

विद्युत सुरक्षा और राष्ट्रीय विद्युत संहिता, 2011

-एक नजर में

**ELECTRICAL SAFETY AND NATIONAL
ELECTRICAL CODE 2011**

- AT A GLANCE



BUREAU OF INDIAN STANDARDS

Electricity is inseparable part of our life but it is also life taking factor if not handled properly. Anyone can be exposed to electrical hazards at home or work. Electricity not only utilized in every industry it is also a major industry. Precaution, awareness, rules and regulations can make the proper path to flow the current in safe and usable manner.

ELECTRICAL HAZARD

Electrical hazard is potential to cause harm due to exposure of situation when a person come in contact with energized part of apparatus or conductor and feel the shock, encountered with injuries, burn etc.

Three factors determine the resistance of a substance to the flow of electricity:

- What it is made of.
- Its size.
- Its temperature.
- ❖ Substances with very little resistance to the flow of electrical current are called *conductors*. Examples are metals.
- ❖ Substances with such a high resistance that they can be used to prevent the flow of electrical current are called *insulators*. Examples are glass, porcelain, plastic, and dry wood.
- ❖ Pure water is a poor conductor of electricity, but small amounts of impurities, such as salt and acid (perspiration contains both), make it a ready conductor. Therefore, although dry wood is a poor conductor, when saturated with water it becomes a ready conductor.
- ❖ The same is true of human skin. When skin is dry, it is a poor conductor of electrical current. When it is moist, it readily conducts electricity. Use *extreme caution* when working with electricity where there is water in the environment or on the skin.

HOW ELECTRICAL CURRENT AFFECTS THE HUMAN

Factors affect the severity of the shock a person receives when he or she is a part of an electrical circuit:




- Amount of current flowing through the body (measured in amperes).
- Path of the current through the body.
- Length of time the body is in the circuit.
- The voltage of the current.
- The presence of moisture in the environment.
- The phase of the heart cycle when the shock occurs.



HOW SHOCKS OCCUR



Electric shock occurs in one of three ways. Individuals, while in contact with the ground, must come in contact with:

		
Both wires of an energized circuit.	One wire of an energized circuit and the ground.	A metallic part in contact with an energized wire while the person is also in contact with the ground.



How different levels of exposure to electricity can affect people



Current level (in milliamperes)	Probable effect on human body
0.5 mA	Perception level. Slight tingling sensation. Still dangerous under certain conditions.
5 mA	Slight shock felt; not painful but disturbing. Average individual can let go. However, strong involuntary reactions to shocks in this range may lead to injuries.
6-30 mA	Painful shock, muscular control is lost. This is called the freezing current or "letgo" range.
50-150 mA	Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go. Death is possible.
1000-4300 mA	Ventricular fibrillation (the rhythmic pumping action of the heart ceases.) Muscular contraction and nerve damage occur. Death is most likely.
10,000 mA	Cardiac arrest, severe burns and probable death.



NATIONAL ELECTRICAL CODE 2011

SP 30 : 2011

(First Revision)

THEME OF THE CODE

India is on the path of development and its infrastructure sector has grown progressively. The buildings and services so constructed depend on power for their construction and effective utilization. In fact, power is one of the prime movers of development and electrical energy is the predominant form of energy being used due to ease of generation/conversion, transmission, and final utilization.

Specific regulations, to be adhered to in the supply and use of electrical energy, had been laid down by the *Indian Electricity Act* and the *Indian Electricity Rules* framed thereunder. The agencies involved have varied practices in view of their diverse interests and different accessibility levels to technological developments. In order to unify these practices, India's National Electrical Code provides a compendium of several well established codes of practice which provided assistance on economic selection, installation and maintenance of electrical equipment employed in the usage of electrical energy. The code complemented and elaborated on the *Indian Electricity Rules* for the ease of application by the system engineers by recommending the best practices for electrical installations in a consolidated form..

The National Electrical Code is intended to be advisory. It contains guidelines, which can be immediately adopted for use by the various interests concerned. Its provisions are presently not mandatory but are expected to serve as a model for adoption in the interest of safety and economy and with the intent to keep our electrical installation practices at par with the best practices in the world.

What does National Electrical Code 2011 cover?

The National Electrical Code covers the following:

- 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.
- 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.

