

GreenVETAfrica

Training of Trainers Programme



Co-funded by
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2023-2024 GreenVETAfrica



GreenVETAfrica mission is to offer an innovative capacity building programme on Green Waste Management in Nigeria and Ghana

UNIT THREE

ELECTRICAL SYSTEM IN WASTE MANAGEMENT

Objectives

- Understand the fundamentals of electrical systems as they pertain to waste management equipment.
- Grasp the principles of electrical circuits, wiring, and electrical components commonly found in waste management machinery.
- Apply electrical safety measures and best practices to ensure the secure operation of waste management equipment.

Introduction to Electrical Systems in Waste Management

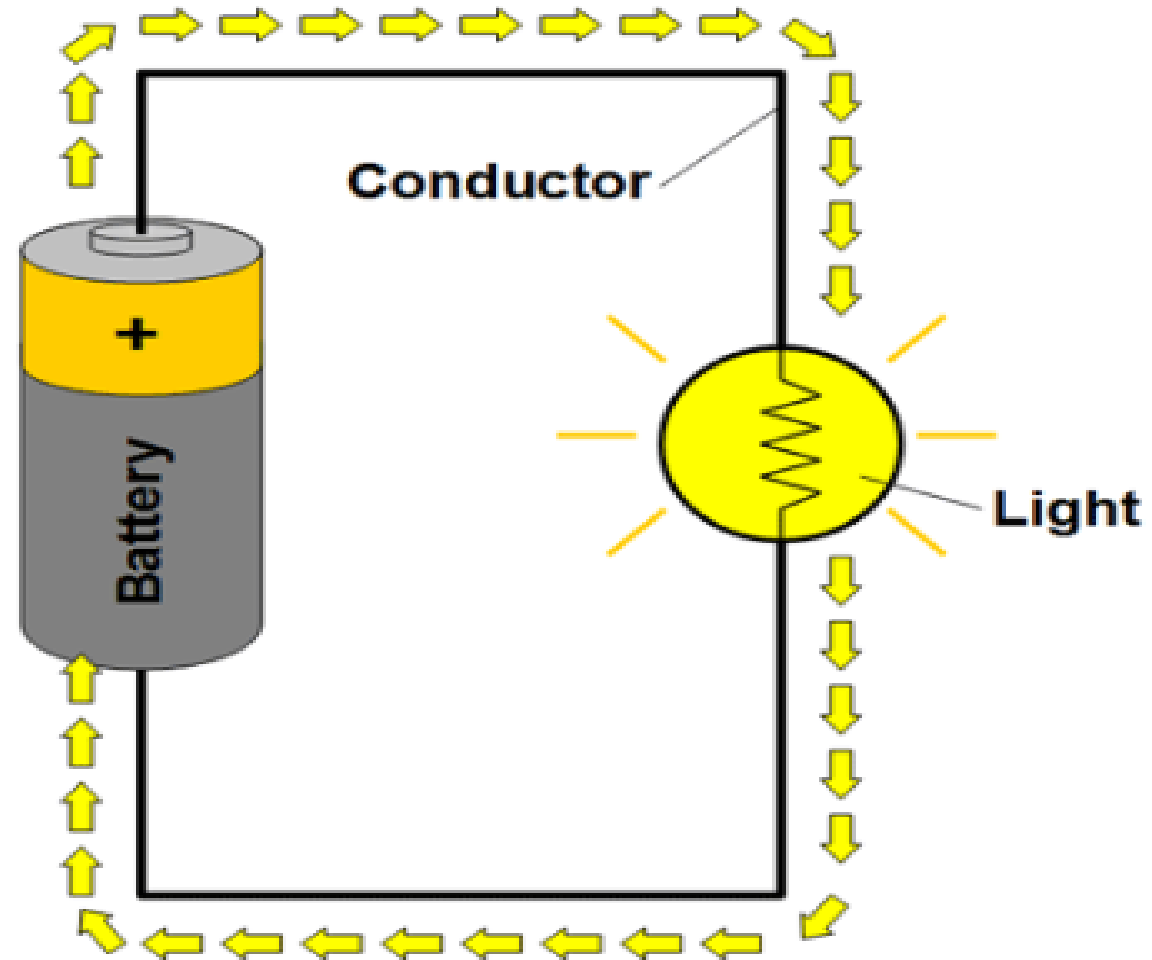
- ❑ Electrical systems automate waste processing, reducing manual labor and the risk of accidents. They ensure timely waste collection, lower operational costs, and enhance worker safety.
- ❑ Electrical systems optimize energy use, lower greenhouse gas emissions, and support recycling. They facilitate compliance with environmental regulations, reducing fines and contributing to sustainability.



