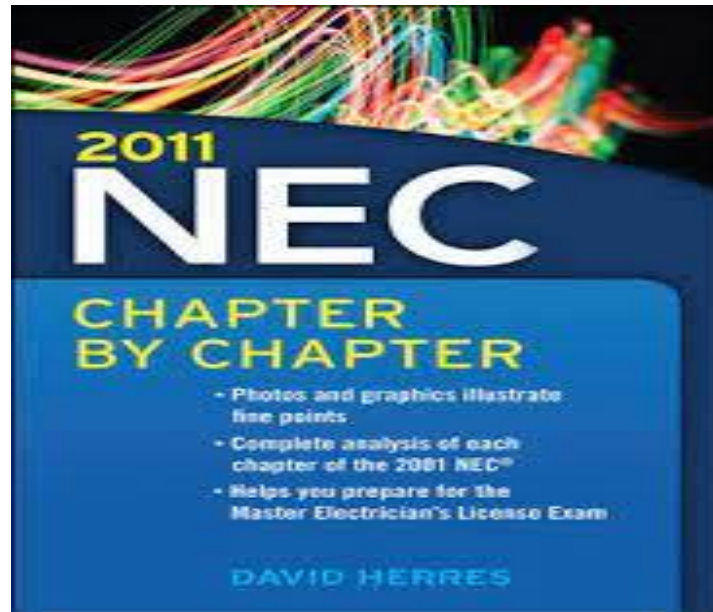


Presentation on
NEC -2011 The National Electrical Code
(SP-30-2011)(First Revision)



भारतीय मानक ब्यूरो

To day's topics

- NEC Code -2011- The salient features
- IS 5216 (Part 1): 1982 Recommendations on Safety Procedures and Practices in Electrical Work: Part 1 General
- IS 5216 (Part 2): 1982 Recommendation on Safety Procedures and Practices in Electrical Work: Part 2 Life Saving Techniques for treatment for electric shock

NEC 2011- The main object of this code

- This code of practice provides guidance on economic selection, installation and maintenance of electrical equipment employed in the electrical energy installation including safety aspects.
- The code is an elaborated version of the IE Rules 1956, IE Act 2003 and relevant standards for the best practices and to provide, unified practices and procedures along with consideration for safety and economic usage of energy in the design, execution, inspection and maintenance of electrical installations of various locations.
- The National Electrical Code is used, nationally and internationally as the basis for safeguarding persons, buildings, and their contents from hazards arising from the use of electricity.

Reference standards for application of this code.

- During the application of this code the following standards are also taken as guide line for each process
- IE Act 2003 General policy decisions
- IE Rule 1956 and CEA Regulations 2010 Safety regulations in Electrical installations
- EC Act 2001 For Energy conservation and Energy sustainability
- Factory rules 1948 Among other points Safety in electrical installations
- IS 15652, IS 3043 , IS 3034 etc.,

**Electrical
Hazards**

**CHEMICAL & DUST
HAZARDS**

(cleaning products,
pesticides, asbestos, etc.)

**Fire
Hazards**

**BIOLOGICAL
HAZARDS**

(mold, insects/pests,
communicable diseases, etc.)

**ERGONOMIC
HAZARDS**

(repetition, lifting, awkward
postures, etc.)

**WORK
ORGANIZATION
HAZARDS**

Things that cause STRESS!

SAFETY HAZARDS

(slips, trips and falls, faulty
equipment, etc.)

PHYSICAL HAZARDS

(noise, temperature
extremes, radiation, etc.)

Different Kinds of Hazards identified in Industries

Types of Accidents

- Hazard identification and risk assessment, Prevention and Control methods have been discussed in IE Rules and CEA Regulations and other statutory standards.
- Most of the Accidents identified are due to
 - 1. Fire
 - 2. Hazardous chemicals, gases and Oils
 - 3. Direct contact with Electricity
 - 4. Fall from heights, confined space
 - 5. Static Energy Generation

Hazards that Associate with Electricity

- Falls from ladder, thrown back fall to the ground on a sharp edge due to Electric shock.
- Accidents due to Electricity Induction.
- Thermal burns – due to fire accidents because of Electrical Accidents.
- Wires or cables – uninsulated portion of wires and cables damaged cables or wires. Associated with unorganized sector
- Heavy explosions in Substations, Transformers, Circuit breakers, CTS and PTs etc.
- Electrical hazards due to lightning,/ conductor snapping/ Pole /Towers breaking and damages due to heavy gales and thunder storms.
- Improper maintenance of Transformers and live parts contact with green plants etc.,
- Oil leakages and spillages in the Transformer yard. Storage of Hazardous oils with in the vicinity of live transformers etc.,
- Conductor snapping on HT/EHT lines.

