

# **SOME STUDIES ON REGULATORY ASPECTS OF ELECTRICAL SAFETY WITH PARTICULAR REFERENCE TO INDIAN POWER SYSTEM**

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## **INTRODUCTION**

The purpose of Electricity Act & Regulations are directed at eliminating the human cost to individuals, families and the community of death, injury and destruction that can be caused by electricity. Accordingly, the purpose of this Act also Regulations are to establish a legislative framework for preventing persons from being killed or injured by electricity; and preventing property from being destroyed or damaged by electricity

So, Electrical safety is mainly concerned with equipment safety & human safety in broader sense. Regarding this detail Regulations are prepared by Central Electricity Authority (CEA) as per the Electricity Act, 2003 & amendments thereof. Now the salient points of different clauses of the Act by Parliament & Regulations framed by CEA based on the Act are briefed in the following sections.

## **THE MEANS FOR ACHIEVEMENT OF ELECTRICITY ACT, 2003 ON ELECTRICAL SAFETY ISSUE**

The purpose of this Act is to be achieved in the following ways:-

- i) Imposing duties on persons who may affect the electrical safety of others by their acts or omissions;
- ii) Establishing benchmarks for industry and the community generally through—
  - a) Making regulations, ministerial notices and codes of practice about achieving electrical Safety; and
  - b) Introducing safety management systems for particular electricity entities.
- b) Providing for the safety of all persons through licensing and discipline of persons who Perform electrical work
- iii) Providing for protection for consumers against failures of persons who perform electrical work to properly perform and complete the work;
- iv) Establishing the Electrical Safety Directorate/CEA and its committees to :
  - a) Advise the Minister on electrical safety matters;and
  - b) Allow industry and the community to participate in developing strategies for improving Electrical safety; and
  - a) Participate in developing requirements for the licensing and discipline of persons who Perform electrical work

## **PROTECTIVE CLAUSES OF THE “ELECTRICITY ACT, 2003”**

The relevant clauses are as follows:

- Protection of Railways, Highways, Airports and canals, docks ,wharfs and piers (Clause : 159);
- Protection of telegraphic ,telephonic and electric signaling lines (Clause : 160);
- Notice of accidents and inquiries (Clause : 161);
- Appointment of Chief Electrical Inspector and Electrical Inspector (Clause : 162);
- Power for licensee to enter premises and to remove fittings or other apparatus of licensee (Clause : 163);
- Exercise of powers of Telegraph Authority in certain cases (Clause : 164);

## **SALIENT FEATURES OF “SAFETY REQUIREMENTS FOR CONSTRUCTION, OPERATION & MAINTENANCE OF ELECTRICAL PLANT & ELECTRIC LINES REGULATIONS, 2011” BY CEA:-**

The features are as follows:-

1. Safety provisions relating to Owners (Clause : 4);
2. Preparation of Safety Manual (Clause : 5);
3. Details of recruitment of Safety Officer by Owner, duty of Safety Officer & formation of Safety Committee by Owner (Clause: 6);
4. Safety provisions relating to Contractors (Clause : 7);
5. Reporting of accidents (Clause : 8);
6. Emergency Management Plan (Clause : 9);
7. Medical facilities to be provided by Owner (Clause : 10);
8. Safety training & awareness by Owner (Clause : 11);
9. Minimum contents of Safety Manual for construction of Electrical Plants & Electric Lines (Schedule – I);
10. Minimum contents of Safety Manual for operation & maintenance of Electrical Plants & Electric Lines (Schedule –II);
11. Elements of on-site emergency management plan for Electrical Plants & Electric Lines (Schedule – III);

## **SALIENT FEATURES OF “MEASURES RELATING TO SAFETY & ELECTRIC SUPPLY, 2010” REGULATIONS BY CEA:-**

1. Designating persons to operate & carry out the work on electrical lines & apparatus (Clause: 3)
2. Inspection of designated Officers & other safety measures (Clause: 4);
3. Appointment of Electrical safety Officer by Suppliers (Clause: 5);
4. Safety measures for operation & maintenance of Electrical Plants (Clause: 6);
5. Safety measures for operation & maintenance of Transmission & Distribution systems (Clause : 7);
6. Keeping of Records & Inspection thereof (Clause: 8);
7. deposit of Maps (Clause : 9);
8. Deposit of Printed Copies (Clause : 10);
9. Plan for area of supply to be made & kept open for inspection (Clause : 11);
10. General safety requirements pertaining to construction, operation, protection, installation & maintenance of electric supply lines & apparatus (Clause : 12);
11. Service lines & apparatus on consumer's premises (Clause : 13);

