclosures.
- (5) In any oil mine at any place within zone-0 hazardous area, no electrical equipment shall be used and where it is not practicable, intrinsically safe apparatus are only to be used which shall

be conforming to relevant Indian standards or relevant international standard where Indian Standards are not available and such installation of apparatus shall conform to relevant Indian standards or relevant international standards where Indian Standards are not available and the details of installation, certified by the Owner/ Agent/ Manager/ Installation manager shall be submitted to the Electrical Inspector of mines.

(6) In any coal-seam of degree second and degree third gassiness or the hazardous area the supply shall be discontinued;

(i) immediately, if open sparking occurs;

(ii) during the period required for examination or adjustment of the apparatus, which shall necessitate the exposing of any part liable to open sparking;

(iii) the supply shall not be reconnected until the apparatus has been examined by the electrical supervisor or one of his duly appointed assistants and until the defect, if any, has been remedied or the necessary adjustment made; and

(iv) a flame safety lamp shall be provided and maintained in a state of continuous illumination near an apparatus, including portable or transportable apparatus, which remains energized and where the appearance of the flame of such safety lamps indicates the presence of inflammable gas, the supply to all apparatus in the vicinity shall be immediately disconnected and the incident reported forthwith to an official of the mine and such apparatus shall be interlocked with the controlling switch in such a manner as to disconnect power supply automatically in the event of percentage of inflammable gas exceeding one and one quarter in that particular district:

Provided that where apparatus for automatic detection of the percentage of inflammable gas or vapor are employed in addition to the flame safety lamps, such apparatus shall be approved by the inspector of mines and maintained in perfect order.

(7) In any part of a coal-seam of any degree of gassiness or in any hazardous area of an oil fields, if the presence of inflammable gas in the general body of air is found at any time to exceed one and one quarter per cent, the supply of energy shall be immediately disconnected from all cables and apparatus in the area and the supply shall not be reconnected so long as the percentage of inflammable gas remains in excess of one and one quarter per cent.

(8) In oil fields where concentration of inflammable gas exceeds twenty (20) percent of its lower explosive limit (LEL) a system should be in place to activate an audio alarm at Appropriate location. On activation of such alarm immediate action shall be taken to make operations safe and to isolate the cause in order to ensure safety of men, equipment, environment. In case the LEL rises to forty (40) percent, the supply of electricity shall be cut-off immediately from all cables and apparatus lying within thirty metres of the installation and all sources of ignition shall also be removed from the said area and normal work shall not be resumed unless the area is made gas-free:

Provided that such disconnection shall not apply to intrinsically safe environment monitoring scientific instruments.

(9) Any such disconnection or reconnection of the supply shall be noted in the log sheet in hard copy and electronic form which shall be maintained in the form set out in Schedule-XI and shall be reported to the Electrical Inspector of Mines

(10) The provisions of this regulation shall apply to any metalliferous mine which may be notified by the inspector of mines if inflammable gas occurs or if the inspector of mines is of the opinion that inflammable gas is likely to occur in such mine.

Explanation – For the purpose of this regulation;

(1) the expression ‘coal-seam of first degree gassiness’, ‘coal-seam of second degree gassiness’, ‘coal-seam of third degree gassiness’ and ‘flame-proof apparatus’ shall have the meanings respectively assigned to them in the Coal Mines Regulations, **2017**.

(2) The following areas in oil mine or oil fields shall be known as hazardous areas, namely:-

(i) an area of not less than ninety metres around an oil-well where a blow-out has occurred or is likely to occur, as may be designated by the Installation Manager or the senior most official present at the site;

(ii) an area within sixteen metres of an open discharge of petroleum bearing fluid from a well under production test.

(iii) an area within fifteen metres of :

(a) a producing well-head or any point of open discharge of the crude there from or other point where emission of hazardous atmosphere is normally likely to arise; or

(b) any wildcat or exploration well-head being drilled in an area where abnormal pressure conditions are known to exist; or

(iv) any area within three meters of:

(a) any producing well-head where a closed system of production is employed such as to prevent the emission or accumulation in the area in normal circumstances of a hazardous atmosphere; or

(b) exploration or interspaced well-head being drilled in an area where the pressure conditions are normal and where the system of drilling employed includes adequate measures for the prevention in normal circumstances of emission or accumulation within the area of a hazardous atmosphere; or

(3) “hazardous atmosphere” means an atmosphere containing any inflammable gases or vapours in a concentration capable of ignition.

(4) “Zone 0 hazardous area” means “an area in which hazardous atmosphere is continuously present.”

(5) “Zone 1 hazardous area” means “an area in which hazardous atmosphere is likely to occur under normal operating conditions”.

(6) “Zone 2 hazardous area” means “an area in which hazardous atmosphere is likely to occur under abnormal operating conditions”.

**113. Shot-firing.** – (1) When shot-firing is in progress adequate precautions shall be taken to protect apparatus and conductors, other than those used for shot-firing, from injury.

(2) Current from lighting or power circuits shall not be used for firing shots.

(3) The construction of shot firing cables shall conform to IS 5950 and adequate precautions shall be taken to prevent such cable touching other cables and apparatus.

**114. Signaling.** - Where electrical signaling is used,-

(i) adequate precautions shall be taken to prevent signal and telephone wires coming into contact with other cables and apparatus;

(ii) the voltage used in any one circuit shall not exceed 30 V;

(iii) contact-makers shall be so constructed as to prevent the accidental closing of the circuit; and

(iv) bare conductors, where used shall be installed in suitable insulators.

**115. Haulage.** - Haulage by electric locomotives on the overhead trolley-wire system, at voltage not exceeding 650 V and haulage by storage battery locomotives may be used with the prior permission in writing of the Electrical Inspector of mine, and subject to such conditions as he may impose in the interests of safety

**116. Earthing of neutral points.** - Where the voltage of an alternating current system exceeds 30 Volts, the neutral or mid-point shall be earthed by connection to an earthing system in the manner specified in regulation 102.

Provided that when the system concerned is required for blasting and signaling purposes, the provisions of this regulation shall not apply.

Provided further, that in case of unearthed neutral system, it shall be equipped with a suitable ground protection system approved by the Electrical Inspector of Mines to ensure isolation of power supply to the faulty section in Appropriate manner.

**117. Supervision.** - (1)(i) One or more electrical supervisors shall be appointed in writing by the owner, agent or manager of a mine or by the agent or the owner, of one or more wells in an oil field to supervise the installation and such number of supervisors shall be on duty as per guidelines of schedule XII and/or as directed by the Electrical Inspector of mines.

(ii) The electrical supervisor so appointed shall be the person holding a valid Electrical Supervisor's Certificate of Competency, covering mining installations issued by the Appropriate Government.

(iii) Adequate number of electricians as per guidelines mentioned in schedule **XII** and /or as directed by the Electrical Inspector of Mines shall be appointed in writing by owner, agent or manager of a mine or by the owner or Agent of ~~in~~ an oil field for carrying out the duties.

(iv) The Electrician shall be a person holding license under sub-regulation (1) of regulation 31

(v) For small open cast mines and below ground mines receiving supply at voltage not more than 1000 V and not having portable or transportable apparatus, electrical supervisor and electrician shall be appointed for more than one mine with the approval of the Electrical Inspector of Mines.

(2) Every person appointed to operate, supervise, examine or adjust any apparatus shall be competent to undertake the work which he is required to carry out as directed by the Engineer.

(3) The electrical supervisor shall be responsible for the proper performance of the following duties, by himself or by an electrician appointed under sub-regulation (1).

(i) thorough examination of all apparatus, including the testing of earth conductors and metallic coverings for continuity, as often as may be necessary to prevent danger;

(ii) examination and testing of all new apparatus, and of all apparatus, re-erected in the mine before it is put into service in a new position.

(4) In the absence of any electrical supervisor, the owner, agent or manager of the mine and oil field shall appoint in writing a substitute electrical supervisor.

(5) (i) The electrical supervisor or the substitute electrical supervisor appointed under sub-regulation (4) to replace him shall be personally responsible for the maintenance at the mine or oil-field, of a log-book made up of the daily log sheets prepared in the form set out in Schedule- XI.

(ii) The results of all tests carried out in accordance with the provisions of sub-regulation (3) shall be recorded in the log-sheets prepared in the form set out in Schedule- XI.

### **118. Training of personnel engaged for operation and maintenance of electrical installations in Mines and oil fields:**

(i) The persons engaged for operation and maintenance of electrical installations in Mines are required to undergo the type of training meant for the particular mining installations (Coal/Oil/Metal) as per Schedule-XIII Part-I, II & III as applicable

(ii) The Owner /Agent of the mine shall arrange for training of their personnel engaged in the operation and maintenance of electrical installations of mines in his own institute or any other institute recognized by the Central Government or State Government.

Provided that the existing employees shall have to undergo the training mentioned in sub-regulation (i) within three years from the date of coming into force of these regulations.

(iii) The refresher training shall be imparted at a periodicity of intervals not more than two years. A register or in electronic form by the Owner/Manager/Agent of a mine or by the owner or agent, of one or more wells in an oil fields of the mine shall be maintained wherein the names of the persons trained, due date of refresher training etc., shall be entered. The register maintained shall be produced before the Electrical Inspector whenever required by him.



## Chapter X

### Additional Safety requirements for Generating Stations

#### 119. Safety provisions for Thermal Power Plant-

##### (1) Power and control cables, and cabling

- (a) (i) Power and control cables shall be flame retardant low smoke (FRLS) type with fire survival (FS) cables to be provided for certain essential auxiliaries.
  - (ii) Cables to be directly buried shall be essentially armoured type.
  - (iii) FRLS cables and FS cables shall meet test requirements as per IS 694 and IS 17505 (Part-1).
  - (iv) De-rating factors for site ambient and ground temperatures, grouping and soil
- (b) (i) Cable installation shall be carried out as per relevant IS and other applicable standards.
  - (ii) Power cables and control cables shall be laid on separate tiers. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables with higher voltage grade cables in topmost tier and control cables in bottommost tier.
  - (iii) All cables associated with one unit shall preferably be segregated from cables of other units.
  - (iv) Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

##### (2) Fire detection, alarm and protection system.-

- (i) A comprehensive fire detection, alarm as well as fire protection system shall be installed for the Station in conformity with relevant IS.
- (ii) Automatic fire detection and alarm system shall be intelligent and addressable type and shall be provided to facilitate detection of fire at the incipient stage and give warning to the firefighting staff.
- (iii) Major equipment to be used for fire detection and protection system shall be in accordance with relevant IS.
- (iv) Dedicated fire water storage and pumping facilities of adequate capacities shall be provided for the fire fighting system as per TAC guidelines.  
Provided that the main fire water pumps shall be electrically driven and standby pumps shall be diesel engine driven.
- (v) All major and minor fire risks in the Station shall be protected against fire by suitable automatic fire protection systems.

Provided that the following systems shall be generally adopted for various fire risks:

- (a) Automatic high velocity water spray system as per IS 15325, shall be provided for the following areas:
  - (i) Lubricating oil systems including storage tanks, purifier units, coolers, turbine oil canal pipelines;
  - (ii) Generator seal oil system tanks, coolers;

- (iii) Steam generator burner fronts.
- (b) Steam turbine bearing housing and air pre-heater shall be provided with manually actuated high velocity water spray system.
- (c) Automatic medium velocity water spray system, complying with TAC guidelines, shall be provided for the areas relating to:
  - (i) Cable galleries, cable vaults, cable spreader rooms, cable risers, cable shafts etc.;
  - (ii) Coal conveyors, transfer points, crusher houses etc.;
  - (iii) Fuel oil pumping stations;
  - (iv) LDO and day oil tanks;
  - (v) DG set building.
- (d) Automatic foam system shall be provided for fuel oil storage tanks as per NFPA and Oil Industries Safety Directorate (OISD) guidelines.
- (e) Automatic inert gas flooding system, comprising of 2x100% inert gas cylinder batteries conforming to NFPA, shall be provided for Unit control rooms, control equipment rooms and area above false ceiling of these rooms.
- (vi) Portable fire extinguisher as per TAC guidelines shall be provided for each room/area of power station in addition to fixed fire protection system to extinguish fire in its early phase to prevent its spread.
- (vii) Fire station and fire tenders along with trained staff shall be provided for the Station.
- (viii) Passive fire protection measures such as fire barriers for cable galleries and shafts etc., fire retardant coatings, fire resistant penetration sealing for all openings in floors, ceilings, walls etc., fire proof doors etc. shall be provided to prevent spreading and for containment of fire.

#### **120. Safety requirement for Biomass and waste to energy installations-**

All Biomass Plants and Waste to energy Plants including Municipal Solid Waste (MSW) or Refuse Derived Fuel (RDF) shall comply with the safety standards as mentioned in Regulation 119 and other relevant part of this safety standard for the common equipment as applicable (as such plant includes Boiler and Steam Turbine for Power Generation).

#### **121. Safety requirement for hydro-electric generating stations,-**

- (i) Fire escape staircases or / galleries shall be provided in main station building or / Cavern.
- (ii) Each equipment room shall be provided with alternate exits to be used in case of fire / or accidents, as per requirements of the Factory Act and other statutory requirements.
- (iii) Metal oxide surge arresters of suitable rating shall be provided for surge protection of generators.
- (iv) i) Resistance temperature detectors (RTD) or any other type of temperature sensors at suitable locations for temperature monitoring of stator core, stator winding and bearings shall be provided.  
ii) Suitable arrangement for rotor winding temperature monitoring shall also be provided.
- (v) Fire fighting system

(a) General-

- (i) The state of the art fire detection, alarm and protection system shall be provided for the station. The fire protection system as well as hydrant system shall be designed complying with the guidelines of National Fire Protection Association (NFPA).
- (ii) All major and minor fire risks in the Station such as transformers, cable galleries or shafts, control rooms etc. shall be protected against the fire by suitable automatic fire protection systems. The state of the art automatic fire detection and alarm system shall be provided to facilitate detection of fire at the incipient stage and warning to fire fighting staff.
- (iii) Portable and mobile fire extinguishers shall be provided to extinguish fire in the initial stage to prevent its spread.

(b) The provision shall be made for water sprinkler system for oil plant rooms, especially in an underground power house. In addition, provision shall also be made for fire hose cabinets and hydrants inside the power house as well as for the transformer area. The water supply for the permanent fire protection installation should be based on the largest fixed fire suppression system demand plus the maximum hose stream demand of not less than 1890 L/min for a 2-hour duration. Two nos. of fire pumps, each capable of pumping water to fill the overhead water tank in 6 hours time shall be provided.

(c) Fire Protection System for Generator

- a. Either water based or CO<sub>2</sub> type of fire suppression system shall be provided.
- b. A water based system shall be adopted in underground power stations because release of CO<sub>2</sub> gas in an underground installation shall be hazardous.

(vi) (i) EHV or HV or LV power cables, busducts and control cables– Cables shall be fire retardant, low smoke, low halogen (FRLSH) type. Directly buried cables shall be essentially armoured type.

(ii) Cables shall be derated for the site ambient and ground temperatures, grouping and soil resistivity as per relevant IS. Wherever feasible or practical, HV or LV busduct shall be used for interconnection.

(vii) A comprehensive procedure for segregation or separation of cables of different types and voltages shall be adopted for cable installation. For laying of cables in a power house, a broad based system involving cable gallery, tunnels, trenches, cable racks, shafts etc. shall be provided. In outdoor switchyards, a cable trench system shall be provided. The main considerations shall be:

- (a) Segregation and proper spacing shall be maintained;
- (b) Control, auxiliary low voltage (upto 1.1 kV) power and medium voltage (above 1.1 kV and upto 66 kV) power cables shall be laid in separate trays;
- (c) Proper attention shall be given to ventilation and heat dissipation aspects particularly in case of HV cables.

## **Chapter XI**

### **Additional Safety Provisions for Electric Vehicle Charging Stations**

**122. General safety requirement for electric vehicle charging stations.** - (1) All electric vehicle charging stations shall be designed, installed, tested, certified, inspected and connected in accordance with the provisions of this chapter.

(2) All electric vehicle charging stations shall be provided with protection against the overload of input supply and output supply fittings.

(3) All electric vehicle charging points shall be installed so that any socket-outlet of supply is at least 800 millimetre above the finished ground level.

(4) A cord extension set or second supply lead shall not be used in addition to the supply lead for the connection of the electric vehicle to the electric vehicle charging point and it shall be so constructed so that it cannot be used as a cord extension set.

(5) An adaptor shall not be used to connect a vehicle connector to a vehicle inlet.

(6) The electric vehicle parking place shall be such that the connection on the vehicle when parked for charging shall be within five meter from the electric vehicle charging point.

(7) Portable socket-outlets are not permitted to be used for electric vehicle charging.

(8) (a) Suitable lightning protection system shall be provided for the electric vehicles charging stations as per Indian Standards Code IS/ IEC 62305.

(b) The complete structure of charging station of electric vehicles charging stations should offer equipotential bonding using adequate sized conductors.

(9) The electric vehicle charging station shall be equipped with a protective device against the uncontrolled reverse power flow from vehicle.

(10) One second after having disconnected the electric vehicle from the supply (mains), the voltage between accessible conductive parts or any accessible conductive part and earth shall be less than or equal to 42.4 V peak (30 V rms) , or 60 V D.C., and the stored energy available shall be less than 20 J (as per IEC 60950) and if the voltage is greater than 42.4 V peak (30 V rms) or 60 V D.C., or the energy is 20J or more, a warning label shall be attached in an Appropriate position on the charging stations.

