Indian Standards
On
Fire and Electrical Safety

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BIS, Bhubaneswar
Safety, Health and Environment at Work Place

- Constitution of India provide detailed provisions for the rights of the citizens
- safety and health risks at workplaces and to provide measures so as to ensure safe and healthy working conditions for every working man and woman in the nation
Fire Safety

- On an average 300 deaths per year
- Huge property losses
- About 69% fires are caused by electricity
- More prevalent in high rise building
BIS Committee- CED 22

Fire Fighting Sectional Committee, CED 22 of BIS is engaged in formulation of Indian Standards on Fire Fighting equipments/extinguishers using water, carbon dioxide, foam, dry powder and halon as extinguishing agents, detectors, sprinklers, hoses, water fittings, hydrants, water supplies etc.
Approach towards Fire and Life safety

- FIRE PREVENTION
- LIFE SAFETY
- FIRE PROTECTION
1) **Fire Prevention** — Covering aspects of fire prevention pertaining to planning, design and construction of buildings on passive fire protection measures, also describing the various types of building materials and their fire rating.

2) **Life Safety** — Covering life safety provisions in the event of fire and similar emergencies, also addressing construction and occupancy features that are necessary to minimize danger to life from fire, smoke, fumes or panic.

3) **Fire Protection** — covering the significant appurtenances and their related components and guidelines for selecting the correct type of equipment and installation meant for fire protection of the building, depending upon the classification and type of the building.
FIRE PREVENTION

- IS 1641 `Code of Practice for Fire Safety of Buildings (General): General Principles of Fire Grading and Classification’
- IS 1642 ‘Fire Safety of Buildings (General): Details of Construction – Code of Practice’
- IS 1643 ‘Fire Safety of Buildings (General): Exposure Hazard - Code of Practice’
LIFE SAFETY

- IS 1644 ‘Fire Safety of Buildings (General) : Exit Requirements and Personal Hazard - Code of Practice’
- IS 2189 ‘Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of Practice’
FIRE PROTECTION

- IS 2190 Selection, Installation and Maintenance of First-Aid Fire Extinguishers – Code of Practice’
- IS 949 ‘Functional Requirements for Emergency (Rescue) Tender’
- IS 950 ‘Functional Requirements for Water Tender, Type B for Fire Brigade use’
FIRE PROTECTION (contd…)

- IS 15105 ‘Design and Installation of Fixed Automatic Sprinkler Fire Extinguishing Systems - Code of Practice’
- IS 15493 ‘Gaseous Fire Extinguishing Systems : Part 1 General Requirements’
HIGH RISE BUILDING

- Building above 15m Height (N.B.C.)
- A High-rise Building is one in which Emergency Evacuation is not practical and in which fires must be fought internally because of height.
PROBLEMS IN HIGHRISE BUILDINGS

- 3-D spreading of fire
- Violation of fire safety norms
- Delayed access to seat of fire
- Total Evacuation
- Limitation of the fire fighting equipment
- Limitations posed by the fire fighters
- People’s behavior
NATIONAL BUILDING CODE OF INDIA 2016
Applicability of the code

To Service as model for adoption by

- Public works department, other government construction departments and other construction agencies.

- To be adopted by State Government / local bodies
National Building Code (NBC)

- Birth of NBC 1970
- First Revision of NBC 1983 (after 13 years)
- Second Revision of NBC-IV 1997 (after 14 years)
- 3rd Revision of NBC 2005 (after 22 years)
- 4th Revision of NBC 2016
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Classification of Building in NBC 2016

- Group A Residential
- Group B Educational
- Group C Institutional
- Group D Assembly
- Group E Business
- Group F Mercantile
- Group G Industrial
- Group H Storage
- Group J Hazardous
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<td>Lodging or rooming houses (A-1)</td>
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<td>One or two family dwelling (A-2)</td>
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<td>Dormitories (A-3)</td>
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<td>Apartment houses (flats) (A-4)</td>
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<td>Hotels (A-5) &amp; Starred hotels (A-6)</td>
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<td>Group B</td>
<td>Educational</td>
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<td>Schools up to senior secondary level (B-1)</td>
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<td>Others/training institutions (B-2)</td>
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<td>Group C</td>
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<td>Custodial institutions (C-2)</td>
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<td>Assembly</td>
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<td>D-1 to D-6</td>
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<td>D-7 Underground and elevated MRTS</td>
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<td>Group E</td>
<td>Business</td>
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<td>E-1 to E-5 (offices, banks, labs, computer, telephone exchanges, broadcasting stations)</td>
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<td>Group F</td>
<td>Mercantile</td>
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<td>F-1 to F-3 (shops, departmental stores, markets &amp; underground shopping centres)</td>
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<td>Group G</td>
<td>Industrial</td>
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<td>Low hazard (G-1)</td>
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<td>Moderate hazard (G-2)</td>
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<td>Group H</td>
<td>Storage</td>
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<td>Group J</td>
<td>Hazardous</td>
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</table>
LIFE SAFETY