12. Switchgear on consumer's premises (Clause : 14);
13. Identification of earthed & earthed neutral conductors & position of switches & switchgear therein (Clause : 15);
14. Earthed terminal on consumer's premises (Clause : 16);
15. Accessibility of bare conductors (Clause : 17);
16. Danger Notices (Clause : 18);
17. Handling of electric supply lines & apparatus (Clause : 19);
18. Supply to vehicles & cranes (Clause : 20);
19. Cables for portable or transportable apparatus (Clause : 21);
20. Cables protected by bituminous materials (Clause : 22);
21. Street Boxes (Clause : 23);
22. Distinction of different circuits (Clause : 24);
23. Distinction of installations having more than one feed (Clause : 25);
24. Accidental charging (Clause : 26);
25. Provisions applicable to protective equipment (Clause : 27);
26. Display of instructions for resuscitation of persons suffering from electric shock (Clause : 28);
27. Precautions to be adopted by owners, consumers, occupiers, electrical contractors, electrical work men & suppliers (Clause : 29);
28. Periodical inspection & testing of installations (Clause : 30);
29. Testing of consumer's installation (Clause : 31);
30. Installation & testing of Generating Units (Clause : 32);
31. Precaution against leakage before connection (Clause : 33);
32. Leakage on consumer's premises (Clause : 34);
33. Supply & use of electricity (Clause : 35);
34. Provision for supply & use of electricity in multi-storied buildings more than 15 meters in height (Clause : 36);
35. Conditions applicable to installations of voltage exceeding 250 volts (Clause : 37);
36. Appeal to Electrical Inspector in regard to defects (Clause : 38);
37. Precautions against failure of supply & notice against failure (Clause : 39);
38. Test for resistance of insulation not exceeding 650 volts (Clause : 40);
39. Connection with earth not exceeding 650 volts (Clause : 41);
40. Earth leakage protective device for the same voltage level (Clause : 42);
41. Approval by Electrical Inspector exceeding voltage 650 volts (Clause : 43);
42. Use of electricity at voltage exceeding 650volts (Clause : 44);
43. Inter-locks & protection for use of electricity at voltage exceeding 650 volts (Clause : 45);
44. xiv) Testing, operation & maintenance (Clause : 46);
45. Precautions to be taken against excessive leakage in case of metal-sheathed electric supply lines exceeding 650 volts (Clause : 47);
46. Connection with earth for apparatus exceeding 650 volts (Clause : 48);
47. General conditions as to transformation & control of electricity exceeding 650 volts (Clause : 49);
48. Pole type Sub-Stations (Clause : 50);
49. Condensers (Clause : 51);
50. Supply to luminous tube sign installations of voltage exceeding 650 volts but not exceeding 33 KV (Clause : 52);
51. Supply to electrode boilers of voltage exceeding 650 volts but not exceeding 33 KV (Clause : 53);
52. Supply to X-Rays & high frequency installations (Clause : 54);
53. Safety requirements for overhead lines, underground cables & generating stations : Material & strength (Clause : 55);

54. Safety requirements for overhead lines, underground cables & generating stations : Joints (Clause : 56);
55. Safety requirements for overhead lines, underground cables & generating stations : Maximum stresses & factors of safety (Clause : 57);
56. Clearance above ground of the lowest conductor of overhead lines (Clause : 58);
57. Clearance between conductors & Trolley wires (Clause : 59);
58. Clearance from buildings of lines of voltage & service lines not exceeding 650 volts (Clause : 60);
59. Clearance from buildings of lines of voltage exceeding 650 volts (Clause : 61);
60. Conductors at different voltages on same supports (Clause : 62);
61. Erection or alterations of buildings, structures, flood banks & elevation of roads (Clause : 63);
62. Transporting & storing of material near overhead lines (Clause : 64);
63. General clearances (Clause : 65);

### **SALIENT FEATURES OF “MEASURES RELATING TO SAFETY & ELECTRIC SUPPLY, 2015” AMENDMENT REGULATIONS BY CEA**

#### **Before Amendment:**

**Regulation 30(2):-** The periodical inspection and testing of installations of voltage above 650 V belonging to the supplier shall also be carried out at intervals not exceeding five years by the Electrical Inspector.

#### **Existing Arrangement:**

Vide Notification by Govt. of W.B. dated 05.03.2012 the Electrical Inspectors are authorized to do periodical inspection & testing of:

- (a) Electrical installations for voltage exceeding 650 volts, and
- (b) Electrical installations of cinema halls, multistoried buildings with height of more than 15 meter for an electricity service connection for the connected load of 125 KVA & above supplied at voltage exceeding 230 volts.