(11) A vehicle connector used for Direct Current (D.C.) charging shall be locked on a vehicle inlet if the voltage is higher than 60 V D.C. and the vehicle connector shall not be unlocked (if the locking mechanism is engaged) when hazardous voltage is detected through charging process including after the end of charging and in case of charging system malfunction, a means for safe disconnection shall be provided.

(12) The Direct Current (D.C.) electric vehicle charging point shall disconnect supply of electricity to prevent overvoltage at the battery, if output voltage exceeds maximum voltage limit sent by the vehicle.

(13) The electric vehicle charging points shall not energize the charging cable when the vehicle connector is unlocked and the voltage at which the vehicle connector unlocks shall be lower than 60V.

(14) safety clearance between the oil based charging point and EV charging point is to be specified from the safety point

(15) Exclusive transformer of adequate capacity shall be provided for EV public charging station.

(16) Only dry type transformers shall be used.

(17) Only four core cable shall be used for charging points which require three phase power.

(18) Switch boards and panels shall be of IP54

(19) UG cables shall not cross the UG tank or oil pipe line.

(20) Only double compressed glands shall be used for terminating cables.

(21) UG cables through the charging area or vehicles passage shall be minimized and if provided shall be at a minimum depth of 1m.

**123. Earth protection system for charging stations.** - (1) All residual current device for the protection of supplies for electric vehicle shall, -

(a) have a residual operating current of not greater than 30 mA;

(b) interrupt all live conductors, including the neutral; and

(c) have a performance at least equal to Type A and be in conformity with IS 732-2018.

(2) All residual current devices used for the protection of supplies to electric vehicle shall be permanently marked to identify their function and the location of the charging station or socket outlet they protect.

(3) Each electric vehicle charging points shall be supplied individually by a dedicated final sub-circuit protected by an overcurrent protective device complying with IS/IEC 60947-2, IS/IEC 60947-6-2 or the IEC 60269 series and the overcurrent protective device shall be part of a switchboard.

(4) Co-ordination of various protective devices shall be required.

(5) Where required for service reasons, discrimination (selectivity) shall be maintained between the residual current device protecting a connecting point and a residual current device installed upstream.

(6) All electric vehicle charging stations shall be supplied from a sub-circuit protected by a voltage independent residual current device and also providing personal protection that is compatible with a charging supply for an electric vehicle.

(7) All electric vehicle charging stations shall be provided with an earth continuity monitoring system that disconnects the supply in the event that the earthing connection to the vehicle becomes ineffective.

(8) The wiring and earthing of all electric vehicle charging stations shall be as per IS 732/IS 3043.

(9) The cable may be fitted with an earth-connected metal shielding and the cable insulation shall be wear resistant and maintain flexibility over the full temperature range.

(10) A protective earth conductor shall be provided to establish an equipotential connection between the earth terminal of the supply and the conductive parts of the vehicle which shall be of sufficient rating to satisfy the requirements of IS 732.

**124. Requirement to prevent fire for electric vehicle charging stations.** - (1) Firefighting system for charging stations shall be provided in accordance with the provisions of these regulations.

(2) Enclosure of charging stations shall be made of fire retardant material with self-extinguishing property and free from Halogen.

(3) Fire detection, alarm and control system shall be provided as per relevant Indian Standards.

(4) Power supply cables used in charging station or charging points shall conform to IEC 62893-1 and its relevant parts.

**125. Testing of charging stations.** - (1) All apparatus of charging stations shall have the insulation resistance value as stipulated in the relevant IS 17017(part-22).

(2) The owner of the charging station shall ensure that the tests as specified in the manufacturer's instructions for the residual current device and the charging station have been carried out.

**126. Inspection and periodic assessment of charging stations.** - (1) Every charging station shall be tested and inspected by the owner or the Electrical Inspector or Chartered Electrical Safety Engineer before energisation of charging stations.

(2) The owner of the charging station shall ensure that test and inspection of charging station is being carry out every year in the initial period of first three years after the energisation of charging station and in every four years thereafter.

(3) The owner of the charging station shall establish and implement a safety assessment programme for regular periodic assessment of the electrical safety of charging station.

**127. Maintenance of records.** - (1) The owner of the charging station shall keep records in regard to design, construction and labelling to be compatible with a supply of standard voltage at a nominal frequency of 50 Hertz of the charging station.

(2) The owner of the charging station shall keep records of the relevant test certificate as indicated in these regulations and as per IEC 61851.

(3) The owner of the charging station shall keep records of the results of every inspection, testing and periodic assessment and details of any issues observed during the assessment and any actions required to be taken in relation to those issues.

(4) The owner of the charging station shall retain a copy of all records, as specified in sub regulation (1), (2) and (3) of above, either in hard form or in electronic form, for at least seven years and shall provide a copy of the records to the officials during the inspection.

**128. International Standard for charging stations.** - (1) The safety provisions of all Alternating Current charging stations shall be in accordance with IEC 61851-1, IEC 61851-21 and IS 17017 (part-22).

(2) The safety provisions of all Direct Current charging stations shall be in accordance with IEC 61851-1, IS 17017 (part-21), IS 17017 (part-23) and IS 17017 (part-24).

(3) Where the connection point is installed outdoors, or in a damp location, the equipment shall have a degree of protection of at least IPX4 (Ingress Protection Code) in accordance with IS/ IEC 60529.

## **Chapter XII**

### **Additional safety requirements for HVDC**

**129.General Safety requirements.-** (1) A wire mesh shall be provided beneath the walk way; wherever constructed above the hanging valves in the valve hall.

(2) A comprehensive fire detection, alarm and protection system shall be provided. Valve Hall shall have Air aspiration system (fast and early smoke detection system) Suitable Infra-Red(IR) detector to detect the flashover inside the Valve Hall shall also be provided. The Valve hall wall shall be suitable for minimum 3 hour fire rating.

(3) Cables used for sensitive measurements shall be laid in separate and completely screened or covered channels or galvanised steel pipes.

(4) A separate emergency source of illumination with automatic initiation shall be provided in every room or compartment of HVDC station.

(5) No oil immersed apparatus shall be kept with in the valve hall.

(6) All doors of compartments containing modules equipped with laser diodes and junction boxes of the fibre optic cables shall be locked and marked with laser warning symbols.

**130.Fencing of filter banks.-** (1) AC and DC filter banks area shall be efficiently protected by fencing or other means not less than 1.8 metres in height so as to prevent access to the conductors and apparatus therein by any unauthorised person and the fencing of such area shall be earthed effectively.

(2) The gate of fencing and earth switch of the filter bank shall be interlocked such that the gate can be opened only after the disconnection and discharging of the filter bank completely.

(3) The air core smoothing reactor shall be fenced all around and the fence shall not fall in the Magnetic Clearance Contour (MCC) of the smoothing reactor.

(4) Common neutral bus in AC filters shall be earthed at one point only.

**131.Earthing requirements.-** (1) Converter transformer shall be provided with separate perimeter earthing conductor.

(2) The line side neutral of the converter transformer bank shall be earthed at one point only.

(4) Every part of support structure circumference of the air cored reactor shall be earthed in a manner such that it is not forming closed loops.

(5) Radio Frequency Interference (RFI) screen of valve hall shall be electrically connected and effectively earthed.

(6) Metallic sheeting, prefabricated structure members and trusses housing HVDC apparatus shall be electrically connected and effectively earthed.

(7) Insulating pads or sleeves shall be provided between the steel reinforcement, in foundation beneath the smoothing reactor, wherever they are crossing each other.



## Chapter XIII

### Additional safety requirements for GIS

**132.General Safety requirements.-** (1) A separate emergency source of illumination with automatic initiation shall be provided in every room or compartment of GIS station.

(2) Cable cover protection unit shall be provided between flanges of GIS and cable termination unit.

(3) GIS installation of 220 kV and above voltage shall be provided with partial discharge monitoring system.

(4) SF6 gas leakage rate from any single compartment of GIS to atmosphere and between compartments shall not exceed as stipulated in IS/IEC 62271-203.

**133.Earthing requirements.-** (1) Enclosure of GIS bay shall be earthed for high frequency transient voltage, as per OEM (Original Equipment Manufacturer) recommendations, apart from the regular earthing.

(2) Earthing of GIS installation shall be as per relevant IS/IEC 61936 .

(3) Travelling wave energy generated inside the GIS due to switching operations shall be diverted to the ground by providing effective earthing from bushing shroud to the earth.

## Chapter XIII

### Additional safety requirements for solar installations

#### 134. General safety requirements.-

(1) Solar modules cable & connectors shall be UV protected. The connectors junction boxes/ combiner boxes /enclosures shall be of minimum to IP 65 (for outdoor)/ IP 54 (indoor) and as per IEC 60529 specifications. Inverters and other electrical/electronic equipment to be well ventilated.

(2) Proper Segregation and clearance to be provided between positive and negative components including wiring, terminal boxes, etc. inside the combiner box.

(3) While working on the combiner box , it shall be ensured that there is no current flow and is completely isolated from input side.

(4) All interior and exterior DC conduit, enclosures, cable assemblies, junction boxes, combiner boxes, and disconnectors shall be identified with permanent marking.

(5) All cabling/wiring shall be as per IS and having of appropriate size & rating; considering the losses, maximum load, voltage drop within permissible limit and other related factors. All connections shall be properly made through suitable lug/terminal crimped with use of suitable proper cable glands. All cable shall be laid in appropriate cable tray with suitable clearance from ground/roof/wall.

(6) Clear pathways of minimum 75 cm in width for roof access and emergency exit shall be provided for roof top system. There should be clear pathways, walkways between the rows/columns of solar panels as is required for cleaning and maintenance. Cables should be laid in trenches as it would obstruct the movement of manpower and cleaning equipment.

(7) Ground mounted solar installations shall be efficiently protected by fencing or other means not less than 1.8 metres in height so as to prevent unauthorised entry.

(8) Disconnection switches or circuit breakers provided in combiner boxes to disconnect the PV system from all other conductors of the system shall be located at a readily accessible location and shall be manually operable.

(9) Three phases on the AC side, and positive and negative conductor on the DC side shall be marked and identified with different colours.

(10) Inverter unit for solar PV shall be installed in the periphery of the building and as near as the solar panel preferably in the top floor itself.

Provided that the DC cable shall be UV protected or routed through UV protected pipe.

(11) PV installation, cable selection, overload protection, earthing system and design shall conformed to IEC62548

(12) There shall be a manual disconnection switch to isolate the system from Grid and shall be situated outside of AC Combiner Box.

(13) All cable shall be of appropriate size, having excellent resistance to heat, cold, water, oil, abrasion, UV radiation, shall be used in the system.

(14) Protection shall be deployed (for both input and output) on site for overload, surge current/voltage, short circuit, high/over Temperature, over/ under voltage and over/ under frequency & reverse polarity and lightning.

(15) All the PV systems connected to distribution grid below 33kV shall comply with Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations, 2010 as amended time to time.

(16) The Solar Power Plant shall be equipped with fault ride through capability as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019.

(15) PV modules shall contain clear indelible marking laminated inside the glass as per relevant IS/IEC.

**135. Earthing requirements.-** (1) Solar earthing shall be conform to IEC 62548.

(2) Earthing for AC and DC system shall be interconnected so as to have equipotential bonding.

(3) The frame of inverter cabinet shall be connected with the earthing bus bar through the earthing terminals using flexible braided copper wire.

(4) Protective earthing shall be provided inside the inverter cabinet.

(5) All metal casing/shielding of the plant, each array structure of the PV yard, equipment, inverters & control systems shall be grounded through proper earthing.

(6) Earthing System shall connect all non –current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV module mounting structures in one long run. The earth strips shall not be bolted. Earthing GI strips shall be interconnected by proper welding.

(7) There shall be adequate number (Minimum four (04) numbers) of interconnected earth pit provided in each location. Minimum required gap shall be provided in between earth pits as per relevant standard.

**136. Protection, testing and interlocking requirements.-**

- 1) The SPV power plant shall be provided with lightning and over voltage protection by deploying required number of lightning arresters.
- 2) Every combiner box shall be provided with suitable Surge Protective Device with arc extinguishing capability as per IS 16463 series to avoid any risk of fire.
- 3) The input circuits of combiner box shall be provided with over current protection as per IS/IEC60269-1.
- 4) The output circuits of combiner box shall be provided with isolation protection.
- 5) Earth fault protection/ insulation monitoring for PV array and inverter shall be provided.

- 6) All PV modules safety qualification shall comply with relevant IS/IEC requirements for construction and requirements for testing in order to provide safe electrical and mechanical operation during their expected lifetime.
- 7) The minimum requirements for the design and manufacture of PCE/Inverters for safety like protection against electric shock, energy, fire, mechanical and other hazards shall comply with relevant IS/IEC.

**137. Handling of solar installations apparatus.-** Persons designated under regulation 3(1) or engaged or appointed under sub regulation (1) of Regulation 7 or sub regulation (1) regulation 8 shall be provided with dark glasses in addition to the PPEs required as per regulation 21 before entering the solar installations.

**138. Requirement to prevent fire for solar installations.-**

- (1) Firefighting system for inverter room and control room shall be as per sub-regulation (2) of Regulation 46.
- (2) Enclosure of combiners box shall be made of fire retardant material with self-extinguishing property and free from Halogen.
- (3) Portable fire extinguishers shall also be kept at various locations in plants to take immediate action in case of fire caused by electrical short circuits.

**139. Additional Safety requirements for Floating Solar PV (FSPV) energy installations**

- (1) The FSPV installations should comply with all the safety requirements mentioned in this chapter as far as solar components are concerned.
- (2) In Floating Solar Power Projects the PV modules are subjected to continuous corrosion due to nature water body ,therefore solar panels should comply with the relevant IS/IEC standards for tests of salt mist, ammonia corrosion etc.
- (3) Floating platform / floaters should be tested for environmental stress cracking of HDPE, Stress cracking resistance of HDPE, Standard test method for tensile properties of plastics etc. as per the relevant standard.

## Chapter XV

### Additional safety requirements for wind energy installations

#### 140. General safety requirements

- (1) The wind turbines shall be located as per the guidelines of the Ministry of New and Renewable Energy.
- (2) The protection of enclosures shall be of minimum to IP 65 (for outdoor) and IP 20 (for indoor).
- (3) Very early smoke detection system shall be installed in nacelle to provide early warning and alarm functions in the event of an electrical fire.
- (4) Fire protection system shall be designed considering remote locations of wind generator and vast area covered having lack of communication and access and to prevent major fire spread.
- (5) Provided that fire fighting system shall have remote annunciation of fire signaling system to one or more control centres.
- (6) Fluid piping shall be routed below all electrical equipment to preclude leaked fluid dripping on the equipment.
- (7) Transformers for wind turbine applications shall be as per IS 2026-16.
- (8) Lightning protection for blades, nacelles and towers shall be provided as per IS/IEC 62305.
- (9) Shield(s) shall be provided to isolate sparks generated from high speed brakes from combustible equipment components and locations where leaked combustible fluids can accumulate.
- (10) Protection shall be deployed on site for overload, surge current, high Temperature, over/ under voltage and over/ under frequency & reverse polarity and lightening.
- (11) The Lighting Arrestor LA shall be installed to protect the array field, all machines and control panels installed in the control rooms.
- (12) The Wind power plant shall be provided with lightning and over voltage protection by deploying required number of lightning arresters.
- (13) Portable fire extinguishers shall also be kept at various locations in plants to take immediate action in case of fire caused by electrical short circuits.
- (14) Earthing System shall connect all non –current carrying metal receptacles, electrical boxes, appliance frames, etc. The earth strips shall not be bolted. Earthing GI strips shall be interconnected by proper welding.
- (15) There shall be adequate number of interconnected earth pit provided in each location. Minimum required gap shall be provided in between earth pits as per relevant standard.
- (16) Danger board shall be provided as per the IE Act. /IE rules as amended up to date.
- (17) Ensure all lifting equipment (including load attachment points) is suitable, capable of supporting the load, in good condition, and in receipt of any statutory inspections required.
- (18) Any wind turbine workers exposed to a potential fall should be supported by a certified personal fall arrest system (PFAS) such as a full body safety harness.
- (19) The wind turbine generators shall be equipped with fault ride through capability as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019.

**Chapter XVII**  
**Miscellaneous**

**141. Deviations** (1) The Central Government or the State Government, as the case may be, by order in writing, allow deviations in respect of matters referred in these regulations except regulation 32.

(2) The Electrical Inspector or the inspector of mines may, by order in writing, allow deviations in respect of matters referred in regulations 14 to 19, 30, 37(2)(3) and (5), 38(3), 39(1) to (iv), 43(xii), 45, 46(2), 48, 54 to 56, 59 to 63, 67, 74, 77, 81 to 94, 104, 109(6), (8) and (10), 116 and 119 to 140

Explanation- Every order allowing the deviations by the Electrical Inspector or the Inspector of Mines under sub-regulation (2) shall be placed before the Central or State Government which may disallow or revise such deviations.