Metal Scrap Shredder

Current Flow

□ In electrical circuits, current is the flow of electric charge. It travels from the positive terminal (usually the source of power) to the negative terminal (usually the ground or return path). In waste management, current flow is essential for powering various electrical components in equipment like conveyor belts, compactors, and sorting machines.



Voltage

- Voltage represents the electrical potential difference between two points in a circuit. It is measured in volts (V). Waste management equipment typically operates at specific voltage levels, ensuring that machinery receives the necessary power to function effectively. Common sources of voltage include batteries, generators, solar panels etc.



Resistance

- Resistance, measured in ohms (Ω), represents the opposition to the flow of electrical current. Waste management machinery often contains electrical components with specific resistance values. Understanding resistance is crucial for designing circuits that provide the correct amount of power to these components. Resistance are loads in an electric circuits



Power

- ❑ Power, measured in watts (W), is the rate at which electrical energy is transferred or consumed. It determines how much work an electrical device can do. In waste management, knowing the power requirements of equipment helps in efficient energy management.

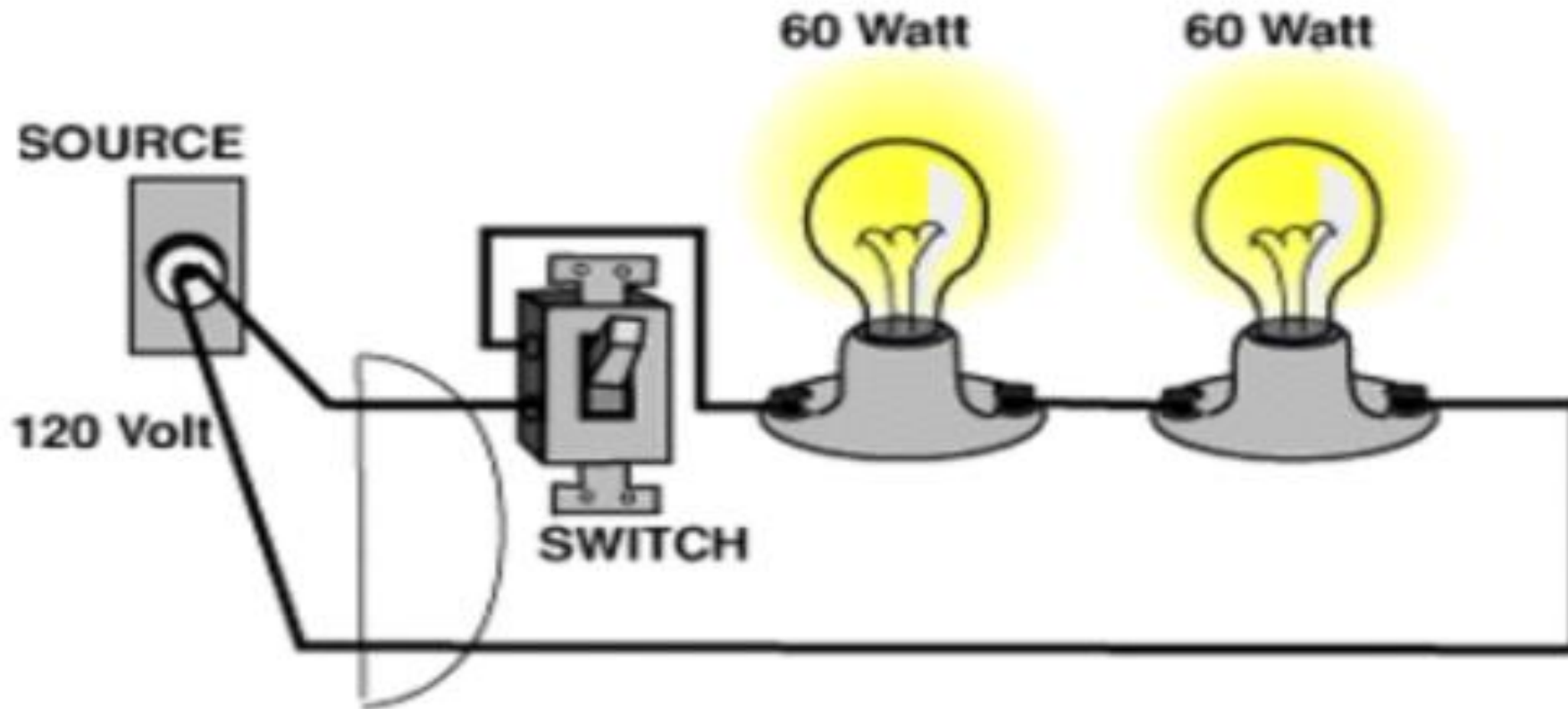


Series Circuits

- ❑ In a series circuit, components are connected end-to-end, forming a single path for current flow. If one component fails or is disconnected, it breaks the entire circuit. Series circuits are not commonly used in waste management equipment due to their lack of redundancy and flexibility.
- ❑ Series circuits may be used in some simple control circuits for waste management equipment where redundancy is not critical. However, they are not ideal for complex systems.



