केविप्रा
cea

मानकः पथप्रदर्शकः
Bureau of Indian Standards

NFE
NATIONAL FEDERATION OF ENGINEERS
FOR ELECTRICAL SAFETY

Electrical Safety Handbook for Students

A heartfelt thanks from the NFE

We owe a debt of gratitude for their various sponsors to their immediate response to our request for sponsoring this handbook, in its **English** version. We sincerely thank them for help in spreading the message of Electrical Safety amongst one of the influential sections of the Society, namely the teenage children. We believe that these children, with insistence and persuasiveness, can bring about a sea change in the behaviour of their peers, parents and ultimately, the society at large towards cultivating a healthy respect towards Electricity. This shall be done by demanding the use of standard and quality products and insisting on getting the Electrical works done by qualified, experienced and certified personnel thus contributing to an Electrically Safe Bharat.

As per the Statistics of the Department of Education, Govt. of India, in 2023 about 191 lakhs registered for the 10th Class examination and 160 lakh students for the 12th Class examination. Reaching every one of these students across the whole of India is a mammoth task requiring tremendous effort, financial and logistical support. We earnestly request the contribution of each and every individual and organisation, interested in having Electrical Safety, towards this ambitious target of ours. Any contribution, however small, will add to our efforts in achieving our aim of an Electrically Safe Bharat.

This copy of the Electrical Safety Handbook would not have reached you without the generous contribution of sponsors. It is towards the support for this endeavour of ours, and the trust reposed in us, that we are sincerely gratefully to them.

Sincerely yours,
National Federation of Engineers for Electrical Safety

Publishers

PREFACE

From the first ever detection of a flowing current, caused due to a spark by electricity jumping across a broken conductor, we have come a long way. Electricity is now the life force that runs in the veins of civilization, reaching out to every nook and corner of edifices of modern society. Be it a modest hut, a high-rise apartment or an industry, from an illuminated street to wearable devices, electricity is the driving force from the miniscule to the colossal scale.

However, this Electricity has the potential to go out of control inflicting irreversible damages, grievous injuries and even snuff out life itself. Use of good quality electrical appliances, materials, accessories and the correct installation procedures ensure prevention of accidents such as electrocution and fire while also offering trouble free and long life for the connected electrical equipment.

Electricity and its use has always been taken seriously by the Engineering fraternity all over the world. And elaborate provisions in the form of Standards, Codes, Guidelines & Best Practices have been framed to ensure its proper and safe usage. However in India these provisions have not been given due importance by most of the last mile people i.e., technicians and the end users. Due importance is to be given to share the knowledge of these provisions, and their importance, to these last mile user groups in general and School going children in particular. This necessitates the code in a much simpler languages so that the laymen, and students, know the precautions that are necessary to be adopted for safe use of electricity.

This handbook initiated by the Central Electricity Authority (CEA) and supported by the Bureau of Indian Standards (BIS) is organised by the National Federation of Engineers for Electrical Safety (www.nfees.org) and intends to provide this technical guidance in simple language, and with lots of images, to ensure safety of students and the future citizens of our country. This will help create an electrically safe India.

Suggestions for the improvement of the book, including submission of relevant images, are most welcome. Any such suggestions may be emailed to admin@nfees.org with the subject line “School Safety Awareness Handbook”.

घनश्याम प्रसाद
अध्यक्ष तथा पदेन सचिव भारत सरकार
GHANSHYAM PRASAD
Chairperson & Ex-officio Secretary
To the Government Of India

केन्द्रीय विद्युत प्राधिकरण
भारत सरकार
विद्युत मंत्रालय
सेवा भवन, आर,के, पुरम
नई दिल्ली–110066
Central Electricity Authority
Ministry of Power
Sewa Bhawan, R. K. Puram
New Delhi-110066

आज़ादी का अमृत महोत्सव

FOREWORD

Electricity one of the greatest inventions of mankind, transforming the way we live, work, and communicate. However, with its immense benefits come inherent risks, and ensuring electrical safety is of paramount importance, particularly for our younger generation.

India, as a rapidly developing nation, witnesses a significant number of electrical accidents each year, many of which are preventable through education and awareness. It is imperative that we equip our children with the knowledge and tools necessary to identify and mitigate electrical hazards, thereby safeguarding their well-being and that of those around them.

I am delighted to introduce the handbook: - "Electrical Safety Handbook for School Students", a comprehensive guide meticulously prepared by National Federation of Engineers for Electrical Safety (NFEES) that serves as a valuable resource for students, educators, and parents alike.

We believe that by equipping students with knowledge about electrical safety from an early age, we can instill responsible habits and prevent accidents.

I would like to thank team of NFEES for sharing their expertise through a lucid and educative handbook on electrical safety for school students.

(Ghanshyam Prasad)

सत्यमेव जयते

Foreword

Electricity is undoubtedly the lifeline of a modern society, powering our industries, homes, farm sector, schools, health sector, modern transportation system and beyond. However, with its immense benefits and incredible power if due precautions are not taken well in time the electricity system poses a few inherent risks also. Thus, it is important that we disseminate appropriate knowledge in safe practices of electricity system. In this regard we need to equip the masses and especially the young minds (of which the student community forms the largest chunk) with the knowledge and skills necessary to navigate the electrified world safely.

The **"Electrical Safety Handbook for School Students"** serves as a comprehensive guide, packed with useful information and practical easy to follow tips designed to impart education and empower students to recognize the safe practices which will help in mitigating the electricity system related hazards in different segments. From understanding basic electrical concepts to practicing safe behaviors around electricity, this handbook will serve as one of the valuable resources for students, educators, and parents alike. We should always remember, that the age is no bar for learning, and in that sense everyone of us is a "STUDENT".

I extend my heartfelt gratitude to my colleagues (especially team of the Chief Electrical Inspectorate formation, **Central Electricity Authority**), innumerable professional through whom we learned and developed various useful concepts, the "Bureau of Indian Standards **(BIS)**" along with "National Federation of Engineers for Electrical Safety **(NFEES)**" who have contributed with dedication in bringing out this invaluable resource as a piece of knowledge. I am confident that the knowledge gained by going through this handbook will inculcate among the readers a due awareness, positive impact, safe habits, and practices in the electricity sector at all steps. It is worthwhile to note that the concepts learned at an early age and practicing them in the life remains in the memory till end, and serves for the larger benefits of the society.

As we embark on this journey of imparting education and empowerment, let us reaffirm our commitment towards prioritizing "SAFETY" in all aspects of our lives. Together, let us strive to create a simple, safer, secure, economical, and more resilient electricity for growth of economy and service to society.

This generation as well as the future generations should keep in mind that the life gone in any form of accidents, be it due to unsafe practices of electricity or otherwise cannot be brought back and compensated by any means.

I wish a safer future for one and all and hope everybody will contribute up to its full might towards bringing in and enforcing "safety" in a wholesome manner from their inner core.

With all the best wishes !

Jai Bharat !

Ashok Kumar Rajput
Member (Power Systems)
Central Electricity Authority

New Delhi
June, 2024

सत्यमेव जयते

Foreword

Electricity is a powerful force that, when harnessed properly, enhances our lives in countless ways. However, without proper knowledge and respect for its potential dangers, it can also pose serious risks, particularly to those who are unaware or ill-informed. In a world where electricity powers nearly every aspect of our lives, understanding how to use it safely is paramount, especially for our younger generation.

It is my distinct honor and privilege to present this Handbook on "Electrical Safety for School Students" prepared by National Federation of Engineers for Electrical Safety (NFEES). This handbook serves as a comprehensive guide designed specifically for school students, aiming to educate and empower them with the knowledge and skills necessary to navigate the electrical landscape safely. From understanding basic electrical principles to recognizing potential hazards and adopting best practices for prevention, this handbook covers a wide range of essential topics in an accessible and engaging manner.

I commend the dedication and expertise of my team consisting of Ms. Arpita Upadhyay, Deputy Director, Sh. Alok Kumar, Deputy Director, Sh. Rahul Singh, Deputy Director and Gaurav Srivastava, Assistant Director of CEA along with team of NFEES and BIS behind this handbook for their commitment to promoting electrical safety education. I also urge educators, parents, and students alike to embrace this resource as a valuable tool in fostering a culture of safety within our schools and communities.

Rishika Sharan

Chief Engineer &
Chief Electrical Inspector to Govt. of India

New Delhi

June, 2024

प्रमोद कुमार तिवारी, आई ए एस
PRAMOD KUMAR TIWARI, IAS
महानिदेशक
Director General
दूरभाष/Phone : + 91-11-2323 7991, 2323 6980
ई-मेल/E-mail : dg@bis.gov.in
वैबसाईट/Website : http://www.bis.gov.in

सत्यमेव जयते

भारतीय मानक ब्यूरो
(भारत सरकार)
मानक भवन, 9, बहादुरशाह ज़फर मार्ग,
नई दिल्ली - 110 002
Bureau of Indian Standards
(Government of India)
Manak Bhawan, 9, Bahadur Shah Zafar Marg,
New Delhi - 110 002

MESSAGE

With the growing usage of electricity and the development of increasingly complex electrical infrastructure in the country, the need for ensuring the safety of electrical installations and appliances has also grown. Electrical accidents have been the cause of loss of life and property at a significate scale. The tragedies reported become even more painful because they could have either been prevented or the impact thereof been mitigated substantially if users were aware of the basic electrical safety requirements.

It is in this context that empowering the users with the knowledge of electrical safety assumes paramount importance. This handbook, developed by the Bureau of Indian Standards in collaboration with Central Electricity Authority and National Federation of Engineers for Electricity, therefore, fulfils an important need.

I extend my sincere appreciation to all those who have worked tirelessly to prepare this handbook, and I encourage students, educators, and parents to utilize this resource to instil a culture of practicing electrical safety and use electricity responsibly.

(Pramod Kumar Tiwari)

राजीव शर्मा
RAJEEV SHARMA
वैज्ञानिक–जी एवं उप महानिदेशक (मानकीकरण- I)
Scientist-G & Deputy Director General (Standardization - I)
दूरभाष/Phone : + 91-11-2323 7481
ई–मेल/E-mail : scgt@bis.gov.in
वैबसाईट/Website : http://www.bis.gov.in

सत्यमेव जयते

भारतीय मानक ब्यूरो
(भारत सरकार)
मानक भवन, 9, बहादुरशाह ज़फर मार्ग,
नई दिल्ली - 110 002
Bureau of Indian Standards
(Government of India)
Manak Bhawan, 9, Bahadur Shah Zafar Marg,
New Delhi - 110 002

MESSAGE

Electricity plays a crucial role in our daily lives, powering our homes, schools, and communities. However, it is essential to understand the potential hazards associated with electricity. Electrical accidents can lead to severe injuries and even fatalities. Therefore, it is vital for students to prioritize electrical safety.