- Common sources identified on a power systems under IE Rules 1956 are
 1. Lightning from high raised structures
 2. Switching surges
 3. Contact LT lines with a high voltage lines and or may be other system
 4. Line to ground fault
 5. Failure of lightning arrestors

Scope of NEC Code -2011

NEC -2011 The National Electrical Code Covers

- a) Good practices of **safety** and for selection of various electrical equipment forming part of power systems;
- b) Recommendations concerning safety and related matter in electrical installations of buildings or industrial, structures, promoting recommendations
- c) General safety procedures and practices in electrical work;
- d) Additional precautions to be taken for use of electrical equipment under special environmental conditions like explosive and other chemicals Ex: Mining, Pharma and Chemical Industries.

NEC-2011 APPLIES TO:

- | | |
|---|---|
| <ul style="list-style-type: none">• Standby generating plants• Building substations• Domestic dwellings• Office buildings either Govt. and Private.• Shopping and commercial complexes• Educational and other Institutions• Recreation and other public premises• Medical establishments | <ul style="list-style-type: none">• Hotels• Sports buildings• Industrial premises• Temporary and permanent outdoor installations• Agricultural premises• Installations in hazardous areas• Solar Photovoltaic installations• Transmission and Distribution systems |
|---|---|

National Electric Code Applies in general

- It covers the requirements relating **to standby or emergency generating stations and captive substations intended for serving an individual occupancy and intended to serve a building or a group of buildings normally housed in and around it. Ex: Gated communities**
- It gives guidelines on layout and building construction aspects, selection of equipment, transformer installations, switching stations and station auxiliaries.
- Harmonized with corresponding IEC standards, Indian Specification Standards
- Code is intended to be advisory, not mandatory

NEC CODE application at Hazardous areas

- Many liquids, gases, vapours and chemicals an industry generated, processed, handled and stored. The areas comes under Zone 0(More hazardous),Zone1 and Zone 2
- With regard to electrical installations, ignition sources include arcs, sparks or hot surfaces produced either in normal operation or under specified fault conditions.
- **NEC provides guidelines for electrical installations and equipment in locations where a hazardous atmosphere is likely to be present with a view to maximizing electrical safety.**

NEC contains 8 parts with 30 sections.

- ***Part 1 General and Common Aspects in Transmission systems.***
- Part 2 Electrical installations in stand by generating stations and captive substations
- Part 3 Electrical installations in non Electrical installations in non-industrial
- Part 4 Electrical installations in industrial buildings
- Part 5 Outdoor installations
- Part 6 Electrical installations in agricultural premises
- Part 7 Electrical installations in Hazardous area
- Part 8 Solar Photovoltaic (PV) power supply systems

Part 1 General and Common Aspects

- Section 1 Scope of the National Electrical Code
- Section 2 Definitions
- Section 3 Graphical Symbols for Diagrams, Signs
- Section 4 Guide for preparation of diagrams, tables, and marking
- Section 5 units and systems of measurement
- Section 6 Standard Values
- Section 7 Fundamental principles
- Section 8 General Characteristics of buildings
- Section 9 Wiring Installations

- Section 10 Short Circuit Calculations
- Section 11 Electrical aspects of building services
- Section 12 Selection of equipment
- Section 13 Erection and pre commissioning testing of installations.
- Section 14 Earthing
- Section 15 Lightning protection
- Section 16 Protection against voltage surges
- Section 17 Guidelines for power factor improvement
- Section 18 Energy Efficiency aspects
- Section 19 Safety in electrical work
- Section 20 Tables

Part I Section 1 Cl 3.2 This code applies to Electrical installations for *selection of various equipment w.r.t to safety* in the following installations

- a) Standby/emergency generating plants and building substations;
- b) Domestic dwellings; Office buildings, shopping and commercial establishments includes identification of escape routes.
- d) Recreation and other public premises;
- e) Medical establishments; f) Hotels & Restaurants;
- g) Sports buildings; h) Industrial premises;
- j) Temporary and permanent outdoor installations;
- k) Agricultural premises;
- m) Installations of specific equipment in hazardous areas;
- L) Solar photovoltaic installations.