- Exit requirements
- Occupant load
- Egress components
- Exit capacities and arrangement
- No. of exits
- Max. travel distance
- Doorways, corridors & passageways
- Staircases - pressurization
- Ramps
- Compartmentation
- Smoke control
- Illumination/escape lighting
- Fire detection & alarm system
- Fire fighting shaft
FIRE PROTECTION

- Fire Fighting Installation
  - Fire extinguisher
  - First aid hose reel
  - Wet riser
  - Down comers
  - Yard hydrant
  - Automatic sprinkler system
  - Manually operated electric fire alarm system
  - Automatic detection and alarm system
  - Underground static water storage tank
  - Terrace tank over respective tower terrace
  - Pump near underground tank
  - Pump at terrace tank level
  - Dry riser (for hilly areas or industrial areas)

- Fire protection requirements for high rise buildings
- Fire drill & evacuation procedures
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<th>IS No.</th>
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<td>IS 15883</td>
<td>Construction Project Management- Guidelines:</td>
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<td>Part 6 Scope Management</td>
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<td>Part 8 Risk Management</td>
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<td>Part 9:2018</td>
<td>Part 9 Communication Management</td>
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<td>Part 10 Human Resource Management</td>
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<td>Part 12:2016</td>
<td>Part 12 Integration Management</td>
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<tr>
<td>IS 16416:2016</td>
<td>Guidelines for Construction Project Formulation and Appraisal</td>
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<tr>
<td>IS 16601:2016</td>
<td>Guidelines for Habitat and Welfare Requirements for Construction Workers</td>
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Electrical Accidents-Statistics

- 25% of all fires occur due to electricity
- About 25 deaths per day due to electrocution
  NCRB, (India) (2011)
- 42% of total fires occur due to electrical sources
- 8% deaths that occur in Indian factories are due to electricity
Electrical Safety
Cardiac arrest and respiratory failure
Electric Shock

- Received when current passes through the body
- Severity of the shock depends on:
  - Path of current through the body
  - Amount of current flowing through the body
  - Length of time the body is in the circuit

- LOW VOLTAGE DOES NOT MEAN LOW HAZARD
Electrical Hazards

- A dangerous condition such that contact or equipment failure can result in:
  - Electric Shock
  - Arc flash burn
  - Thermal burn
  - Arc blast
NATIONAL ELECTRICAL CODE (NEC) - 2011
NEC -2011
The National Electrical Code Covers

a) Standard good practices for selection of various items of electrical equipment forming part of power systems;

b) Recommendations concerning safety and related matter in the wiring of electrical installations of buildings or industrial structures, promoting compatibility between such recommendations and those concerning the equipment installed.
Scope of NEC (Contd.)
The NEC also Covers

c) General safety procedures and practices in electrical work; and

d) Additional precautions to be taken for use of electrical equipment for special environmental conditions like explosive and active atmosphere
NEC APPLIES TO:

- Standby generating plants
- Building substations
- Domestic dwellings
- Office buildings
- Shopping and commercial centres
- Institutions
- Recreation and other public premises
- Medical establishments
NEC APPLIES TO:

- Hotels
- Sports buildings
- Industrial premises
- Temporary and permanent outdoor installations
- Agricultural premises
- Installations in hazardous areas
- Solar Photovoltaic installations
NEC DOES NOT APPLY TO:

- Traction, motor vehicles, installations in rolling-stock, on board-ships, aircraft or installations in underground mines
- Systems of distribution of energy to public
- Power generation and transmission for such systems
- Guidelines on the payment for electrical work done in installations
National Electrical Code

(Contents)

NEC contains
8 Parts and
30 Sections
NEC CONTENTS

- **Part 1** General and Common Aspects
- **Part 2** Electrical installations in stand by generating stations and captive substations
- **Part 3** Electrical installations in non-industrial buildings
- **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  Assessment of General Characteristics of buildings
Section 9  Wiring Installations
Section 10 Short Circuit Calculations
Part 1 General and Common Aspects

Section 11 Electrical aspects of building services
Section 12 Selection of equipment
Section 13 Erection and precommissioning 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
Section 14 Earthing

- Earthing provides safety of persons and apparatus against earth faults
- Covers design consideration
- Assistance derived from IS 3043, and updated
- Aspects related to cascading, discrimination and limitation added
Section 15 Lightning protection

- Electrical aspects of lightning protection of buildings and effects of lightning on the electrical installations covered
- Lightning protection aspects from structural safety point of view not covered
- Lighting protection is a major area of concern
- Assistance has been derived from IS 2309 and updated
- Lightning protection of hazardous location covered under Part 7.
Part 1