The National Electrical Code applies to electrical installations such as those in:

- a) Standby/emergency generating plants and building substations;
- b) Domestic dwellings;
- c) Office buildings, shopping and commercial centres and institutions;
- d) Recreation and other public premises;
- e) Medical establishments;
- f) Hotels;
- g) Sports buildings;
- h) Industrial premises;
- i) Temporary and permanent outdoor installations;
- j) Agricultural premises; and
- k) Installations in hazardous areas.
- l) Solar Photovoltaic installations

The Code applies to circuits other than the internal wiring of apparatus.

The Code does not apply to traction, motor vehicles, installations in rolling-stock, on board-ships, aircraft or installations in underground mines.

The Code covers only electrical aspects of lightning protection of buildings and in so far as the effects of lightning on the electrical installations are concerned. It does not cover lightning protection aspects from structural safety point of view.

The Code is also not intended to apply to:

- a) Systems of distribution of energy to public; and
- b) Power generation and transmission for such systems.

The Code also does not cover guidelines on the payment for electrical work done in installations.

CONTENTS

PART 1	GENERAL AND COMMON ASPECTS		Covers fundamental aspects of installation practice are common for most of the types of electrical installations.
	Section 1	Scope of the National Electrical Code	<ul style="list-style-type: none"> ✓ Standard good practices for selection of various items of electrical equipment forming part of power systems; ✓ 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; ✓ General safety procedures and practices in electrical work; and ✓ Additional precautions to be taken for use of electrical equipment for special environmental conditions like explosive and active atmosphere.
	Section 2	Terminology	Covers definitions based on International electrotechnical vocabulary
	Section 3	Graphical Symbols for Diagrams, Letter Symbols and Signs	Covers graphical symbols for diagrams, letter, symbols and signs used in installation diagrams
	Section 4	Guide for Preparation of Diagrams, Charts, Tables, and Marking	<ul style="list-style-type: none"> ✓ Various diagrams and charts are to be prepared during planning and execution, for the sake of uniformity, different types of diagrams, charts, tables and marking have been defined. ✓ Paper sizes are also referred
	Section 5	Units and Systems of Measurement	Covers units and systems of measurement in electrotechnology in accordance with International System of Units (SI)


	Section 6	Standard Values	Covers standard values of ac and dc distribution voltages, preferred values of current ratings and standard system frequency.
	Section 7	Fundamental Principles	<ul style="list-style-type: none"> ✓ Enumerates the fundamental principles of design and execution of electrical installations. ✓ Covers aspects such as materials (to conform to relevant IS), workmanship, competency
	Section 8	Assessment of General Characteristics of Buildings	Recommended method of identification of the external influences on the electrical installation such as environment, utilization and method of construction of the building.
	Section 9	Wiring Installations	Covers essential design and constructional requirements for electrical wiring installation
	Section 10	Short-Circuit Calculations	Covers guidelines relating to short circuit withstand capability of electrical equipment and to check permissible voltage drop in cables and flexible cables upto equipment terminals.
	Section 11	Electrical Aspects of Building Services	Covers requirements for installation work relating to building services such as Lighting and ventilation, Air-conditioning and heating, and Lifts and escalators that use electric power.
	Section 12	Selection of Equipment	Covers essential criteria for selection of equipment, and users of the Code are recommended to make reference to individual product codes for detailed guidelines.
	Section 13	Erection and Pre-commissioning Testing of Installations	Covers general principles of erection of installation and guidelines on initial testing before commissioning.
	Section 14	Earthing	Covers the essential requirements associated with earthing in electrical installations. These relate to general conditions of soil resistivity, design parameters of earth electrode, earth bus and earth wires and methods of measurements.
	Section 15	Lightning Protection	Covers the essential design and construction details of lightning protective systems.