Under Part 1 Section 7 Fundamental Principles

- 3.0.1 The installations should be in conformity with I E Rules
- 3.0.2 Materials : All materials, fittings, equipment and their accessories, appliances, etc, used in an electrical installation shall conform to safety standards.
- 3.2 Distance from Electric Lines No building shall be allowed unless the following minimum clearances are provided from the overhead electric supply lines:

Clearances of the lines from the buildings (Refer IE Rules also)

Voltages	Vertical clearance	Horizontal Clearance	
Low and Medium	2.5 Mtrs	1.2 mtrs	
High Voltage upto 11 KV	3.7 Mtrs	1.2 mtrs	
11 KV -33 KV	3.7 Mtrs	2.0 mtrs	
EHT > 33 KV	3.7 Mtrs	2.0 mtrs	

For extra high voltage lines apart from the minimum clearances indicated, a vertical and horizontal clearance of 0.30 m for every additional kV or part thereof shall be provided.

Under Part 1 Section 7 Fundamental Principle

- 3.3 Lighting and Ventilation: general requirements discussed in Part 1/Section 14.
- 3.6 Location and Space for Electrical control Equipment .
- Need for and location and requirements of building substation.
- b) Load centre ,
- c) Layout,
- d) Room/spaces required for electrical utility,
- e) Location and requirements of switch rooms,
- f) Levels of illumination, and
- g) Ventilation.

Cl:4 Part-1 Section 7 DESIGN OF ELECTRICAL INSTALLATION

- **Cl 4.0.2 The following factors shall therefore be kept in view while designing:**
- a) Characteristics of the available supply or supplies,
- b) Nature of demand,
- c) Emergency supply or supplies,
- d) Environmental conditions,
- e) Cross-section of conductors,
- f) Type of wiring and methods of installations,
- g) Protective equipment,
- h) Emergency control,
- j) Disconnecting devices on emergencies,

Cl 4 Section 7 Part-1

- 4.1 Protection for Safety: Ex: a) Shock currents; and
- b) Excessive temperatures likely to cause burns, fires and other injurious effects.
- 4.2.5 Cross-section of Conductors
- The cross-section of conductors shall be determined according to: maximum temperature, voltage drop, electromechanical stresses likely to occur due to short-circuits
- 4.2.8 Emergency Control
- 4.2.11 Accessibility to Electrical switchgear for ease of operation during emergency

Section 8 ASSESSMENT OF GENERAL CHARACTERISTICS OF BUILDINGS(We are not much concerned about this section)

SECTION 9 WIRING INSTALLATIONS (Part-1)

This Section 9 of the Code covers the essential design and constructional requirements for electrical wiring Installations

4.1 Principles of Good and adequate Lighting

4.1.1 Cable for AC Circuits

4.1.2 Electromechanical Stresses IN PVC wiring, cables

4.1.3 Guidelines on principles of good lighting design can be had from IS 3646 (Part 1). Reference should be made to National Lighting Code, or National Electric code

CI 5 ,Section 9 Part1
MAINS INTAKE AND DISTRIBUTION OF ELECTRICAL ENERGY IN
CONSUMERS' PREMISES

- 5.1 Distribution Board System
- 5.2 Distribution Boards to be designed and selected in such a way to provide plenty of wiring space, adequate size to accommodate the cables including surge protective device and earth leakage protective devices.
- 5.2.6 Circuit Charts, single line diagrams and Labelling on the equipment
- 5.2.4 Location of Distribution Boards
- 5.4 Correct Sizes of Cables, by total load is expected to be connected with 10-15% factor of safety

Section 9 of Part-I

- 5.6 MV/LV Bus bar Chambers (400/230V)
- 5.7 Earthed Neutrals To comply with IE Rules, 1956 and CEA Regulations
- 5.8.14 Identification of Cables and Conductors IS 11353 gives guidance on uniform system of marking and identification of cables and conductors.
- 5.14.2 Emergency Lighting is very critical for at hospitals, theatres, hotels, factories, offices, shops, cinemas and certain specified places of entertainment and practically all types of premises excluding houses.
- 5.14.1 Lighting Adequate lighting is to be provided
- 5.14.3 Fire Alarms and Detection