Section 19 Safety in electrical work

- Safety is of paramount importance at all time in the installation, operation and maintenance.
- Covers safety procedures and practices in electrical work.
- Permit to work system, Safety practices, Safety Posters
- Safety Instruction - working on mains and apparatus
- Refers to:
NATIONAL ELECTRICAL CODE

- Contains guidelines which can be adopted immediately
- Harmonized with corresponding IEC standards
- Gives reference to related Indian standards
- Code is intended to be advisory
- Code is not mandatory
- Should be adopted in interest of safety and economy
- Keep our electrical installation practices at par with the best national and international practices
NATIONAL ELECTRICAL CODE

SP 30 : 2011 NATIONAL ELECTRICAL CODE

Available at BIS Sales offices
Available for online sale at BIS sales portal www.standardsbis.in
Safety of Household and Similar Electrical Appliances

- IS 302 (Part-1) : General Requirement
  - Rated Voltage up to 250 V (single phase)
  - Rated Voltage up to 415 V (3 phase)

- IS 302 (Part-2) : Specific Requirements
  - IS 302 (part-2, Section 3) – Electric Iron
Indian Standard

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

PART 1 GENERAL REQUIREMENTS

(Sixth Revision)
IS 302 (Part-1) : General Requirement

- Type of Insulation and construction
- Extra voltage protection
- Thermostat and cut-out
- Classification of equipment
- Marking and construction
- Leakage current at operating temperature
- Moisture resistance
  - IPX 1 to IPX 7
- Stability and mechanical hazard
Indian Standard

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

PART 2 PARTICULAR REQUIREMENTS

Section 3 Electric Iron

(First Revision)
Safety of Households and similar electrical appliances – Part 2, Section 3 – Electric Iron

- Protection against access to live parts
- Transient over voltage
- Moisture resistance
- Provision for earthling, etc.
(Clause 101.1)

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Industry Specific Standards on Fire safety

- IS 13694:1993 – Fire Safety in Iron and Steel Industries
  - Blast Furnace
  - Steel Melting Shop
  - Coke Oven
  - Re-heating furnace
  - Hot Mill (rolling mill)
  - Fire detection and alarm system
  - Fire extinguishing system
WAREHOUSING INCLUDING COLD STORAGES
IS 3594 : 1991

- CODE OF PRACTICE FOR FIRE
  SAFETY OF INDUSTRIAL BUILDINGS:
  GENERAL STORAGE AND
  WAREHOUSING INCLUDING COLD
  STORAGES
Other standards on safety

- IS 9457 : 1980 - Safety colours and safety signs
- IS 11972 : 1987 - Code of practice for safety precautions to be taken when entering a sewerage system.
- IS/ISO/IEC : GUIDE 51 - Guidelines for the inclusion of safety aspects in Standards
Other standards on safety

- IS 5424 : 1969 - Specification for rubber mats for electrical purpose
- IS 6305 : 1980 Part 1 & 2 - Safety code for powered industrial trucks
- IS 4130 : 1991- Safety code for demolition of buildings
## Standards on PPE (Body)

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<td>Industrial safety belts and harnesses – Specification</td>
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<td>IS 4501 : 1981</td>
<td>Specification for aprons, rubberized, acid and alkali resistant</td>
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<td>IS 6153 : 1971</td>
<td>Specification for protective leather clothing</td>
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<td>IS 7352 : 1974</td>
<td>Specification for X-ray lead rubber protective aprons</td>
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<td>IS 8519 : 1977</td>
<td>Guide for selection of industrial safety equipment for body protection</td>
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<td>IS 8990 : 1978</td>
<td>Code of practice for maintenance and care of industrial safety clothing</td>
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Standards on PPE (Ears)

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<td>IS 6229 : 1980</td>
<td>Method for measurement of real ear protection of hearing protectors and physical attenuation of ear muffs</td>
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<td>IS 8520 : 1977</td>
<td>Guide for selection of industrial safety equipment for eye, face and ear protection</td>
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<td>Specification for ear protectors</td>
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<td>Equipment for eye and face protection during welding</td>
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<td>IS 5983 : 1980</td>
<td>Eye protectors</td>
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<td>IS 7524 : 1980 Part 1</td>
<td>Method of test for eye protectors:- Non - optical tests</td>
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<td>IS 8521 : 1977 Part 1</td>
<td>Industrial safety face shields – with plastic visor</td>
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<td>IS 8521 : 1994 Part 2</td>
<td>Industrial safety face shields – with wire mesh visor</td>
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<td>Code of practice for maintenance and care of industrial safety equipment for eyes and face protection</td>
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<td>Specification for visor for scooter helmets</td>
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<td>IS 9995 : 1981</td>
<td>Specification for visor for non-metal police and firemen’s helmets</td>
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<td>IS 14352 : 1996</td>
<td>Miners safety goggles – Specification</td>
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<td>IS 2925 : 1984</td>
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<td>IS 4151 : 1993</td>
<td>Specification for protective helmets for scooter and motor cycle riders</td>
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Thank You