**Handling of electric supply lines and apparatus**

**[See sub-regulation (3) of regulation (21)]**

**Part-I**

**Precautions to be observed**

- (1) Hotline Maintenance trained personnel only are designated to do work on line.
- (2) Work permit will be taken from the terminal substations at each end of the line.
- (3) Work shall be performed with proper planning and prior understanding and clarity.
- (4) Favourable climatic condition for hotline operations is sunny weather. If the weather forecasts rain or thunderstorms work will not begin.
- (5) Organisation of work shall be discussed among the members and responsibility of each team member fixed.
- (6) Before going to the work site all equipment and tools shall be inspected and checked for correct operation.
- (7) Auto re-closure shall be in 'OFF' position for the line at both ends.
- (8) The work procedure shall be discussed with the team member at the tower location and the responsibility of each member shall be properly defined.
- (9) The land in close vicinity to the tower shall be cleared to provide a site area for the required tools.
- (10) All cleaned hot sticks, strain carrier and other assemblies shall be kept on the hotline tool rack to avoid ground contact.
- (11) Wear helmet, safety shoes and safety belt shall compulsorily be used.
- (12) All hot sticks and ladders shall be cleaned and checked for integrity by the hot sticks Tester.
- (13) All linemen in the hotline team shall be equipped with personal protective equipment during the work.
- (14) No live-line team members on the tower and conductor shall wear any metallic chain, wristwatch or ring to avoid any circulating current.
- (15) The team linemen will wear conductive socks, boots, helmets and hand gloves. The 'hot-end' lineman shall wear complete bare hand suit.
- (16) Tarpaulin sheet should be laid on the work area.
- (17) A light vehicle shall be kept nearby during entire work period.

**Tools normally required for hot line maintenance operation :**

The following tools conforming to relevant Indian Standard or equivalent specifications shall be used in on-line working.

- (1) Wire tongs
- (2) Wire tongs saddle
- (3) Tie sticks
- (4) Strain link sticks
- (5) Roller link sticks

- (6) Suspension link sticks
- (7) Auxiliary arms
- (8) Strain carrier
- (9) Gin poles
- (10) Cum-a-along clamp
- (11) Safety equipment like conductor guards, X-arm guards, insulator covers, hand gloves etc.
- (12) Hot sticks

**Safe Working Distance :**

The following safe working distances shall be observed for hot line maintenance operations

Phase to Phase	Safe Clearance
kV	Meter
11	0.61
33	0.71
66	0.91
110	1.02
132	1.07
220	1.52
400	2.13



**Handling electric supply lines and apparatus for carrying out shutdown work or testing**

**[See sub-regulation (3) of regulation (21)]**

**Part-II**

**Precautions to be observed**

(1) Before commencement of any shut down work or testing in an electric supply line or apparatus, the Engineer or Supervisor in-charge of the work or testing shall identify the possible hazards, such as; electrocution, flash over, fall of person from height, fall of objects from height, failure of Tools & Plants, fire, etc., that may be encountered while carrying out the work or testing near charged area and take necessary precaution to protect the working personnel.

(2) The Engineer or Supervisor in-charge of the work shall, before commencement of any work, brief the entire working group or gang of the hazards that may be encountered and the necessary precautions to be taken by them.

(3) The Engineer or Supervisor in-charge of the work shall obtain proper Permit-To-Work (PTW) from the concerned Operation In-charge(s) and ensure that the electric supply line or apparatus or section is isolated from all sources of energy, de-energized and earthed.

(4) The Engineer or Supervisor in-charge of the work shall ensure that adequate and Appropriate local earths are fixed at the zone of working, and the earthing rods remain connected to the isolated section of the electric supply line or apparatus or section till all men and materials have been moved away to safe zone and PTW is returned on completion of the work.

(5) If the local earths are required to be removed for any testing purpose, the same shall be done only when all the working personnel are in the safe zone, on the ground or on the tower, and in the presence of the Engineer or Supervisor. If the working personnel are required to go up or approach the conductor(s) subsequently for any work, such as, removal of test leads, tightening or adjustment, they shall be permitted to proceed only after re-fixing the local earths, as required.

(6) The Engineer or Supervisor in-charge of the work shall positively confirm by suitable means that the electric supply line or apparatus or section is totally dead before giving clearance for the working personnel to approach same.

(7) The Engineer or Supervisor in-charge of the work shall, while carrying out the shut down work or testing, ensure that working personnel are maintaining safe distance from the adjacent charged electric supply line or apparatus or section, and also, no objects, such as, Tools & Plants, ladders, cranes, man-lifts, etc., are moved, so as to infringe the safe distance, endangering the working personnel.

(8) Mobile cranes, derricks, man lifts and wheel mounted ladders shall be effectively earthed when being moved or operated in close proximity with energized apparatus or section.

(9) Portable ladders and poles shall be carried only in the horizontal position when being moved in close proximity with energized lines or equipment or area.

**Further Precautions to be observed**

(1) Adequate and effective supervision shall be ensured by the owner as well as the contractor for all activities while working or testing on electric supply lines and apparatus when any shut down work or testing is done near charged electric supply line or apparatus or section.

(2) Lone worker shall never be allowed to work on electric supply lines, equipment and apparatus or while testing.

(3) Sufficient supervisory personnel shall be deployed for close monitoring while various type of works are under progress at the same or different locations. Supervising work shall never be delegated to the sub-contractors' personnel.

(4) The deployed Supervising Personnel shall not leave the working spot when shut down work at height or testing is in the progress, as the working personnel may not be aware of the consequences of unsafe practices. No other work, which requires them to move out of the location, shall be undertaken by Supervising personnel, when shut down work or testing is in the progress.

(5) Wherever shut down activities are required to be carried out for more than one day on the any electric supply lines, apparatus or section, earthing(s) provided at the said work site shall be inspected by the Engineer or Supervisor every day morning for their healthiness, fitness and proper tightening, before giving clearance for the working personnel to climb the tower or structure to resume the work.

**Handling HVDC apparatus for carrying out shutdown work or testing**

**[See sub-regulation (3) of regulation (21)]**

**Part-III**

**Precautions to be observed**

- (1) The Engineer or Supervisor in-charge of the work shall obtain proper Permit-To-Work (PTW) from the concerned Operation In-charge(s) and ensure that the electric supply line or apparatus or section is isolated from all sources of energy, de-energised and earthed.
- (2) Before commencement of any shut down work or testing of HVDC apparatus, the Engineer or Supervisor in-charge of the work or testing shall identify the possible hazards, such as; electrocution, flash over, fall of person from height, fall of objects from height, failure of Tools & Plants, fire, etc., that may be encountered while carrying out the work or testing near charged area and take necessary precaution to protect the working personnel.
- (3) The Engineer or Supervisor in-charge of the work shall, before commencement of any work, brief the entire working group or gang of the hazards that may be encountered and the necessary precautions to be taken by them.
- (4) Attach warning labels to all neighboring installation parts (to be removed after the works have been carried out).
- (5) The Engineer or Supervisor in-charge of the work shall allow access to the Valve hall, DC Filter Area, AC Filter Area and DC hall (if any) only when the apparatus therein are completely de-energised effectively earthed.,
- (6) The work on AC/DC filter bank shall only begin after earthing the entire capacitor bank.
- (7) There shall be at least 10 minutes time gap between earthing the entire capacitor bank and starting the work on bank. There after unit must be short circuited.
- (8) The de-energized bushing shall be checked for stored charge by touching all the surfaces of both indoor and outdoor side composite insulators and all other parts of the bushing using a proper test instrument.
- (9) The gas pressure inside HVDC through wall bushing shall be reduced to a level prescribed by the manufacturer before starting any work or handling of the bushing.

**Handling Gas Insulated Switchgear (GIS) apparatus for carrying out shutdown work or testing**

[See sub-regulation (3) of regulation (21)]

**Part-IV**

**Precautions to be observed**

- (1) The Engineer or Supervisor in-charge of the work shall obtain proper Permit-To-Work (PTW) from the concerned Operation In-charge(s) and ensure that the electric supply line or apparatus or section is isolated from all sources of energy, de-energised and earthed.
- (2) Operation, maintenance and repair must be carried out by trained and certified personnel only.
- (3) Before commencement of any shut down work or testing of GIS apparatus, the Engineer or Supervisor in-charge of the work or testing shall identify the possible hazards, such as; electrocution, flash over, fall of person from height, fall of objects from height, failure of Tools & Plants, fire, etc., that may be encountered while carrying out the work or testing near charged area and take necessary precaution to protect the working personnel.
- (4) The Engineer or Supervisor in-charge of the work shall, before commencement of any work, brief the entire working group or gang of the hazards that may be encountered and the necessary precautions to be taken by them.
- (5) Wear hearing protection during operation.
- (6) Take care when touching the enclosure at any time as enclosures may heat up to the temperature of 70°C.
- (7) Observe the procedures for storage, transportation, and the use of filling equipment.
- (8) Wear the personal protective equipment: respirator mask (self-contained breathing equipment if necessary), protective overall, protective gloves, safety shoes, safety glasses.
- (9) Attach warning labels to all neighboring installation parts (to be removed after the works have been carried out).
- (10) Provide proper electrical clearance as required by interlocking rules. Mark e.g. main circuits and control circuits with Appropriate tags.
- (11) Block off neighboring live parts with screens, insulating mats or spacer grids in order to prevent unintended contacts.
- (12) While working on any compartment in GIS, the immediate adjacent compartment(s) must be also depressurized for safety of the working person.
- (13) SF<sub>6</sub> gas following events such as arc faults becomes contaminated and contains poisonous substances. Hence, handling of SF<sub>6</sub> in such cases must be done using proper PPEs and by a trained personnel preferably from the original equipment manufacturer (OEM).
- (14) The switchgear installation shall not be operated if the density of SF<sub>6</sub> gas indicated at the density monitors is not in the operating range.
- (15) Do not remove any protective covers if an assembly is energized.
- (16) The Engineer or Supervisor in-charge of the work shall ensure that adequate and Appropriate local earths are fixed at the zone of working, and the earthing rods remain connected to the isolated section of the electric supply line or apparatus or section till all men and materials have been moved away to safe zone and PTW is returned on completion of the work.

## Forms of Inspection Report

[See regulation (32)]

## FORM I

(Installations of voltage up to and including 250V)

Report No. \_\_\_\_\_ Date of Inspection by Electrical Inspector or self-certification by owner  
\_\_\_\_\_

Date of Last inspection or self-certification \_\_\_\_\_

1. Consumer No. \_\_\_\_\_
2. Voltage and system of supply:
  - (i) Volts \_\_\_\_\_
  - (ii) No. of Phases \_\_\_\_\_
  - (iii) AC/DC \_\_\_\_\_
3. Type of wiring \_\_\_\_\_
4. Name of the consumer or owner \_\_\_\_\_
5. Address of the consumer or owner \_\_\_\_\_
6. Location of the premises \_\_\_\_\_
7. Particulars of the installations: \_\_\_\_\_

		Number	Connected Load in KW
(a)	(i) Light Points	_____	_____
	(ii) Fan Points	_____	_____
	(iii) Plug Points	_____	_____

State type of wiring whether casing capping, lead covered of teak wood batten, concealed conduit, Tough Rubber Sheathed and any other type.

- (b) Other equipment (complete details to be furnished):
  - (i) \_\_\_\_\_
  - (ii) \_\_\_\_\_

Total connected load in KW \_\_\_\_\_

Maximum current demand in Amps \_\_\_\_\_

(on the basis of total connected load)

- (c) Generators details i.e. Make, S. No, KVA rating and Voltage:
  - (i) \_\_\_\_\_
  - (ii) \_\_\_\_\_

General conditions of the installation:

Sl. No.	Regulation Nos.	Requirements	Report
8.	Regulation-14	(i) Is/Are there any visible sign(s) of overloading in respect of any apparatus wiring? (ii) Condition of flexible cords, sockets, switches, plug-pins, cut-outs and lamp holders and such other fittings. (iii) General condition of wiring. (iv) Whether any unauthorised temporary installation exist? (v) State if sockets are controlled by individual switches. (vi) Any other defect or condition which may be a source of danger. If yes give details.	Yes/No  Satisfactory/Not Satisfactory  Satisfactory/Not Satisfactory Yes/No  Yes/No  Yes/No
9.	Regulation-15	Give report on condition of service lines, cables, wires, apparatus and such other fittings placed by the supplier or owner of the premises. If not satisfactory give details.	Satisfactory/Not Satisfactory
10.	Regulation-16	Whether suitable cut-outs provided by the supplier at the consumer's premises are within enclosed fire proof receptacle?	Yes/No
11.	Regulation-17	(i) State if switches are provided on live conductors. (ii) State if indication of a permanent nature is provided as per Regulation so as to distinguish neutral conductor from the live conductor. (iii) Whether a direct line is provided on the neutral in the case of single phase double pole iron clad switches instead of fuse ?	Yes/No  Yes/No  Yes/No
12.	Regulation-18	(i) State if earthed terminal is provided by the supplier. (ii) Have three pin plugs been provided for plug points ? (iii) General visible condition of the earthing arrangement.	Yes/No  Yes/No  Satisfactory/Not Satisfactory
13.	Regulation-19	Are the live parts in accessible position ?	Yes/No
14.	Regulation-36	Leakage on premises: State insulation resistance between conductors and earth in Mega Ohms.	----- M Ohms
15.	Regulation-37	(i) State if linked switches of requisite capacity are provided near the point of commencement of supply.	Yes/No

		(ii) State if the wiring is divided in suitable number of circuits and each such circuit is protected by suitable cut-out.	Yes/No
		(iii) State if supply to each motor or apparatus is controlled by suitable linked switch.	Yes/No
16.	Regulation-43	(i) Have the frames of every generator, stationary motor and so far as practicable portable motor and the metallic parts (not intended as conductors) of all other apparatus used for regulating* or controlling electricity been earthed by two separate and distinct connections with earth ?	Yes/No
		(ii) Is the earth wire free from mechanical damage ?	Yes/No
		(iii) In the case of conduit, or lead covered wiring, has the conduit or lead-cover been efficiently earthed ?	Yes/No
		(iv) If the consumer has his own earth-electrode, state if it is properly executed and has been tested. If yes give value of earth resistance.	Yes/No ----- Ohms.
17.	Overhead Lines	(i) State if the consumer has any overhead lines.	Yes/No
		(ii) Does the overhead line near the premises of consumer meets the requirement of regulation 60, 62 and 63? If not, give details.	Yes/No
		(iii) Is guarding provided for overhead lines at road crossings?	Yes/No
		(iv) Any other remarks.	

Date :

Signature of the Inspecting Officer/ supplier /owner

Name \_\_\_\_\_

Designation \_\_\_\_\_

File No. \_\_\_\_\_

Copy forwarded to Electrical Inspector for .....

\* Not applicable to isolated wall tubes or to brackets, electroliers, switches, ceiling fans and such other fittings (other than portable hand lamps and transportable apparatus) unless provided with earth terminal.

## FORM II

**(Form for Self Certification under Regulation 32)  
(Installations of voltage level more than 250V up to and including 1000 V)**

Report / Application No. \_\_\_\_\_

Date of Inspection by Electrical Inspector

or self-certification by supplier/owner/Consumer \_\_\_\_\_

Date of Last inspection or self-certification \_\_\_\_\_

1. Consumer No. \_\_\_\_\_
2. Voltage and system of supply:
  - (i) Volts \_\_\_\_\_ (ii) No. of Phases \_\_\_\_\_ (iii) AC/DC \_\_\_\_\_
3. Name of the consumer or owner \_\_\_\_\_
4. Address of the consumer or owner \_\_\_\_\_
5. Location of the premises \_\_\_\_\_
6. Particulars of the installations

(a) Motors:

Make	No.	H.P.	Amps.	Voltage
------	-----	------	-------	---------

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_

(b) Other equipment (complete details to be furnished):

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_

Total connected load KW / KVA

\_\_\_\_\_

(c) Generators details i.e. Make, S. No, KVA rating and Voltage:

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_

7. General condition of the installation:

Sl. No.	Regulation Nos.	Requirements	Report
1.	Regulation-3	Is the register of designated persons properly made and kept up to date duly attested ?	Yes/No
2.	Regulation-14	(i) Is/Are there any visible sign(s) of overloading in respect of any apparatus wiring?	Yes/No
		(ii) Whether any unauthorised temporary installation exist?.	Yes/No
		(iii) Are the electric supply lines and apparatus so installed, protected, worked and maintained as to prevent danger ?	Yes/No
		(iv) Any other general remarks.	