I am pleased to introduce to you this Handbook on Electrical Safety Guidelines for School Students, which has been meticulously prepared by the Bureau of Indian Standards in collaboration with Central Electricity Authority and National Federation of Engineers for Electrical Safety. This handbook is an invaluable resource that has been designed to empower students with knowledge about electrical safety. By understanding and applying the principles outlined in this handbook, students can play a vital role in creating an environment that is safe for everyone.

I encourage each of you to utilize this handbook as a means to promote electrical safety awareness and contribute to a secure learning environment for all.

Wishing you a safe and fulfilling educational journey.

(Rajeev Sharma)

ACKNOWLEDGEMENTS

This handbook is the culmination of collective insights and standards developed by numerous organizations dedicated to electrical safety. We, The National Federation of Engineers for Electrical Safety (NFE – www.nfees.org) extend our deepest gratitude to the following bodies for their invaluable contributions:

Central Electricity Authority (CEA), for their comprehensive Regulations on Electrical Safety.

Bureau of Indian Standards (BIS), for their role in harmonizing the Indian standards with international best practices, ensuring a global standard of safety.

International Electrotechnical Commission (IEC), for their comprehensive international safety standards which have been a guiding framework.

We also acknowledge the efforts of all the electrical engineers, technicians, and safety officers whose daily diligence in adhering to these standards ensures a culture of safety at the workplace. Their commitment to excellence is the backbone of our handbook.

The various Central and State Boards of School Education, AICTE and the various State Boards of Technical Education for their valuable and enthusiastic cooperation in spreading the message of Electrical Safety amongst the student fraternity.

Last but not the least we profusely thank all those active members of the NFE for their positive suggestions in enhancing the value of this handbook.

Suggestions for the improvement of the Handbook are most welcome and may be sent to admin@fees.org with the subject heading “School Safety Handbook”.

National Federation of Engineers for Electrical Safety,
Chennai, India

Electrical Safety
Handbook for Students

Index

Remember,
Electrical safety.

It is not a Choice,
It is a Responsibility.

1 DEFINITIONS

For the purpose of this guideline, following definitions apply:

CEA (Central Electricity Authority)

Central Electricity Authority is established under section 3 of the Electricity (Supply) Act, 1948. The functions and duties of CEA are delineated under Section 73 of the Electricity Act, 2003. Besides, CEA has to discharge various other functions as well under Section 3 (National Electricity Policy & Plan), Section 8 (Hydro Electric Generation), Section 34 (Grid Standards), Section 53 (Provision relating to Safety and Electric Supply), Section 55 (Use of Meters) and Section 177 (Making of Regulations) of the Electricity Act, 2003.

NFE (National Federation of Engineers for Electrical Safety)

National Federation of Engineers for Electrical Safety is a body of Professional Engineers involved in promotion of Electrical Safety culture in India.

ISI Marking

The mark that certifies whether a product conforms to Indian Standard (IS) developed by the Bureau of Indian Standards (BIS), the National Standards Body of India. From the CML number, the product's certification and originality can be verified through BIS CARE APP.

BIS (Bureau of Indian Standards)

Bureau of Indian Standards is the National Standards Body of India responsible for the harmonious development of the activities of standardization, marking and quality certification of goods in our country.

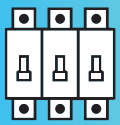
IS (Indian Standard)

Indian Standard developed by the Bureau of Indian Standards (BIS), the National Standards Body of India.

IEC (International Electrotechnical Commission)

International Electrotechnical Commission is the body that makes international standards on electrotechnology. IEC is responsible for the harmonious development of the activities of standardization, marking and conformity assessment systems for electrical, electronic and information technologies around the world.

1.1 ELECTRICAL TERMINOLOGY

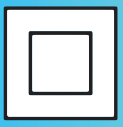


Circuit Breaker

A mechanical switching device capable of making, carrying and breaking electric currents under normal circuit conditions and under specified abnormal circuit conditions, such as those of Short Circuit, for a specified time.

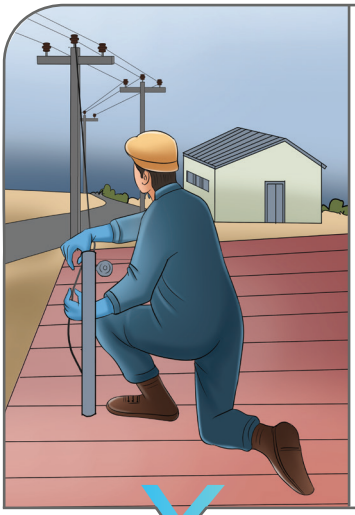
Class I Equipment

An appliance that requires a safety connection to the earthing arrangement and Equipotential Bonding of the building; these devices have generally three pin or have a provision for this connection.



Class II Equipment

An appliance that has been designed in such a way that it does not require a safety connection to the Earthing System or Equipotential Bonding of the building; these devices are generally two pin and also called double insulated equipment.



Competent Person

A person who possesses sufficient technical knowledge, relevant practical skills and related experience for the nature of the electrical work undertaken and is able, at all the time, to prevent danger, and where appropriate, injury to that person and others.

Distribution Board

A board assembled with different types of switching, controlling and protective devices (such as Circuit Breakers, Isolator and Residual Current Device (RCD) etc.) associated with outgoing electric circuits fed from incoming electric circuits.

Earthing

Connection of the exposed conductive parts of an installation to the main earthing terminal (also called as main earth busbar) of that installation.

Electrical Appliance

A current using equipment used in houses or similar purpose.

Electrical Installation

Assembling associated electrical equipment in a building, including switchboards, distribution boards, fixed wiring and socket outlets.

Equipotential Bonding

Electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential.

Extension Board/Cord

A length of flexible electrical power cable with a plug on one end and one or more sockets on the other end.

Extraneous Conductive Part

Conductive part such as metal pipes, handrails, doors, steel in structural columns and floors, etc liable to introduce a potential, generally the earth potential.

Fixed Equipment

An electrical appliance that is fixed permanently in a building (e.g. Air conditioners, water heaters, fan, light fittings, switches, socket). The appliance plugged to the socket are not fixed equipment (e.g. refrigerator, mixer grinder, microwave oven, washing machine etc).

Fuse

A device which disconnect the electricity supply and protect people and property. Fuses are to be replaced if it operates.

Isolator

An ON/OFF switch when there is no current flow. (A mechanical switching device capable of opening and closing a circuit when a negligible current flows; capable of carrying currents under normal circuit conditions, and under abnormal circuit conditions, such as those of short-circuit, for a specified time).

Miniature Circuit Breaker (MCB)

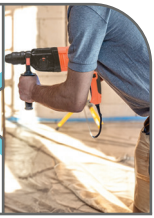
A device which disconnect the electric supply by tripping and protect people and property. Circuit breaker can be reused after rectifying the defect.

Personal Equipment

Any privately owned equipment of plug-in type.

Portable appliance

A handheld appliance, which can be moved while connected to an electricity supply through a lead and plug.



Residual Current Device (RCD)

A device to protect people from electric shock or earth fault. (RCD's with an operating current of ≤ 30 mA are only capable of protecting people from electric shock).

Short Circuit

A high current flow producing heat and fire. An electrical abnormality when an unintended connection between two points in an electrical system allows excessive current flow. This can cause several problems, including damage to electrical devices, fires, etc.

Socket Outlet

An accessory having socket-contacts designed to engage with the pins of a plug and having terminals for the connection of cables or cords.

Surge Protection Device

A device designed to protect equipment and devices in an electrical installation from voltage spikes; it attempts to limit the voltage supplied to an electric device by either blocking or shorting to ground any unwanted voltages above a safe threshold.

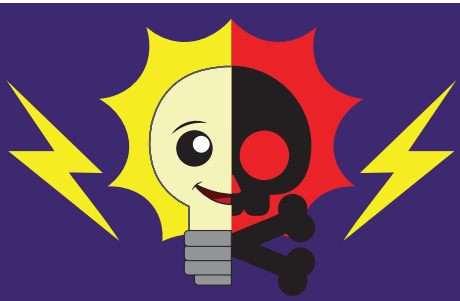
Switch

A mechanical switching device capable of making, carrying and breaking current under normal circuit conditions.

Electrical Safety Coordinator

A teacher appointed by the Principal, with his / her concurrence, to ensure electricity-related safety of the school property and occupants.

2 BASICS OF ELECTRICAL HAZARDS



Electricity: A friend or an enemy?

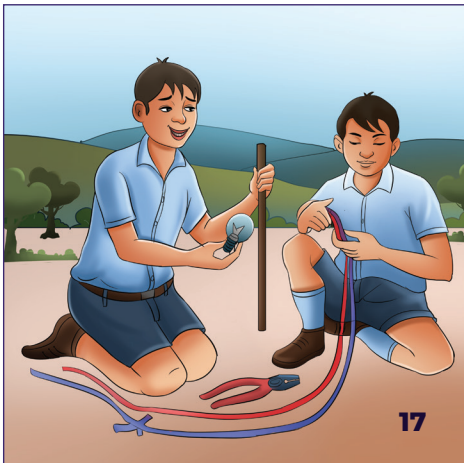
Of course, electricity is your friend! You've had it for years and you really rely on it. But if you don't treat electricity with respect and use it carelessly, it can easily become your enemy.

Electricity is a powerful & versatile form of energy that can be dangerous and deadly if it is not used properly. Let's check out some instances that can make electricity our enemy.

2.1 CAUSES OF ELECTRICAL ACCIDENTS

Electrical accidents are caused by one or a combination of the following factors. By addressing them properly, we can reduce electrical related accidents and hazards.

- Improper design of wiring and incorrect selection of products used in wiring.
- Poor quality construction.
- No proper installation of electrical panels and equipment.



- Inadequate testing and commissioning methods.
- Using sub-standard switchgears, materials and accessories.
- Unsafe environment.
- Carelessness while using electrical equipment.
- Lack of knowledge on operation and maintenance practices.
- Engaging incompetent person for electrical works, inspection & rectification.
- Lacking knowledge on electricity, its safe usage & associated hazards.

2.2 ELECTRICAL CURRENT AND ITS EFFECT ON HUMAN BODY

The effects of electricity on human body depend on many variables, such as:

- The magnitude of the current.
- Duration of contact.
- Body mass: Children provide less resistance while adults provide more resistance.
- Gender of the person.
- Moisture on the body.
- The path of the current.
- The type of current, Alternating Current (AC) or Direct Current (DC).

Did you know?

- Electricity always return to its source
- When you touch or come close to an electric line, the current may flow through you.
- Less than one ampere of electricity can burn, severely injure or cause death.
- The current drawn by a tiny 7-Watt, 230-Volt LED light (30 milli Amperes) is enough to kill you.
- Leave no room for mistakes, never put yourself into electricity's path.

