NEMSA's 2nd Stakeholders Forum

CONSEQUENCES OF BAD ELECTRICAL INSTALLATIONS IN BUILDINGS AND FRAMEWORK FOR IMPROVED SAFETY

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Presentation Outline

This lecture highlights electrical installation practices with the attendant consequences of installations that fall below standard regulations and offer suggestions for enhanced safety and quality of supply.

1. Introduction
2. Electrical Installations in Buildings
3. General Electrical Installation Scope of Work
4. Requirements for Good Electrical Installation in Buildings
5. Causes of Bad Electrical Installations
6. Signs of Bad Electrical Installations
7. Consequences of Bad Electrical Installations
8. Framework for Improved Safety
9. Conclusion

Introduction

Introduction

Electrical Circuit:

- Involves flow of electrons (current) in a closed path.
- Source: which could be a generator, battery or dry cell
- Load: consumes the electric current such as electric light bulb, fans, motors.
- Medium: connecting wires between the source and load .
- Control/regulatory device, e.g switch.

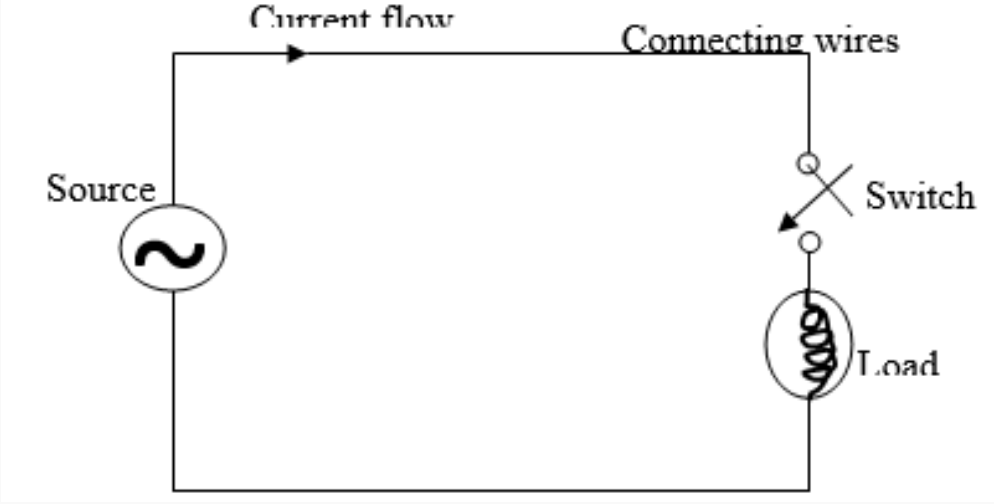

Figure 1: Electrical Circuit

Electrical Installations in Buildings

Electrical Installations in Buildings

Electrical Installations involves:

- Process of connecting electric circuit to produce power.
- Involves fixing in position the various electrical apparatus, necessary control gears and connecting wires in such a manner that the arrangement is ready deliver power safely and for effective use.

BASIC COMPONENTS IN ELECTRICAL INSTALLATIONS

Equipment at the supply point

- These are arranged at the supply point of any installation.
- Must be able to isolate all conductors of the installation from the supply for the purpose of maintenance or faults.
- Offer automatic protection against excess current rise by circuit breakers and against earth leakage current by fuse or residual current device (RCD), commonly known as earth leakage circuit breakers, (ELCBs).

Electrical Installations in Buildings

Electrical Supply Panels/Boards:

- Receives electrical energy from the local electricity authority.
- Serves as a central or main control of electric power to the building.
- Must be properly grounded, insulated and cables connected properly terminated using lugs.

Distribution Board (DB):

- Conducting bars.
- Fuses/breakers.
- Placed in easily accessible locations and capable of being operated without causing danger.

