सचेत

विद्युत सुरक्षा पुस्तिका

SACHET

ELECTRICAL SAFETY HANDBOOK

An initiative of Central Electricity Authority

सत्यमेव जयते

Jointly with

Bureau of Indian Standards

International Copper Association India
Copper Alliance

ieema
your link to electricity

सचेत रहें, सुरक्षित रहें

SACHET

- Stick to Safety Standards
- Adequate use of PPEs
- Coordination at workplace
- Hazards identification
- Emergency action plan
- Training to employees

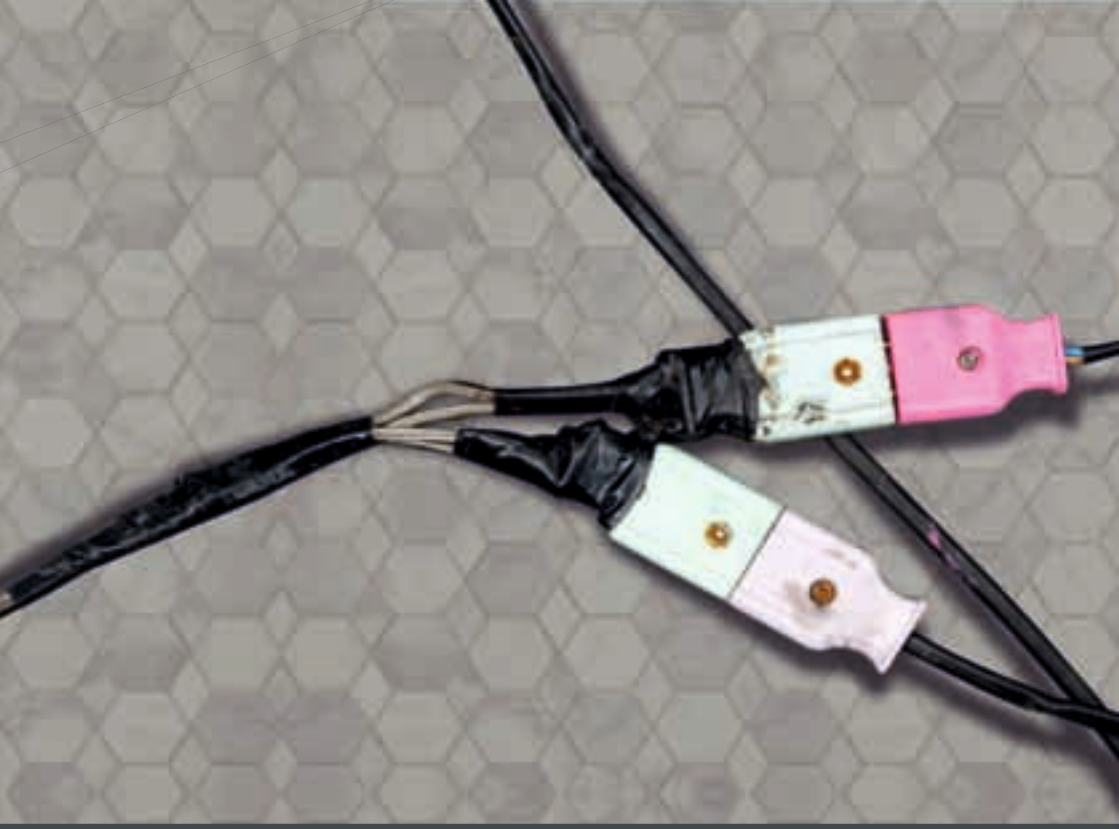
CONTENT

INTRODUCTION

“Safety goes Danger grows”

The abundant usage of electricity in the day to day activities by an individual either at home, office or place of work, be it an industry or a public place is associated with a certain degree of risk to life and property. As electrical energy strikes without warning, vigilance is necessary pre-requisite to avoid accident. Since potential danger from electricity cannot be seen, heard or smelt, it is most essential that knowledge on the extent of damage it could cause is known, so that preventive measures could be initiated in every premises and instance of such electricity use.