2.2.1 - MAGNITUDES OF CURRENT AND ITS EFFECT ON HUMAN BODY

Current	Effect
Below 1 Milliampere	Generally not perceptible
1 Milliampere	Faint tingle
5 Milliampere	Slight shock felt; not painful but disturbing; the average individual can let go; strong involuntary reactions can lead to other injuries
6 to 25 Milliampere (Women)	Painful shocks; loss of muscle control
9 to 30 Milliampere (Men)	The freezing current or "let go" range; if extensor muscles are excited by shock, the person may be thrown away from the power source; individuals cannot let go; strong involuntary reactions can lead to other injuries.
50 to 150 Milliamperes	Extreme pain, respiratory arrest, severe muscle reactions; death is possible
1.0 to 4.3 Amperes	Rhythmic pumping action of the heart ceases; Muscular contraction and nerve damage can occur; death is likely
10 Amperes	Cardiac arrest, severe burns, death is probable

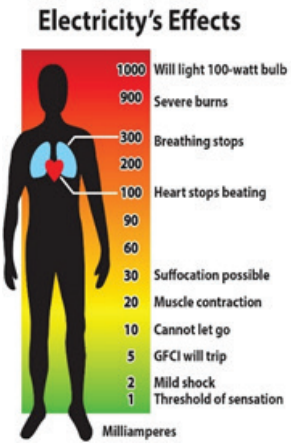


Table 1: Magnitudes of current and its effect on human body

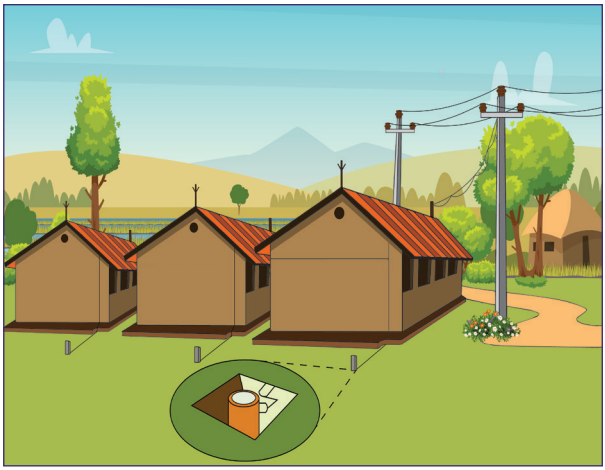
2.3 ELECTRICAL ACCIDENT PREVENTIVE STRATEGIES

2.3.1 - MANDATORY DESIGN REQUIREMENTS

2.3.1.1 - GENERAL SAFETY PRECAUTIONS

- Avoid operating electrical appliances and switches with wet hands.
- Using electrical appliances, which have 3-pin plugs or 3 terminals (such as motors in wells) without protective earth wire lead to hazards.
- For equipment with 2-pin plug (called class 2 equipment), a protective earth wire may not be required.

- Ensure that all wirings are concealed in conduits, trunking or casings to provide adequate mechanical protection from rodents & other potential threats. Ensure that the insulated wires running inside the conduits are not exposed, not even in short lengths. In case you notice any wire without a conduit bring it to the notice of your teachers / parents.
- Ensure that the wires are not exposed when the conduits are connected to junction boxes.
- Wiring to single-phase equipment and sockets contains three types of wires – Phase wire, Neutral wire and Protective Earth wire. These 3 wires should be physically separate.



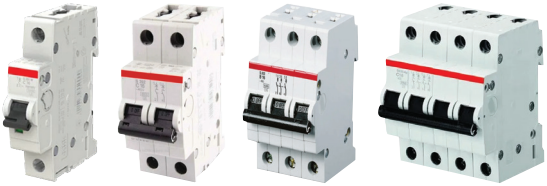
1.3.1.2 - PROTECTIVE DEVICES & DISTRIBUTION BOARD

- Check that the rating of MCB is suitable for the intended purpose. For example, a 4 Amps, single phase installation, a 6 Ampers, 1 or 2 pole, MCB is to be used.
- Install RCD with tripping current of 30 mA rating in your house, in addition to MCBs. The device that is a combination of MCB and RCCB is called RCBO. A RCBO can be installed instead of providing an RCD and an MCB. Check if RCCB / RCBO is provided in your school / residence.
- Check the operation of RCDs at regular intervals (at least once a month) by pressing the Test button on the RCDs. This avoids freezing of the device and ensures proper operation. RCCB (Residual current circuit breakers) are available in Two pole and Four pole versions).

Two pole RCCB

Four pole RCCB

- MCBs (Miniature Circuit Breakers) are used for protection from overloads and short circuits. These are available in single pole, double pole, triple pole, triple pole & neutral and in four pole versions. These are used as both incomer and outgoing in a Distribution Board.

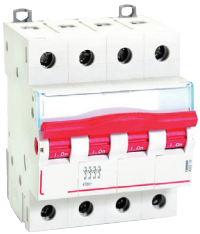


Single pole MCB **Two pole MCB** **Three pole MCB** **Four pole MCB**

- The MCB Distribution Board, or popularly called as MCBDB, are used for distribution of electrical power. Check that the Distribution Board (DB) is located in a properly ventilated, dry area, away from passages and not under staircases. Do not locate a distribution board on external walls, to avoid exposure to extreme weather conditions.

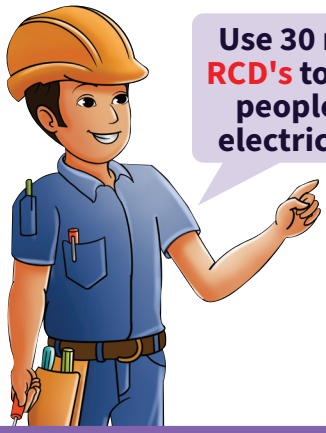
MCB Distribution Board

Two pole isolater



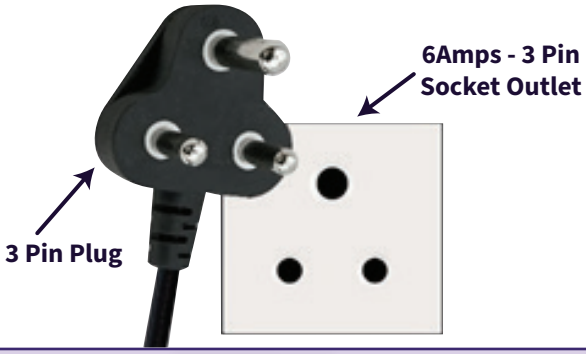
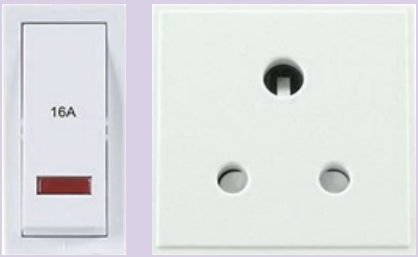
Four pole isolater

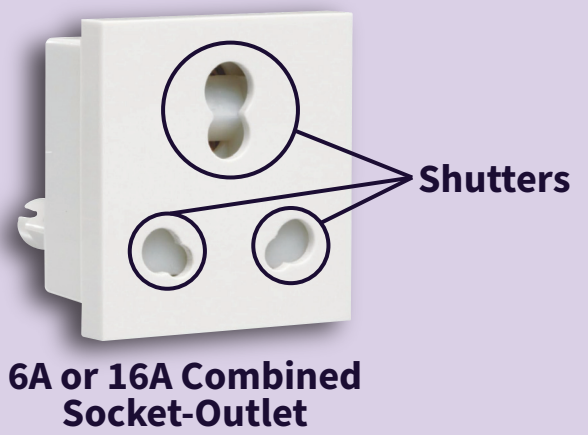
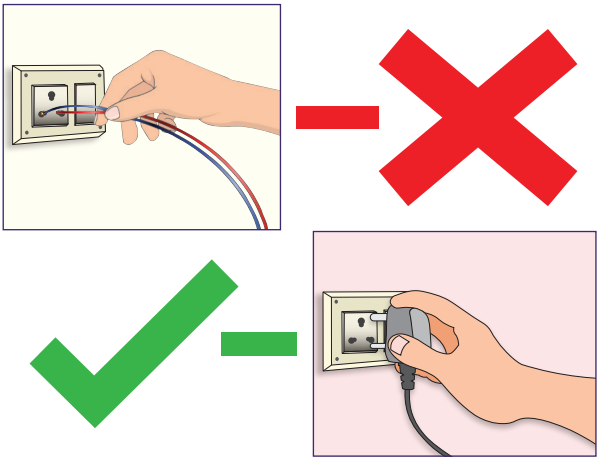
- Isolator does not provide protection such as over current or short circuit. These are available in 2 pole and 4 pole versions and are always used as incomers only.



Use 30 mAmps RCD's to protect people from electric shock.

2.3.1.3 - SOCKET OUTLETS & ELECTRICAL APPLIANCES

Measures	Reference Image
All sockets used should be as per Indian Standards. For domestic usage they are normally rated for 6 Amps and for 16 Amps.	
Small equipment (up to 1000 watts) can be connected to a 6 amps socket. Equipment with high power needs a 16 Amps socket.	 6A or 16A Combined Socket-Outlet
Socket outlets, electrical appliances, etc. should be located safely in such a way that they don't come in contact with water.	
An easily accessible and identifiable switch should be provided near sockets to disconnect the power in an emergency.	

Measures	Reference Image
Any electrical appliance with a metal cover should be properly bonded to the equipotential bonding conductor of the building.	
Use socket outlets with shutters.	 **6A or 16A Combined Socket-Outlet**
Never connect bare wire ends directly to the socket outlets, always connect through plugs.	