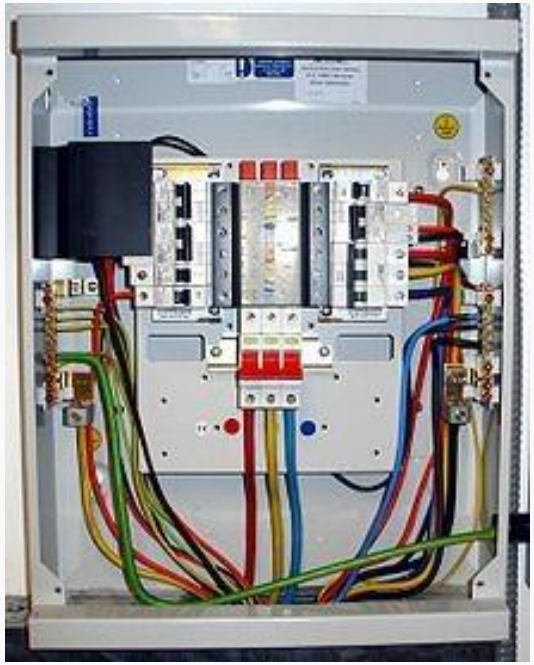

Figure 2: Distribution board

Circuit Breakers and Fuses:

- Protect buildings from excessive current flow.
- They must be properly rated to provide protection to the installation and users alike.

Figure 3: Circuit Breaker

Figure 4: Broken Circuit Breaker

Electrical Cables:

Connecting medium between the source and the various circuits and load points in the building. It comprises:

- The conductor
- Insulation
- Protection against mechanical damage.
- Electrical cables are used depending on the wiring system, ie either Surface wiring or Conduit wiring.

Figure 5: Electrical Cables

For surface wiring:

- Double insulated cables are used where the inner insulation covers the bare conductor, while the outer insulation is for mechanical protection.

Figure 6: Surface Wiring System

For conduit wiring:

- Single insulation cables are used since the cables are run through PVC or galvanized pipes and trunking .
- All cables must be adequately sized for every installation.

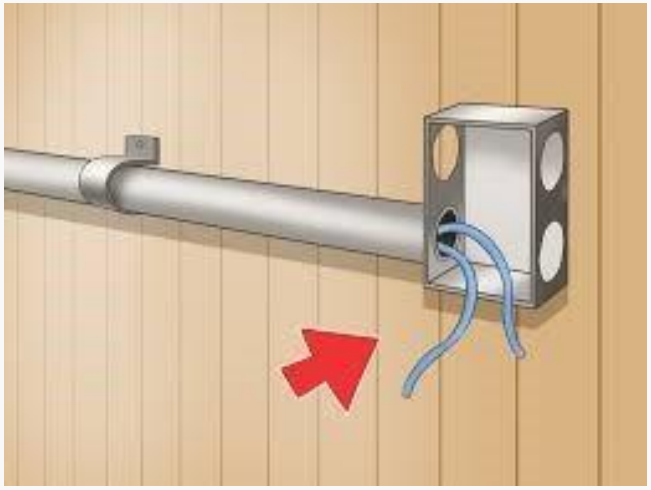

Figure 7: Surface Conduit Wiring System

For conduit wiring:

Figure 8: Concealed Conduit System

Change Over Switches:

- Allows for alternative power supply to the building.
- Must be properly rated.

Figure 9: Change Over Switch

Electrical Outlets:

- Provided in various places in buildings so that current can be taken to supply the uses for which it is needed
- Can be connected permanently or designed to connect or disconnect by means of plug connections will of the users
- Examples are lighting outlets, Fan outlets, Switch outlets, Socket outlets, etc.

Figure 10: 13A Socket Outlet

Electrical Outlets:

Figure 11: Damaged Socket Outlet

Energy meters:

- Energy meters are devices for measuring the amount of electricity consumed by users of electricity.
- They are installed in the consumers premises and used for billing purposes.
- The meters are calibrated in billing units such as Kilowatt hour (kWh), and are read in a billing period.
- They should be located on in an accessible position close to where the electrical panel is located and installed in such as to only monitor the supply from the supply utility to give accurate reading of electric energy consumed from the supply authority.

