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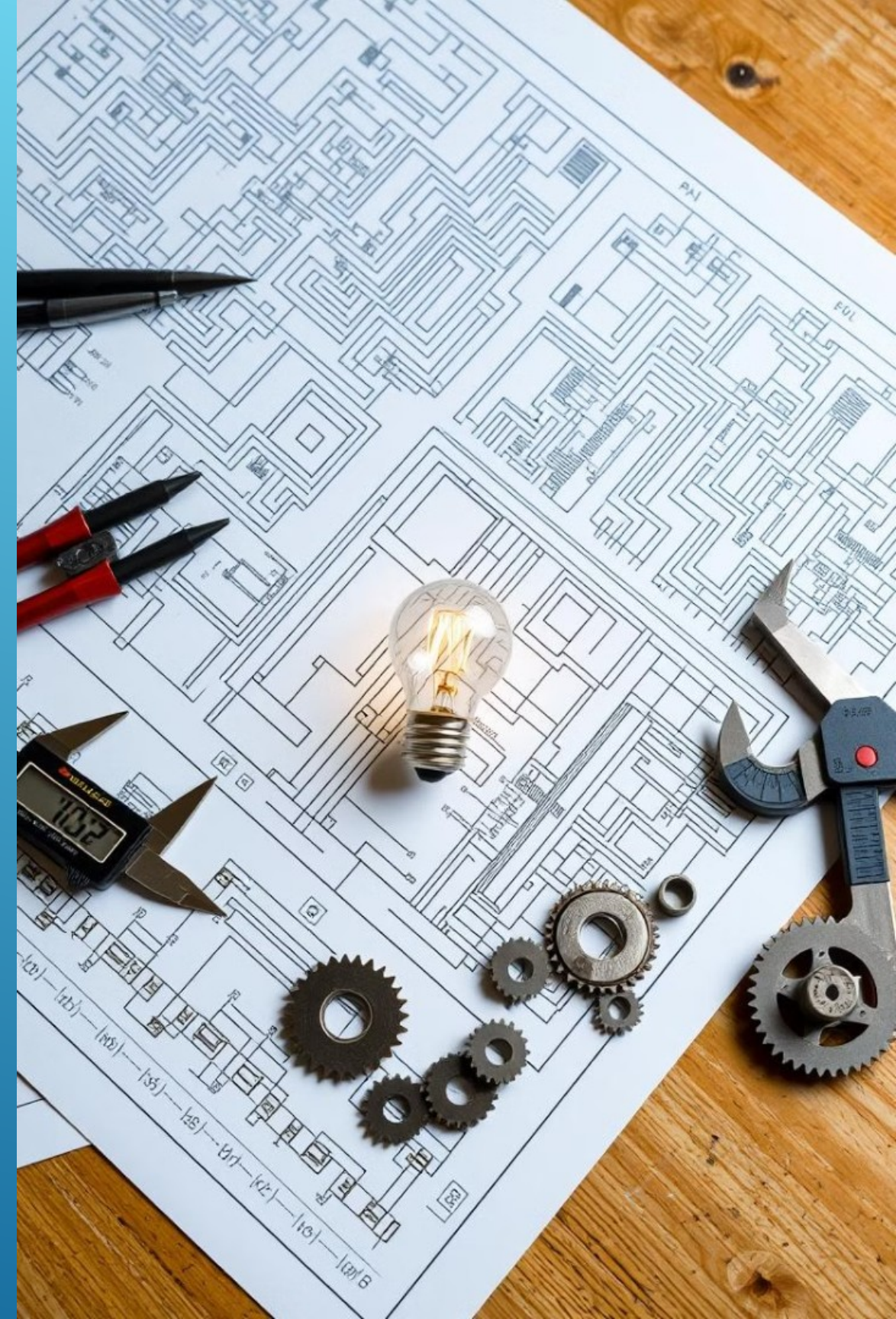
SATBAYEV  
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Lecture 15

# Practical Applications of Electrical Theory

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Electrical theory underpins the technology and devices that power our modern world. From powering our homes to driving industrial machinery, a deep understanding of electrical principles is crucial for engineers, electricians, and anyone working with electricity.



# Understanding the Fundamentals

## 1 Voltage, Current, Resistance

The three core concepts that govern the behavior of electrical circuits.

## 3 Circuit Analysis

Understanding how current and voltage flow through different circuit configurations.