Series Circuits

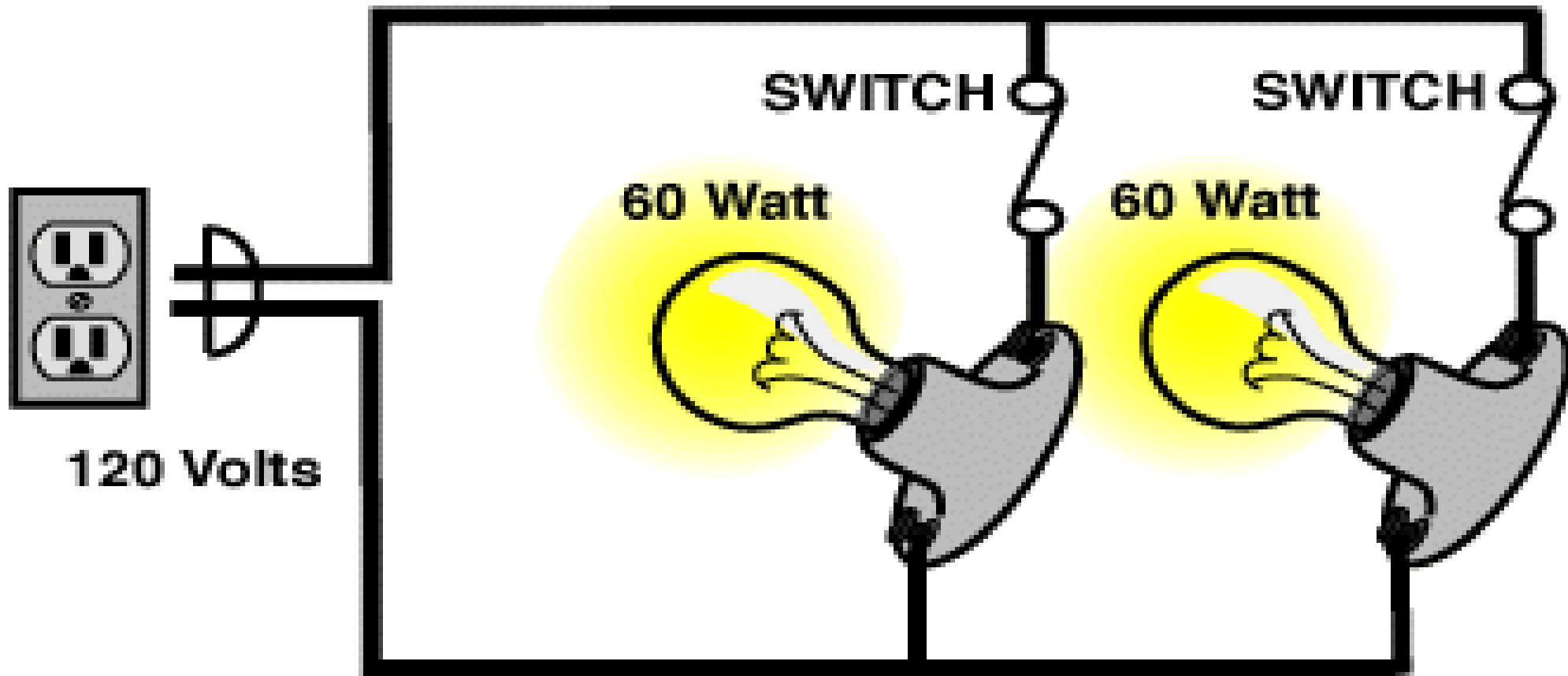


Parallel Circuits



- ❑ In a parallel circuit, components are connected across the same voltage source but have multiple paths for current flow. If one component fails, it does not interrupt the operation of the others. Parallel circuits are widely used in waste management equipment to ensure reliability.
- ❑ Most waste management equipment employs parallel circuits. For example, conveyor belts, motors, and sensors are connected in parallel to maintain continuous operation even if one component malfunctions.