SECTION 10 SHORT-CIRCUIT CALCULATIONS

- IS No. 13234 : 1992 Guide for short circuit calculation in three phase ac systems
- 13235 : 1991/ Calculation of the effects of short IEC 865 (1986) circuit currents
- This Part 1/Section 10 covers guidelines, short circuit calculations and voltage drop calculations for cables and flexible cords and other equipment. Ex: Transformers, Induction motors etc.,

Short circuit calculations equipment Section 10

- Short circuit calculations of the transformers, Induction motors : Fault calculations are one of the most common types of calculation carried out during the design and analysis of electrical systems.
- These calculations determine the maximum current flowing through circuit elements during abnormal conditions – short circuits and earth faults.
- This will also help us to calculate the size of the earth conductor as per IS 3043(Details can be seen in specification.),Insulation values of windings etc.

Short circuit calculation on 100KVA Transformer for Example

- Transformer rating in kVA., =100 KVA
- Impedance (Z%): Z= 5% impedance.
- The transformer short circuit current is calculated as follows:
 - $I_{\text{fault-actual}} = \frac{\text{T/F Cap}}{\sqrt{3} \times V \times Z\%}$
 - where $I_{\text{fault}} = \frac{100 \text{ KVA}}{1.732 \times 415 \text{ V} \times 5\%} = 2778 \text{ Amps}$
 - Fault current on Secondary side of T/F at Full load condition= 2.778 KA
- As per IS 3043, Cross Section Area of Earthing Conductor
- $(A) = (I_f \times \sqrt{t}) / K$ Where: t = Fault current Time (Second). K = Material Constant. K = 205(copper)
- $A = \frac{2778 \text{ A}}{205} = 13.55 \text{ Sq MM} \times 1.5 \text{ Factor of safety} = 20 \text{ Sqmm} = 6 \times 4 \text{ mm Flat}$ is adequate.

SECTION 11 ELECT ASPECTS OF BUILDING SERVICES

- The buildings include commercial, administrative, high raised buildings
- 4.1.2 Good lighting design shall take into account the following:
 - a) Planning the brightness pattern, visual performance, safety and amenity and surroundings;
 - b) colour rendering index
 - c) Controlling glare, stroboscopic effect and flicker;
 - d) Lighting for movement;
 - e) Provision for emergency lighting in walk ways and common corridors;
 - g) Maintenance factors in lighting installation;

Section 11

- 5.1 Methods of Ventilation
- **6.0 Air conditioning and heating services**
- **7 Electrical aspects of Lifts and escalators**
- **Number of lifts, size, capacity and position;**
- **b) Number of floors served by the lift;**
- **c) Height between floor levels;**
- **d) Provisions for machine room and proper access to it;**
- **e) Provisions for ventilation and emergency lighting; Communication systems in the lift.**
- **9.0 ELECTRICAL ASPECTS OF FIRE ALARM AND FIGHTING SYSTEMS**
- **9.1 Fire and smoke Detectors,**
- **9.2 Wiring for Fire Alarm Systems**
- **9.3 Fire Fighting Equipment and escape routes.**

Part-1 SECTION 12 : SELECTION OF EQUIPMENT

- Section 12 of the Code covers general criteria for selection of equipment.
- NOTE — This Part 1/Section 12 shall be read in conjunction with the Indian Standard/Codes on individual equipment
- 2.4 Prevention of Harmful Effects
- All electrical equipment shall be selected so that it will not cause harmful effects on, during normal service including switching operations. the other factors which may have an influence on selection of equipment include;
 - a) Power factor,
 - b) Inrush current,
 - c) Asymmetrical load, and
 - d) Harmonics in the supply system.
 - e) Maximum fault current that it can with stand

Part-1 Section 13

- Cl 4 / Section 13 INSPECTION AND TESTING
- 4.1.1 Inspection and testing shall be carried out to put in service with the I E Rules, 1956 for the completed installations or addition and alteration takes place or any installation is not in use for more than 6 months, the pre commissioning test is to be conducted before the restart.
- 4.1.2 After putting the installation into service periodic inspection and testing shall be carried out.
- At the completion of wiring, a general inspection shall be carried out by competent personnel to verify that the provisions of this Code and that of I E Rules, 1956 have been complied with
- Ex: Motors, Transformers, cables including IR Values, breakers etc.

Cl 4.3.7 / Sec 13 Part-1 Earthing

- For checking the efficiency of earthing the following tests are recommended (see IS 3043):
 - a) The earth resistance of each electrode is measured.
 - b) The earth resistance of earthing grid is measured.
 - c) All electrodes are connected to the grid and the earth resistance of the entire earthing system is measured.
- These tests shall preferably be done during the summer months

SECTION 14 EARTHING (This subject will be discussed in another session in detail.