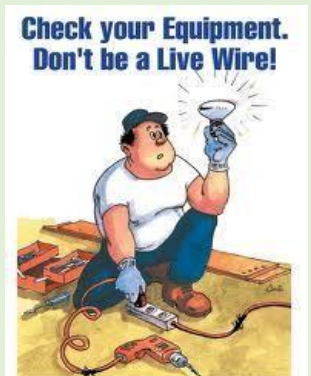
	Section 16	Protection against Voltage Surges	Covers the protection requirements in low voltage electrical installation of buildings
	Section 17	Guidelines for Power Factor Improvement	Covers causes for low power factor and guidelines for use of capacitors to improve the same in consumer installations.
	Section 18	Energy Efficiency Aspects	Covers the aspects to be considered for selection of equipment from energy conservation point of view and guidance on energy audit.
	Section 19	Safety in Electrical Work	Covers guidelines on safety procedures and practices in electrical work.
	Section 20	Tables	Covers frequently referred tables in electrical engineering work
PART 2	ELECTRICAL INSTALLATIONS IN STANDBY GENERATING STATIONS AND CAPTIVE SUBSTATIONS		Covers essential requirements for electrical installations in stand-by generating stations and captive substations intended to serve a building or group of buildings.
PART 3	ELECTRICAL INSTALLATIONS IN NON-INDUSTRIAL BUILDINGS		Covers requirements for major types of non-industrial occupations.
	Section 1	Domestic Dwellings	Covers requirements for electrical installations in domestic dwellings.
	Section 2	Office Buildings, Shopping and Commercial Centres and Institutions	Covers requirements for electrical installations in Office Buildings, Shopping and Commercial Centres and Institutions etc
	Section 3	Recreational, Assembly Buildings	Covers requirements for electrical installations in Recreational centres, Assembly Buildings etc
	Section 4	Medical Establishments	Covers requirements for electrical installations in Medical Establishments etc
	Section 5	Hotels	Covers requirements for electrical installations in Hotels etc
	Section 6	Sports Buildings	Covers requirements for electrical installations in Sports Buildings etc
	Section 7	Specific Requirements for Electrical Installations in multistoried Buildings	Covers requirements for electrical installations in multistoried Buildings etc

PART 4	ELECTRICAL INSTALLATIONS IN INDUSTRIAL BUILDINGS		Covers the guidelines for design and construction of electrical installations in industrial buildings.
PART 5	OUTDOOR INSTALLATIONS		Covers requirements for electrical installations of installations erected outdoor.
	Section 1	Public Lighting Installations	Covers general principles governing the lighting of public thoroughfares. The requirements are based on recommendations of the International Commission on Illumination (CIE)
	Section 2	Temporary Installations Outdoor	Covers the requirements for outdoor electrical installations of temporary use.
	Section 3	Permanent Installations Outdoor	Covers requirements for permanent outdoor installations, for operations of equipment and machinery therein used for the purposes such as: Winning, stacking and primary processing; Secondary processing; transport conveying; associated pumping and water, ancillaries etc.
PART 6	ELECTRICAL INSTALLATIONS IN AGRICULTURAL PREMISES		Covers requirements for the fixed electrical installations in agricultural premises
PART 7	ELECTRICAL INSTALLATIONS IN HAZARDOUS AREAS		Covers recommendations for electrical installations in chemical industries, petroleum refineries and other similar areas where hazards of explosion due to gases and vapours exist.
PART 8	SOLAR PHOTOVOLTAIC (PV) POWER SUPPLY SYSTEMS		Covers essential requirements for electrical installations for power supply system based on the solar photovoltaic energy including systems with ac modules.



How to Avoid Hazards?

- ✓ All the electrical material used must be  marked.
- ✓ The electrification work shall be entrusted to qualified and licensed electrical contractor only.
- ✓ Adequate capacity of MCB or ELCB/RCCB shall be provided in the installation as per standard.
- ✓ Poor quality and undersize wire shall not be used.
- ✓ Joints shall be avoided in the wiring and if necessary then shall be insulated with insulating tap.
- ✓ Storage of flammable material near electric panel, circuit breaker and switch room, working in wet humid condition leads to electrical accidents.
- ✓ Always turn off the device before unplugging it or plugging it.
- ✓ Never use equipment with frayed cords, damaged insulation or broken plugs.
- ✓ Public especially children shall be made aware about dangers associated with power lines and electrical networks.
- ✓ Keep electrical wires of equipment away from hot surfaces to prevent damage of the insulation.



ELECTRICAL SAFETY AT/NEAR SCHOOL



- 1 . Schools should be located far away from the substations or supply lines.
2. Open distribution box, junction box,street box etc should not be there either in the school or in the way to school.
3. Transformers should be fenced adequately and properly.

DO's

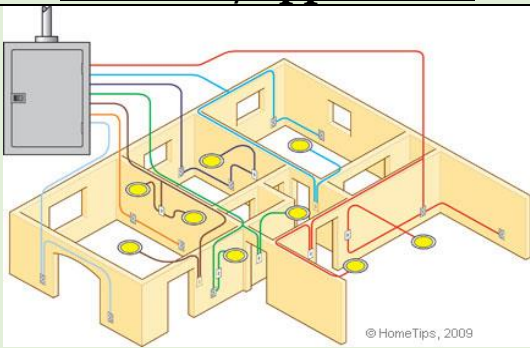

- a. DO ask for help when you need to use electrical equipment.
- b. DO have safety caps on all unused electrical items

Dont's

- a. DON't ever climb the fence around a electrical substation.
- b. DON't take shelter under any structure in rain/storm that has supply lines in its vicinity.