3.	Regulation-15	Give report on condition of service lines, cables, wires, apparatus and such other fittings placed by the supplier or owner of the premises. If not satisfactory give details.	Satisfactory/Not Satisfactory
4.	Regulation-16	Whether suitable cut-outs/CBs provided by the supplier at the consumer's premises are within enclosed fire proof/resistant receptacle?	Yes/No
5.	Regulation-17	(i) Whether switches are provided on live conductors? (ii) Whether indication of a permanent nature is provided as per Regulation so as to distinguish neutral conductor from the live conductor as per IS color code? (iii) Whether a direct line is provided on the neutral in the case of single phase double pole iron clad switches/Isolators/CBs instead of fuse ?	Yes/No Yes/No Yes/No
6.	Regulation-18	(i) Whether earthed terminal is provided by the supplier? (ii) General visible condition of the earthing arrangement.	Yes/No Satisfactory/Not Satisfactory
7.	Regulation-19	(i) Are bare conductors in building inaccessible? (ii) Whether readily accessible switches have been provided for rendering them dead ?	Yes/No Yes/No
8.	Regulation-20	Whether "Danger Notice" in Hindi and the local language of the district and of a design as per relevant Indian Standard is affixed permanently in conspicuous position?.	Yes/No
9.	Regulation-21	(i) Whether insulating floor or mats conforming to IS-15652:2006 have been provided? (ii) Whether identification of panel has been provided on the front and the rear of the panel?	Yes/No Yes/No
10.	Regulation-23	Whether flexible cables used for portable or transportable equipment covered under the Regulation, are heavily insulated and adequately protected from mechanical injury?.	Yes/No
11.	Regulation-24	State the condition of metallic coverings provided for various conductors.	Satisfactory/Not Satisfactory
12.	Regulation-26	Whether the circuits or apparatus intended for operating at different voltage(s) are distinguishable by means of indication(s) of permanent nature?.	Yes/No
13.	Regulation-28	Whether all circuits and apparatus are so arranged that there is no danger of any part(s) becoming accidentally charged to any voltage	Yes/No

		beyond the limits of voltage for which it/they is/are intended ?	
14.	Regulation-29	(i) In the case of generating stations, whether fire-buckets filled with clean dry sand have been conspicuously marked and kept in convenient situations in addition to fire-extinguishers as per IS 3034 suitable for dealing with minor electric fires ? (ii) Whether First Aid Boxes or cupboards conspicuously marked and properly equipped are provided and maintained?. (iii) Is adequate staff trained in First Aid Treatment and fire fighting?	Yes/No  Yes/No  Yes/No
15.	Regulation-30	(i) Whether instructions in English or Hindi and the local language of the district and where Hindi is the local language, in English and Hindi, for the resuscitation of persons suffering from electric shock have been affixed in a “conspicuous place”?. (ii) Are the designated persons able to apply instructions for resuscitation of persons suffering from electric shock ?	Yes/No  Yes/No
16.	Regulation-36	Leakage on premises: State insulation resistance between conductors and earth in Mega Ohms.	----- M Ohms
17.	Regulation-37	(i) Whether a suitable linked switch, or circuit breaker is placed near the point of commencement of supply so as to be readily accessible and capable of being easily operated to completely isolate the supply ? (ii) Whether every distinct circuit is protected against excess electricity by means of a suitable circuit breaker or cut-out ? (iii) Whether suitable linked switch or circuit breaker is provided near each motor or apparatus for controlling supply to the motor or apparatus? (iv) Whether adequate precautions are taken to ensure that no live parts are so exposed as to cause danger?	Yes/No  Yes/No  Yes/No  Yes/No
18.	Regulation-39	(i) Whether clear space of 100 cm is provided in front of the main switchboard? (ii) Whether the space behind the switchboard exceeds 75 cm in width or is less than 20 cm?	Yes/No  Yes/No  Yes/No

		(iii) In case the clear space behind the switchboard exceeds 75 cm. state whether a passage way from either end of the switchboard to a height of 1.80 metres is provided.	
19.	Regulation-43	<p>(i) Has the neutral point at the transformer and generator been earthed by two separate and distinct connections with earth?</p> <p>(ii) Have the frame of every generator, stationary motor and so far as practicable portable motor and the metallic parts (not intended as conductors) of all transformers and any other apparatus used for regulating or controlling electricity and all apparatus consuming electricity at voltage exceeding 250V but not exceeding 1000 V been earthed by two separate and distinct connections with earth ?</p> <p>(iii) Have the metal casings or metallic coverings containing or protecting any electric supply line or apparatus been properly earthed and so joined and connected across all junction boxes as to make good mechanical and electrical connection?</p> <p>(iv) Whether the consumer's earth-electrode is properly executed and has been tested. If yes, give value of earth resistance?</p> <p>(v) Is the earth wire free from any mechanical damage ?</p> <p>(vi) Whether record of earth resistance value maintained?</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>----- Ohms.</p> <p>Yes/No</p> <p>Yes/No</p>
20.	Regulation 44	Whether Residual Current Device of Appropriate capacity as defined in Regulation have been provided?	Yes/No
21.	Regulation-47	Have the protections and interlocks for the generating units been provided. Details of the protections shall be given.	Yes/No
22.	Overhead Lines	<p>(i) State if the consumer has any overhead lines.</p> <p>(ii) Does the overhead line near the premises of consumer meets the requirement of regulations 60, 62 and 63? If not, give details.</p> <p>(iii) Is guarding provided for overhead lines as per regulation 76?</p> <p>(iv) Any other remarks.</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>

Date :

Signature of the supplier/ Owner / Consumer

Name \_\_\_\_\_

Designation \_\_\_\_\_

File No. \_\_\_\_\_

To: Office of Electrical Inspector for .....

**FORM III**  
**(Form for Self Certification under Regulation 32 /45)**  
**(Installations of voltage exceeding 1000 V)**

Report / Application No. \_\_\_\_\_

Date of Inspection by Electrical Inspector or self-certification by supplier/owner/Consumer  
 \_\_\_\_\_

Date of Last inspection or self-certification \_\_\_\_\_

1. Consumer No. \_\_\_\_\_
2. Voltage and system of supply:  
 (ii) Volts \_\_\_\_\_ (ii) No. of Phases \_\_\_\_\_ (iii) AC/DC \_\_\_\_\_
3. Name of the consumer or owner \_\_\_\_\_
4. Address of the consumer or owner \_\_\_\_\_
5. Location of the premises \_\_\_\_\_
6. Particulars of the installations

(a) Transformer: (complete detail to be enclosed)

Make	S. No.	K.V.A. rating	Voltage rating	Type
------	--------	---------------	----------------	------

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

(b) Generators details i.e. Make, S. No, KVA rating and Voltage:

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

(c) List of equipment with complete details of HT /LT switchgears/ apparatus with their rating to be furnished):

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

(iii) List of Motors with rating, protection, overload setting, size of earth conductor used to be furnished

(d) Total connected load KW / KVA \_\_\_\_\_

Complete list of connected load to be furnished.

7. General condition of the installation:

Sl. No.	Regulation Nos	Requirements	Report
1.	Regulation-3	Is the register of the designated persons properly made and kept up to date duly attested?	Yes/No
2.	Regulation- 5	Whether Electrical Safety Officer as required under the Regulation is designated?	Yes/No
3	Regulation-14	(i) Is/Are there any visible sign(s) of overloading in respect of any apparatus?	Yes/No Yes/No

		<p>(ii) Whether any unauthorised temporary installation exist?</p> <p>(iii) Whether the motors and controlling equipment are being over hauled periodically and record kept of the same in a register?</p> <p>(iv) Whether the transformer oil samples are being tested periodically and results recorded in a register? State value of dielectric strength of oil.</p> <p>(v) Whether suitable lightning arrestors have been provided near the transformers for protection against lightning?</p> <p>(vi) Whether earth resistance is being measured periodically in dry and wet season and results recorded in a register? Copy of record to be enclosed.</p> <p>(vii) Any other defect or condition which may be a source of danger. If Yes please explain?</p> <p>(viii) Whether operation and maintenance data has been clarified, categorized and computerized for prompt and easy retrieval?</p> <p>(ix) Whether predictive maintenance is being performed for installation of voltage exceeding 1000 V?</p> <p>(x) Whether residual life assessment and life extension programmes are being undertaken for installations or equipment of voltage exceeding 1000 V (applicable for installations or equipment more than 15 years old)?</p> <p>(xi) Whether all required type and routine tests at factory done for equipment . Deficiencies and Discrepancies in above test report and results, if any, shall be reported?</p> <p>(xii) Are there deficiencies in construction with reference to Indian Standard requirements. Please specify.</p>	<p>Yes/No</p> <p>Yes/No</p> <p>----kV/mm</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>
4.	Regulation-15	Give report on condition of service lines, cables, wires, apparatus and such other fittings placed by the supplier or owner of the premises. If not satisfactory give details.	Satisfactory/Not Satisfactory
5.	Regulation-16	Whether suitable cut-outs/CBs provided by the supplier at the consumer's premises are within enclosed fire proof/resistant receptacle?	Yes/No

6.	Regulation-17	(i) Whether switches are provided on live conductors? (ii) Whether indication of a permanent nature is provided as per Regulation so as to distinguish neutral conductor from the live conductor as per IS color code? (iii) Whether a direct line is provided on the neutral in the case of single phase double pole iron clad switches/CBs instead of fuse ?	Yes/No Yes/No Yes/No
7.	Regulation-18	(i) Whether earthed terminal is provided by the supplier? (ii) General visible condition of the earthing arrangement.	Yes/No Satisfactory/Not Satisfactory
8.	Regulation-19	(i) Are bare conductors in building inaccessible? (ii) Whether readily accessible switches have been provided for rendering them dead?	Yes/No Yes/No
9.	Regulation-20	Whether "Danger Notice" in Hindi and the local language of the district and of a design as per relevant Indian Standard is affixed permanently in conspicuous position?.	Yes/No
10.	Regulation-21	(i) Whether the practice of working on live lines and apparatus is adopted? If so, have the safety measure been adopted as per Schedule-III I? (ii) Whether insulating floor or mats conforming to IS-15652:2006 have been provided? 14. (iii) Whether identification of panel has been provided on the front and the rear of the panel?	Yes/No Yes/No Yes/No
11.	Regulation-23	Whether flexible cables used for portable or transportable equipment covered under the Regulation, are heavily insulated and adequately protected from mechanical injury?.	Yes/No
12.	Regulation-24	State the condition of metallic coverings provided for various conductors.	Satisfactory/Not Satisfactory
13.	Regulation-26	Whether the circuits or apparatus intended for operating at different voltage(s) are distinguishable by means of indication(s) of permanent nature?.	Yes/No
14.	Regulation-28	Whether all circuits and apparatus are so arranged that there is no danger of any part(s) becoming accidentally charged to any voltage beyond the limits of voltage for which it/they is/are intended ?	Yes/No

15.	Regulation-29	<p>(i) In the case of generating stations and enclosed sub stations, whether fire-buckets filled with clean dry sand have been conspicuously marked and kept in convenient situations in addition to fire-extinguishers as per IS 3034 suitable for dealing with minor electric fires ?</p> <p>(ii) Whether First Aid Boxes or cupboards conspicuously marked and properly equipped are provided and maintained?.</p> <p>(iii) Is adequate staff trained in First Aid Treatment and fire fighting?</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>
16.	Regulation-30	<p>(i) Whether instructions in English or Hindi and the local language of the district and where Hindi is the local language, in English and Hindi, for the resuscitation of persons suffering from electric shock have been affixed in a “conspicuous place” ?.</p> <p>(ii) Are the designated persons able to apply instructions for resuscitation of persons suffering from electric shock ?</p>	<p>Yes/No</p> <p>Yes/No</p>
17.	Regulation-36	<p>Leakage on premises: State insulation resistance between conductors and earth in Mega Ohms.</p>	----- M Ohms
18.	Regulation-37	<p>(i) Whether a suitable linked switch, or circuit breaker, or emergency tripping device is placed near the point of commencement of supply so as to be readily accessible and capable of being easily operated to completely isolate the supply?</p> <p>(ii) Whether suitable linked switch or a circuit breaker to carry and break the full load current on the secondary side of a transformer?</p> <p>(iii) Whether every distinct circuit is protected against excess electricity by means of a suitable circuit breaker or cut-out?</p> <p>(iv) Whether linked switch or circuit breaker or emergency tripping device is provided near the motor or other apparatus at voltage exceeding 1000 V but not exceeding 33kV for controlling supply to the motor or apparatus?</p> <p>(v) Whether adequate precautions are taken to ensure that no live parts are so exposed as to cause danger?</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>
19.	Regulation-39	<p>(i) Whether clear space of 100 cm is provided in front of the main switchboard?</p>	Yes/No



		(ii) Whether the space behind the switchboard exceeds 75 cm in width or is less than 20 cm? (iii) In case the clear space behind the switchboard exceeds 75 cm. State whether a passage way from either end of the switchboard to a height of 1.80 meters is provided.	Yes/No Yes/No
20.	Regulation-46	(i) Whether all conductors and apparatus including live parts thereof are inaccessible? (ii) Whether all windings of motors or other apparatus are suitably protected? (iii) State in case of transformers or reactors or switches or static condensers involving the use of more than 2,000 litres of oil in one chamber, if suitable oil soak pits are provided? (iv) Where 9,000 litres or more of oil is used in any one oil tank, has provision, been made for draining away or removal of oil which may leak or escape from such tank(s)? (v) Whether trenches inside sub-station containing cables are filled with non-inflammable material or completely covered with non- inflammable slabs? (vi) Are conductors and apparatus so arranged that they may be made dead in sections for carrying out work thereon? (vii) Whether separate cable trays are provided for control/Power/AC/DC cables? (viii) Whether suitable firefighting system as per the Regulation has been provided? (ix) Whether the baffle walls of four hours fire rating between apparatus or consumer premises, in a substation or a switching station with apparatus having more than 2000 litres of oil are installed, have been provided as required under the Regulation?	Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No Yes/No
21.	Regulation-47	Whether protections and interlocks have been provided? Give the details of the protection schemes and their settings.	Yes/No
22.	Regulation-50	(i) Have the frames of every generator, stationary motor, and so far as practicable portable motor and metallic parts not intended as conductors of all transformers and any other apparatus used for regulating or controlling electricity and all electricity	Yes/No

		<p>consuming apparatus at voltage exceeding 1000 V but not exceeding 33kV been earthed by two separate and distinct connections with earth?</p> <p>(ii) Is the earth wire free from any mechanical damage?</p> <p>(iii) Has the neutral point at the transformer and generator been earthed by two separate and distinct connections with earth?</p> <p>(iv) Have the metal casings or metallic coverings containing or protecting any electric supply line or apparatus been properly earthed and so joined and connected across all junction boxes as to make good mechanical and electrical connections throughout their whole length?</p> <p>(v) Whether earthing has been properly executed and has been tested. If yes, give value of earth resistance.</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No -----Ohms</p>
23.	Regulation-51	<p>(i) Is the outdoor (except pole type) sub-station efficiently protected by fencing not less than 1.8 metres in height?</p> <p>(ii) Whether the mounting of a transformer on a single pole or H pole is at a height such that height of live parts above the surface accessible to general public shall be 4.3 m (minimum) for rated voltages upto 52 kV and 6m (minimum) for rated voltages above 52 kV?</p>	<p>Yes/No</p> <p>Yes/No</p>
24	Regulation-52	<p>(i) Where platform type construction is used for pole type sub-station, has sufficient space for a man to stand on the platform been provided?</p> <p>(ii) Has hand-rail been provided and connected with earth (if metallic and if sub-station has not been erected on wooden supports and wooden platform)?</p>	<p>Yes/No</p> <p>Yes/No</p>
25.	Regulation-53	Has suitable provision been made for immediate and automatic or manual discharge of every static condenser on disconnection of supply?	Yes/No
26	Overhead Lines	<p>(i) What is the minimum size of the conductors of overhead lines used? State the type of conductors.</p> <p>(ii) Whether clearances above ground of the lowest conductor of overhead lines are as per regulation 60? State clearance.</p>	<p>Size of Conductor ---</p> <p>Yes/No</p> <p>--- metres</p> <p>Yes/No</p>

		(iii) On the basis of maximum sag, whether vertical clearances where the line of voltage exceeding 1000 V passes above or adjacent to any building or part of a building are as per regulation 63? State clearance.	--- metres
		(iv) On the basis of maximum deflection due to wind pressure, whether horizontal clearances between the nearest conductor and any part of such building are as per regulation 63? State clearance.	Yes/No
		(v) Where conductors forming parts of system at different voltages are erected on the same supports, whether adequate provision has been made as per regulation 64 to guard against danger to linemen and others from the lower voltage system being charged above its normal working voltage by leakage from or contact with the higher voltage system ?	--- metres Yes/No
		(vi) Where overhead lines cross or are in proximity to each other whether they have been suitably protected to guard against possibility of their coming in contact with each other as per regulation 71?	Yes/No
		(vii) Has every guard wire been properly earthed as per regulation 72 at each point at which its electrical continuity is broken?	Yes/No
		(viii)(a) Whether metal supports of overhead lines and metallic fittings attached thereto are permanently earthed as per regulation 74?	Yes/No
		(b) Has each stay-wire (except in case where an insulator has been placed in it at a height not less than 3 meters from the ground) been earthed as per regulation 74?	Yes/No
		(ix)(a) Whether overhead line is suitably protected with a device for rendering the line electrically harmless in case it breaks as per regulation 76?	Yes/No
		(b) Whether anti-climbing devices have been provided at each support as per regulation 76?	Yes/No
		(x) (a) Has the owner of overhead lines adopted efficient means for diverting to earth any electrical surges due to lightning in every overhead line which is so exposed as to be liable to injury from lightning as per regulation 77?	Yes/No

	(b) Whether earth lead from the lightning arrestors is connected to a separate earth electrode as per regulation 77?	Yes/No
	(xi) Whether unused overhead lines are maintained in a safe mechanical condition as per regulation 78?	Yes/No
	(xii) Whether statutory clearances from Authorities i.e. Forest Department/Railways/ PTCC/Defence (AHQ)/Civil Aviation have been taken as per Indian standard. If yes, enclose copies of the same.	Yes/No
	(xii) Any other remarks.	