CAUSES OF ELECTRICAL ACCIDENTS & ELECTRICAL FIRE



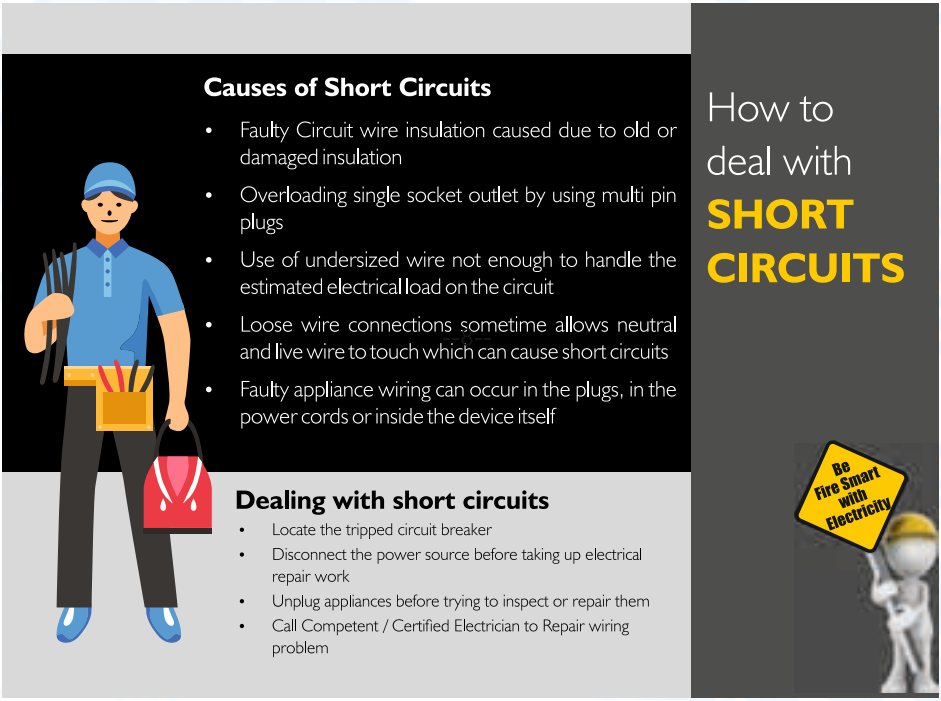
Nearly one third of home electrical fires began with **ignition of wire or cable insulation.**

CAUSES OF ELECTRICAL ACCIDENTS & ELECTRICAL FIRE

1. Use of old tools and cables which are prone to cause earth leakage due to their inadequate insulation resistance.
2. Use of undersized wires and cables.
3. Dragging of metal plates/Street sections/equipment above cables which may result in insulation damage / failure.
4. Repairing electrical equipment / hand tools with power ON
5. Dropping tools to live busbars accidentally.
6. Excavating buried cable route which may contain live cables.
7. Not providing route markers for buried cables.
8. Scaffolding / crane boom touching overhead lines.
9. Haphazard way of taking power from distribution board without proper plug sockets and with multiple twisted joints.
10. Not using proper fuse wires or use of conductors as a fuse wire in emergency.
11. Use of bare fuse wire in High Rupturing Capacity (HRC) fuse carriers.
12. Entry of moisture into switch boards.
13. Assuming low voltages to be safe.
14. Use of earth / structure as neutral or return path for glowing a bulb or operating hand tools.
15. Use of protection devices with higher ratings

STOP ACCIDENTS BEFORE THEY STOP YOU!

16. Wrong design of the electrical installations
17. Inadequate protection scheme
18. Insufficient clearance for cooling and maintenance of transformer
19. Lack of preventive maintenance of electrical equipment
20. Insufficient fault isolators amounting to wrong selection of circuit breaker/load break switch
21. Improper bus ratings
22. Not providing proper earthing to electrical equipment
23. Improper stringing of the Over Head lines without adequate clearance between phases and between phase & earth
24. No provision of anti-climbing devices on towers / poles
25. Improper termination / jointing of cable
26. No provisions of LT Kiosks/LT cut outs
27. Improper location and not providing fencing the oil filled transformers
28. "Chalta-hai" attitude.



Causes of **OVERLOAD & SHORT CIRCUITS**

- ☑ Inferior grade materials
- ☑ Undersizing of wiring
- ☑ Improper earthing
- ☑ Insulation failure
- ☑ Loose conductors
- ☑ Poor design

OVERLOADED electrical circuits are potential **FIRE HAZARDS.**

Timely
REPLACE or repair
DAMAGED or
LOOSE
electrical cords.

ELECTRICAL SAFETY PRECAUTIONS

A flammable Item
that is too close to a
light fixture
or bulb is the leading factor
contributing to
electrical fires.

GIVE THEM SPACE!