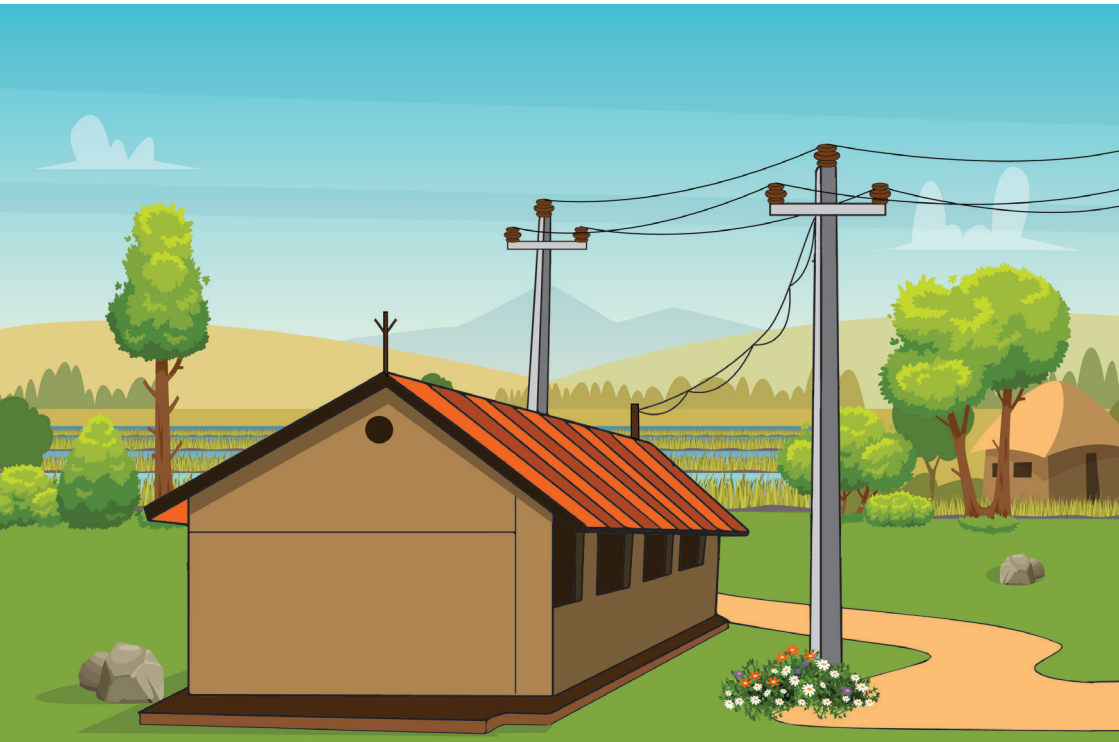
2.3.1.4 - WORKSHOPS AND COMPUTER LABS IN SCHOOLS

Request your Electrical Safety Coordinator to ensure the following:

- Installation of separate double pole isolators for single phase equipment in workshops
- Installation of separate four pole isolators for three-phase equipment in workshops.
- Usage of only 12 Volts power supply with isolation transformer for soldering iron.
- Verify that the electrical supply is adequate to cater to the expected load. Provision of separate socket outlets for computer monitors and equipment. Avoiding usage of extension boards and multipin sockets for this purpose.
- Enclose all cables in the computer lab in plastic trunking (also called Cable Management System / Cable Trunking).

2.3.1.5 - LIGHTNING PROTECTION

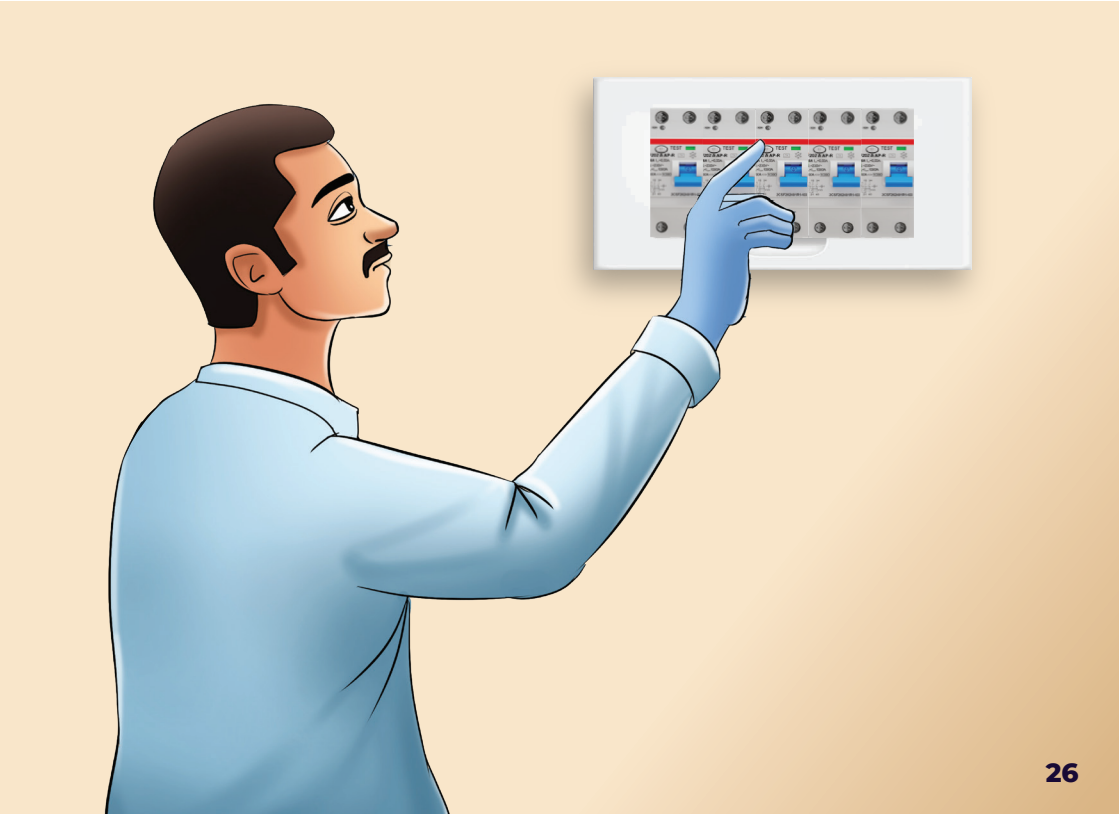
- Installation of a direct Lightning Protection System (LPS) for structural protection of the building. LPS consists of combination of air termination rods and mesh, several down conductors and earth termination.
- Preferable usage of earth electrode as a ring all around the building. All down conductors should be connected to the ring earth electrode.
- Preferable installation of the ring earthing 1 meter away from the building & 0.5 meter below soil.
- Connection of the main earth terminal of the electrical distribution board to the ring earthing.
- Installation of Surge Protective Device (SPD) to protect electrical installation from transient surges during lightning and installation of these SPDs at the main distribution board.



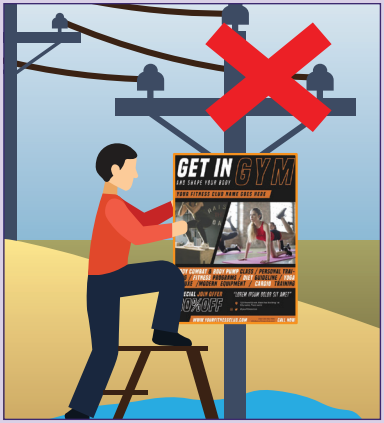
2.3.2 - MANDATORY OPERATIONAL & MAINTENANCE REQUIREMENTS

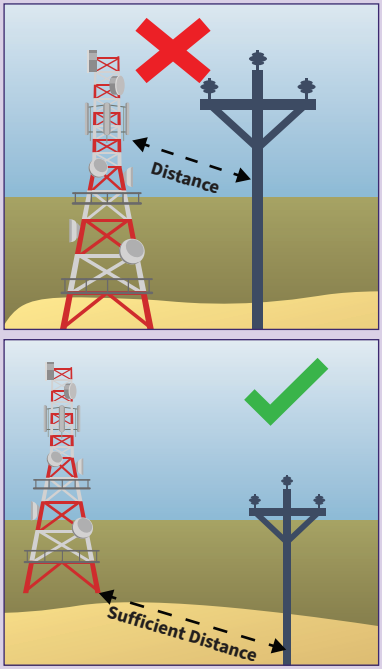
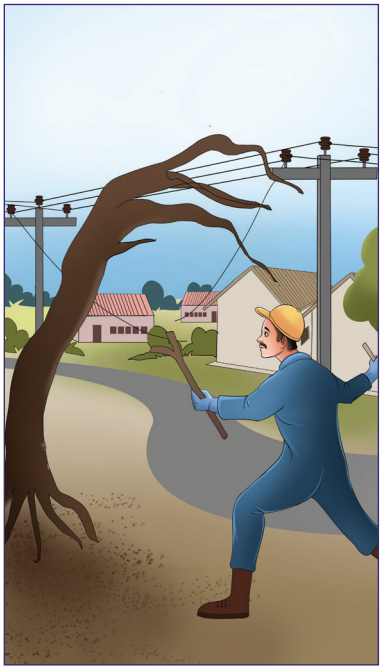
2.3.2.1 - TESTING INTERVALS FOR RESIDUAL CURRENT DEVICES (RCD)

- As per the National Electrical Code (NEC) of India 2023, protection from an electrical shock can be assured with RCDs having a sensitivity of 30mA or less. If 30mA RCDs are tripping due to excessive leakage current in a group of circuits, install RCDs for each circuit in the system to avoid nuisance tripping of the RCD. Note that it is not recommended to increase the sensitivity rating to avoid nuisance tripping due to high leakage.
- Check the operation of RCDs at a regular interval (at least once a month) by pressing the Test button. This avoids freezing of the device and ensures proper operation.



2.3.2.2 - OUTDOOR ENVIRONMENT

Situation	What to Do	Reference Image
Do not touch or play with any wire which is lying or fallen on ground.	Inform nearby adults to call the electricity department help centre or municipality or police helpline or fire emergency helpline, and inform about the fallen wire or electric pole.	
Do not allow advertisement boards or any other items on poles with powerlines.	Inform the electricity department for removal of such advertisement boards.	
If you see any vehicle loaded above the height of power lines.	Ask nearby adults to stop the vehicle and at the same time inform the electricity department to take action.	

Do not try to erect flags, mask or antennas near power lines.	If you see any such flags, antennas erected on or nearby electric poles ask someone to inform elctricity department authorities.	
Trees growing near power lines.	Inform the Electricity department for pruning the trees.	

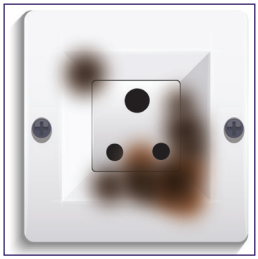
2.3.2.3 - EXTENSION BOARDS AND CORDS

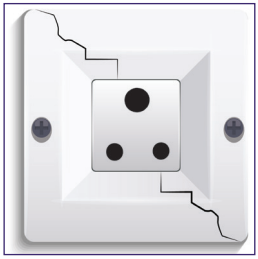
- Do not connect any loose wires to extension boards. It should be with proper electric plug which should be inserted in the extension boards.
- Use only good quality extension boards and with proper ampere rating. It should have fuse protection to prevent any short circuits.
- Use only 3 wire type extension cords. Do not use any modified extension cords with multiple wire joints.
- Use only cords, connection devices and fittings equipped with strain relief mechanism.
- Always remove the plug top by pulling the plug, cord should not be used for pulling plug.
- Do not use flexible cords that have been damaged or modified.