In addition to above, following electrical equipment wise test details to be given, if applicable:

Sl. No.	Equipment	Test Conducted	Test Results	Remarks
1.	Linked Switch with fuses (s)	i) Mechanical operation ii) Rating of Fuse iii) Contact of blades	Smooth/Trouble some -----Amps Full/Partial	
2.	Isolator (Sl. No.--- Make: Capacity: -	i) Mechanical operation ii) Remote Operation iii) Local Operation iv) Measurement of contact resistance v) Interlocking with earth switch vi) Interlocking with Circuit Breaker vii) IR Values Open condition Closed condition	Ok/Not ok Ok/Not OK Ok/Not Ok ----- micro Ohms  OK/Not OK  Ok/Not OK  Phase to Phase and Phase-Earth	
3.	Circuit Breaker (Circuit breaker location and no.)	1. Rating of Circuit Breaker a. Type b. Voltage c. Normal Current d. Rupturing Current  2. IR Values  Open condition Closed Condition  3. Contact Resistance including Dynamic Contact Resistance Measurement  4. Mechanical Operation  5. Remote operation	----- ----- kV ----- Amps -----KA -----M Ohm Ph-Ph      Ph-E ---            --- ---            ---  -----micro ohm  Instant smooth /time gap ( Sec.)	

	Circuit breaker control circuits	6. Local Operation 7. Interlocking with Isolator 8. Interlocking with earth switch  9. Alarm and Trip for OTI/WTI/Buchholz/PRV/etc., 10. Earth Fault Relay 11. Over Current Relay 12. Under Voltage Relay 13. other safety Alarms 14. Whether all the provisions of Regulation 37 are satisfactory?	OK/not OK OK/not OK OK/not OK OK/not OK  OK/not OK  OK/not OK OK/not OK OK/not OK	
4.	Transformer No., Location, (Transformer Sl. No. Make, Capacity, Voltage Ratio, )	1. Insulation Resistance Values i) HT to LT ii) HT to Earth iii) L T to Earth 2. Break down Voltage test Oil sample I (Top) Oil Sample II (Bottom) 3. Vector Group Test 4. Polarity Tests 5. Magnetising Balance 6. Tan Delta Test 7. Oil level in conservator tank 8. Oil level in breather cup 9. OTI/WTI settings 10. OTI/WTI alarm and trip operation 11. Operation of Buchholz relay 12. Operation of PRV 13. Oil leakage 14. Interlock of door switch of dry transformer 15. Clearances i) Side Clearance: ii) Between two Transformers 16. Body Earth Resistance 17. Neutral Earth Resistance 18. Earth Flat size Material used i) Body: ii) Neutral: 19. Operation of ONLOAD & OFFLOAD Tap Changers	-----M ohm -----M ohm -----M ohm  -----kV -----kV  OK/not OK OK/not OK OK/not OK OK/not OK OK/not OK OK/not OK A/T---- °C A/T----°C OK/not OK OK/not OK OK/not OK OK/not OK OK/not OK  -----Cms -----Meters  ----- Ohm N <sub>1</sub> ---Ohm N <sub>2</sub> ---Ohm  OK/not OK	

		<p>20. Sweep Frequency Resonance Analysis Test (SFRA)</p> <p>21. Dielectric Frequency Resonance Analysis(DFRA) Test</p> <p>22. Partial Discharge Tests</p>	<p>OK/not OK</p> <p>OK/not OK</p> <p>OK/not OK</p>	
5	DG Generators: Generator No., Location, (Alternator and Engine Sl. No. Make, Capacity, )	<p>1. Type of Generator</p> <p>2. Interlocking with other supply sources</p> <p>3. Body earth resistance</p> <p>4. Neutral earth resistance</p> <p>5. Earth Flat size Material used ( Cu/Al)</p> <p>i)Body:</p> <p>ii)Neutral:</p> <p>6. Generator Protection details</p>	<p>OK/not OK</p> <p>----- Ohm</p> <p>N<sub>1</sub>---Ohm N<sub>2</sub>---Ohm</p>	
6.	Cable (Details to be given: size, length, type)	<p>1. Insulation Resistance Values:</p> <p>1. Ph - Ph :</p> <p>2. Ph – Earth :</p> <p>3. Ph – Earth + other Ph :</p> <p>2. Cable trays</p> <p>3. Cable tray earthing</p> <p>4. Cables bending radius</p>	<p>----- M Ohm</p> <p>-----M Ohm</p> <p>-----M Ohm</p> <p>Provided/ Not provided</p> <p>Ok/not OK</p> <p>OK/not OK ___ metre</p>	
7.	Panels	<p>1. No. of panels</p> <p>2. Location of panel</p> <p>3. Rating of the panel</p> <p>4. Size and current rating of the main Bus bars and the distribution Bus bars of the panel</p> <p>5. Whether the Bus bar size of the panel suitable to rating of the panel</p> <p>6. IP Protection of panel</p> <p>7. Type of cable entry</p> <p>8. No. of Incomers and Bus couplers in a Panel</p> <p>9. Ratings of the Circuit Breakers</p> <p>10.No. of MCCBs of each rating in the panel</p>	<p>-----</p> <p>To be enclosed.</p> <p>___Amps</p> <p>___ mm , ___Amps</p> <p>Yes/No</p> <p>_____</p> <p>Top Entry/Bottom Entry</p> <p>___Nos.</p> <p>___Amps</p> <p>___Nos.</p>	

		11. No. of spare MCCBs of each rating 12. Panel Clearance from the wall 13. Clearance between two panels i.e. adjacent panels 14. Whether all the provisions of Regulation 39 followed 15. Size of the Earth strip used for earthing of the panel	____Nos. ____ mm ____mm Yes / No ____sq. mm	
8.	Earthing	1. Metal and Size of Earth Strips 2. Type of earthings 3. Location and No. of earth electrode 4. Values of Earth resistance of each earth electrode and Grid 5. Earth mat resistance	Cu/Al/GI --- Sq. mm Plate/Pipe/Counterpoise ____Nos. ____ $\Omega$ ____ $\Omega$	
9.	Potential Transformer	(i) Ratio test (ii) Polarity test (iii) BDV of oil (iv) IR test  (v) tan Delta and Capacitance measurement	OK/not OK OK/not OK -----kV (R) P-E-----M Ohm (Y) P-E-----M Ohm (B) P-E-----M Ohm  -----	
10.	Current Transformer	(i) Ratio test (ii) Polarity test (iii) BDV of oil (iv) IR test  (v) tan Delta and Capacitance measurement	OK/not OK OK/not OK -----kV (R) P-E-----M Ohm (Y) P-E-----M Ohm (B) P-E-----M Ohm  -----	
11.	Over Head lines and DP structure	1. Size of the Poles of DP structure 2. Clearance between the phases –phase and phase to earth. 3. Ground clearance of the conductors 4. Check of electrical clearance along the route of over head line,	_____ _____ _____ Ok/ Not Ok Ok/ Not Ok	

	<p>5. Check of guarding and clearance at road crossings</p> <p>6. Check the footings of the poles</p> <p>7. Earthing arrangements</p> <p>8. What is the minimum size of the conductors of over head lines used? State the type of conductors.</p> <p>9. Whether all the provisions of regulation 60, 63, 64, 71, 72 and 74 are satisfied.</p>	<p>Ok/ Not Ok</p> <p>Ok/ Not Ok</p> <p>_____</p> <p>Yes / No</p>	
General Observations:			
1.	Check of Phase to Phase , Phase to Ground and Sectional clearance		
2.	Check of Manufacture test reports of individual equipment ( Copies to be enclosed)		
3.	General observation and views ( Specific deviation from the requirements of the Regulations shall be clearly brought out)		

Date :

Signature of the Supplier /Owner / Consumer

Name \_\_\_\_\_

Designation \_\_\_\_\_

File No. \_\_\_\_\_



(For Self Certification by Supplier /Owner /Consumer)

**CERTIFICATE**

**(Under Regulation 45 of CEA (Measures relating to Safety & Electricity Supply) Regulation,2022)**

**This is to certify that the electrical installation is complete in all respects and the work has been carried out conforming to the CEA (Measures relating to Safety & Electricity Supply) Regulation, 2022 (as amended) and relevant Standards of IS/NEC/IEC. The site tests done are found to be in order and it is electrically safe to operate the apparatus free from any danger.**

Encl: Test reports

(Signature)

Self-certifying supplier / owner / consumer

Name \_\_\_\_\_

(Signature)

Chartered Electrical Safety Engineer

Name \_\_\_\_\_

File No. \_\_\_\_\_

To: Office of Electrical Inspector for .....

**Forms of Inspection Report**  
**[See sub-regulation (3) of regulation (32)]**

**FORM IV**  
**(Electrical Installations in Mine)**

Report No. \_\_\_\_\_ Date of Inspection \_\_\_\_\_ :

Date of Last inspection \_\_\_\_\_ Name of the Inspecting Officer: \_\_\_\_\_

1. Name of the Mine
2. Name of the Owner
3. Name of the Agent
4. Name of the Mine Manager
5. Name of the Colliery Engineer
6. Name of the Safety Officer
7. Name of the designated Electrical Safety Officer
8. Name of the Electrical Supervisor
9. Name of the workman Inspector (Electrical)
10. Name of the Engineer (concerned Section)
11. Name of the Working seam
12. Working District Inspected
13. Name of the persons accompanied during inspection:
14. Voltage and system of supply:
  - (vi) Volts \_\_\_\_\_
  - (vii) No. of Phases \_\_\_\_\_
  - (viii) AC/DC \_\_\_\_\_

15. Particulars of the installations/apparatus installed and their location as per mine plan:

16. *Illumination level:*

17. Percentage of methane/other explosive gas :

18. Dry Bulb temperature, wet bulb temperature in case of underground mine.

19. Velocity/speed of air in case of underground mine

General conditions of the installation:

Sl. No.	Regulation Nos.	Requirements	Report
1	Reg-98	On or before the first day of February in every year, notice in the form set out in Schedule IX or Schedule-X whichever is applicable is sent.	Yes/No
2.	Reg-99	The plans specified under this regulation are kept in the office of the mine manager and available to the electrical Inspector of mines.	Yes/No
3	Reg. 100	<p>1. Adequate illumination by electricity without causing glare and strain shall be provided in the mines.</p> <p>2. Whether efficient means of communication is provided between the point where the switchgear under sub-regulation (1) regulation 107 is erected, the shaft bottom and other distributing centers in the mine.</p> <p>3. Whether Fire extinguishing appliances of adequate capacity and of an approved type are installed and properly maintained in every place containing apparatus, other than cables, telecommunication and signaling apparatus.</p> <p>4. Is minimum clearance above ground of the lowest conductor of over head lines or over head cables where dumpers or trackless vehicles are being operated, not less than twelve meters in height</p>	<p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No Satisfactory/Not Satisfactory</p> <p>Yes/No</p>
4	Reg. 101	<p>1. Are Transformers and switchgear placed in a separate room, compartment or box where necessary to prevent danger of mechanical damage?</p> <p>2. Is the room, compartment or box substantially constructed and kept dry &amp; illuminated</p> <p>3. Is efficient ventilation provided for all apparatus installed therein?</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>
5	Reg. 102	(1) Is earthing carried out by connection to an earthing system at the surface of the mine	Yes/No

		<p>and in a manner approved by Electrical inspector of mines.</p> <p>(2) Are all metallic sheaths, coverings, handles, joint boxes, switchgear frames, instrument covers, switch and fuse covers of boxes, all lamp holders, unless efficiently protected by an insulated covering made of fire resisting material, and the frames and bedplates of generators, transformers and motors, including portable motors, earthed by connection to an earthing system in the manner specified in regulation 102.</p> <p>(3) Are all conductors, of an earthing system having conductivity, at all parts and all joints, at least equal to fifty per cent of that of the largest conductor used solely to supply the apparatus</p>	<p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No</p>
6	Reg. 116	Whether the neutral or mid-point earthed by connection to and system in the manner specified in regulation 102.	Yes/No
7	Reg. 103	<p>(1) Is automatically disconnection of supply to any part of the system, where a fault, including an earth fault, occurs and is the fault current limited to the specified values, by employing suitably designed, restricted neutral system of power supply?</p> <p>(2) Whether the operation of the switchgear and the relays are recorded daily at the generating station, sub-station or switch station in a register kept for the purpose?</p> <p>(3) Whether the effectiveness of the switchgear and the protective system being always kept and maintained in working order,</p> <p>(4) Whether the switchgear and the protective system checked once every three months and the result thereof recorded in a separate register kept for the purpose.</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>
8	Reg. 104	<p>1. Is electricity transmitted into a mine at a voltage exceeding 11000 Volts and used therein at a voltage exceeding 6600 Volts</p> <p>2. Is the voltage of Hand-held portable apparatus used, not exceeding 125 V?</p> <p>3. In underground, Whether the lighting system has a mid or neutral point connected with earth and the voltage not exceeds 125 V between phases is used?</p>	<p>Yes/No</p> <p>Yes/No Applicable/ Not applicable</p> <p>Yes/No Applicable/ Not applicable</p> <p>Yes/No</p>

		<p>4. On the surface of a mine or in an open cast mine has the neutral or the midpoint of the lighting system is connected with earth and the voltage between the phases not exceeds 250 V?</p> <p>5. Is the voltage of portable hand-lamps used in underground working of mine or oil fields not exceeding 30V?</p>	Yes/No Applicable/ Not applicable
9	Reg. 105	Where electricity is transformed, has suitable provision made to guard against danger by reason of the lower voltage apparatus becoming accidentally charged above its normal voltage by leakage from or contact with the -higher voltage apparatus.	Yes/No
10	Reg. 107	<p>1. Whether properly constructed switchgear for disconnecting the supply of electricity provided at a point approved by Electrical inspector of mines.</p> <p>2. When any cable or overhead line supplying electricity from the aforesaid switchgear is live, whether a person designated to operate the said switchgears is available within easy reach thereof.</p> <p>3. Whether the main mechanical ventilator operated by electricity interlocked with the switchgear so as to automatically disconnect the power supply in the event of stoppage of main mechanical ventilator.</p> <p>4. Whether every motor is controlled by switchgear, arranged so as to disconnect the supply from the motor and from all apparatus connected thereto and whether such switchgear be so placed to easily operate by the person designated to operate the motor.</p> <p>5. Is the switchgear so placed, disconnects the supply automatically, in the event of conditions of over-current, over-voltage and single phasing?</p> <p>6. Is the Auxiliary fan interlocked with the switchgear controlling power supply to the in bye face equipment of below ground coal mine for automatic disconnection of power supply in the event of the stoppage of the auxiliary fan.</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No Applicable/ Not applicable</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No Applicable/ Not applicable</p>
11	Reg. 108	1. Whether all cables are covered with insulating material and efficiently protected from mechanical damage and supported at	Yes/No Satisfactory/Not satisfactory

		<p>sufficiently frequent intervals and in such a manner as to prevent damage to such cables</p> <p>2. Whether all cables are protected by a metallic covering and which contain all the conductors of a circuit and the sheath of metal-sheathed cables and the metallic armouring of armoured cables is of a thickness not less than that recommended in the relevant standard of the Bureau of Indian Standards</p> <p>3. Is the metallic covering of every cable Electrically and mechanically continuous throughout, earthed by a connection to the earthing system of conductivity specified therein and efficiently protected against corrosion?</p> <p>4. Whether the metallic covering of every cable is having a conductivity at all parts and at all joints at least equal to fifty per cent of the conductivity of the largest conductor enclosed by the said metallic covering</p> <p>5. Are the cables and conductors where connected to motors, transformers, switchgear and other apparatus, installed so that they are mechanically protected by securely attaching the metallic covering to the apparatus and the insulating material at each cable end is efficiently sealed so as to prevent the diminution of its insulating properties;</p> <p>6. Whether properly constructed and certified glands or bushes are used to prevent abrasion or to secure gas-tightness</p>	<p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No</p>
12	Reg. 109	<p>1. Whether Flexible cables used for portable or transportable apparatus are covered with insulating material which shall be efficiently protected from mechanical injury.</p> <p>2. Is the flexible metallic covering of a cable, used by itself to form an earth conductor for such apparatus without an earth conductor</p> <p>3. whether every flexible cable intended for use with portable or transportable apparatus connected to the system and to such apparatus by properly constructed connectors</p> <p>4. At every point where flexible cables are joined to main cables, is a circuit breaker provided which is capable of automatically</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>

		<p>disconnecting the supply from such flexible cables?</p> <p>5. Is every flexible cable attached to a portable or transportable machine examined periodically by the designated person?</p> <p>6. Whether Flexible cable exceeding in specified length being used with any portable or transportable</p> <p>7. Are Flexible cables used with apparatus other than portable or transportable apparatus?</p>	<p>Yes/No</p> <p>Yes/No</p>
13	Reg. 110	Whether all portable and transportable machines operate on remote control from the concerned switchgear with relevant provision.	Yes/No
14	Reg. 111	<p>1. Whether all apparatus maintained reasonably free from dust, dirt and moisture, and kept clear of obstruction.</p> <p>2. Whether the following notices in Hindi and local language of the district, so designed and protected as to be easily legible at all times, be exhibited at the following places, namely;-  (i) where electrical apparatus is in use, a notice forbidding undesignated persons to operate or otherwise interfere with such apparatus;  (ii) In the interior or at the surface of the mine where a telephone or other means of communication is provided, a notice giving full instructions to person, at the surface of the mine, designated to effect the disconnection of the supply of electricity to the mine.</p> <p>3. Whether all apparatus, including portable and transportable apparatus, operated only by those persons who are designated for the purpose.</p> <p>4. Where a plug-and-socket-coupling other than of bolted type is used with flexible cables, whether an electrical inter-lock or other approved device provided to prevent the opening of the coupling while the conductors are live.</p>	<p>Yes/No</p> <p>Satisfactory/Not satisfactory</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p> <p>Yes/No</p>
15	Reg. 112	Give report on the compliance of provisions of this regulation as the case maybe.	<p>Yes/No</p> <p>Satisfactory/Not satisfactory</p>
16	Reg. 114	<p>1. Whether adequate precautions are taken to prevent signal and telephone wires coming into contact with other cables and apparatus.</p> <p>2. Is the voltage used in any one circuit not exceeding 30 V?</p>	<p>Yes/No</p> <p>Yes/No</p>

17	Reg. 115	<ol style="list-style-type: none"> <li>1. Whether Haulage by electric locomotives on the overhead trolley-wire system, at voltage not exceeding 1000 V</li> <li>2. Whether haulage by storage battery locomotives used with the prior consent in writing of the Electrical Inspector</li> </ol>	<p>Yes/No</p> <p>Yes/No</p>
18	Reg. 117	<ol style="list-style-type: none"> <li>1. Whether electrical supervisors, as directed by Electrical Inspector are appointed in writing by the owner, agent or manager of a mine or by the agent or the owner, of one or more wells in an oil field to supervise the installation.</li> <li>2. Whether electricians as directed by the Inspector, are appointed in writing by the owner, agent or manager of a mine or by the agent or the owner, of one or more wells in an oil field for compliance with the duties specified in this regulation.</li> <li>3. Whether persons appointed to operate, supervise, examine or adjust any apparatus are competent to undertake the work which he is required to carry out as directed by the Engineer.</li> <li>4. Whether the electrical supervisor is maintaining log-book made up of the daily log sheets prepared in the form set out in Schedule-XI.</li> </ol>	<p>Yes/No</p> <p>Yes/No</p> <p>Yes/No Satisfactory/Not satisfactory</p> <p>Yes/No</p>
19	Reg. 118	<ol style="list-style-type: none"> <li>1. Whether the persons engaged for operation and maintenance of electrical Installations have undergone training meant for the particular mining installations</li> </ol>	<p>Yes/No Satisfactory/Not satisfactory</p>

Date :

Signature of the Inspecting Officer

Name \_\_\_\_\_

Designation \_\_\_\_\_

File No. \_\_\_\_\_

Copy forwarded to Electrical Inspector for .....