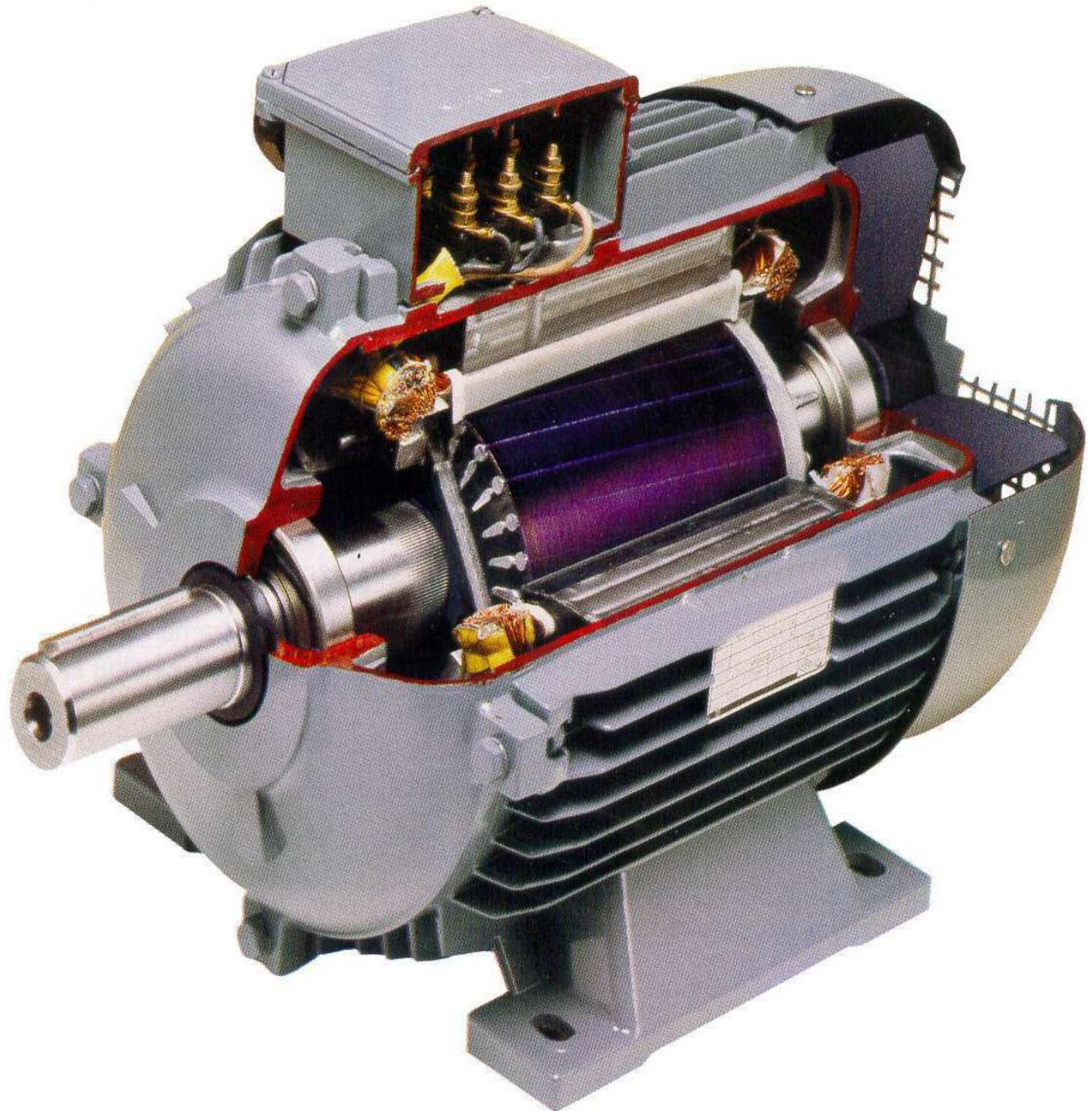
Parallel Circuits



Electric Motors

- ❑ Electric motors are common in waste management equipment such as conveyor systems, compactors, and shredders.
- ❑ Motors convert electrical energy into mechanical motion, driving the operation of machinery. They provide the necessary power to move waste materials, compact trash, or operate cutting mechanisms.
- ❑ Motors are typically controlled by switches or control panels. Sensors may be used to monitor motor performance, ensuring safe and efficient operation.