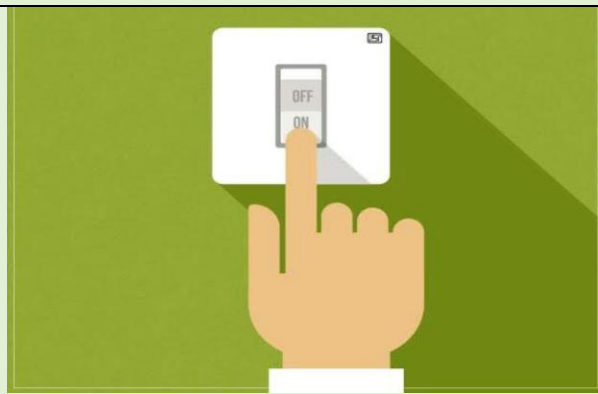
IMPORTANT SAFETY STANDARDS INSIDE OUR HOUSE

<u>S.No</u>	<u>Products/Application</u>	<u>Indian Standard</u>
<u>1</u>	 <p><u>Electrical Installation</u></p>	<p><u>IS 732:2019 Code of practice for electrical wiring installations (Fourth Revision)</u></p>
<u>2</u>	 <p><u>EARTHING</u></p>	<p><u>IS 3043:2018 Code of practice for earthing (Second Revision)</u></p>



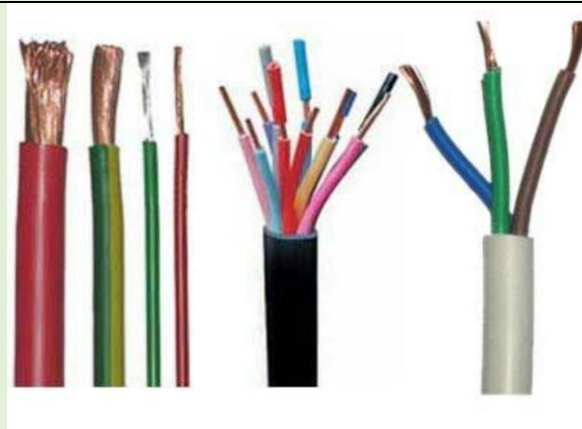
Plugs and Sockets

IS 1293:2019 Plugs and socket - Outlets of rated Voltage up to and including 250 Volts and rated current up to and including 16 amperes - Specification






Switches

IS 3854:1997 Switches for domestic and similar purposes - Specification



Cables

IS 694:2010 Polyvinyl chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750 v

	 <p><u>MCBs</u></p>	<p><u>IS/IEC 60898 : PART 1:2015</u> <u>Electrical accessories - Circuit</u> <u>- Breakers for overcurrent</u> <u>protection for household and</u> <u>similar installations: Part 1</u> <u>circuit - Breakers for a.c.</u> <u>operation</u></p>
	 <p><u>ELECTRICITY METER</u></p>	<p><u>IS 13779:1999 AC static</u> <u>watthour meters, class 1 and 2</u> <u>- Specification</u></p>
	 <p><u>LED BULB</u></p>	<p><u>IS 16102(Part 1) Self-Ballasted</u> <u>LED Lamps for General</u> <u>Lighting Services Part 1 Safety</u> <u>Requirements</u></p>
	 <p><u>CEILING FANS</u></p>	<p><u>IS 374:2019 Specification for</u> <u>electric ceiling type fans and</u> <u>regulators</u></p>

FIRST AID



FIRST AID

- **A person getting electric shock needs to be disconnected from the source of power. The disconnecting switch/breaker should be identified and turned off.**
- **Unfortunately, if connected device cannot be located, the victim can be pried or pulled from the circuit by an insulated object such as dry wood board, piece of non-metallic conduit or rubber electrical cord.**
- **Immediate medical response should be provided to victims i.e check for breathing and pulse, then apply Cardio-pulmonary Resuscitation (CPR) as necessary to maintain oxygenation.**
- **If a victim is still conscious, he needs to be closely monitored and cared -for until trained emergency response personnel arrive.**
- **The victim should be kept warm and comfortable to avoid danger of physiological shock.**

ELECTRIC SHOCK & it's MANAGEMENT विद्युत्ताघात एवं उसके प्रबंध नियम



Upon contact with the high tension wire, जल विद्युती विद्यमान होत के कारणक २२ जल पर



Electric Shock upon contact with exposed live wire
from branch frame must never be a risk of any type.