Energy meter:

Figure 12: Electrical Meter

General Electrical Installation Scope of Work

General Electrical Installation Scope of Work

- Prepare Electrical layout drawings and schematic drawings.
- Calculations and computation to determine electrical. specifications, maximum load, cable/sizing, distribution board and breaker rating, etc.
- List out materials and component requirements.
- Lay conduits or trunkings in the building in line with electrical layout drawings.
- Install boxes for switches and sockets.
- Install distribution board and main breakers in-line with electrical drawings.
- Implement draw-in of cables from distribution board to switches, lighting/fans points and sockets outlets.
- Implement earthing/grounding for the electrical system.
- Install lights switches, sockets and other accessories.
- Test the installation and obtain test certificate.
- Obtain service connection from power utility company.
- Prepare for commissioning of electrical installation.

General Electrical Installation Scope of Work

The scope of work must be done in compliance to lay down standard specifications and regulations by NEMSA in-line with International best practice and procedures.

Requirements for Good Electrical Installation in Buildings

Requirements for Good Electrical Installation in Buildings

Electrical designs and schematic drawings:

- The electrical installation design work involves planning the electrical services from the beginning, taking all possible factors into consideration instead of carrying out the installation in a haphazard manner.
- The electrical design layout drawings show the required positions of all equipment, metering and control gears, outlets (lightings, switches and sockets), direction of cable runs, etc, to be installed in the building.
- The Technician must be able to interpret the drawings for implementation.
- Note: Upon completion of installation, a set of drawings are also required to be made showing all modifications to the original plan for record purposes and are referred to especially during maintenance.

Requirements for Good Electrical Installation in Buildings

Cable Sizing/Ratings:

- Cables are selected such that the maximum allowable voltage drop limit is not exceeded to avoid large voltage drop in the circuit or power losses resulting from heat
- When selecting cable sizes, the type of wiring system to be used, the current carrying capacity of the cable, the cable length and voltage drop is considered.

Requirements for Good Electrical Installation in Buildings

Termination and Joints:

- Pipes must be securely connected to the knockout boxes through male bush and couplers.
- Cable glands and lugs must be used to properly secure the cables.
- Cable jointing must be properly carried out to avoid leakage of current at the joints.
- All connection points in the entire installation must be rigid to avoid partial contacts.

Termination and Joints:

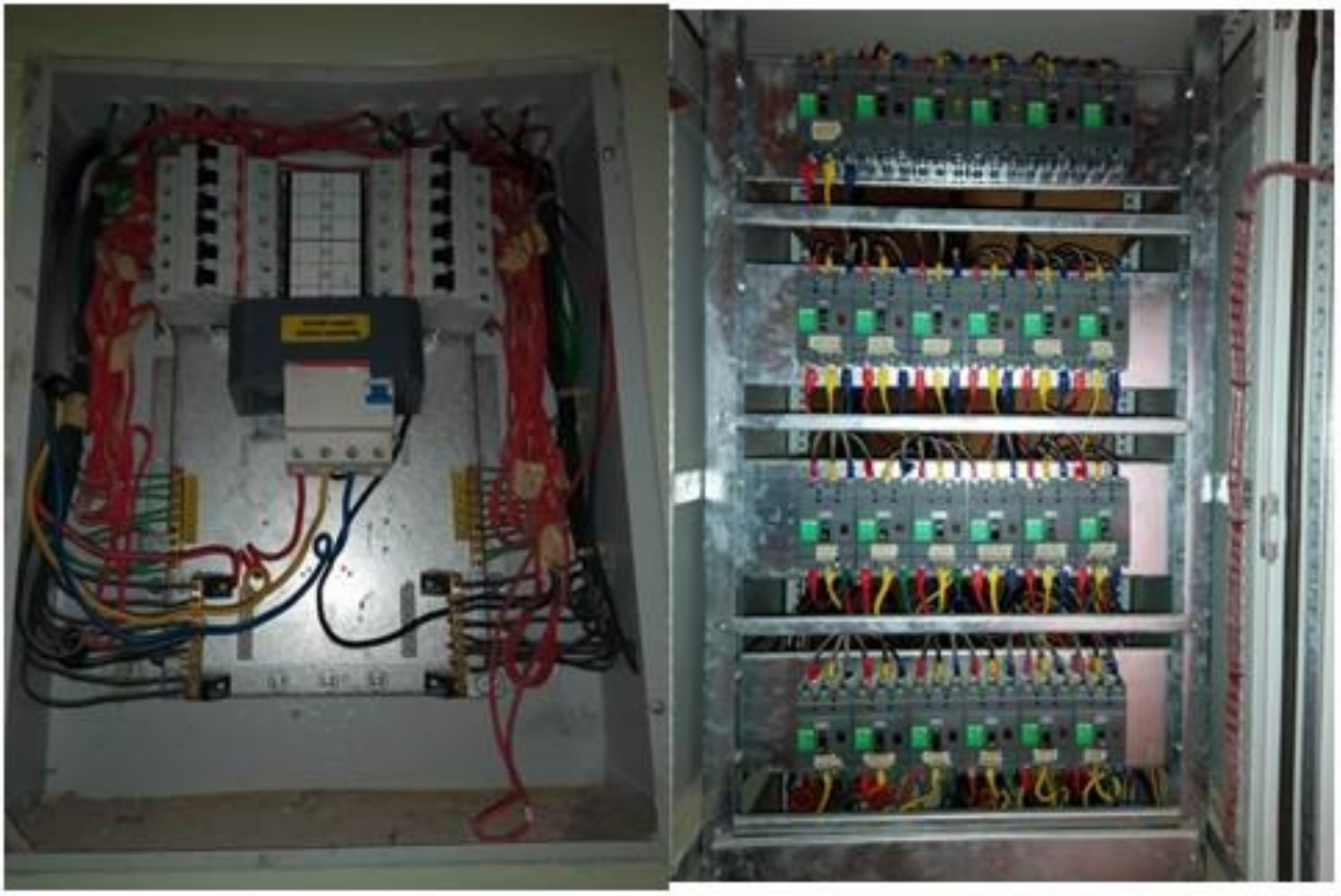

Figure 13: Proper Termination of cables in distribution board

Requirements for Good Electrical Installation in Buildings

Termination and Joints:

Figure 14: Poor Termination of cables in distribution board

Requirements for Good Electrical Installation in Buildings

Earthing:

- Connection of the neutral conductor of the consumers supply and the metallic part of an installation which are exposed to touch to the general mass of the earth.
- Done to provide a path of minimum impedance for the flow of leakage current to the ground.
- Cable jointing must be properly carried out to avoid leakage of current at the joints.
- For a good earthing system, the earthing circuit impedance must be low, (2 ohms) to allow leakage current flow to the ground.

Requirements for Good Electrical Installation in Buildings

Earthing:

Figure 15: Electrical Earthing

Earthing:

Figure 16: Corroded Electrode

Requirements for Good Electrical Installation in Buildings

Earthing:

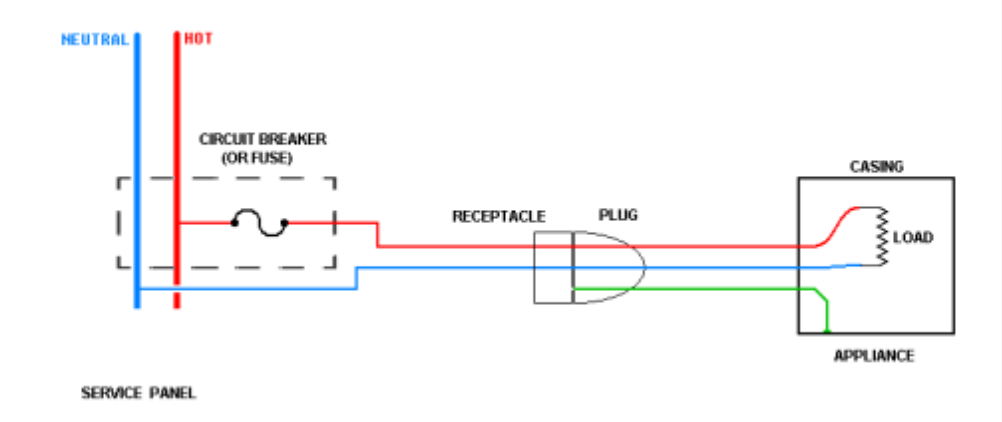

Figure 17: Improper Electrical Earthing

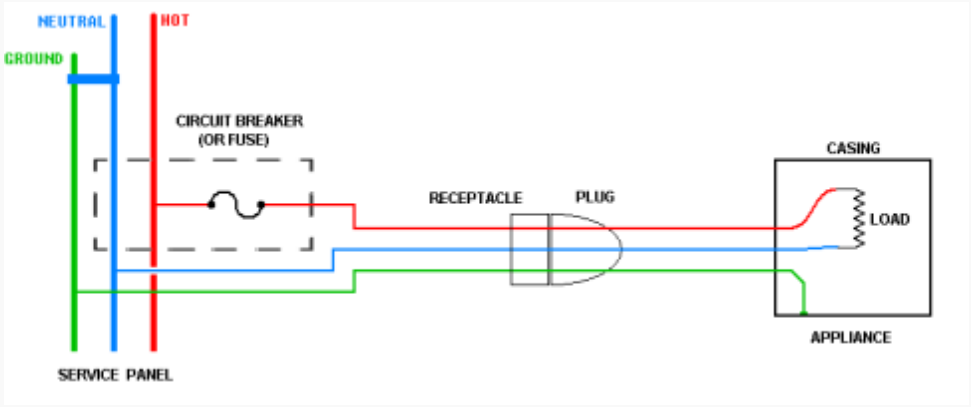

Figure 18: Proper Electrical Earthing

Protective Devices:

- Installed at the Incomer of distribution panels and boards and the outgoing circuits to protect them from excessive current.
- They must be properly sized and rated.
- They include fuses, circuit breakers, etc.

Figure 19: Overloaded Circuit Breakers

Requirements for Good Electrical Installation in Buildings

Installation Testing/Certification:

It is very important to carry out testing because there is a possibility for faults to occur after installation through,

- Damaged insulation.
- Broken connections.
- Deterioration of the components or faulty apparatus

Requirements for Good Electrical Installation in Buildings

Tests Include:

- Polarity test to ensure correct connection of accessories and no break in conductor.
- Effectiveness of earthing system test to ensure the earthing circuit impedance is low and within acceptable limit.
- Insulation resistance test to ensure that the resistance values between conductor and earth and between the conductors are within acceptable values.
- Ring circuit test to ensures continuity throughout the circuit.

Causes of Bad Electrical Installation

Causes of Bad Electrical Installation

Bad electrical installation is one in which standard procedures and practices in line with regulations are not followed, they include:

- Lack of preliminary electrical designs.
- Improper costing of projects.
- Use of unskilled Personnel to execute electrical installations.
- Use of Substandard Materials.
- Absence /Lack of Good pre-commissioning tests after an installation.
- Lack of proper earthing in most installations.
- Poor Maintenance.
- Unpatriotic Attitude.

Signs of Bad Electrical Installation

Signs of Bad Electrical Installation

Signs of bad electrical installation include:

- Burnt Smells.
- Unstable lighting.
- Heat in the electrical outlets.
- Noise in Distribution Board.
- Sparking outlets and junction boxes.
- Shocking outlets.
- Charred outlets.
- Too many numbers of extension boxes.

Signs of Bad Electrical Installation

- Frequent blown out fuses and tripping of circuit breakers.
- Frequent blown out of light fittings.
- Low voltage.
- Wrong switch connection.
- Damaged and exposed cables/burnt insulation.
- Poor contacts.

Consequences of Bad Electrical Installation

Consequences of Bad Electrical Installation

- **Frequent electrical surge**: Attributed to bad wiring in the building and can damage electrical equipment and components to electrical supply outlets whether they are in use or not, thus degrading their life expectancy greatly
- **Frequent burnt out light fittings:** When this happens, anxiety is raised in the homes, jobs in offices and industrial buildings are impaired.
- Flickering: This is particularly not suitable for commercial and industrial environment where constant illumination is needed and could lead to power arching, and then possible fire outbreak if not checked.
- **Excessive bright or dim light**: Causing improper illumination around the building due to bad mains to neutral connection during installation.
- **Light switches not working properly:** Use of substandard productS or bad workmanship. It causes anxiety and discomfort in homes and interrupt activities in business environment and industrial buildings.