- Ensure that all socket outlets installed on extension cords are incorporated with shutters.
- Avoid using extension leads along the walkways and corridors.
- Ensure that extension boards have at least the minimum protection features, such as over current protection with the reset option and residual protection lesser than 30 mA.
- Ensure that an individual switch is available on the extension board, where its leads are more than 1.5 meters long.
- Ensure that the extension boards are at a safe location, where they do not get damaged due to external bodies. Otherwise, they should be securely mounted on a wall where there is no external impact on the boards.
- Do not overload extension boards or cords by connecting another extension board sockets with multiple outputs.
- Always check (inspect and test) extension board leads for any damages, before using them. Ensure that they are not covered by mats, drawn across corridors or other congested areas. Note that extension cords, which are in a tight coil, may overheat and catch fire.

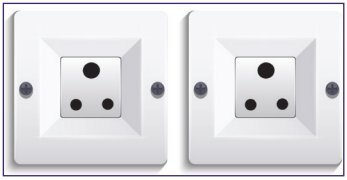
- Extension boards and extension cords should have indicator light to check the power availability.
- Only use extension leads fitted with suitably insulated connectors & plugs.

2.3.2.4 - PLUGS AND SOCKETS





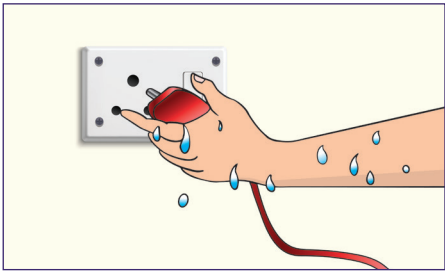
- Restrict multiple output from plug socket outlets.
- Avoid using piggy-back plugs and double adaptors, as they are unsafe.
- Ensure that all electrical plugs are as per ISI marked. Plugs should fit snugly into their outlets. Loose or wobbling plugs in the outlet are potential fire hazards and should be repaired or otherwise removed from the service.
- Engage a competent person to check the discoloured and heated outlets and plug tops to find out the cause of discolouration etc. and to rectify or replace the faulty ones as per the requirement.
- Avoid using Multi Sockets. Remove them from the sockets when they are not used.
- Switch off the MCB of relevant circuit or main MCB while doing any electrical-related work, such as upgrading or repairing.
- Check whether flexible cords are effectively anchored.
- Ensure that the inner cores of the flexible supply cords are not exposed or twisted.
- Ensure that the external sheaths are not cut, abraded, twisted or damaged to such extent that the insulation is visible.



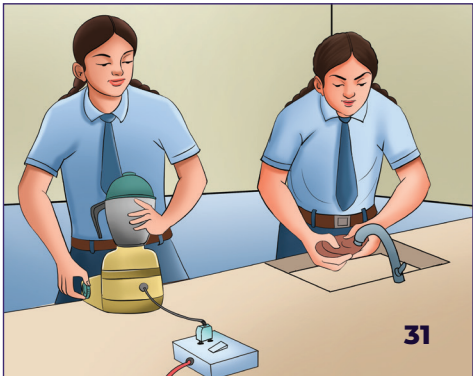
2.3.2.5 - OTHER ELECTRICAL EQUIPMENT / APPLIANCES

- Check whether covers and guards are in place and secured as required by manufacturer/supplier.
- Visually inspect all electrical equipment for any damage before use.
- Remove equipment with frayed cords, missing ground prongs, cracked tool casings etc. from service.
- Switch off any appliances as well as plug base switches (if available) before plugging them to the electrical supply.

- The earth wire of power supplied to the premise should be properly connected to the common earth bar.
- All electrical equipment earthing arrangement should be done properly.
- Do not use electricity when only two wires are available (when there is no protective earth wire available) unless the circuit is protected with a 30 mA RCD.
- Do not remove earth pins or prongs from cords and plugs connected appliances or extension cords.
- Do not use electrical appliances for purposes other than they have been designed for, or it will no longer ensure the safety features built in by the manufacturer.
- Do not use appliances meant to be used for indoor work for outdoor work.
- Be extremely cautious when using electricity where there is water in the environment or on the skin.
- Always switch off the power supply in case of replacement of bulbs and any apparatus.



- Always use 3-pin plug top for heavy load appliances (such as refrigerators, mixers, irons, wet grinders, washing machines, heating appliances and UPS). Ensure that the third pin is efficiently connected to the common earth busbar in the distribution board.
- Do not connect portable generators to internal wiring installations without the advice of a competent person for safety reasons.
- Only a competent person should install water geysers to ensure safety.
- Do not use electrical extension cords or appliances near swimming pools. Even an RCCB of 30 mA cannot protect people in wet environment.
- Do not use electric appliances in the bathroom, unless they are specially designed to be used in wet conditions.
- Avoid using electrical equipment under wet conditions that can trigger the conductive properties.



2.3.2.6 - PAT TESTING OF NEW AND OLD APPLIANCES/EQUIPMENTS

- Check any old equipment before use for wear & tear and damages in insulation. Request a competent person to conduct a PAT (Portable Appliance Test) to ensure safety of the device.
- PAT testing of electrical CLASS 1 equipment is recommended.
- Old and new appliances, extension cords and multiple-socket outlets should be tested with a PAT tester by a competent person.
- Any damaged appliances should be repaired or replaced immediately. If you are unable to repair them by yourself, get them repaired by a competent person only.
- Ensure that the testing of appliances is carried out periodically at least once in 5 years.
- Ensure that no faulty equipment is used until it is repaired for safe operation.

2.3.2.6 - EXAMPLES OF VERIFICATION

- All power outlets and switches should be checked before using.
- If the premise is rented out to a third party, an inspection check / verification should be carried out before re-using the electrical installation, to ensure electrical safety.
- Do not forcefully switch on a tripped MCB without identifying and rectifying the fault.

2.3.2.7 - MOBILE CHARGING

Charging mobile phones has become our second nature. It's crucial to prioritise safety during this routine activity. By following these precautions, you can significantly reduce the risk of electrical shocks.

Precaution	Explanation
Use of chargers and cables.	Always use original charger and cable provided by the manufacturer that are certified to meet safety standards. Inferior-quality chargers and cables can be hazardous and increase the risk of electrical shocks. Look for ISI or CRS certification marks by BIS.  
Verify cables & chargers regularly.	Before plugging in your charger, carefully examine the cable and adapter for any signs of wear & tear. Look for frayed wires, exposed metal, or bent prongs. If you notice any damage, immediately replace the charger or cable to avoid potential electrical hazards.
Keep water away.	Water and electricity is a dangerous combination. Ensure that the charging area remains dry always. Avoid using your mobile or tablet if it's charging in or near a wet environment, such as near a sink or bathtub. Remember, even a small amount of water can increase the risk of electrical shocks.

Precaution	Explanation
Avoid overloading power outlets.	Overloading can cause overheating, which may lead to electrical accidents. Avoid plugging multiple chargers or devices into the same socket. For multiple charging points, consider using a power strip with built-in overload protection.
Handle chargers with dry hands.	Moisture can conduct electricity, necessitating handling chargers with dry hands. Do not use wet or damp hands to charge your phone or other such devices, as it can cause an electrical shock.
Avoid charging near flammable materials.	Heat generated during charging can potentially ignite these materials, leading to fire hazards. Keep the charging area free from flammable materials, such as paper, fabric or aerosol cans.
Avoid calling. Don't use phone while charging.	The voltage supplied to the phone while charging is high. It can damage internal parts or explode battery if you use the phone that is still plugged into the charger. It is better to remove the charger from the port when you want to call someone.
Don't leave a charger plugged in overnight.	Avoid leaving your phone charging unattended, particularly overnight. While your phone is clever enough to stop taking a charge once the battery is full, a problem may occur if the charger itself overheats, especially if left on a flammable surface.
Do not cover the charger or device.	While charging a device, allow heat to dissipate properly. Avoid covering your device or the charger with any fabric, pillow or other objects that may trap heat. Overheating can damage the battery and increase the risk of electrical accidents.
Unplug a charger carefully.	When unplugging a charger, always grip the plug itself and do not pull the cable. Yanking the cord can damage the cable or cause the prongs to break, potentially exposing live wires and increasing the risk of electrical shocks.

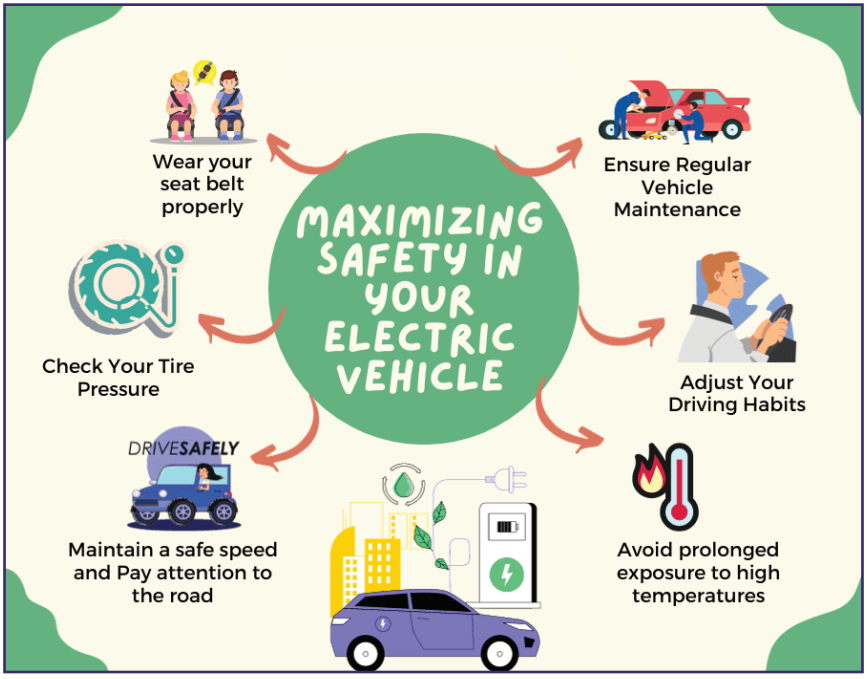
Precaution	Explanation
Educate children.	Educate children the importance of safety precautions while charging mobile devices and the potential dangers of electricity. Keep chargers and cables out of their reach to prevent accidental contact or tampering.
Use wireless charging.	Consider using wireless charging options that eliminate the need for cables altogether. Wireless chargers are designed with safety measures to reduce electrical accidents Use certified wireless charging pads from reliable manufacturers only.

2.3.2.8 - EV CHARGING

Electrical vehicles are being used in large numbers. Charging of these EVs has become more widespread. By following these precautions, you can significantly reduce the risk of electrical shocks and accidents.