ELECTRICAL SAFETY PRECAUTIONS

- Display single line diagram, shock treatment chart, emergency contact phone numbers etc. in electrical switchgear room.
- Fix danger / caution boards on conspicuous positions.
- Keep a good first aid kit at easily accessible place and check / replace contents at regular intervals.
- Adopt colour coding of wires, Green colour should be used only for earthing.
- Locate switches in such a way that they are easily accessible during emergencies.
- Always follow good housekeeping.
- Ensure availability of proper protection device (ensure correct rating) in each circuit.
- Never use single pole switch or fuse in neutral.
- Never pull out plugs without switching off.
- Use only three pin plugs in single phase circuits.
- Clearly mark circuit breakers & switches to indicate the load / circuit.
- In high current and inductive circuits, switches should be provided and operated before fuses.
- Ensure overhead lines are switched off before movement of cranes in their vicinity.

Get all the electrical work done only by a **QUALIFIED ELECTRICIAN**

ELECTRICAL SAFETY PRACTICES

“Accident brings tears, SAFETY brings cheers”

- DO NOT renew a blown fuse, until the cause is identified and rectified.
- DO NOT close any switch unless you know why it was kept open.
- DO NOT Touch or tamper with any electrical equipment or conductor, unless you have made sure that it is DEAD and EARTHED.
- DO NOT Work on live circuit without the permission of the supervisor and make sure that All safety precautions have been taken and you are accompanied by a second person competent to render first aid.
- DO NOT disconnect earthing connection or by-pass safety gadgets installed on mains and apparatus.
- DO NOT open or close switch or fuse slowly or hesitantly and do it quickly.
- DO NOT Touch an electrical system or circuit when your hands are wet .
- DO NOT use wires with poor insulation.
- DO NOT disconnect a plug by pulling flexile cable when the switch is on or off.
- DO NOT work on energised circuit without taking extra precautions, such as use of rubber gloves.
- DO NOT throw water on the electrical equipment in case of fire.
- DO NOT allow visitors and unauthorised persons to touch or handle electrical apparatus or come within the danger zone of high voltage apparatus.
- DO NOT test circuit with bare fingers.

SAFETY PRACTICES FOR CONTRACTORS

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PLANNING:

- A single line diagram should be submitted by the contractor to safety department for approval before execution of work & only after the approval of the single line diagram, the work should be executed
- Only trained and authorized personnel should carry out any service or repair

DISTRIBUTION PANELS:

- All electrical panels should be easily accessible & have a minimum statutory clearance
- Ensure that panel's surrounding is free from combustible and flammable materials
- Tapping should be done from maintenance panel only after prior written approval.
- Prior to operation all power supply and protective devices should be checked
- All panels should be duly grounded to avoid ground fault current.
- Panels should be fitted with Ground Fault Current Interruptors (GFCI) to avoid fault currents
- When not in use, electrical panels doors should be closed and latched
- All distribution panels should display current rating
- Panels should be at least to an IP44 rating to avoid dust entry and protect from wet condition
- To avoid toppling, the base of the panels should be securely fixed to the ground

ELECTRICITY SUPPLY FROM PANELS TO WORK AREA:

- Only designated person should be permitted to work on live electric.
- Employees should be provided efficient personal protective equipment complying BIS standards or any relevant international standards;
- Electrical contractors must ask themselves every day whether: -
  i. There are effective lockout/tagout (LOTO) & Permit to work procedures in place;
  ii. Employees are properly trained for safe work practices;
  iii. Safety talks are done with workers regularly;
  iv. Portable electrical tools are grounded
  v. ELCB/RCD/Ground fault circuit interrupters and/or an assured equipment grounding program are in place for carrying out the assigned electrical work.

- Power should be tapped only from the designated sources as instructed.
- More attention to be given when power supplies serve more than one job, switching errors can result in energizing the wrong equipment, leading to possible hazards for the personnel.
- The panel board should be earthed.
- Provide signs or lights to warn personnel when the supply is energized.
- When using tools near electrical hazards, all tools must have a double insulated casing to prevent contact with energized parts.
- Before entering into power supply or associated equipment enclosure, following precautions should be taken:-
    - De-energiseation of the equipment
    - Open and lock out the main input circuit breaker, auxiliary power circuits should be checked
    - Discard damaged cords, cords that become hot or cords with exposed wiring
    - Power tools should be inspected for frayed power cords, broken plugs and cracked or broken housing electrical equipment should be Unplugged before repairing or servicing it
- Inspection, Testing and Labelling of the equipment must be ensured before start of the work.
- The post meant for cable support should be earthed duly
- Electrical cords should be placed away from areas where they may be pinched and areas where they may pose a tripping or fire hazard (e.g, doorways, walkways, under carpet etc.)
- Male and female industrial sockets should be used for connections of cords and no joints should be made with PVC tapes.
- Any crane or vehicle movement in the vicinity of supply lines should be monitored. Avoid any electrical contact with supply end and maintain sufficient clearance.
- Cable should run to the required length with minimum joints.
- No live ends of a conductor should be left unattended.
- Do not let Electrical equipments to be suspended by the cords.
- Never leave holder without lamps or plugs.
- Ensure that apparatus is properly discharged before handling.