		(12) Under Voltage Relay: (13) SF6 pressure alarm and trip operation test	OK/not OK OK/not OK	
3	Transformer Sl. No. ----	(A) Insulation Resistance Values: 1. HT to LT : 2. HT to Earth: 3. LT to Earth: (B) Break down Voltage Test Oil Sample – I(Top) Oil Sample – II (Bottom) (C) Vector Group Test: (D) Polarity Tests: (E) Magnetizing Balance: (F) Tan Delta Test ( as per capacity) (G) Oil level in conservator Tank: (H) Oil level in breather cup: (I) OTI/WTI settings : (J) OTI/WTI alarm and trip operation (K) Operation of Buchholz relay : (L) Operation of PRV (M) Oil leakage (N) Interlock of door switch for dry transformer (O) Clearances for Side clearance : Between two Transformers:(P) Body earth resistance Neutral earth resistance	-----M ohm -----M ohm -----M ohm -----kV -----kV OK/not OK OK/not OK OK/not OK OK/not OK OK/not OK OK/not OK A/T---- °C A/T----°C OK/not OK OK/not OK OK/not OK OK/not OK -----Cms -----Meters ----- Ohm N <sub>1</sub> ---Ohm N <sub>2</sub> ---Ohm	
4	DG Set Sl. Nos. for 1. Alternator: 2. Engine :	(A) Interlocking with other Supply Sources: (B) Body earth resistance Neutral earth resistance	OK/not OK ----- Ohm N <sub>1</sub> ---Ohm N <sub>2</sub> ---Ohm	
5	Cables Size: Sq. mm	(A) Insulation Resistance Values: 4. Ph - Ph : 5. Ph – Earth : 6. Ph – Earth + other Ph : (B) Bending Radius:	----- M Ohm -----M Ohm -----M Ohm OK/not OK	
6	Earthing :	A) Metal and Size of Earth Strips: B) Type of Earthings: (1) Plate Earthing: (2) Pipe Earthing:	Cu/Al/GI --- Sq. mm Yes/No Yes/No Yes/No	

		<p>(3) Counter poise Earthing</p> <p>:</p> <p>(C) Values of Earth resistances of earth electrodes for</p> <p>(1) Reactor Neutral:</p> <p>(2) LAs :</p> <p>(3). Structure:</p> <p>(4) Frames/Bodies of Equipment:</p> <p>(5) Motors :</p>	<p>N<sub>1</sub> ----ohm N<sub>2</sub> ----ohm</p> <p>(R) ---ohm (Y) ---ohm</p> <p>(B) ----ohm</p> <p>-----ohm</p> <p>-----ohm</p> <p>-----ohm</p>	
7	Potential Transformer	<p>(i) Ratio test</p> <p>(ii) Polarity test</p> <p>(vi) BDV of oil</p> <p>(vii) IR test</p>	<p>OK/not OK</p> <p>OK/not OK</p> <p>-----kV</p> <p>(R) P-E-----M Ohm</p> <p>(Y) P-E-----M Ohm</p> <p>(B) P-E-----M Ohm</p>	
8.	Current Transformer	<p>(i) Ratio test</p> <p>(ii) Polarity test</p> <p>(iii) BDV of oil</p> <p>(vi) IR test</p>	<p>OK/not OK</p> <p>OK/not OK</p> <p>-----kV</p> <p>(R) P-E-----M Ohm</p> <p>(Y) P-E-----M Ohm</p> <p>(B) P-E-----M Ohm</p>	
9.	Transmission line	<p>(i) Physical condition of conductor/tower</p> <p>(ii) Check of tower accessories</p> <p>(iii) Tower footing resistance</p> <p>(iv) Conductor continuity test</p> <p>(v) Check of ground clearance</p> <p>(vi) Check of electrical clearance along the route</p>	<p>OK/not OK</p> <p>OK/not OK</p> <p>-----Ohm</p> <p>OK/not OK</p> <p>OK/not OK</p> <p>OK/not OK</p>	

**General Observations :**

<b>Sl.No.</b>	<b>Item</b>	<b>Observations</b>
1.	Check of required phase to phase, phase to ground and sectional clearance.	
2.	Check of equipment lay out and over all installation details.	
3.	Test of resistance of earth mat or earth electrodes as applicable.	
4.	Check of consumer's pre-commissioning test reports of individual equipment.	
5.	Check of manufacturer's routine/type test reports of individual equipment.	
6.	Whether Inspector's approval if applicable is obtained?	
7.	Whether owner's self certification about compliance with the Regulations is obtained?	
8.	General observation and views (specific deviation from the requirements of the Regulations shall be clearly brought out).	

**Name, Signature and Seal of the Authority**

**Form for notice in respect of failure of supply**

**[See sub-regulation (3) of regulation (41)]**

- (1) Name and address of the supplier :
- (2) Date and time of failure of supply :
- (3) Areas affected due to failure :
- (4) Causes of failure :
- (5) Probable time for restoration of supply :
- (6) Additional information, if any :

Date :

(Name, Signature, Designation  
and Seal of Authority)

Place:

Time:

**Minimum safety working clearances where electricity at voltage exceeding 1000 V is supplied, converted, transformed or used**

[See sub-regulation (2)(iii) of regulation (46)]

<b>Highest System Voltage (kV)</b>	<b>Safety Working Clearance (Metres)</b>
12	2.6
36	2.8
72.5	3.1
145	3.7
245	4.3
420	6.4
800	10.3

(1) The above values are valid for altitude not exceeding 1000 m. A correction factor of 1.25 per cent per 100 m is to be applied for increasing the clearance for altitude more than 1000 m and upto 3000 m;

(2) The above safety working clearances are based on an insulation height of 2.44 m which is the height of lowest point on the insulator, where it meets the earthed metal, from the ground;

(3) “Safety Working Clearance” is the minimum clearance to be maintained in air between the live part of the equipment on one hand and earth or another piece of equipment or conductor on which it is necessary to carry out the work, on the other;

(4) The “Highest System Voltage” is defined as the highest rms phase to phase voltage which occurs under normal operating conditions at any time and at any point of the system. It excludes voltage transients (such as those due to system switching) and temporary voltage variations due to abnormal system conditions (such as those due to fault conditions or the sudden disconnection of large loads).

**Minimum safety clearances to be maintained for bare conductors or live parts of any apparatus in out-door HVDC sub-stations, excluding overhead lines of HVDC installations**

[See sub-regulation (5) of regulation (46)]

S.No.	DC Voltage (kV)	Pole to Earth Clearance (Metres)	Ground Clearance (Metres)
1.	100 kV	1.17	4.55
2.	200 kV	1.80	5.65
3.	300 kV	2.45	6.75
4.	400 kV	3.04	8.00
5.	500 kV	3.65	9.00
6.	600 kV	3.98	10.1
7.	800 kV	5.3	11.2

- (1) The above ground clearances are not applicable to equipment that are housed within fence or a building and where access is prevented under energised condition through a suitable safety interlocking scheme;
- (2) The above pole to earth clearances are for conductor-structure electrode configuration using gap factor k equal to 1.35.
- (3) It is recognised that within a substation many different types of electrode configurations shall be there with different values of k, therefore, the above clearance shall be modified based upon the values of gap factor for a particular electrode configuration subjected to the minimum ground clearance.
- (4) Clearance shall be provided for electrical apparatus so that sufficient space is available for easy operation and maintenance without any hazard to the operating and maintenance personnel working near the equipment and for ensuring adequate ventilation.

**Part-A**

**Form for reporting failure of substation equipment & cable of 220 kV and above voltage class**

**[See sub-regulation (8) of regulation (48)]**

1. Name of Substation
2. Utility/Owner of substation
3. Faulty Equipment/cable
4. Rating plate details  
(e.g. MVA, MVAR, Voltage, current, voltage ratio, CT ratio, PT/CVT ratio, tap range, basic insulation level, continuous operating voltage & rated voltage & nominal discharge current of SA, short circuit withstand current & time, duty cycle, size of cable etc., as applicable for equipment/cable)
5. Make/Manufacturer
6. Serial No.
7. Year of manufacturing
8. Date of commissioning
9. Date and time of occurrence/discovery of fault
10. Fault discovered while equipment was in (Service/Maintenance)
11. Present condition of equipment (Completely damaged/reparable)
12. Details of previous maintenance (provide list of all maintenance activity & tests carried out along with date of testing/maintenance and test results)
13. Details of previous failure of same equipment/cable (if the equipment was used after repair or replacement of some parts)
14. Sequence of events leading to failure
15. Details of protection provided for the equipment/cable
16. Details of protection operated during fault and their settings
17. Atmospheric condition at the time of fault
18. Details of Tests done on equipment/cable after failure
19. Details, if any other equipment & accessories affected/damaged by faulty equipment
20. Reason for failure
21. Measures to be taken to avoid recurrence of failure
22. Date of restoration/replacement of faulty equipment/cable
23. Conclusion/recommendations

Note: Attach factory & commissioning test reports; event logger/disturbance recorder data & photographs of failed equipment, if available.

Date :

(Signature and name of Manager/  
Executive Engineer of the installation)  
Contact details (Address /Mobile No./Phone No./Email)

To,  
The Secretary  
Central Electricity Authority  
Sewa Bhawan, R.K.Puram  
New Delhi-110066

Note: for latest form please refer to CEA Website



**Part-B****Form for reporting failure of Towers of 220 kV and above voltage class Transmission lines****[See sub-regulation (8) of regulation (48)]**

1. Name of Transmission line with voltage level:
2. Length of line (km):
3. Type of configuration [(S/C, D/C, S/C strung on D/C towers, Multi Circuit (M/C) narrow base etc.)
4. Number of Towers and Type of Towers failed: [suspension / tension/dead end /special tower  
/river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)]
5. Tower location No. with reference to nearest substation(indicate Name):
6. Name and size of conductor:
7. No. of sub-conductors per bundle and bundle spacing:
8. Number and size of Ground wire/OPGW (if provided):
9. Type of insulators in use(Porcelain / Glass / Polymer/ /Disc/ Porcelain long rod):
10. Configuration of insulators (I / V / Y / tension)
11. No. of insulators per string and No. of strings per phase:
12. Year of construction / commissioning:
13. Executing Agency:
14. Weather condition on the date of failure:
15. Terrain Category:
16. Wind Zone (1/2/3/4/5/6) and velocity of wind:
17. Details of earthing of tower (pipe type/ Counter poise):
18. Line designed as per IS: 802
19. The agency who designed the line:
20. Any Special consideration in design:
21. Date and time of occurrence/discovery of failure:
22. Power flow in the line prior to failure:
23. Any missing member found before / after failure of towers:
24. Condition of foundation after failure:
25. Brief Description of failure: [along with photographs(if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.]
26. Probable cause of failure:
27. Details of previous failure of the line / tower:
28. Whether line will be restored on Emergency Restoration System (ERS) or Spare tower will be used:
29. Likely date of restoration:
30. Present Status:
31. Details of any Tests carried out after failure:

32. Single line diagram / clearance diagram of the failed tower(s) with all dimensions  
(Horizontal and vertical dimensions including the base width of tower)
33. Tower spotting data
34. Tower Schedule for the failed section
35. Sag tension calculation considered for the design of towers
36. Any other relevant information:

Date:  
Manager/Executive

(Signature and name of

Engineer of the installation)

Contact details (Address /Mobile No./Phone

No./Email)

To,  
The Secretary  
Central Electricity Authority  
Sewa Bhawan, R.K.Puram  
New Delhi-110066

Note: for latest form please refer to CEA Website

**Minimum clearance in air above ground and across road surface of Highways or roads or railway corridors or navigational or non-navigational rivers for lowest conductor of an alternating current overhead lines, including service lines of nominal voltage system.**

[See sub-regulation (1) of regulation (60)]

Nominal voltage of system	Clearance above ground			Clearance between conductor and road surface across Highway (m)	Clearance between conductor and rail level across Railway Corridor (m)	Clearance above HFL for River crossing	
	Across Street (m)	Along Street (m)	Elsewhere (m)			Navigational river (m)	Non-navigational river (m)
Upto 1000 V	5.80	5.50	4.60	U/G Cable	U/G Cable	16.50	5.80
11 kV	6.50	5.80	4.60	U/G Cable	U/G Cable	19.00	6.50
22 kV	6.50	5.80	5.20	U/G Cable	14.66	19.00	6.50
33 kV	6.50	5.80	5.20	11.60 or U/G Cable	14.66	19.00	6.50
66 kV	6.50	6.10	5.50	11.60 or U/G Cable	14.66	19.00	6.50
110 kV	6.50	6.10	6.10	11.60	15.56	19.00	6.50
132 kV	6.50	6.10	6.10	11.60	15.56	19.22	6.50
220 kV	7.02	7.02	7.02	12.52	16.46	20.10	7.02
400 kV	8.84	8.84	8.84	14.00	18.26	21.90	8.84
765 kV	18.00*	18.00*	18.00*	18.80	23.40	25.55	18.00
1200 kV	24.00*	24.00*	24.00*	30.00	23.00 (from highest traction conductor)	29.90	24.00

For navigable rivers, clearances shall be fixed in relation to the tallest mast in consultation with the concerned navigational/port authorities.

\* Higher clearance due to predominantly induction effects and time varying electric field (ICNIRP limit: 10 kV/m for occupational exposure) at voltage exceeding 400 kV.

Railway Crossing clearances as per ACS 20 of IRSOD Dated 17-07-2017

**Schedule-VIII-B**

**The minimum clearance in air above ground and across road surface of Highways, or Minimum clearance between conductor and Rail Level or navigational or non-navigational rivers for lowest conductor of High Voltage Direct Current (HVDC) overhead line of nominal voltage system**

[See sub-regulation (6) of regulation (60)]

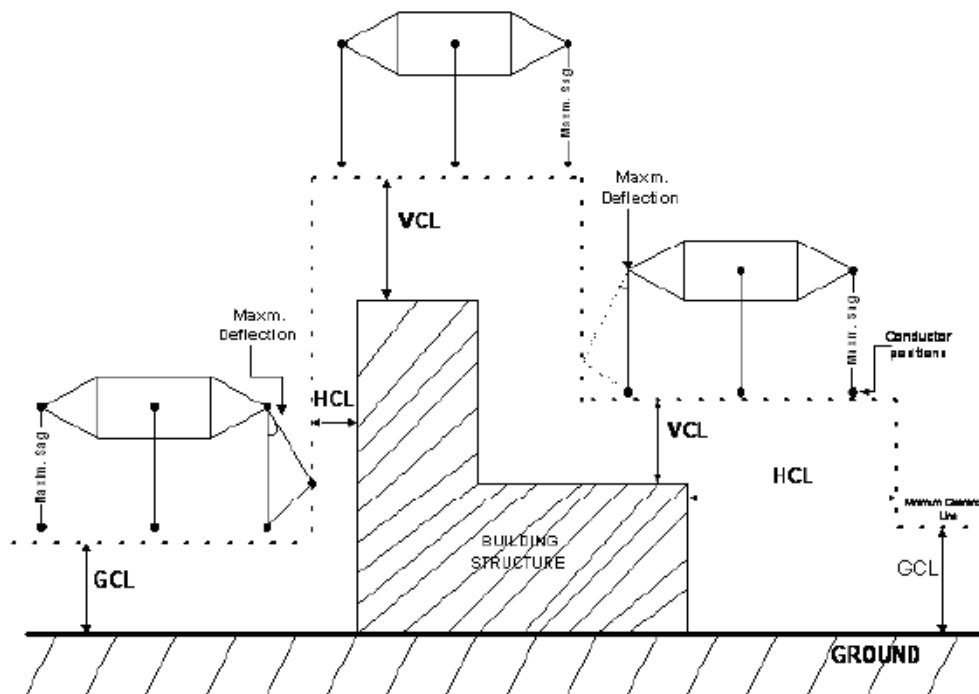
Sl. No.	DC Voltage	Ground Clearance (m)	Clearance between conductor and road surface across Highway (m)	Minimum clearance between conductor and Rail Level (m)	Clearance above HFL for River crossing	
					Navigational River (m)	Non-navigational River (m)
1.	100 kV	6.50	-	-	-	-
2.	200 kV	7.30	-	-	-	-
3.	300 kV	8.50	-	-	-	-
4.	400 kV	9.40	-	-	-	-
5.	500 kV	12.50	17.25	21.23	22.90	12.50
7.	800 kV	18.00	22.75	25.74	25.90	18.00

\* Higher clearance due to predominantly time varying electric field (ICNIRP limit: 10 kV/m for occupational exposure) at voltage exceeding 400 kV.