Precaution	Explanation
Use a certified EV charging station.	Certified charging stations meet all safety standards and are designed to prevent overcharging and overheating. Always use a certified charging station to avoid any safety issues.
Avoid charging your EV in extreme temperatures.	Extreme temperatures can damage the battery and reduce its lifespan. Therefore, it's best to avoid charging an EV in temperatures below freezing or above 100 degrees Fahrenheit.
Avoid charging in wet conditions.	Water and electricity don't mix, so it's important to avoid charging in wet conditions. If you must charge your EV in the rain, ensure that the charging station and the charging cable are not exposed to water.
Use the right extension cord.	If you need to use an extension cord, make sure it's apt for charging the EV. A heavy-duty extension cord that is rated for outdoor use is ideal.

Check the charging cable.	Before plugging in the charging cable to the vehicle, inspect it for any signs of damage. Do not use any damaged or faulty cable.
Do not overcharge.	Overcharging can damage the battery and reduce its lifespan. Most EVs have a built-in mechanism to prevent overcharging, but it's still advised to keep an eye on the charging process.
Check the batteries regularly.	Unlike conventional cars, EVs can experience battery drain even when parked or not in use for a long period. Therefore, track the charging times of the EV & monitor the battery's overall performance to ensure the safe operation of your EV.
Use your EV regularly.	Parking your EV for too long can impact its various components, including its battery pack. Hence, take out the EV for a short spin regularly to maintain the good health of the vehicle.
Do not completely drain or charge the battery.	Avoid draining the battery to 0% or charging up to 100%. If you do it so regularly, it may impact the battery life. Always try to maintain the battery status between 20% to 80%.



3 RESPONSIBILITIES

Various authorities / people are responsible to ensure proper and safe use of Electricity. These are given below:

3.1 RESPONSIBILITIES OF OWNER OF THE BUILDING / SOCIETIES

- Depending on the size of the building, the society/owner of the installation may appoint maintenance staff as required to effectively ensure electrical safety in the premise.
- Take necessary action to appoint a competent person from the area to undertake electrical repairs and equipment testing in the electrical installation. This includes testing of relevant appliances, extension cords and multiple-socket outlets.
- Make sure contractors, sub-contractors and other service providers have the required qualifications and adhere to procedures specified in this guideline.
- Any additions or alterations in the premises, the society/owner of the installation may coordinate with competent person and check whether the existing power supply is adequate to cater to the incoming demand.

Otherwise, suitable precautions should be taken to separate the electricity supply or increase the allotted capacity of the existing supply.

- For construction, temporary power supplies shall be applied from the supply company, depending upon the rules of the supply company.
- Employ a competent person for temporary electrical work, such as sports festivals, festival seasons and exhibitions and such extensions should be equipped with all protective measures, such as 30 mA RCD for the complete power supply, double-insulated wires with mechanical protection for wiring in accessible locations and plugs and sockets should be of suitable current rating with Indian 3-pin plugs and sockets etc.
- Coordinate with the contractor to give necessary facilities to him to avoid accidents. Inform the contractor to organize their work without affecting the safety of people.

- Inform residents and staff of any maintenance or construction activities that will take place.
- Keep records, test reports, warranty cards and built drawings of new constructions, alterations and extensions.
- Provide copies of the electrical designs to the Electrical Safety Coordinators as required to further ensure effective implementation.
- Keep records of contractors and sub-contractors and take timely action to rectify any defects observed. Note that within the defect liability period, contractors are fully responsible for such partial or complete repair.
- Arrange comprehensive annual inspections with the help of all staff and registered competent persons to ascertain the healthiness of the installation.
- If any defect or defects are identified during the above inspections, or by any member or by any other means, immediately record these defects and take

action to rectify the defect to ensure safety. If the repair cannot be made immediately, such affected section or sections shall be isolated from the electrical supply until the defect is rectified. If unable to isolate the particular section, the entire system will need to be de-energized(disconnect the electric circuit from the power supply) until rectification is completed.

- Arrange training programs for the Electrical Safety Coordinators members with the support of NFE and Electricity Licensees.

3.2 RESPONSIBILITIES OF CONTRACTORS /SUB-CONTRACTORS /SERVICE PROVIDERS

- Ensure to take proper authority from the society/owner of the installation before commencing any work. Such work should be undertaken by a competent and approved contractor and should be carried out after ensuring the safety of people.
- Commence construction or maintenance work only after respective drawings / procedures are approved by the society / owner of the installation.
- The contractor should obtain the third party insurance cover.
- Before starting work, the contractor should take all precautions such as fencing, netting, installing safety notice, etc., to avoid any kind of accidents.
- For small contracts, power should be taken via appropriate distribution boards, after getting the approval from the society/owner of the installation. If society/owner of the installation decides to have internal metering to measure the usage during construction period, the contractor is obliged to do so.
- The contractors should not be allowed to use damaged extension cords, unprotected temporary circuits, wires with joints etc.

- All new and renovated electrical installations should be tested and commissioned by a competent person and a certified copy of the test report should be submitted to the principal.
- Comprehensive and accurate as built drawings should be submitted to the society/owner of the installation.
- Any amendment or changes to the installation should be informed to the society/owner of the installation in writing, together with the drawings.
- Test reports, warranty cards and built drawings of new constructions, alterations and extensions should be submitted to the society/owner of the installation.
- If peripheral illumination is required in construction sites, such wiring should be done through electrical conduits.
- Remove the old wiring before installation of new wiring.
- Remove all temporary installations before handing over the site.
- A competent supervisor should lead the maintenance team and take necessary permits required to follow the electrical regulations and safety of staff and equipment.
- Get the "Work Permit" indicating the work to be attended together with the names of competent persons.

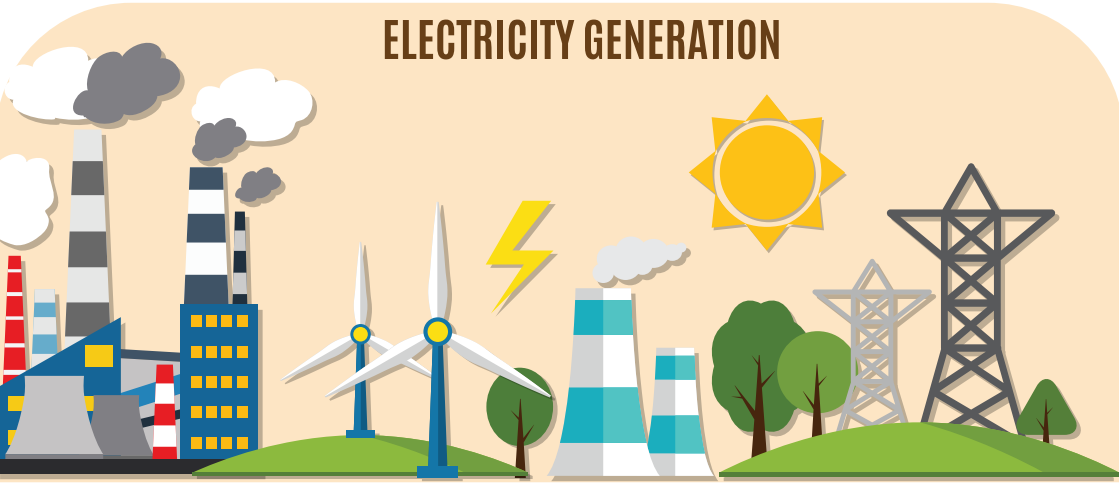
- Put up the sign boards "Men at Work", "Do not switch ON" or "Danger" at construction area.
- Use double-insulated tools for live line repairs.
- After completing the work, all workers should acknowledge in writing that the system is no longer safe to work as it is now live, remove earth from live parts and have the system normalized by the work supervisor.
- It is recommended to employ a permanent electrician if the electrical installation is complex and requires highly competent staff for routine maintenance.

3.3 RESPONSIBILITIES OF SUPPORTING STAFF AND SECURITY

- Visually inspect all electrical equipment before use.
- Visually inspect all equipment and wiring in and around the premises once in a week and after maintenance work.
- Remove any appliances with frayed cords, missing ground prongs, cracked tool casings, etc. from service.
- Attach warning tags to any defective appliances/tools and do not use them until they have been repaired by a competent person.
- Ensure that outdoor lights, garden lights, security lights and temporary lights for festive seasons and sports activities etc. are in a safe condition.
- Switch off these lights during daytime.
- Ensure that all such circuits are powered through a separate RCDs of 30mA sensitivity.

3.4 ALL USERS OF ELECTRICAL EQUIPMENTS

All users of electrical equipment should adhere to mandatory operational requirements listed under **MANDATORY OPERATIONAL & MAINTENANCE REQUIREMENTS.**



3.5 SAFE CLEARANCE FROM DISTRIBUTION LINES

Clearance requirements for the distribution low voltage power lines (upto 650 volts) shall be as follows:

Location	Minimum clearances in metres
Clearance above the ground for the Lines Crossing of public road	5.8 meters
Clearance above the ground for the Lines laid Along roads	5.5 meters
Clearance above the ground for the Lines laid Elsewhere on the road or street	4.6 meters
Vertical clearance above the building (in addition to the maximum sag of the lines)	2.5 meters
Horizontal clearance from the building (in addition to the deflection of wires due to wind pressure)	1.2 meters

4 PROTECTION

4.1 HOW YOU CAN PROTECT YOURSELF?

The fundamental rule is "Hazardous ‘live‘ parts shall not be accessible and accessible conductive parts shall not be hazardous." Simple it may sound, but complicated it gets. That's why we need to be extremely careful when dealing with electricity.

4.2 FIRST AID

During an electrical shock:

- Muscles tighten up, making it almost impossible to pull away from the circuit.
- Lungs constrict, making it hard to breathe.
- Heartbeat is interrupted and blood vessels tighten.
- Burns occur where the electricity enters and leaves the body.
- Anyone who touches someone who is being electrocuted can become part of the circuit as well, that's why never touch anyone who's received an electrical shock.

4.2.1 – PROCEDURE TO FOLLOW IN CASE OF AN ELECTRICAL ACCIDENT/SHOCK

- While seeking assistance, immediately switch off the power and if it is not possible, try to remove the person from the power supply in the most appropriate safe manner (rescue person should use tested and approved gloves or dry wooden plank etc. as an insulator to avoid contacting with the electrical supply through the affected person).

- Keep in mind that only one person should be in command during the rescue operation.

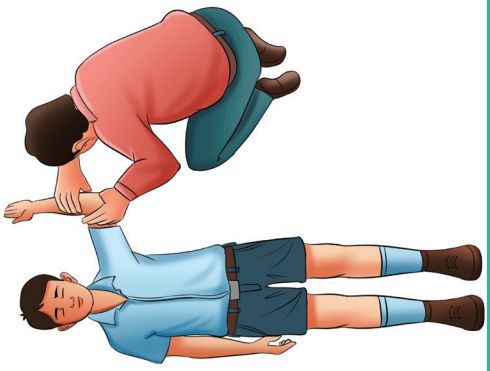
- After rescuing the affected person, shake their shoulders gently and speak to him to test whether they are conscious or unconscious.