The inspection & testing for installations other than the above was left to the supplier concerned.

#### **Amended Regulation:**

Regulation 30(2): The periodical inspection and testing of installation of voltage equal to or below the notified voltage belonging to the supplier or consumer, shall be carried out by the supplier or owner or consumer and shall be self-certified.

Regulation 30(3): The periodical inspection and testing of installations of voltage above the notified voltage belonging to the supplier or consumer shall be carried out by the Electrical Inspector;

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

Provided further that every electrical installations of mine, oil fields and railways shall be periodically inspected and tested by the Electrical Inspector of the Appropriate Government.

#### **ii) Before Amendment:**

**Regulation 32: Installation and testing of generating units:-** Capacity above which generating units will be required to be inspected by the Electrical Inspector before commissioning shall be as per the notification to be issued by the Appropriate Government, under clause (x) sub-section (2) of section 176 and sub-section (1) of section 162 of the Act.

#### **Existing Arrangement**

Vide Notification by Govt. of W.B. dated 21.01.2011 the generating units having capacity above 10 KW are required to be inspected by Electrical Inspector before commissioning.

**Amended Regulation:**

Regulation 32 :- **Installation and testing of generating units:-** The Capacity above which generating units including generating units producing electricity from renewable source of energy will be required to be inspected by the Electrical Inspector before commissioning, shall be as per the notification to be issued by the Appropriate Government under sub-section (1) of section 162 of the Act.

iii) **Before Amendment:**

Regulation 43(1):- Voltage above which electrical installations will be required to be inspected by the Electrical Inspector before commencement of supply or recommencement after shutdown for six months and above shall be as per the notification to be issued by the Appropriate Government, under clause (x) of sub-section (2) of section 176 and sub-section (1) of section 162 of the Act.

**Existing Arrangement:**

Vide Notification by Govt. of W.B. (dated 21.01.2011) all electrical installations having voltage above 650 volts are required to be inspected by Electrical Inspector before commencement or recommencement after shutdown for 6 months.

**Amended Regulation:**

Regulation 43(1):- Every electrical installation of notified voltage and below shall be inspected, tested and shall be self-certified by the owner 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 shall submit the report of self-certification in Form-I or Form-II or Form -III, as the case may be, of Schedule -IV to Electrical Inspector.

Regulation 43(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.

iv) **Amended Regulation:**

Regulation 5(1) :- All suppliers of electricity including generating companies, transmission companies and distribution companies shall designate an Electrical safety Officer for ensuring observance of safety measures specified under these regulations in their organization for construction, operation and maintenance of power stations, sub-stations, transmission and distribution lines.

**Existing Arrangement:**

Electrical Safety Officer is yet to be designated by the stated organizations.

v) **Amended Regulation:**

Regulation 5(A):- Chartered Electrical Safety Engineer: The Appropriate Government may authorize Electrical Safety Engineers having the qualification and experience as specified in sub-regulation (2) of regulation 5 to assist the owner or supplier or consumer of electrical installations for the purpose of self-certification under regulation 30 and regulation 43.

**Existing Arrangement:**

Notification is yet to be issued by this Department.

## CONCLUSION

- i) When shortcuts are taken and safe procedures are not followed, loss of life, permanent disfigurement, lost work time, increased workers' compensation costs, and lawsuits can occur.
- ii) The following are samples of the most common electrical safety related hazards that will pose a risk of being shocked and/or electrocuted.
  - Exposed wires and energized parts;
  - Faulty/broken wiring or equipment;
  - Damaged outlets and missing covers;
  - Worn/damaged electrical cords;
  - Improperly used extension cords;
  - Overloaded outlet;
  - No warning signs;
  - Working under wet condition;
  - Lack of or insufficient protective devices;
  - Unrestricted access to live exposed parts;
  - Lack of or insufficient personal protective equipment (PPE);
  - Insufficient clearances around panels;
  - Lack of/improper lockout/tag out procedures;
  - Failure to maintain proper clearance from overhead lines;
  - Failure to follow manufacturer's instruction when using electrically powered equipment.

So, appropriate action to be taken accordingly to tackle these problems on collective basis.

## 5. REFERENCES

- 1) The Electricity Act, 2003
  - 2) Measures relating to safety & electric supply, 2010 Regulations by CEA
  - 3) Safety requirements for construction, operation & maintenance of electrical plants and Electric lines, 2011 Regulations by CEA
  - 4) Measures relating to safety & electric supply, 2015 Amendment Regulations by CEA
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