- This Part 1/Section 14 of the Code covers general requirements associated with earthing in electrical installations.
- Specific requirements for earthing in individual installations are covered in respective Parts of the Code.
- NOTES
- 1 This Section shall be read in conjunction with the provisions of IS 3043-1987.

What does the Earthing means

- “Earthing” means the provision of a safe path of electrical current to ground, in order to protect structures, plant and equipment ,and safety of human beings from the effects of stray electrical current, and electrostatics discharge;
- Also by providing such an earth surface of uniform potential under and surrounding the station, there can exist no difference of potential in a short distance big enough to shock or injure an attendant when short-circuits or other abnormal occurrences take place.

Processes and Equipment to be earthed.

- Power stations, substations and overhead lines;
- Industrial premises;
- Standby and other private generating plant;
- Medical establishments;
- Static and lightning protection grounding;
- Data processing installations.
- Earth fault protection in consumer's premises
- Earthing of equipment at generating stations
- Earthing of transmission lines, distribution lines etc., high mast lighting, communication towers
- Earthing of Substations and Equipment
- Earthing of industrial consumers' main panels distribution panels, transformers, motors and other equipment which are electrically connected.

Types of Earthing

- ***System Earthing*** : The neutral point in all electrical installations of the system is to be earthed.

Neutrals of Transformers, induction motors, the circuits in distribution panels, instrument transformers both circuitry of HT and LT energy meters for system stability ,cables neutral systems earthing.

- ***Equipment Earthing*** . Body of electrical equipment should be earthed.

Equipment such as motors transformers, panels, energy meters, computers, high frequency equipment like x-ray units, all domestic appliances , industrial appliances etc., should be properly earthed.

System earthing IS 3043 -1987

Pipe earthing

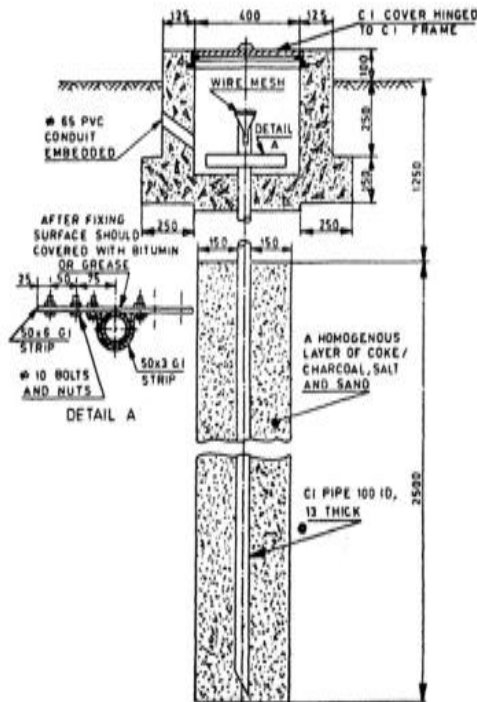


Plate Earthing

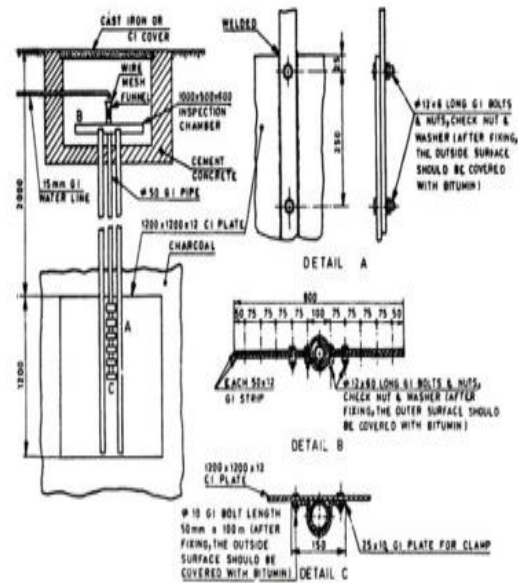
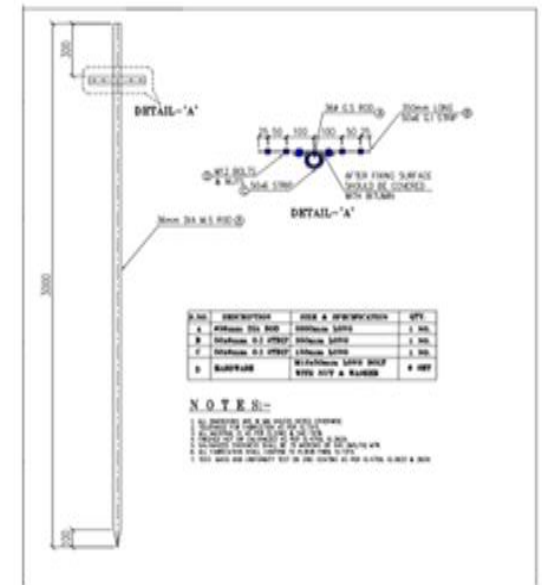