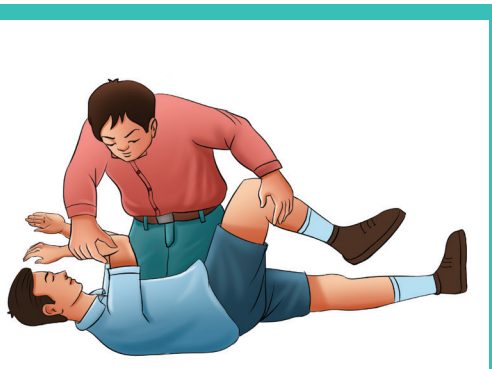
- If the person does not show any response, place the fingertips on their forehead and chin and back his head to open the air way.

- Check the breathing for 10 seconds. Respiratory process can be confirmed by look, listen and feel.

• If the person is breathing, treat the him as an unconscious person and place him in recovery position and loosen tight clothing.

Step 1

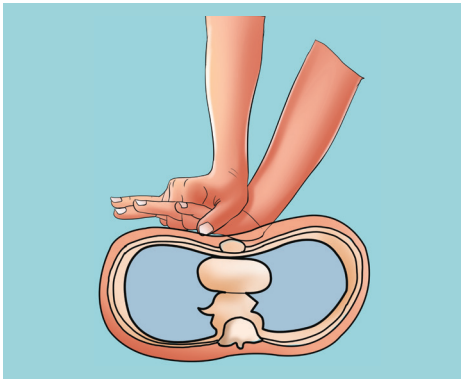




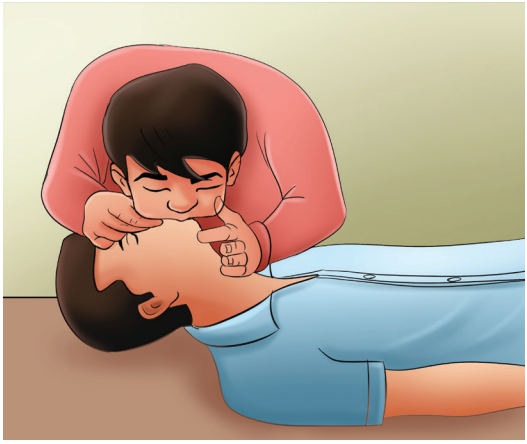
Step 2

Step 3

- If the casualty is not breathing, Interlock the fingers of your both hands. Leaning well over the person, with your arms straight, press down vertically on the breastbone and depress the chest by about 4-5 cm (11/2 in.). Release the pressure without removing your hands from their chest. Compress the chest 30 times at a rate of 100 compressions per minute. The time taken for compression and release should be about the same.



- Tilt the head back, lift the chin, and take a deep breath to fill your lungs with air and place your lips around the person's mouth, ensuring that you have a good seal. Blow steadily into their mouth until the chest rises. Give two rescue breaths.



- Continue this cycle of alternating 30 chest compressions with two rescue breaths.

- Continue this procedure until the person is provided with medical assistance from a doctor.

4.2.2 - FIRST AID FOR BURNS

- Keep the affected people away from fire and smoke.
- Smother any flames by covering them with a blanket.
- Drench the burnt area immediately with cold running water.
- Give fluids if the patient is able to swallow.
- Direct the affected person to the correct medical treatment.

4.2.3 - FIRST AID FOR FRACTURES

- Do not move the suffered person until the injured part is secured and supported unless he is in immediate danger.
- Do not allow the person to eat or drink, because anesthetic may be needed.
- Do not press directly on a protruding bone end of the person.
- Arrange a comfortable transportation for medical treatment.

4.2.4 - FIRST AID FOR DISLOCATED JOINTS

- Do not try to replace a dislocated bone of the affected person into the socket as this may cause further injury.
- Do not move the person until the injured part is secured and supported, unless they are in an immediate danger.

- For a hand or arm injury, safely remove bracelets, rings and watches in case of swelling.
- Do not allow the casualty to eat or drink because anesthetic may be needed.

4.2.5 - EMERGENCY PRACTICES

During an emergency:

- Do not panic.
- Discontinue any work you may be engaged in.
- Switch off the electricity supply if the supply seems dangerous.
- Inform all people of the emergency (by raising the emergency alarm if available)
- Assemble at a previously known safe location.
- Ensure all people arrive at the safe location.

4.2.6 - FIREFIGHTING

Firefighting equipment should be available and should be marked for the type of fire.

The following are the classifications for different types of fires and the appropriate fire extinguishers to be used for each type of fire:

	Types of fire	Extinguisher Type
A	Solid (wood, paper, plastics etc.)	Water / Foam / Powder
B	Liquid (Oil, petrol or spirit type liquids, etc.)	Foam / CO_2 / Powder
E	Gases (LPG, Acetylene, etc.)	CO_2 / Powder
C	Metal (Aluminium, Lead, etc.)	Special Fire Extinguishers
D	Electricity	CO_2 / Powder
F	Cooking oil	Wet Chemical

The following give the details of the type of Fire Extinguishers / extinguishing agents and the types of fire for which it should be used:

Type of Fire Extinguisher	Type of Fire
Class A 	Fire in ordinary combustible materials such as wood, paper, cloth, etc.
Class B 	Fires in the vapour-air mixture over the surface of flammable liquids such as gasoline, HSD, grease, lubricating oil, etc.
Class C 	Fire in the energised electrical equipment; non-conducting extinguishing agents to be used.
Class D	Fires in combustible metals such as magnesium, titanium, sodium, etc.
Class F 	Fires in cooking appliances that involve combustible cooking media (vegetable or animal oils and fats)
Water 	• Considered to be the best fire extinguishing agent • High specific heat and high latent heat of vaporisation (2260KJ/kg) • Extinguishes the fire by cooling the burning material • Relatively inexpensive compared to other extinguishing agents • 1 litre of water is converted to 1600 litres of steam which dilutes the oxygen concentration in the burning zone • **Used on Class A fires only** • **Not to be used on Class B & C fires**

Type of Fire Extinguisher	Type of Fire
Carbon Dioxide 	• Extinguishes the fire by smothering/displacement of oxygen • Removes heat with a very cold discharge thereby reducing the flame temperature • Non-conductive and non-corrosive in nature • Used on Class B & C fires • Usually ineffective on Class A fires • Also used in total flooding systems
Foam 	• Extinguishes the fire by forming a film/blanket over the burning surface thereby smothering/cutting off oxygen to the flame • Prevents re-ignition by suppressing formation of flammable vapours however, re-ignition can occur if foam film/blanket is broken • Not to be used on Class C fires • Types include protein foam, fluoroprotein foam, aqueous film-forming foam (AFFF), alcohol resistant (AR) foam, film-forming fluoroprotein foam (FFFP)
Dry powder 	• Extinguishes the fire by interrupting the chemical reaction between fuel, oxygen and heat thereby inhibiting the chain reaction • Smothers/cuts off oxygen supply by forming a thin layer over the burning material • Effective on Class A, B & C fires
Class F Type	• **Ideal for use on cooking appliances including solid combustible material** • **Contains potassium acetate in liquid form** • **Stored pressure type** • **Certified by BIS** • **Saves cleanup time** • **Available in 9 litre size**

Which extinguisher is used for each class of fire?

A Quick Guide

Type (Fire / Extinguisher)	CLASS A Combustible materials (e.g. paper & wood)	CLASS B Flammable liquids (e.g. paint & petrol)	CLASS C Flammable gases (e.g. butane and methane)	CLASS D Flammable metals (e.g. lithium & potassium)	Electrical Electrical equipment (e.g. computers & generators)	CLASS F Deep fat fryers (e.g. chip pans)	Comments
Water	✓	✗	✗	✗	✗	✗	Do not use on liquid or electric fires
Foam	✓	✓	✗	✗	✗	✗	Not suited to domestic use
Dry Powder	✓	✓	✓	✓	✓	✗	Can be used safely up to 1000 volts
CO2	✗	✓	✗	✗	✓	✗	Safe on both high and low voltage
Wet Chemical	✓	✗	✗	✗	✗	✓	Use on extremely high temperatures

Table 3: Types of fires and extinguisher types

5 IDENTIFIED SHORTCOMINGS AND COMMON MISTAKES

5.1 POOR PRACTICES AND POOR HOUSEKEEPING

Following are the commonly identified shortcomings and defects in electrical installations.

- There is no Electrical Safety Coordinator to look after the electrical system.
- No competent person identified to investigate poor maintenance or conduct poor maintenance checks.
- New constructions, extensions and alterations are not properly coordinated.
- No records available on breakdowns, as built drawings, test reports and warranty cards etc.
- Safe practices are not followed properly during new constructions, extensions and alterations.
- Safe practices are not followed properly during temporary wiring for festivals and exhibitions etc.
- HT lines are running close to premises.
- Having unattended, poorly maintained and broken electrical systems.

5.2 SHORTCOMINGS IN INSTALLATIONS

- Main switchboard related
  - Wrong location of the main panel board with no satisfactory ventilation.
  - Open unused cable entries in the board.
  - No protection from extreme weather conditions, dust etc.

- No easy access to maintenance work.
- No provisions for future expansions.
- Possible access for rodents.
- No easy access in case of emergency.
- Having flammable items within the switchboard room.

- **Protection:**
  - No proper spacing to enable heat dissipation.
  - Loose connections.
  - Multiple circuits originating from one terminal.
  - No consideration for future expansions.
  - RCCBs bypassed.
  - No recurrent checking or testing to ensure proper operation of protective devices.
  - RCCBs with unsuitable leakage currents (100mA or above).
  - Non-functional trip switches and breakers.
  - Use of incorrectly rated wires and unbalanced sizes.
  - Utilizing PVC tape joints for extending the supply of wires and cables is strictly prohibited and should not be employed.

- **Earthing**
  - Protective earth wire physically disconnected from earth terminal at distribution board.
  - Earth wire physically disconnected from earth electrode.
  - Earth wire not taken via shortest straight path.
  - Use of underrated earth cables at main panel earthing.

- **Cables and Miscellaneous**
  - Unprotected outgoing sub-main cables for over current (overloading and short circuits) and directly feeding from bus bars of main panel.
  - No safe routes used or no proper mechanical protection provided for all cables.
  - Selected cables unable to maintain voltage within specified tolerances due to changes being made from time to time without consulting a competent person.
  - Drawing excessive number of wires through conduits.
  - Broken switches, fan regulators and socket outlets connected to the live circuits.
  - Conducting metal-based parts such as roofs, gutters, handrails, cable trays and ladders not properly earthed.
  - Non-compatible plugs and sockets.
  - Plugs used in other countries such as Germany and UK which come along with apparatus of non-Indian origin.