## 2 Electrical Components

Resistors, capacitors, inductors, and other parts that make up complex circuits.



# Ohm's Law: The Cornerstone of Electrical Circuits

## The Equation

Ohm's Law states that the current (I) in a circuit is directly proportional to the voltage (V) and inversely proportional to the resistance (R).

## Applications

Ohm's Law is used to calculate and predict the behavior of electrical circuits, making it a fundamental principle in electrical engineering.

## Importance

Understanding Ohm's Law is crucial for designing, troubleshooting, and maintaining electrical systems and devices.



# Series and Parallel Circuits: Analyzing Complex Setups

## Series Circuits

Components are connected end-to-end, with the same current flowing through each element.

## Complex Circuits

Combining series and parallel configurations to create intricate systems that power our devices and machinery.



## Parallel Circuits

Components are connected to the same two points, with each element having its own current path.



# Electrical Power and Energy: Powering Our World

## Power

The rate at which electrical energy is generated or consumed, measured in watts (W).

## Energy

The total amount of electrical energy used or produced, measured in watt-hours (Wh).

## Efficiency

Maximizing the conversion of electrical energy to useful work, minimizing waste and losses.

## Renewable Sources

Solar, wind, and hydroelectric power are transforming the way we generate and use electricity.

# Electrical Safety: Protecting Ourselves and Our Devices



## Shock Hazards

Proper grounding and insulation are essential to prevent electric shocks and electrocution.



## Fire Risks

Overloaded circuits and faulty wiring can lead to electrical fires, requiring careful monitoring and maintenance.



## Explosive Dangers

Certain environments, like fuel storage areas, require specialized equipment to prevent ignition and explosions.



# Electrical Motors: Powering Machinery and Appliances

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## Induction Motors

Widely used in industrial applications and household appliances due to their efficiency and durability.

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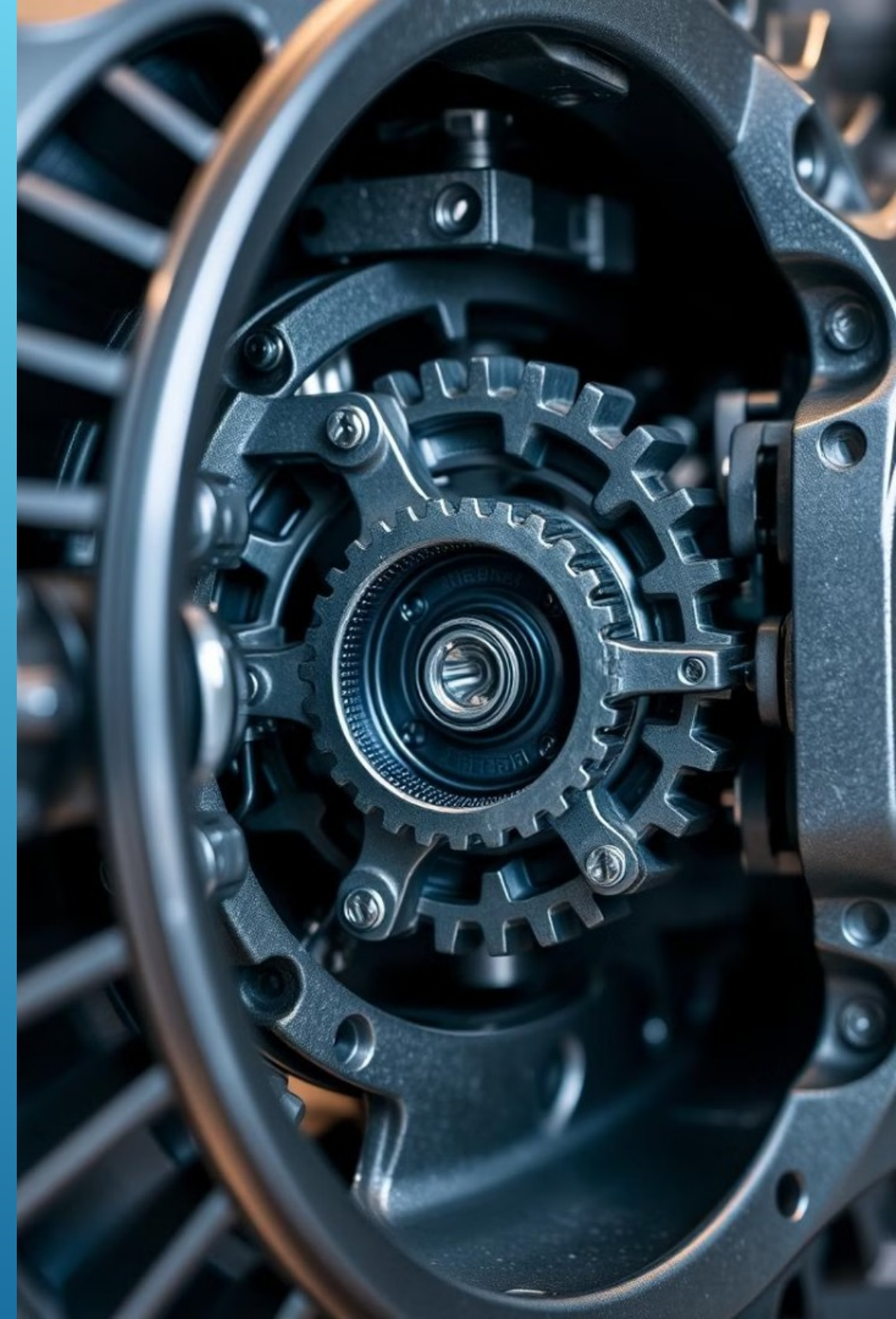
## DC Motors