FIG. 15 TYPICAL ARRANGEMENT OF PLATE ELECTRODE

Rod Earthing



S. No.	DESCRIPTION	SIZE & INFORMATION	QTY
1	Cast Iron or GI Cover	1000x1000x100	1 No.
2	Wire Mesh	1000x1000	1 No.
3	Cast Iron or GI Plate	1200x1200x13	1 No.
4	Charcoal	1000x1000	1 No.
5	10 Bolts and Nuts	M10	10 Nos.
6	50x3 GI Strip	50x3	10 Nos.

NOTES:-

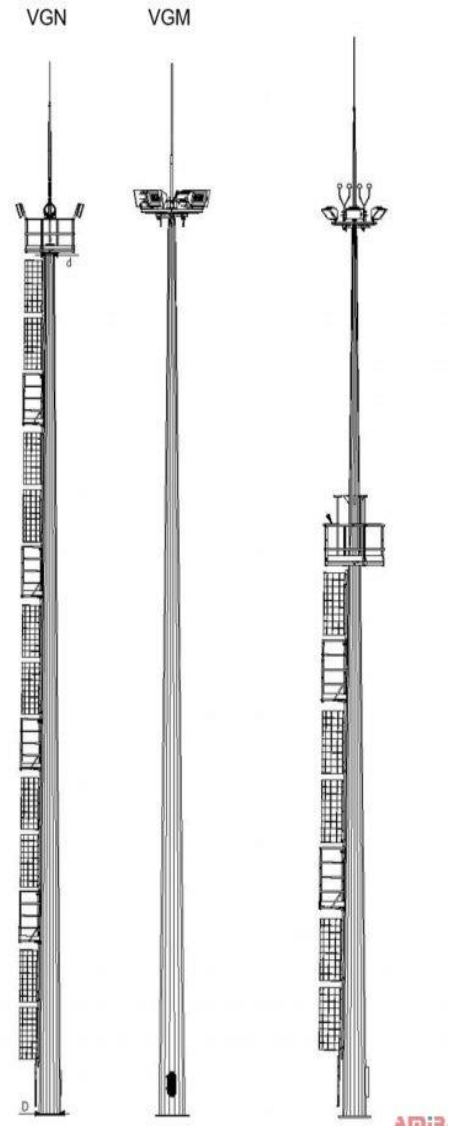
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. THE COVER SHALL BE CAST IRON OR GI.
3. THE WIRE MESH SHALL BE OF 100x100 SIZE.
4. THE CAST IRON OR GI PLATE SHALL BE OF 1200x1200 SIZE.
5. THE CHARCOAL SHALL BE OF 1000x1000 SIZE.

SECTION 15/Part I LIGHTNING PROTECTION

- IS 2309 : 1989 'Code of practice for the protection of buildings and allied structures against lightning (second revision)' for this Section. IS 15086 : Part 5/Surge arrestors

ZONE OF PROTECTION Ref Cl
8.2 of IS 2309

The zone of protection of a lightning conductor denotes the space within which a lightning conductor provides protection against a direct lightning stroke.



Shapes and Minimum Sizes of Conductors for Use Above Ground for the purpose of Earthing

- **Material and Shape Minimum Size**
- i) Round copper wire or copper-clad steel wire
6 mm diameter
- ii) Stranded copper wire 50 mm² (7/3.00 mm
diameter)
- iii) Copper strip 20 mm × 3 mm
- iv) Round GI wire 8 mm diameter
- v) GI strip 20 mm × 3 mm
- vi) Round Al wire 9 mm diameter
- vii) Aluminium strip 25 mm × 3.15 mm

Section 15 Lightning arrestors

- 9.3 Joints and Bonds in the lightning conductor
- 9.3.1 Joints are not allowed in between.
- 9.4 Testing Points
- Each down conductor shall be provided with a testing point in a position convenient for testing normally at height of 1.5 mt from ground level.
- 9.8 Earth Resistance, soil resistance
- 9.6 Earth Electrodes
- 12.1 Inspection
- All lightning protective systems shall be examined by a competent engineer
- A routine inspection shall be made at least once a year for healthiness of Lightning arrestors.