5.3 RESPONSIBILITIES OF THE MANAGEMENT

- A competent person must be employed for carrying out temporary electrical works such as festivals and exhibitions.
- Responsible person must be appointed to ensure electrical-related safety of the occupants.
- Warning tags should be attached for malfunctioning equipment.
- Competent person must be engaged to undertake electrical repairs and equipment testing of the electrical installation.
- Records, test reports, warranty cards and drawings of new constructions, alterations and extensions should be maintained.
- Verification practice should be adopted to identify defects of the electrical installation.
- Before starting work, contractors should take all precautions, such as fencing, netting and safety notice displaying to avoid any kind of accidents.
- Outdoor lights must be switched off during daytime.

5.4 CONCLUSION

All the above observations are deviations that can cause electrical hazards. The scale of the damage may range from small fire, equipment damage to sizable fire, damage to entire building and loss of lives.

Therefore, it is very important to be vigilant about electrical systems and maintain them in compliance with standards. Further, it is equally important to understand how to handle electricity safely, its limitations and maximum current levels that humans can tolerate.

Always use a competent person to identify & investigate any electrical problems.

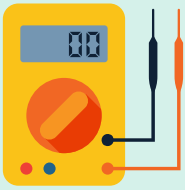
6 VERIFICATION

The checklist given below shall be followed for Verification. Detailed Inspection and testing recommenced in NEC 2023 (SP-30) shall be carried out by a competent person. Contents of this section is for information to students to show examples:

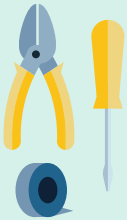
Location	Subject	Status	Comment
Distribution Board	Operation of MCBs		
	RCCB test button and testing		
	Adequately ventilated		
	Easy access		
	Loop impedance test (test to be made on every socket for the respective MCB)		
Wiring	Operation of MCBs		
	RCCB test button and testing		
Plugs and Sockets	All sockets are 3-pin Indian type		
	Plugs used in all appliances are 3-pin Indian type (except for small power devices such as mobile chargers and some audio video equipment)		
	Wires in cords are not exposed		
	Plugs are fixing properly in sockets		
	No BURN marks on plugs & sockets		
	Are not at an unsafe location		
Lamps	Burnt or not installed		
	Not fixed properly		
	Broken Lamp holder / Ceiling rose		
Fans	Fan regulator not working		
	Fan not working		
	Regulator not fixed properly		
	Fan not fixed properly		

Extension boards	Frayed cords		
	Cracked tool casings		
	Discoloured and heated outlets		
	Loose plugs at outlets		
Switches	Hard to switch on/off		
	Loose to switch on/off		
	Not fixed properly		
	Single switch to multiple items		
Appliances	Damaged cords/insulation		
	Located in wet conditions		
	Damaged/removed earth pins		
Earthing	Integrity of earth wire		
	Insulation failures of earth wire		
Outdoor	Powerlines are at a safe distance		
	Exposed temporary wiring		
	Electrical safety at water features		
Service wire and meter			
Tested by:		Next date of testing:	

Always inspect your electrical appliances with a professional to ensure your safety



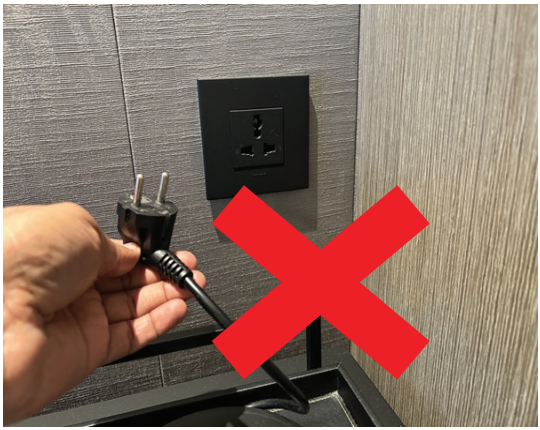
Test and Use



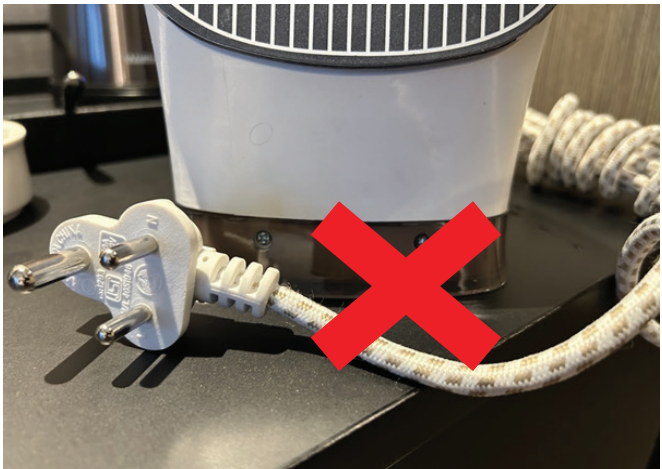
6.1 USE OF NON-STANDARD PRODUCTS BE DISCOURAGED

Nonstandard products and services shall not be used. Several such products are available in the market starting with Energy savers, Digital Earthing, IOT based device claiming that it monitors and provides warning for users on various safety measures of IS732. These products are non standard and may pose a risk.

- Non-standard plugs and sockets used in India. European plug (called as Schuko plug) & Indian socket are not to be used.



- High power equipment with 6 amps plugs (examples). Non-standard practice: 1600 watts electric iron with a 6 amps plug (6 amps is suitable for load up to 1000 watts).



6.2 CHECK AND USE

Things required as protective measure in electrical safety

1. Insulation Mats according to voltage rating of panel

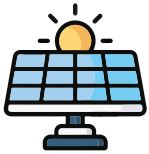
2. Fire Extinguisher based on class of fire

3. First Aid Box with trained personnel in basic first aid

4. Shock Treatment Chart in prominent location

5. List of designated / trained first aid professional

6. Mentioning source of power for easy isolation in case of emergency



7. Solar Photo Voltaic installation

6.3 GENUINE BIS STANDARD MARKS

IS : 8034

CM/L-7407873

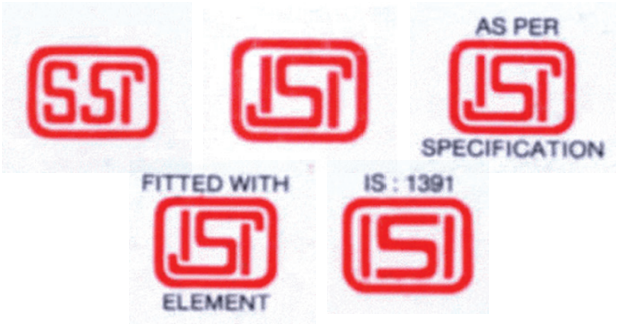
IS : 8448

CM/L - 8530025618

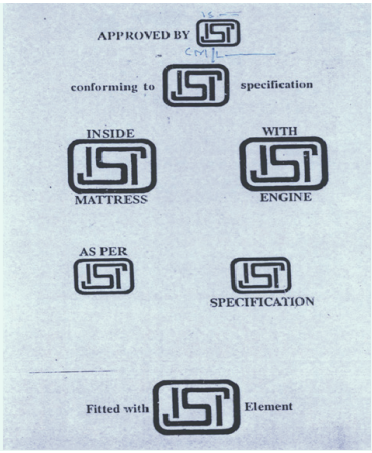
IS 15298

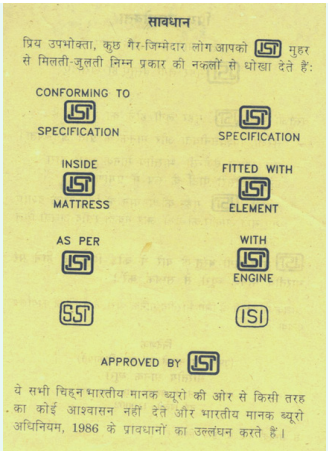
CM/L-3793581

6.3.1 - SPURIOUS AND MISUSE OF MARKS

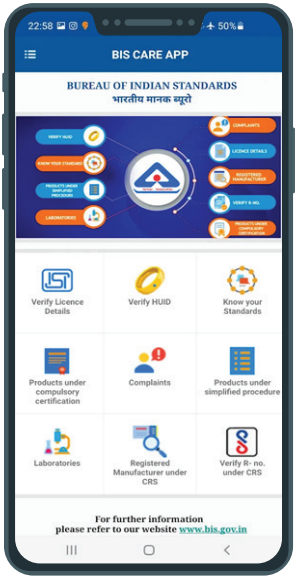


6.3.2 - SOME CASES OF MISUSE





6.3.3 - BIS CARE APP



7 NOTES

NFE
NATIONAL FEDERATION OF ENGINEERS
FOR ELECTRICAL SAFETY

ABOUT NFE

The National Federation of Engineers for Electrical Safety (NFEES) is a body of electrical engineering professionals working in the field of electrical safety by improving skill and facilitating accreditation of practicing electrical engineers, working closely with electrical inspectorates of state and central governments, electrical designers, safety officers, and engineers in the field of quality, safety and standards.

VISION

To make every electrical installation free of accidents such as electrocution and fire due to short circuits and increasing the reliability of the electrical installation, thus contributing to the saving of life and property and supporting sustainable development.

MISSION

We shall strive to achieve our vision through getting accredited for product and personnel certification which shall focus on electrical safety by design, manufacturing, installation and maintenance of electrical product & installation by competent and qualified manpower using quality resources including product, processes and procedures.

8 USEFUL LINKS

1. Safety related links on CEA website:
https://cea.nic.in/safety-lineman/?lang=en

2. Sachet Magazine:
https://cea.nic.in/wp-content/uploads/safetylineman/2024/05/Sachet_Magazine__Bilingual.pdf

3. BIS website:
www.bis.gov.in

4. BIS Licence/hallmark related details:
www.manakonline.in

5. Know your standard link:
https://www.services.bis.gov.in:8071/php/BIS_2.0/bisconnect/knowyourstandards/indian_standards/isdetails

6. For subject-wise list of products available under certification
https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category

7. For list of products under BIS mandatory certification,
https://www.bis.gov.in/product-certification/products-under-compulsory-certification/

8. Guidance document on Quality Control Orders
https://www.bis.gov.in/wp-content/uploads/2021/07/Guidance-document-on-QCOs-Revised-1.pdf

9. Videos on Electrical Safety: The Official Channel of the NFE
https://youtube.com/@nfeindia?si=a1MNmSFgdyvewAQS

O-37, Plot-8, Bharathidasan Street
Thirunagar, Jafferkhanpet,
Chennai, Tamil Nadu - 600 083, INDIA
www.nfees.org
admin@nfees.org