Electric Shock due to faulty electrical connections and carelessness:
see [basic safety in electrical work](#) or [firearm](#)

EFFECTS LIMIT

1. Fatal paralysis of heart.
1. पतनक अथवा पतनजन।
2. Stoppage of breathing.
2. पतनका का पतनजन, निमनक श्वास रुक जात है।
3. Burns, deep or superficial or both.
3. जलने के घातः लम्ब या अल्प/और गहरी के अन्तर।

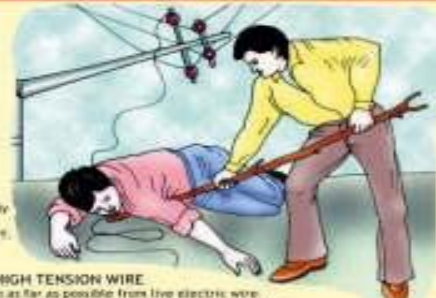
MANAGEMENT पाठ्यपुस्तक विवरण



Switch off the power and remove the plug. If possible, ask a qualified electrician to do the work.



2. Break electrical contact without directly touching the cassette:
 simply, we use an iron pin
 (see photo)



2. HIGH TENSION WIRE

Keep as far as possible from live electric wire. Push the wire away from the casualty or drag the casualty away from the wire. Use only dry and non-conducting material like rope, branch of a tree, dry cloth, etc.

2. उच्चतर विभागीय विद्यालय स्तर

जहाँ एक समान ही विद्युत लाई को टूट गई।
जिन्हीं मुराबे जिन जगजगत् भराव में लौट पड़ने
कागड़े, जो लम्बाई जलित की जगह में गहरा
जो जल को जल करने में टूट गई।



Relevance programs
for imagination
might look like:
find ways to...



Do not give casualty anything to drink. Rinse the burnt area with cold water and apply bandage. Move at 45 to 60 degrees if it is not too hot and you can. Do not lift it.



Apply expiration pressure.
 never more than 10 lb. force



Expiration by chest compression.
 never start before at least one of these



Inspiration by chest expansion.
 सभी जीवों की श्वास वायुमंडल में
 वायुमंडल में वायुमंडल में ।



Call the doctor or take the casualty to a hospital.

PRECAUTIONS सुझावधान

LOW VOLTAGE

1. Seek professional help.
2. Store in a dry insulated material like wooden planks, folded newspaper, rubber mat, etc., and use insulated tools only.
3. Use dry rubber gloves, if available.

HIGH VOLTAGE

1. Do not attempt yourself. Seek professional help.
2. Keep as far as possible from a snapped live H.T. wire.
3. Do not touch the casualty until the electrical contact is broken.

निम्न विभागी विद्युत नमूना

1. पंचमरा को समझना है।
 2. लकड़ी को पीसकर पात, लकड़का को पीसना पात या सबकुछ पचाना, लकड़ी पात सबकुछ को खा ही सज्जन-कर्म। लकड़का पीसकर खा ही सज्जन-कर्म।
 3. यदि सबकुछ को पचानेमें असमर्थ हो तो लकड़ा चर्चने को।
- उपध विभक्ती विद्वान् संन्य**
1. पंचमरा को समझना है।
 2. पित्तका अध्ययन को विद्वान् कहा भी जा रहा है।



ELECTRIC SHOCK EMERGENCY RESUSCITATION

Safeguard Yourself

If a patient collapses due to **ELECTRIC SHOCK**, break the circuit by switching off the current at the mains, removing the plug or wrenching the cable free. If unable to reach the cable, socket or mains, use or stand on some **DRY** non-conducting material and using a broom, safety hook, wooden chair or stool, push the casualty away from the source of electricity **A**. Once the area is safe

Check Casualty Response

If unconscious, open the airway and check for normal breathing (for up to 10 seconds). **B**

If the casualty is breathing, place in the recovery position **D**, dial **102** for an ambulance, monitor and record breathing every ten minutes or until medical assistance arrives.

If Casualty is Not Breathing Normally

If the casualty is not breathing normally, dial **102** immediately and commence CPR

Commence CPR

Commence CPR. Alternate 30 chest compressions with two rescue breaths. **C** Repeat this sequence as necessary