SECTION 16 PROTECTION AGAINST **VOLTAGE SURGES**

- Voltage surges is a sudden change in the operating conditions in an electrical network causes transient phenomena to occur. Transients may be generated may be by lightning and even normal utility switching operations.
- Inside the home or business, transients are generated by motors starting and stopping, fluorescent lighting, copiers, vending machines, welding operations, and many other sources
- Section has been derived from IEC 61643-12-2008 ‘Low-voltage surge protective devices — Part 12:
- Surge protective devices connected to low-voltage power distribution systems — Selection and application principles’..
- Lightning is a high frequency electrical phenomenon which produces voltage surges on all conductive elements, and especially on electrical loads and wires.

4.1 Voltage Surges Section 16-Part 1

- A voltage surge disturbs equipment and causes electromagnetic radiation in the electrical circuits which is likely to destroy the equipment.
- There are four types of voltage surges which may disturb electrical installations and loads:
 - a) Atmospheric voltage surges,
 - b) Operating voltage surges,
 - c) Transient overvoltage at industrial frequency,
 - d) Voltage surges caused by electrostatic discharge
 - E) Sudden load throw in the system.

CI 4.3/Section 16 Basic Functions of Surge Protection Devices (SPDs)

- During the occurrence of surges: the SPD responds to surges and diverting surge current through it, to limit the voltage to its protective level.
- After the occurrence of surges: the SPD recovers to a high-impedance state after the surges and extinguishes any possible power follow current.



- 4.1.1 Atmospheric Voltage Surges
- Atmospheric voltage surges, that is, lightning, comes from the discharge of electrical charges accumulated in the clouds.
- 4.1.2 Operating Voltage Surges The opening of protection devices (fuse, circuit breaker), and the opening or closing of control devices (relays, contactors, etc).



Location at which the surge protector is installed

SECTION 17 GUIDELINES FOR POWER-FACTOR IMPROVEMENT

- Assistance has been derived from IS 7752 (Part 1) : 1975 'Guide for the improvement of power factor in consumer installations: Part 1 Low and medium supply voltages'.
- POWER FACTOR
- 4.1 The majority of ac electrical machines and equipment draw from the supply an apparent power (kVA) which exceeds the required useful power (kW).
- This is due to the reactive power (kVAR) necessary for alternating magnetic field. The ratio of useful power (kW) to apparent power (kVA) is termed the power factor of the load. The reactive power is indispensable and constitutes an additional demand on the system.

Sec 17 /Part-1 Cl 4.3 Principle Causes of Lower Power Factor

- 4.3 Principle Causes of Lower Power Factor
- 4.3.1 The following electrical equipment and apparatus have a lower factor:
 - a) Induction motors of all types particularly when they are under loaded,
 - b) Power transformers and voltage regulators,
 - c) Arc welders,
 - d) Induction furnaces and heating coils,
 - e) Choke coils and magnetic systems, and
 - f) Fluorescent and discharge lamps, neon signs, etc.

- 4.3.2 The principal cause of a low power factor is due to the reactive power flowing in the circuit. The reactive power depends on the inductance and capacitance of the apparatus normally at no load conditions of inductive equipment.
- **4.4 *Effect of Power Factor to Consumer***
- 4.4.1 The disadvantages of low power factor are as follows:
 - a) Overloading of cables and transformer,
 - b) Decreased line voltage at point of application,
 - c) Inefficient operation of plant, and
 - d) Penal power rates by increased power demand.

Section 17 Part 1 Power Factor

4.4.2 The advantages of high power factor are as follows:

- a) Reduction in the current;
- b) Reduction in power cost;
- c) Reduced losses in the transformers and cables,
- d) Lower loading of transformers, switchgears, cables,
- e) Reduction in Maximum demand.
- f) Improvement in voltage conditions and apparatus performance; and Ex : Agriculture motors.
- g) Reduction in voltage dips caused by welding and similar equipment.