Provide precise speed and torque control, making them ideal for robotics, automotive, and aerospace applications.

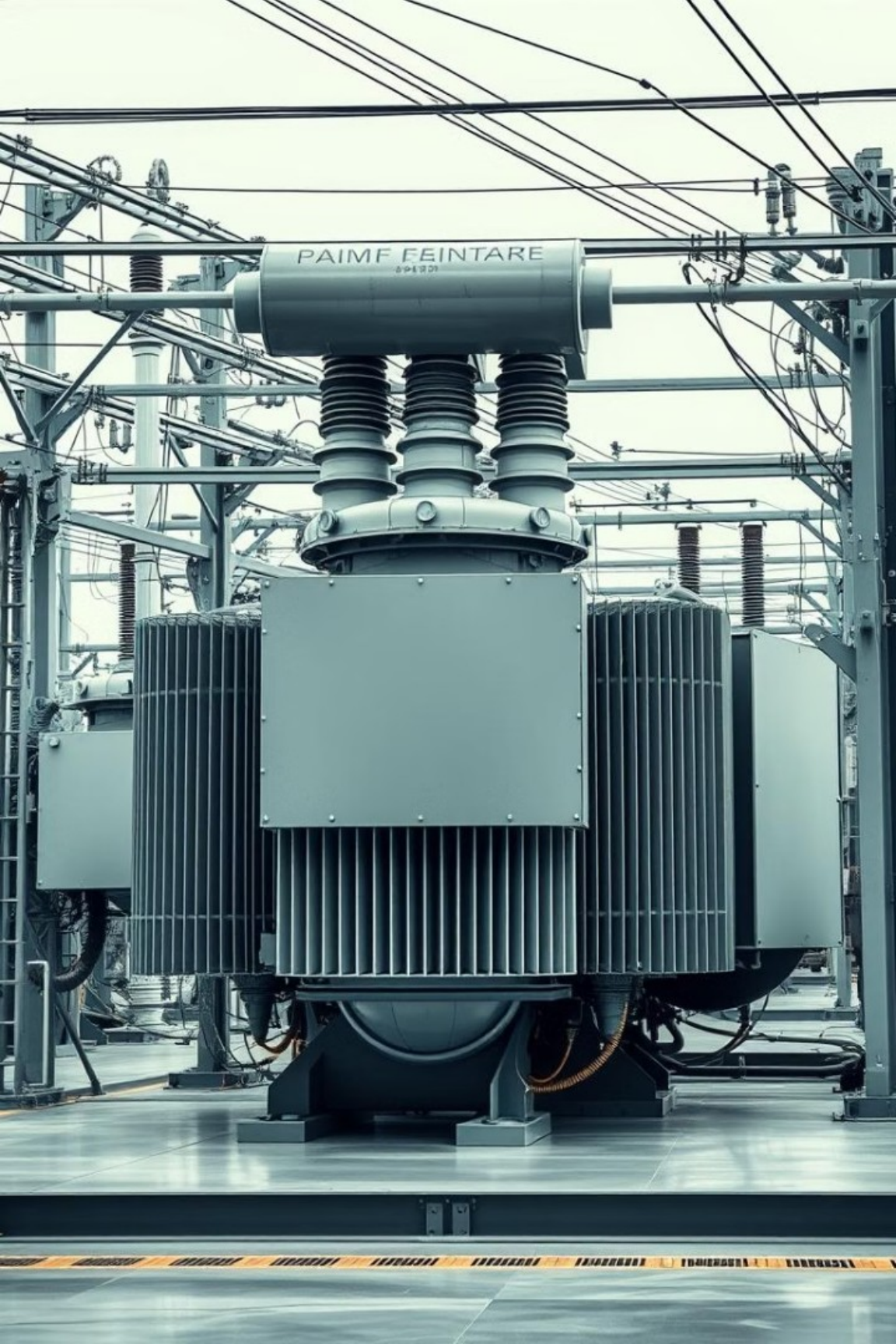
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## Stepper Motors