Consequences of Bad Electrical Installations

- Frequent tripping of circuit breakers: Affects production process in manufacturing plant building with associated huge financial loss with each breaker trip:
- High electrical bill: High current in the system which are not interrupted by the protective devices result to un-necessary financial waste thus raising anxiety and discomfort in homes and interrupt activities in business environment and industrial buildings, since this makes the consumers pay for energy not actually used by them, thereby making power utility gain more.
- Dead outlets: limit office productivity, caused halt of production process with accompanied financial losses.
- Electric shock and death: Electric shock can cause varying damage to the body depending on the amount of current that flows through the body and body resistance. In severe cases, fall, serious burn and death may result.

Consequences of Bad Electrical Installations

- Over heating/fire outbreak: If excessive heating is sustained in the system without check, arching and sparks sets in and fire may result. The consequences are most grievous as human lives and unquantifiable properties are engulfed in the inferno of electric fires.
- Damage of Equipment/home appliances: Faulty (bad) connections could result disastrous consequences such as electric shock/electrocution due to failed earthing system, equipment damages due to improper protection equipment sizing and possible fire outbreak due to faulty (bad) insulation
- High power losses: Sudden and unexpected power loss obstruct normal living in homes, disrupt office activities and terminate production process with accompanied huge financial losses.
- Sags and dips: draws a lot of power when they are turned on causing improper operation and possible damages to other devices which are connected to the same electrical supply lines.

Consequences of Bad Electrical Installations

Given the risk associated with the use of electricity, offering a safe and reliable service of electrical installation in buildings to end users is paramount. Therefore, there is need for the enforcement of standard practice and procedures of electrical installations in buildings by statutory regulating agencies (NEMSA) to ensure compliance with standard specification, regulating codes and ethics for improved safety.

The consequences in all is loss of lives and valuable properties due to bad/poor electrical installations

Framework for Improved Safety

Framework for Improved Safety

Suggestions for Enhanced Safety and Quality of Supply

Certain measures must be taken for proper electrical installation in buildings to ensure safety of lives and properties:

- Proprer and adequate design/electrical layout drawings by qualified personnel must be produced.
- Installations and maintenance work must be done in accordance with the design layout.
- All electrical personnel involved in the installation and maintenance work must be certified by NEMSA.

Framework for Improved Safety

- Installation testing must be done upon completion of the installation work.
- Completion certificate which shows the full details of the electrical installation must be obtained.
- Inspection certificate which shows the records of the state of the installation after a comprehensive test is carried out must equally be obtained.
- Unpatriotic attitude of some electric power consumers to illegally tap into the local electricity distribution system must be discouraged.

Framework for Improved Safety

- Discouraging the operations and practices of quacks to encourage the younger professionals.
- Engineering and Regulation and Monitory arm of COREN must do their work with due diligence.
- The Government should ensure that all installations are designed and supervised by competent professionals.
- Regulatory bodies should provide an avenue for Electrical personnel to appeal against any unfavorable decision by regulatory agencies.
- Experienced Engineers should mentor younger Engineers to acquire the necessary knowledge and skills.

Conclusion

Conclusion

Electrical energy is the most important blessings that science have ever given to man for the benefits of mankind but ironically, it can kill and bring about great loss to materials and properties. It is a known fact that in Nigeria, most of the fire incidents in buildings are traced to electrical faults resulting from either inadequate or no design for the affected buildings, poor maintenance of the electrical installations, the use of substandard equipment/cables and sometimes illegal connections by unscrupulous and unpatriotic citizens. It is therefore recommended that standard requirements and regulations, codes, ethics, practice and procedures for electrical installation and operation be adopted and enforced for improved safety.

THANK YOU FOR LISTENING

AND

REMAIN BLESSED

Questions?