- 5.3 Capacitors for power factor improvement may be arranged as described in IS 7752 (Part 1).

The successful operation of power factor improvement depends very largely on the positioning of the capacitor on the system. Ideal conditions are achieved when the highest power factor is maintained under all load conditions.

The location of capacitors normally at load points or at the generation point of RKVA.

SECTION 18 ENERGY EFFICIENCY ASPECTS

- Energy conservation aims at eliminating the waste of energy and minimization of losses. The Energy Conservation Act, 2001, has been constituted by GOI to identify the Energy losses in equipment and recommend the ways to plug the losses and to increase the system efficiency.
- This Section provides guidance to the consumers of electrical energy, with regard to the selection of equipment from energy conservation point of view and on energy audits.

Why Energy audit is required

- It is due to increase in Power tariffs every year and Electricity bills.
- Increased demand in power sector as well as the consumer.
- Increased wastage in power due to innocence and ignorance.
- Increase in pollution and improper control methods for pollution levels
- Reduction in fossil fuels across the world and non availability for future generation
- 5.1 'Energy Audit' means the verification, monitoring and analysis of the use of energy including submission of a technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption.

Energy efficiency can be increased in the following equipment

- Induction motors
- Power and Distribution Transformer
- Cables
- Sub station equipment
- Lighting
- Boilers
- Air compressors
- Induction Furnaces
- Internal and external Lighting .
- Pumps and pump motors
- Domestic and agricultural motos

Section 18 –Part 1

- 5 ENERGY AUDIT- Energy Managers-Energy Auditors-Process of energy audit- Calculations of pay back period-report preparation –Discussions with top management –Implementation of recommendation made by Energy auditor.
- 5.4 Energy Conservation Building Code formulated by the Bureau of Energy Efficiency and prescribed by the Central Government shall be implemented for new buildings having connected load of 500 kW and above or contract demand of 600 kVA and above, once the same or modified version has been notified by the respective State Governments. List of energy intensive industries and other establishments specified as designated consumers is given in the Energy Conservation Act, 2001

SECTION 19 SAFETY IN ELECTRICAL WORK

- This Part 1/Section 19 of the Code covers guidelines on safety procedures and practices in electrical work
- IS 2551 : 1982 Specification for danger notice boards.
- IS 5216 (Part 1) : Recommendations on safety 1982 procedures and practices in electrical work: Part 1 General
- IS 5216 (Part 2) : Recommendations on safety 1982 procedures and practices in electrical work:
- Part 2 Life saving techniques 8923 : 1978 Warning symbol for dangerous voltages
- SP 31 : 1986 Method of Treatment of Electric shock
- IE Rules 1956
- CEA Safety regulations 2010
- Electrical safety clauses in Factory rules of concerned states.

SECTION 19 SAFETY IN ELECTRICAL WORK

- 3 PERMIT-TO-WORK SYSTEM- Process and procedures – importance of Work permit system – Impart training how to maintain the work permit systems for all process heads.
- Standard operating procedures-preparation and communication-Training for the relevant personnel
- Covers safety procedures and practices in electrical work. Standard operating procedures, JSA,HIRA, Correction and corrective actions-Proactive methods
- Competency of personnel-Identification of competent personnel.
- Documentation and safety manuals.

- 5 SAFETY PRACTICES: Top management commitment, frequent training and awareness programmes for all personnel including contract employees and maintain records to that effect.
- 6 SAFETY POSTERS
- 6.1 The owner of every medium, high and extra high voltage installation is required to fix permanently, in a conspicuous position a danger notice in Hindi or English and the local language of the district on every motor, generator, transformer, all supports or high and extra high voltage etc. The danger notice plate shall conform to IS 2551
- 7 ACCIDENTS AND TREATMENT FOR ELECTRIC SHOCK See SP 31 and IS 5216 (Part 2).

- Main features of Part-I is completed
- PART 2 of this code

ELECTRICAL INSTALLATIONS IN STAND-BY GENERATING STATIONS AND CAPTIVE SUBSTATIONS

- Part 3 of this code.

PART 3 ELECTRICAL INSTALLATIONS IN NON-INDUSTRIAL BUILDINGS

- PART 4 ELECTRICAL INSTALLATIONS IN INDUSTRIAL BUILDINGS

PART 5 OUTDOOR INSTALLATIONS Page 303

End of the Session .
Any Questions please ?