- All electrical cords and appliances must have apt weather protection
- Do not attach Electrical cords to the building surfaces/structures
- Caps should be used in Unused sockets to avoid direct contact and mechanical damage
- Firm Mounting of Receptacles in their enclosures and it should not move when the plug is inserted.
- Double insulation should be ensured in cables to prevent from fraying and possible mechanical damage
- Cables running over the ground should be avoided if they pose a trip hazard or electrocution
- Cables should be laid either underground or routed minimum 4m above from the ground level
- The cable should be routed above the ground with the minimum height of 6m from the ground level where it is crossing the passage meant for vehicle movement, where underground laying is not possible.
- If the cables are laid underground, the cable route markings should be made with boards which should display the direction and the current rating
- All extension boards should be minimum IP44 type
- Use of extension cord should be minimized
- When not in use, tools should be unplugged
- •
  Never whip a cord to unplug it
- Ensure that the cable must be secured inside the equipment by non-conducting faces so that it cannot slip
- Electrical equipment that has grounded three pronged plugs should only be used
- Do not attempt to remove by yourself, If a prong breaks off inside an outlet
- Do not remove the prongs of an electric plug. If plug prongs are missing ,loose or bent replace the entire plug

ADDITIONAL SAFE MEASURES:

- We should stay at least 10 feet away from overhead power lines
- Ensure Proper illumination in all areas where electrical hazards are to be encountered and an emergency lighting system should be in place as well
- Never drill a wall or floor without checking for any concealed utility electrical system
- Specialized personnel protective equipment and clothing should be provided

to the personnel to work on energized line or equipment

The following safety features should be ensured while working with energized line/equipment:

- Insulated tools to avoid shocks
- Rubber gloves
- Shock resistant safety boots/shoes
- Safety glasses/goggles
- Flame resistant clothing if there exists any risk of an electric arc that could cause a fire

Precautions to be taken while working with a hand tool:

- Follow permit system while doing maintenance / repair.
- Always wear hand gloves.
- Wear an electrical safety shoe while working with electricity.
- Stand on rubber mat while working.
- Residual current device (RCD) with 30mA sensitivity should be ensured in the operating circuit.
- Earth the phase conductors, while working and use locks to prevent inadvertent 'switching on' during repairs.
- Work on live terminal boxes, panels etc., should be done by using only one hand to the extent possible. Touching of any conducting / metal part with other hand should be avoided.
- Well insulated overall sheathed 3 or 4 core cables should be used.
- Joints in wires should be avoided.
- Do not use earth as neutral.
- Secure tight connections. A neutral disconnection stops the equipment but causes electrocution on touching the terminals (including the neutral terminal).
- The body of the equipment should be earthed using third core of the cable.
- Only flexible cables should be used to connect handtools (avoid single strand / stiff wires). Use rubberised sheath / sleeves near terminals and ends, to avoid cuts due to frequent twisting / fatigue
- Follow proper interconnection techniques – Plug a socket, terminal blocks, welding receptacles etc.
- Power supply for hand tools should be from centre tap earthed transformers.