1. Highway clearances required 4.75 m higher than ground clearances (considering the vehicle height is 4.75, as mentioned in the Indian Road Congress documents, 1983).
2. Railway clearances required 10% higher value than HVAC values (HVAC values are mentioned in Indian Railway document :IRSOD, 2004).
3. Navigational River clearances as mentioned in the Regulation of Inland Waterways Authority of India (Classification of Inland Waterways in India), Regulation, 2006.

**Ground, Vertical and Horizontal clearances**

[See sub-regulation (6) of regulation 60, sub-regulation (5) of regulation 62 and sub-regulation (5) of regulation 63]



GCL: Clearances as per Regulation 61  
 VCL: Clearances as per Regulation 62 & 63  
 HCL: Clearances as per Regulation 62 & 63

**FORM OF ANNUAL RETURN FOR MINES**

[See sub-regulation (1) of regulation 98]

This form must be correctly filled up by the owner, agent, manager or engineer and sent to the Inspector not later than the first day of February every year.

**Part A**

Year ending 20

Name of Mine  
 Situation of Mine  
 Postal address of Mine  
 Name and address of owner  
 Name of agent  
 Name of manager  
 Name of engineer  
 Name of Electrical Supervisor

State  
 District

**Part B**

- (1) System of supply (whether direct current or alternating current)  
 Voltage of supply  
 Periodicity (if alternating current)  
 Source of supply.
- (2) Voltage at which electricity is used for :-  
 Lighting  
 Power
- (3) Particulars of Motor etc.

**POWER**

(a) On Surface

Type of Motor (H.P./K.W.) / apparatus and voltage	Type of control gear	Location	Purpose for which used

(b) In Mine

Type of Motor (H.P./K.W.) / apparatus and voltage	Type of control gear	Location	Purpose for which used	Ventilation	Percentage of inflammable gas or vapour

**LIGHTING**

Type of light fitting	Wattage	Location	Percentage of inflammable gas or vapor

**FORM OF ANNUAL RETURN FOR OIL-FIELDS****[See sub-regulation (1) of regulation 98]**

This form must be correctly filled up by the owner, agent, manager or engineer and sent to the Inspector not later than the first day of February every year.

**Part A**

Year ending 20

Situation of Oil-field State  
 Name of Oil-field District  
 Postal address of Oil-field  
 Name and address of owner  
 Name of agent  
 Name of manager  
 Name of engineer  
 Name of Electrical Supervisor

**Part B**

- (1) System of supply (whether direct current or alternating current)
  - Voltage of supply
  - Periodicity (if alternating current)
  - Source of supply.
- (2) Voltage at which electricity is used for :-
  - Lighting
  - Power
- (3) Particulars of Motor etc. in use on the field :-

**(a) On wells**

No. or other identifying Mark of well	Drilling or pumping	Type and H.P of motor	No. of lamps and type	Other electrical appliances
1	2	3	4	5

**(b) Not on wells**

Type and H.P of motor	Purpose for which used	Identifying mark on map
1	2	3

- (4) Other electrical appliances, not including in item3, in use on the field.

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Appliances Type and size in KW.	Purpose for which used	Identifying mark on map
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**LOG SHEET FOR MINES AND OIL-FIELDS**

**[See sub-regulation (9) of regulation 112, clause (i) and (ii) of sub-regulation (5) of regulation (117)]**

Daily Log sheet for

- (1) Name of Electrical Supervisor
- (2) Report as to:-
  - (a) Condition of the insulation of the system.
  - (b) Specified defects of insulation (particulars of each failure of apparatus should be given).
  - (c) Accidents or dangerous occurrence (including any cases of electric shock and any cases of open sparking in apparatus in use in places where regulation 112 applies).
  - (d) Disconnection and reconnection of supply as required by sub-regulation (9) of regulation 112.
  - (e) Examination of earth fault detectors or recorders as provided by sub-regulation (3) of regulation 102.
  - (f) Examinations of apparatus as provided by Regulation 117.
    - (i) Routine examinations as required by clause (i) of sub-regulation (5) of regulation 117.
    - (ii) Special examination\* as required by clause (ii) of sub-regulation (5) of regulation 117.
- (3) Remarks:-  
Signed  
Examined by

Electrical Supervisor:

Engineer:

Manager.

\*State which apparatus has been examined or tested and result.

NOTE:- This log sheet should be filled in as completely as possible. If, for instance, there are no defects of insulation to report, the word 'none' should be written in the vacant space.



**Part-I**

**Guidelines for determining adequacy of designated supervisors on duty in every mine or oil-field while electricity is being used**

**[See sub-regulation (1)(i) of regulation (117)]**

Adequate number of electrical supervisors shall be designated in a mine for conducting the operation and maintenance works of electrically operated machinery/ equipment/ apparatus in accordance with the provisions of Regulations.

1. In case of belowground mine having conventional and semi-mechanized workings, at least one electrical supervisor shall be designated in each working district in each shift of operation/ maintenance.
2. In case of belowground mechanized mines consisting of Longwall machinery, continuous miners, Blasting Gallery or alike equipment, at least two electrical supervisors shall be designated for each machinery and associated apparatus/ substations in each shift of operation/ maintenance
3. In opencast mine consisting of Dragline, Bucket wheel excavators, High capacity shovels or any alike equipment, at least one supervisor shall be designated for each such machinery/ equipment inclusive of their switchgear based on size & type of equipment in each shift of operation/ maintenance.  
Provided that where the aggregate capacity of machinery is less than 2MVA, the HEMM and associated switchgear can be grouped to bring under one supervisor.
4. In opencast mine consisting of HEMM such as Electrically operated Shovels & Drilling Machines, associated switchgear, distribution lines, substations etc., at least one electrical supervisor shall be designated in each shift of operation/ maintenance for maximum up to six numbers of such electrically operated machinery/ equipment.
5. In case of opencast mines consisting of small and conventional electrical machinery such as substation equipment, distribution lines, production machinery, pump installations or any alike equipment, one electrical supervisor shall be designated in each shift of operation/maintenance.
6. In case of oil/ gas/ coal based power plants with associated substations which are supplying electricity to mine installations and forming part of mine, one electrical supervisor in general shift of operation/ maintenance shall be designated.
7. In case of oil fields, where electrically operated drilling rigs inclusive of generators, substation apparatus and other electrical machinery are in use, one electrical supervisor in general shift of operation/ maintenance per rig shall be designated.
8. In oil fields of production installations, group gathering stations, well pads or any alike installations where substations and electrically operated equipment are in use,

at least one electrical supervisor in general shift of operation/ maintenance shall be designated.

9. For the surface installations of a mine consisting of substations, switch stations, distribution lines and other electrically operated machinery/ equipment, at least one electrical supervisor in each shift shall be designated for operation/ maintenance.

Provided that where the aggregated capacity of substations and downstream electrically operated machinery is more than 10MVA, additional electrical supervisor shall be designated in each shift of operation/ maintenance.

**Part-II**

**Guidelines for determining adequate number of designated electricians on duty in every mine or oil-field while electricity is being used**

**[See sub-regulation (1)(iii) of regulation (117)]**

Adequate number of electricians shall be designated in a mine for conducting the operation and maintenance works of electrically operated machinery/ equipment/ apparatus in accordance with the provisions of Regulations:

1. In case of belowground mine having conventional and semi-mechanized workings, at least two electricians shall be designated for each working district in each shift of operation/ maintenance.
2. In case of belowground mechanized mines consisting of Longwall machinery, continuous miners, Blasting Gallery or alike equipment, at least four electricians shall be designated for each machinery/ associated apparatus/ substations in each shift of operation/ maintenance
3. In opencast mine consisting of Dragline, Bucket wheel excavators, High capacity shovels or any alike equipment, at least two electricians shall be designated for each such machinery/ equipment inclusive of their switchgear based on size & type of equipment in each shift of operation/ maintenance.  
Provided that where the aggregate capacity of machinery is less than 1MVA, the HEMM and associated switchgear can be grouped to bring under one electrician.
4. In opencast mine consisting of HEMM such as Electrically operated Shovels & Drilling Machines, associated switchgear, distribution lines, substations etc., at least one electrician shall be designated in each shift of operation/ maintenance for maximum up to two numbers of such electrically operated machinery/ equipment.
5. In case of opencast mines consisting of small and conventional electrical machinery such as substation equipment, distribution lines, production machinery, pump installations or any alike equipment are in use, at least one electrician shall be designated in each shift of operation/maintenance and additional electrician shall be designated based on the type and size of installations and the area to be covered.
6. In case of oil/ gas/ coal based power plants with associated substations which are supplying electricity to mine installations and forming part of mine, at least one electrician in each shift of operation/ maintenance shall be designated.
7. In case of oil mines, where electrically operated drilling rigs inclusive of generators, substation apparatus and other electrical machinery are in use, two electricians in each shift of operation/ maintenance per rig shall be designated.
8. In oil fields of production installations, group gathering stations, well pads or any alike installations, where substations and electrically operated equipment are in use, at least one electrician in each shift of operation/ maintenance shall be designated. Where the distance between such installations exceeds one KM,

additional electrician shall be designated based on the type and size of installations and the area to be covered.

9. For the surface installations of a mine consisting of substations, switch stations, distribution lines and other electrically operated machinery/ equipment, at least two electricians in each shift shall be designated for operation/ maintenance.

Provided that where the aggregated capacity of substations and downstream electrically operated machinery is more than 5MVA additional electricians shall be designated in each shift of operation/ maintenance.

**Guidelines for determining adequate number of designated electricians on duty in every mine or oil-field while electricity is being used**

**[See sub-regulation (1)(iii) of regulation (117)]**

Adequate number of electricians shall be appointed in a mine for conducting the operation and maintenance works of electrically operated machinery/ equipment/ apparatus in accordance with the provisions of Regulations:

1. In case of belowground mine having conventional and semi-mechanized workings, at least two electricians shall be deployed for each working district in each shift of operation/ maintenance.
2. In case of belowground mechanized mines consisting of Longwall machinery, continuous miners, Blasting Gallery or alike equipment, at least four electricians shall be deployed for each machinery/ associated apparatus/ substations in each shift of operation/ maintenance
3. In opencast mine consisting of Dragline, Bucket wheel excavators, High capacity shovels or any alike equipment, at least two electricians shall be appointed for each such machinery/ equipment inclusive of their switchgear based on size & type of equipment in each shift of operation/ maintenance.

Provided that where the aggregate capacity of machinery is less than 1MVA, the HEMM and associated switchgear can be grouped to bring under one electrician.

4. In opencast mine consisting of HEMM such as Electrically operated Shovels & Drilling Machines, associated switchgear, distribution lines, substations etc., at least one electrician shall be deployed in each shift of operation/ maintenance for maximum up to two numbers of such electrically operated machinery/ equipment.
5. In case of opencast mines consisting of small and conventional electrical machinery such as substation equipment, distribution lines, production machinery, pump installations or any alike equipment are in use, at least one electrician shall be appointed in each shift of operation/maintenance and additional electrician shall be appointed based on the type and size of installations and the area to be covered.
6. In case of oil/ gas/ coal based power plants with associated substations which are supplying electricity to mine installations and forming part of mine, at least one electrician in each shift of operation/ maintenance shall be appointed.
7. In case of oil mines, where electrically operated drilling rigs inclusive of generators, substation apparatus and other electrical machinery are in use, two electricians in each shift of operation/ maintenance per rig shall be appointed.
8. In oil fields of production installations, group gathering stations, well pads or any alike installations, where substations and electrically operated equipment are in use, at least one electrician in each shift of operation/ maintenance shall be appointed. Where the distance between such installations exceeds one KM, additional electrician shall be appointed based on the type and size of installations and the area to be covered.

9. For the surface installations of a mine consisting of substations, switch stations, distribution lines and other electrically operated machinery/ equipment, at least two electricians in each shift shall be appointed for operation/ maintenance.

Provided that where the aggregated capacity of substations and downstream electrically operated machinery is more than 5MVA additional electricians shall be appointed in each shift of operation/ maintenance.

### **Training of personnel engaged for operation and maintenance of electrical installations in Mines**

(i) The persons engaged for operation and maintenance of electrical installations in Mines are required to undergo the type of training meant for the particular mining installations (Coal/Oil/Metal).

(ii) The refresher training shall be imparted at a periodicity of intervals not more than two years. A register by the Owner/Manager/Agent of a mine or by the agent or the owner, of one or more wells in an oil fields of the mine shall be maintained wherein the names of the persons trained, due date of refresher training etc shall be entered. The register maintained shall be produced before the Electrical Inspector whenever required by him.

(iii) The Owner /Agent of the mine shall arrange for training of their personnel engaged in the operation and maintenance of electrical installations of mines in his own institute or any other institute recognized by the Central Government or State Government.

Provided that the existing employees shall have to undergo the training mentioned in sub-regulation 118(i) within three years from the date of coming into force of these regulations.

**SCHEDULE XIII**

**TRAINING SYLLABUS FOR ELECTRICAL SUPERVISOR AND  
ELECTRICIANS OF MINES**

**General Instructions**

1. The content of training courses and on the job training / practical training may be designed keeping in view the technical requirements as applicable.
2. The periodical refresher training may be customized as per the assessment and requirement.
3. After the lecture course is completed, the trainees are required to be taken on visit to a few modern power stations, testing labs, mechanized mine, manufacturer facilities of transformer, motors, switchgears etc.,
4. Facilities of training institute / for creation of training institute:
  - I. The training institute shall have devoted facilities — building, residential and recreation facilities
  - II. The training institute shall have a full time Head of institute and adequate number of teaching faculty /staff. The institute may engage visiting faculty from operations in order to enhance the operating skills of the trainee.
  - III. The training institute shall have adequate number of lecture halls, seminar and conference hall/ auditorium, library, computer centre, workshop, laboratories etc.,
  - IV. The institute shall have facilities to arrange refresher courses to those personnel who are already designated electrical supervisor in their work fields.
  - V. The institute shall fill up the Assessment form for Electrical Supervisors/ Electricians towards the performance of each participant.
5. The threshold marks for passing through the evaluation test, inclusive of practical test and written shall be 50% of total marks.