Offer precise positioning and speed control, common in CNC machines, 3D printers, and other high-precision devices.







# Transformers: Stepping Up and Down Voltages

## Step-Up Transformer

Increases voltage, reduces current, used for efficient long-distance power transmission.

## Step-Down Transformer

Decreases voltage, increases current, used to power household appliances and electronics.

## Isolation Transformer

Separates electrical circuits, providing safety and protection against electrical shocks.

# Residential Wiring: Powering Our Homes Safely

## Main Service

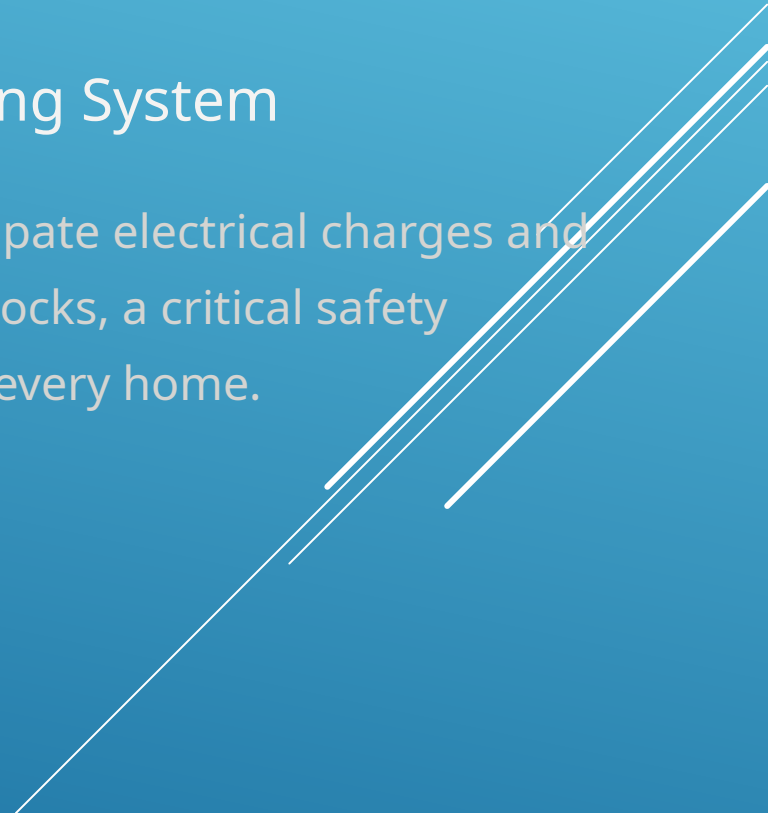
The entry point where electricity enters a home, typically from overhead power lines or underground cables.

## Circuits and Breakers

Distribute and protect electrical circuits throughout the home, ensuring safe and reliable power.

## Grounding System

Helps dissipate electrical charges and prevent shocks, a critical safety feature in every home.





# Electrical Grounding and Earthing: Ensuring Proper Connections

## 1 Purpose of Grounding

Provides a safe path for excess electrical current to flow to the earth, preventing shocks and fires.

## 2 Grounding Methods

Can be achieved through copper rods, metal water pipes, or other conductive materials buried in the ground.

## 3 Importance in Safety

Proper grounding is a crucial safety measure in electrical systems, protecting people and equipment.

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