ELECTRICAL SAFETY NEAR/AT SCHOOL

ELECTRICAL SAFETY NEAR/AT SCHOOL

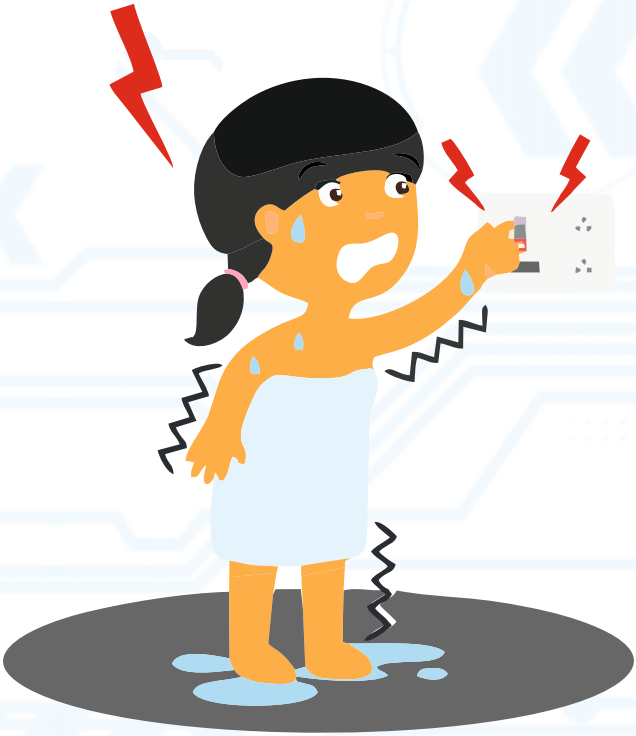
- Schools should be located far away from the substations, supply lines.
- Open Distribution box, junction box, street box, etc. should not be there either in the school or on the way to school.
- Transformers should be fenced adequately.

Do's

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

Don'ts

- DON'T ever climb the fence around an electrical substation.
- DON'T use electrical appliances near water.
- DON'T take shelter under any structure in rain/storm that has supply lines in its vicinity.
- Don't climb or touch a tree near power lines.



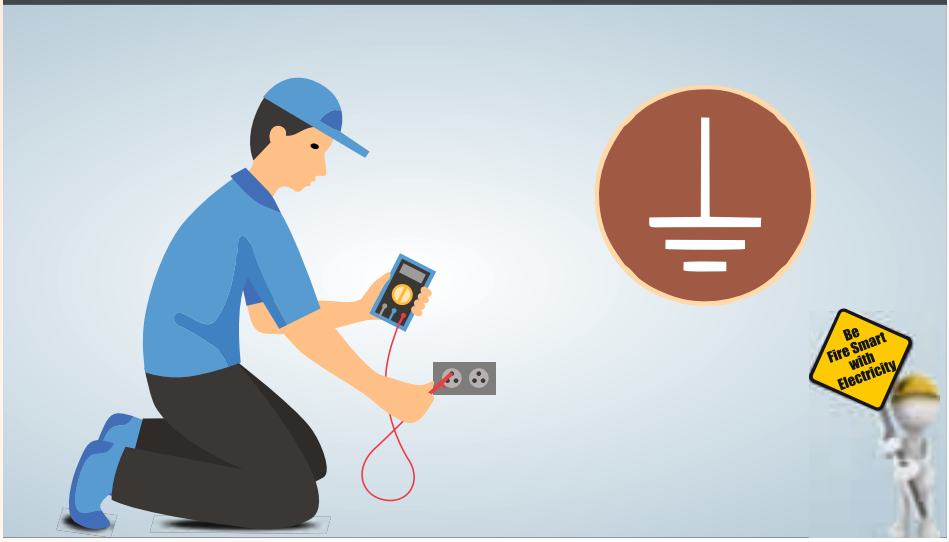
Do not touch electrical appliances or wires with **WET HANDS**.

ROLE OF EARTHING IN ELECTRICAL SAFETY

Earthing helps you & your home in following manners: -

- It ensures that all electrical equipment are at earth thus safeguarding from electric shocks through direct contact
- It protects electrical equipment from getting damaged due to heavy currents
- It maintains stable voltages in three phase circuits even under unbalanced load conditions
- It protects tall buildings from getting harmed under lightning

Things that you **SHOULD CARE** about while buying a new house



PRECAUTION AGAINST LIGHTNING

Take following measures in case of lightning:

In Open Terrain:

- Put your feet as close together as possible, wrap your arms around your legs and tuck your head in. Keep a distance of 3 m to the next person.
- Avoid trees, groves, edges of the forest and wood poles of overhead lines. Keep a distance of 10 meter from all trees and limbs.

In the mountains:

- Keep off the peak, avoid being the highest point around.
- Keep a distance of at least 3 meter from other people and metal objects such as hooks, ladders and ropes.

On a playing ground:

- Be at least 3 m away from radio masts and flagpoles. Put down flags, umbrellas and golf clubs.

During fishing or hunting:

- Lay down your fishing rod and seek shelter on land.
- Hunters should immediately leave open tree stands at the first sign of lightning and thunder.

During camping:

- Never erect your tent directly next to poles or pylons, at the edge of the forest or next to isolated trees.
- Use an insulating mattress and do not touch the tent poles during a thunderstorm.
- Keep a distance of at least 3 m from other tents and caravans.
- Crouch down in your tent on an insulating dry mattress.