**SCHEDULE XIII**

**PART-I**  
**TRAINING SYLLABUS FOR ELECTRICAL SUPERVISOR OF MINES (For**  
**Coal or Metal Mines)**

<b>Item No</b>	<b>Particulars</b>	<b>Number of Hours</b>
1	Electrical Machineries: I. Operation maintenance, pre-commissioning test of different types of motors (AC &DC) II. Operation maintenance, pre-commissioning test of different types of generators (AC &DC), III. Operation maintenance, pre-commissioning tests of different types of transformers.	4
2	Electric Drives and Control: (i) Operation maintenance of Different types of starters including AC Drive, DC Drive, soft starters etc.,	2
3	Switchgear and protective devices: (i) Operation maintenance, pre-commissioning tests of different types of circuit breakers (ii) Different types of protective schemes/protective devices and their operation maintenance,	2
4	Earthing system: Requirements, types of earthing, maintenance, chemical earthing and relevant provisions of IS - 3043.	3
5	Neutral system of power supply: a. solid neutral earthing, restricted neutral earthing, isolated neutral earthing , advantages / disadvantages; b. provisions of the Regulation for suitably designed restricted neutral system of power supply and the requirement of neutral fail safe relay	3
6	Operation and maintenance of substations and generating stations including maintenance of storage battery and related auxiliaries.	3
7	Design and layout of sub-station, Safety in sub-station, switchyard and switchboards i. Safe working clearance; ii. Guarding of live apparatus; iii. Standard Operating Procedure (SOP) of circuit breakers, transformers, isolators, surge arresters, instrument transformers, storage tanks etc.,	3
8	Operation, maintenance of overhead lines and underground cables I. Safety measures in overhead lines II. Types of stays, its markings, grouting, stay insulator, binding etc., III. Types of guarding and clearances, earth/neutral wire, anti-climbing devices, and their erection. IV. Selection and fixing of control devices viz. Linked switches, fuses, isolators, and earthing switches, lightning arrestors etc.	4

	V. Cables and conductors, their classification, construction, insulation types, laying, mining type cables and the related standards, cable jointing techniques and junction boxes	
9	<p>Electrical apparatus and machinery for mine installation ( as applicable for a particular type of mine Oil/Coal/Metal)</p> <p>I. Winders, man riding system, cranes</p> <p>II. Electrically operated HEMM, portable transportable machinery, dragline, bucket wheel excavator, SDL,LHD, Road header, shearer, continuous miner</p> <p>III. Salient features of Flameproof and intrinsically safe apparatus for use in hazardous atmosphere of mine (coal/Oil) and relevant provisions of the IS/IEC 60079 series of standards, operation and maintenance of the flameproof and intrinsically safe apparatus;</p> <p>IV. LMD, Environment monitoring system</p> <p>V. Circuit diagram of Drill control panel, GEB, different types of circuit breakers, starters, Lighting &amp; Signaling unit.</p> <p>VI. Safety requirement of belt conveyor system installed in the belowground coal mine, OCP</p> <p>VII.Safety requirements of Drilling Rig in oil mine</p> <p>VIII. Any other special type of Electrical machinery / apparatus used in mines(coal/oil/metal)</p>	8
10	<p>General safety:</p> <p>I. Procedure for obtaining permission to work for carrying out operations and maintenance of electrical equipment (permit to work as per <b>IS:5216</b>);</p> <p>II. Safety in electrical workshop</p> <p>III. Firefighting equipment, their type, use and periodical maintenance, indicators, and recorders etc.</p> <p>IV. First aid training, resuscitation of persons suffering from electric shock etc.,</p>	4
11	<p>Legislation/statutes as amended from time to time:</p> <p>I. Provisions of Central Electricity Authority( measures relating to safety and electric supply), Regulations 2022;</p> <p>II. Provisions of Electricity Act,2003</p> <p>III. Relevant provisions of the mines Act, 1952</p> <p>IV. Relevant provisions of the Coal Mines Regulation,1957</p> <p>V. Relevant provisions of Metalliferous Mines Regulation, 1961</p> <p>VI. Relevant provisions of Oil Mines Regulation, 1984</p>	5
12	<p>On-Site emergency management plan in case of contingency related to electricity:</p> <p>I. Emergency response procedure including response to off-site emergency management plan and crisis and disaster management plan;</p>	3

	II. Risk assessment information giving possible nature of incidents and events giving rise to emergency conditions, risk analysis and impact assessment;	
13	<p>Record keeping</p> <p>I. Maintenance of Supervisors log sheet</p> <p>II. Register of designated persons</p> <p>III. History sheets of the electrical equipment/apparatus with regard to the repair/maintenance</p> <p>IV. Maintaining and updating the circuit diagram of the installations and electrical apparatus like breakers, starters etc.</p> <p>V. Register recording the testing of relays using secondary injection kit and the due date of testing</p> <p>VI. Register recording the testing of CTs and relays using primary injection kit and the due date of testing</p> <p>VII. Register for maintenance of flameproof and intrinsically safe apparatus(coal/Oil mine)</p>	3
14	<p>On Job training/ Practical/Laboratory Training</p> <p>I. Practical tests( type, routine) of transformer, motor</p> <p>II. Testing of CTs including relays through primary injection kit</p> <p>III. Testing of relays through secondary injection kit</p> <p>IV. First aid training</p> <p>V. Operation of different types of fire extinguishers</p>	8
15	Written Examination to evaluate performance, feedback on training	1
Duration of the training course in hours		56

**SCHEDULE XIII****PART-II**  
**TRAINING SYLLABUS FOR ELECTRICAL SUPERVISOR OF MINES ( FOR**  
**OIL MINES)**

<b>Item No</b>	<b>Particulars</b>	<b>Number of Hours</b>
1	Brief introduction of AC/DC Motors, alternators, transformers and their application, operation and maintenance.	4
2	Brief Introduction of Switchgear, Protection techniques, operation and maintenance.	4
3	I. Earthing system: Requirements, types of earthing, maintenance, chemical earthing and relevant provisions of IS - 3043. II. Neutral system of power supply: Solid neutral earthing, restricted neutral earthing, isolated neutral earthing , advantages / disadvantages;	4
4	I. Measurement of Insulation Resistance, earth electrode resistance II. Maintenance of Battery bank	3
5	I. Lock-out/Tag out (permit to work as per IS:5216) and PTW system II. Hazardous area classification and selection of equipment for hazardous area. Salient features of Flameproof and intrinsically safe apparatus for use in hazardous area and relevant provisions of the IS/IEC 60079 series of standards, operation and maintenance of the flameproof, intrinsically safe apparatus and other apparatus conforming to the relevant Ex standards	5
6	Record keeping: I. Maintenance of Supervisors log sheet II. Register of designated persons III. History sheets of the electrical equipment/apparatus with regard to the repair/maintenance IV. Maintaining and updating the circuit diagram of the installations and electrical apparatus like breakers, starters etc. V. Register recording the testing of relays using secondary injection kit and the due date of testing VI. Register recording the testing of CTs and relays using secondary injection kit and the due date of testing VII. Register for maintenance of flameproof and intrinsically safe apparatus(coal/Oil mine)	3
7	Design layout, Safety in sub-station, switchyard and switchboards i. Safe working clearance; ii. Guarding of live apparatus; Standard Operating Procedure (SOP) of circuit breakers, transformers, isolators, surge arresters, instrument transformers, storage tanks etc.	3
8	Operation, maintenance of overhead lines and underground cables I. Safety measures in overhead lines II. Types of stays, its markings, grouting, stay insulator, binding etc.,	3

	<p>III. Types of guarding and clearances, earth/neutral wire, anti-climbing devices, and their erection.</p> <p>IV. Selection and fixing of control devices viz. Linked switches, fuses, isolators, and earthing switches, lightning arrestors etc.</p> <p>V. Cables and conductors, their classification, construction, insulation types, laying, mining type cables and the related standards, cable jointing techniques and junction boxes</p>	
9	<p>General safety:</p> <p>I. General Safety to be observed in oil and gas mine and adherence to operator's Safety Rules.</p> <p>II. Firefighting equipment, their type, use and periodical maintenance, indicators, and recorders etc.</p> <p>III. First aid training, resuscitation of persons suffering from electric shock etc.</p>	3
10	<p>Legislation:</p> <p>I. Provisions of Central Electricity Authority (measures relating to safety and electric supply), Regulations 2022;</p> <p>II. Provisions of Electricity Act, 2003</p> <p>III. Relevant provisions of the mines Act, 1952</p> <p>IV. Relevant provisions of Oil Mines Regulation, 1984 (amended version)</p>	5
11	On job training/ practical/Laboratory training	4
12	Written examination to evaluate the performance for awarding the License	1
	Total	42

**SCHEDULE XIII****PART-III**  
**TRAINING SYLLABUS FOR ELECTRICIANS OF MINES**

<b>Item No</b>	<b>Particulars</b>	<b>Number of Hours</b>
1	Basic Electrical Engineering: (i) Symbols of various electrical items/ machines/elements (ii) Sketches and circuit diagrams for the electrical systems / installations i.e. different types of distribution networks, starters and other electrical apparatus (iii) Different types of tools and devices being used to maintain the electrical installations / apparatus such as Insulation tester, earth tester, multimeter etc.,	3
2	Electrical Machineries: I. Different types of motors (AC &DC), their applications, operation and maintenance II. Different types of generators (AC &DC), their application, operation and maintenance III. Different types of transformers, cooling of transformers, transformer oil, protective devices in the transformer, the common causes of failures, operation & maintenance.	3
3	Electric Drives and Control: Starting and speed control of motors, different types of starters and their operation maintenance	2
4	Switchgear and protective devices: I. General Idea on Operation & Maintenance of different types of circuit breakers , CT/PT II. General idea on different types of relays such as over-current, earth fault relays, broken conductor/negative sequence/ unbalance/single phasing preventer, Differential protection etc., III. Various protective schemes with circuit diagram: for motors, generators, transformers, capacitor banks etc.,	3
6	Earthing system: Requirements, types of earthing, maintenance, chemical earthing and relevant provisions of IS - 3043.	2
7	Neutral system of power supply: I. Solid neutral earthing, restricted neutral earthing, isolated neutral earthing, advantages / disadvantages II. Provisions of the statutory Regulation for suitably designed restricted neutral system of power supply and the requirement of neutral fail safe relay	2
9	Operation and maintenance of substations and generating stations including maintenance of storage battery and related auxiliaries	3
10	Protection against voltage surges and lightning	1
11	Operation, maintenance of overhead lines and underground cables I. Safety measures in overhead lines II. Types of stays, its markings, grouting, stay insulator, binding etc.,	4

	<p>III. Types of guarding and clearances, earth / neutral wire, anti-climbing devices and their installation / erection.</p> <p>IV. Selection and fixing of control devices viz. Linked switches, fuses, isolators, and earthing switches, lightning arrestors etc.,</p> <p>V. Cables and conductors, their classification, construction, insulation types, laying, mining type cables and the related standards, cable jointing techniques and junction boxes</p>	
12	<p>Electrical apparatus and machinery for mine installation ( as applicable for a particular type of mine like Coal/Metal/Oil)</p> <p>I. Winders, man riding system, cranes</p> <p>II. Electrically operated HEMM, portable transportable machinery, dragline, bucket wheel excavator, SDL,LHD, Road header, shearer, continuous miner</p> <p>III. Salient features of Flameproof and intrinsically safe apparatus for use in hazardous atmosphere of mine (coal/Oil) and relevant provisions of the IS/IEC 60079 series of standards, operation and maintenance of the flameproof and intrinsically safe apparatus</p> <p>IV. LMD, Environment monitoring system</p> <p>V. Circuit diagram of Drill control panel, GEB, different types of circuit breakers, starters, Lighting &amp; Signaling unit.</p> <p>VI. Safety requirements of belt conveyor system installed in the belowground coal mine, OCPs etc.,</p> <p>VII. Safety requirements of Drilling Rig in oil mine</p> <p>VIII. Any other special type of Electrical machinery / apparatus used in mines (coal / oil / metal)</p>	8
13	<p>General safety:</p> <p>I. Procedure for obtaining permission to work for carrying out operations and maintenance of electrical equipment (Permit to work as per <b>IS:5216</b>);</p> <p>II. Safety in electrical workshop</p> <p>III. Firefighting equipment, their type, use and periodical maintenance, indicators, and recorders etc.,</p> <p>IV. First aid training, resuscitation of persons suffering from electric shock etc.,</p>	4
14	<p>Legislation/statutes as amended from time to time: Relevant regulations of Provisions of Central Electricity Authority( measures relating to safety and electric supply), Regulations 2022</p>	4
15	<p>On Job training/ Practical/Laboratory Training</p> <p>I. Erection and pre commissioning testing of transformers, motors, generators, switchgear</p> <p>II. Measurement of earth resistance, insulation resistance etc.,</p> <p>III. Testing of CTs, relays etc.,</p> <p>IV. First aid training</p> <p>V. Operation of different types of fire extinguishers</p>	8
16	<p>Written Examination to evaluate performance, feedback on training</p>	1
<p>Duration of the training course in hours</p>		48

**Qualification & Experience for Authorising  
CHARTERED ELECTRICAL SAFETY ENGINEER  
[See sub-regulation (1) of regulation 6]**

**1. Qualification of Chartered Electrical Safety Engineer:**

- (a) The Chartered Electrical Safety Engineers shall be an Electrical Engineering degree holder or equivalent degree with at least five years experience in operation and maintenance of electrical installations and also shall have the knowledge of Electricity Act, Rules and Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulations, 2022 (as amended) or an Electrical Engineering Diploma holder with at least 10 years of experience in operation and maintenance of electrical installations and also shall have the knowledge of Electricity Act, Rules and Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulations, 2022 (as amended).
- (b) He/ She shall qualify the prescribed test/ interview conducted by Electrical Inspectorate Department of the concerned Government, after paying the requisite fees. The procedure for the test/interview shall be decided by the respective Government.
- (c) Notwithstanding anything contained in clause (a), the Chartered Electrical Safety Engineer shall have the knowledge of other relevant Acts and Regulations related to the electric supply in the respective State Government.
- (d) Retired Electrical Inspector who were already notified by Appropriate Government would be eligible for CESE. However, state Government would have the responsibility to take the decision on exemption for test/ interview for retired Electrical Inspector.
- (e) The Chartered Electrical Safety Engineers shall not hold any post in Govt./Semi Govt./PSUs or associated with any organisations which directly or indirectly influence the working of CESE.
- (f) He/ She shall for all the time in his possession have the basic testing equipment (some basic testing equipment given in Annexure-I) as may be prescribed by the office of the Electrical Inspector for testing of the electrical installations.

**2. Scope of work:**

The Chartered Electrical Safety Engineers shall assist the owner or supplier or consumer of electrical installations for the purpose of self-certification upto the level of notified voltage under regulation 32 and regulation 45 of Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulations, 2022 (as amended), provided those installation are not be covered under section 54 of Electricity Act, 2003.

**3. Duties & Responsibilities of Chartered Electrical Safety Engineer:**

- (i) He / She shall carry out recommended tests as per the relevant Regulation and Standards.
- (ii) He / She shall test electrical installations & keep a record thereof in Form-I/ Form-II/ Form-III as the case may be (as given in Schedule-II) and submit the same along with photographs/ video of the apparatus tested to the respective office of the



Electrical Inspector within seven working days from the date of testing and will produce the same at the time renewal.

- (iii) The Owner shall carry out the recommendations given by the CESE in his report, within the time prescribed in the report. In case the owner fails to rectify the shortcomings as identified by the CESE even after the prescribed period, the CESE shall inform the same to the office of the Electrical Inspector within a period of 15 days from the expiry of the time prescribed in the report of rectification. Such records shall be made available to the office of the Electrical Inspector by the owner/ CESE, as and when required.
- (iv) If, on inspection of installation of the owner or supplier or consumer, as the case may be, the CESE is satisfied that the installation is likely to be dangerous for the use of electricity, he/ she shall bring the same to the notice to the owner and the office of Electrical Inspector within the period of 48 hours from the date of testing. The Electrical Inspector on receipt of such notice should take immediately action as per Regulation 33.

#### **4. Fees and levies of CESE:-**

- (a) Testing of electrical installation in a single premise up to notified voltage under Regulation 45 is Rs. 5000/-.
- (b) Periodic Testing of electrical installation in a single premise up to notified voltage under Regulation 32 is Rs. 3000/-.

Fees to be levied by the CESE from the Utilities shall be received in the modes other than cash.

#### **5. Accessibility of CESE to the Consumers:** The Appropriate Government shall upload the name of the authorized chartered Electrical Safety Engineer, within 15 days, on the web portal of the Government or Department dealing with matters of inspection of electrical installations for the information of the owner, supplier and consumer.

#### **6. Others terms and conditions:**

- (a) It shall be the responsibility of owner of the Installation to maintain & operate the installation in a condition free from danger and as recommended by the manufacturer /CEI/EI/CESE or by the relevant codes of practice of the "Bureau of Indian Standards."
- (b) The authorisation of a Chartered Electrical Safety Engineer shall be liable to be suspended or cancelled by the Electrical Inspector, if he/she is found to be indulging in willful negligence, mal-practice, misuse or any other activities affecting directly and in-directly the safety of electrical installations. However, no such authorisation shall be suspended/ cancelled unless an opportunity of being heard is given to the concerned CESE.
- (c) The authorisation of a Chartered Electrical Safety Engineer shall be initially for the period of three years at the time of registration and the authorisation shall be extended for a period of additional two years at a time by the office of the CEI/EI based on the performances of CESE. However, the authorization will cease automatically on his/her attaining the age of 65 years. There shall be only one time fees of Rs. 10000/- for the registration as CESE.

- (d) In case of any dispute arising between CESE and owner or supplier or consumer on the inspection, the decision of the Electrical Inspector of the respective Government on the same, shall prevail.
- (e) Any electrical installation which have been checked/tested by the CESE could be inspected/ revisited by the CEI/EI in case he/ she is not satisfied with the check/ testing carried out by CESE.
- (f) The testing equipment used by the CESE shall be calibrated at any NABL accredited laboratory at least once in every two years.

## Annexure-I

### Basic testing equipment.

- 01. **Voltmeter:** use to measure the voltage of any equipment/electrical apparatus.
- 02. **Ammeter:** an instrument for measuring electric current in amperes.
- 03. **Multimeter:** A multimeter can measure voltage, current, and resistance.
- 04. **Line Insulation Tester/ Earth Resistance Tester:** an instrument for measuring the resistance of electrical insulation.
- 05. **Line Tester.**
- 06. **Tong-tester:** An electrical meter with integral AC current clamp is known as a clamp meter or clamp-on ammeter or tong tester.
- 07. **Safety Helmet:** It should be available as per indian standard (IS:2925).
- 08. **Safety Belt:** It should be available as per indian standard (IS: 2521).
- 09. **Safety Shoes:** It should be available as per indian standard.
- 10. **Hands Gloves:** It should be available as per indian standard.
- 11. **Others necessary testing kits:** as suggested by the office of the CEI/EI.
- 12 **Leakage current detection equipment.**
- 13 **Loop impedance meter**
- 14 Phase sequence tester
- 15 mili Amperes (mA) leakage detection clamp

**Schedule-XV**

Relevant Indian Standards (IS) for sub-regulation 21(2) issued by Bureau of Indian Standards

1. IS 4770: Rubber Gloves - Electrical Purposes
2. IS 15298: Personal Protective Equipment
3. IS 3521: Industrial Safety Belts and Harnesses Specification
4. IS 2925: Specification for Industrial Safety Helmets
5. IS 13772: Hand Tools for Live Working up to 1000 V AC and 1500 V DC