Electric Motors



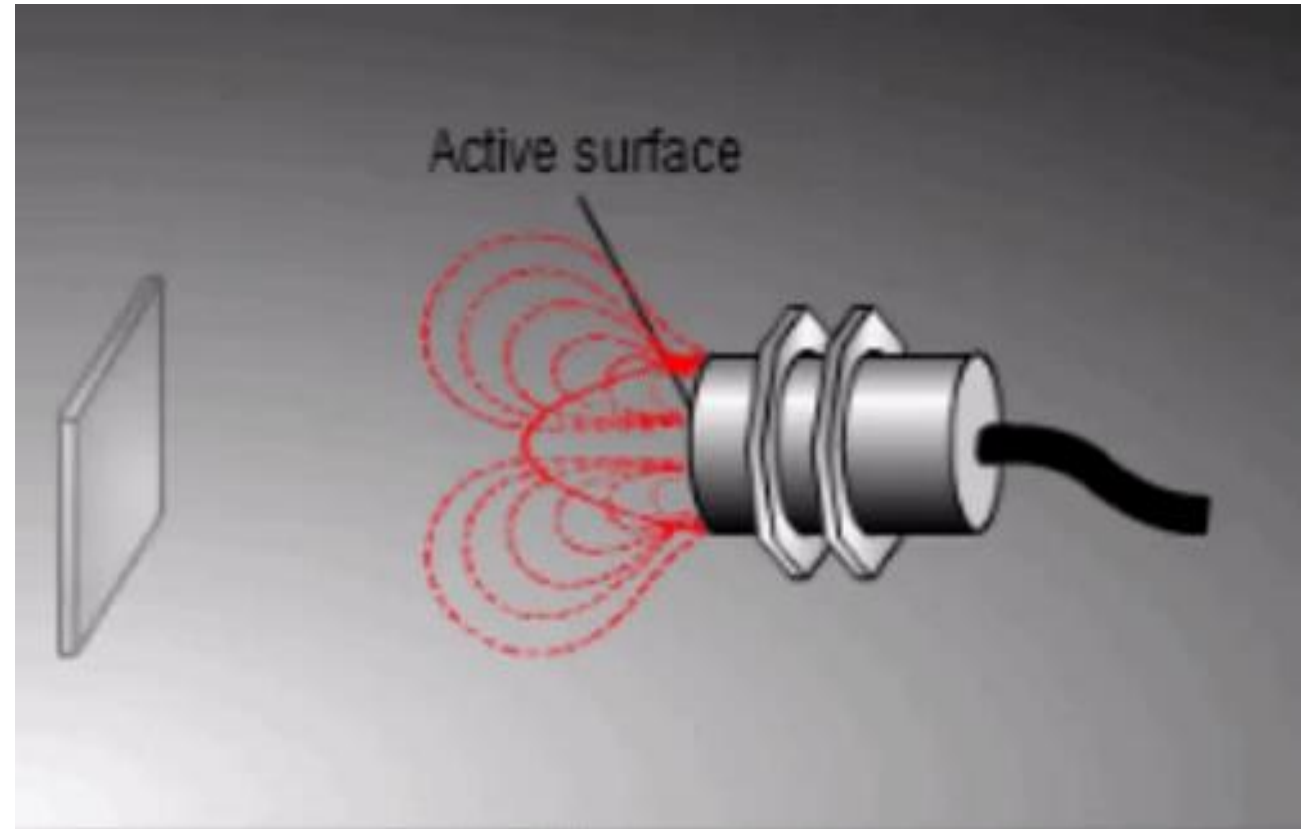
Electric Motor



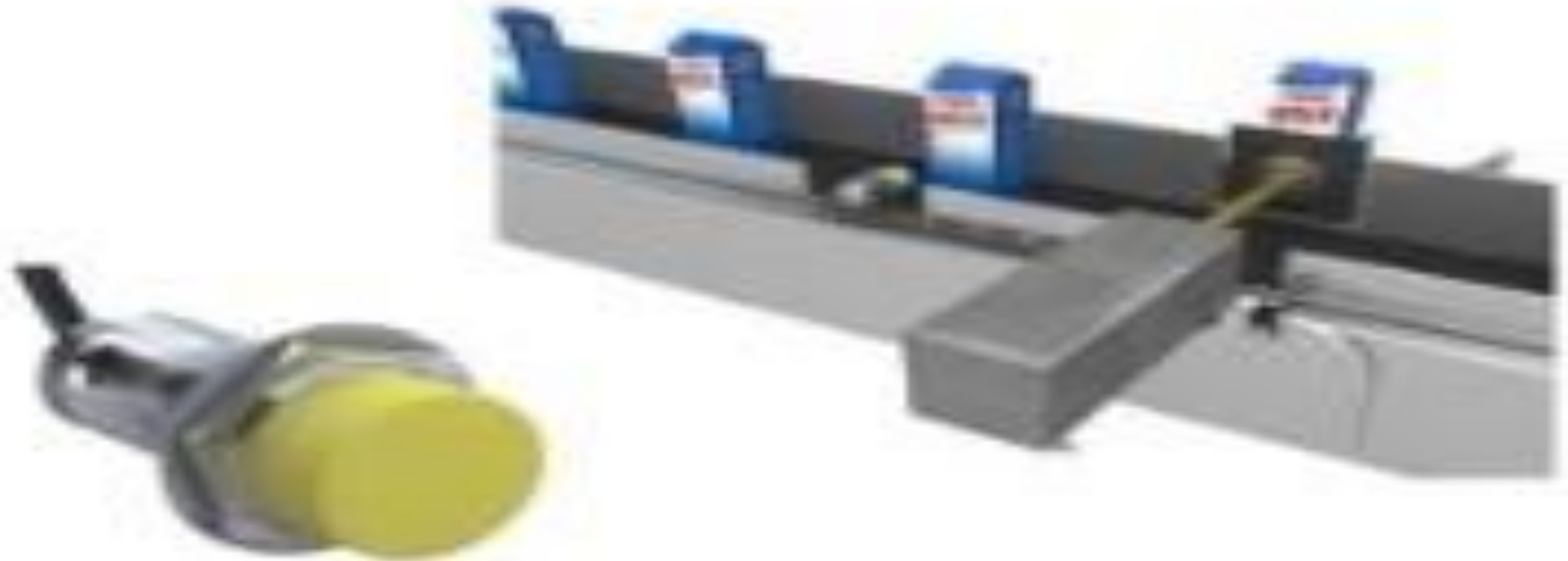
Sensors

- ❑ Sensors in waste management machinery include proximity sensors, photoelectric sensors, and load sensors.
- ❑ Sensors detect specific conditions or variables within the equipment. For example, proximity sensors can detect the presence of waste materials on a conveyor belt, while load sensors measure the weight of compacted waste.
- ❑ Sensors provide input to control panels or programmable logic controllers (PLCs), which then trigger appropriate actions. For instance, when a sensor detects a full waste container, it may signal the compactor to activate.