In open water:

- Leave the water right away and take cover at the first sign of lightning and thunder.

Under the Tree:

- Avoid trees, grooves and edges of the forest and keep a distance of 10 meter from all trees and limbs.

On-board a boat:

- Go into the boat, crouch down and do not touch the rig or any other metal objects.

Riding a bicycle:

- If on a bicycle or motorcycle, stop riding, seek shelter (for example under a bridge) or crouch down at a distance of at least 3 meter from your vehicle.

Inside a car:

- In case of heavy rain or rolls of thunder, it is advisable to stop at the next possible place or wait until the thunderstorm has disappeared to avoid being blinded by the light and therefore losing control.

Indoors:

- Adequate lightning protection system shall be installed.

Avoid using the following during thunderstorm:

- Watching TV
- Surfing the internet
- Talking over mobile/telephone
- Taking shower/bath

What to do if someone is struck by lightning:

- Common injuries from being struck by lightning can be nerve and muscle paralysis, impaired eyesight and hearing as well as raised blood pressure.
- Try to calm the lightning victim if he/she is conscious. Softly talk to the victim until help arrives.
- If the victim is unconscious, put him/her in the recovery position. Check the victim's pulse and breathing. If the lightning victim has no pulse or heartbeat, lay him/her on his/her back and immediately begin cardiopulmonary resuscitation (heart massage and resuscitation). Do not stop until the victim starts to move, his/her chest begins to rise and fall or help arrives to take over.

Recovery position

Heart Massage

Resuscitation

FIRST AID

First Aid:

- A person getting electric shock needs to be disconnected from the source of electrical power. The disconnecting switch/breaker should be identified and turned off
- Unfortunately, If the connected device cannot be located, the victim can be pried or pulled from the circuit by an insulated object such as a 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
विद्युताघात एवं उसके प्रबंध नियम

EFFECTS

1. Fatal paralysis of heart.
2. Stoppage of breathing.
3. Burns, deep or superficial or both.

MANAGEMENT

1. EXPOSED LIVE WIRE

Stand on dry insulated material like wood, folded newspaper, rubber mat, etc.

2. HIGH TENSION WIRE

3. Give artificial respiration & external cardiac massage.

5.

PRECAUTIONS

LOW VOLTAGE

1. Seek professional help.
2. Stand on 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 line or T. wires.
3. Do not touch the casualty until the electrical contact is broken.

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)

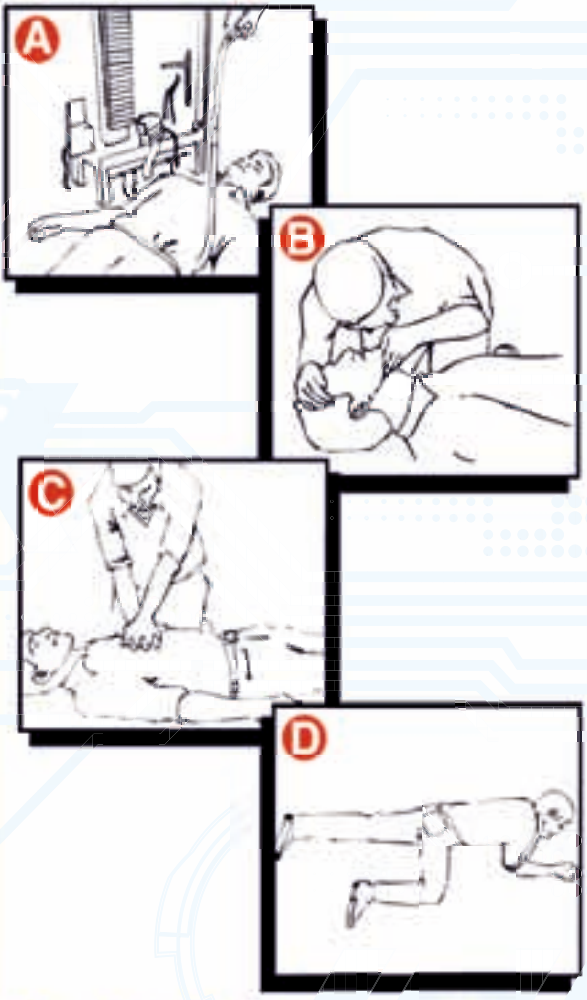
If the casualty is breathing, place in the *recovery position* (D), dial 102 for an ambulance, monitor and record breathing every ten minutes or until medical assistance arrives.

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



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