Sensors



Capacitive Proximity Sensors



Switches

- ❑ Switches can include push-button switches, limit switches, and safety switches.
- ❑ Switches are used to control the electrical circuit. They can start or stop machinery, change operating modes, or provide emergency shut-off capabilities.
- ❑ Switches are often integrated into control panels or control circuits. They allow operators to control and manage the equipment's functions safely.

Switches



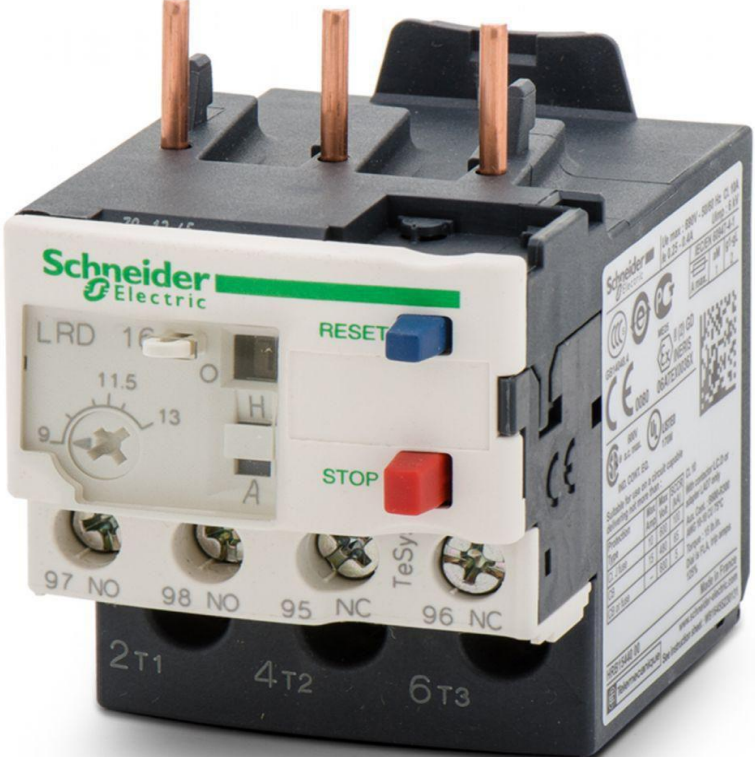
Relays and Contactors

- ❑ Relays and contactors serve as switching devices that control the flow of electrical current in a circuit. They are used to open or close electrical contacts and allow or interrupt the power supply to various components or devices.
- ❑ Relays are typically smaller, low-power switching devices used for signal-level applications. Contactors, on the other hand, are larger and designed for high-power applications, such as controlling motors and heavy loads. Contactors can handle higher current and voltage ratings compared to relays.

Application of Relays and Contactors

- Relays and contactors find applications in a wide range of industries, including industrial automation, HVAC systems, and manufacturing processes. They are crucial for tasks like starting and stopping motors, controlling lighting systems, and managing complex electrical circuits.

Relays and Contactor



Circuit Breaker and Fuses

- ❑ Circuit breakers and fuses are designed to protect electrical circuits from overcurrent conditions. Overcurrents can occur due to short circuits (a direct connection between hot and neutral wires) or overloads (excessive current drawn by the circuit).
- ❑ Circuit breakers are resettable protection devices that can be manually switched back to the "on" position after tripping due to an overcurrent event. Fuses, on the other hand, are non-resettable and must be replaced when they "blow" or "fuse" due to an overcurrent.

Application of Circuit Breaker and Fuses

- Circuit breakers and fuses are widely used in residential, commercial, and industrial electrical systems to ensure safety and prevent electrical fires and equipment damage. They are installed at various points in the circuit to interrupt the flow of electricity when necessary, safeguarding both people and property from electrical hazards.

Circuit Breaker and Fuse

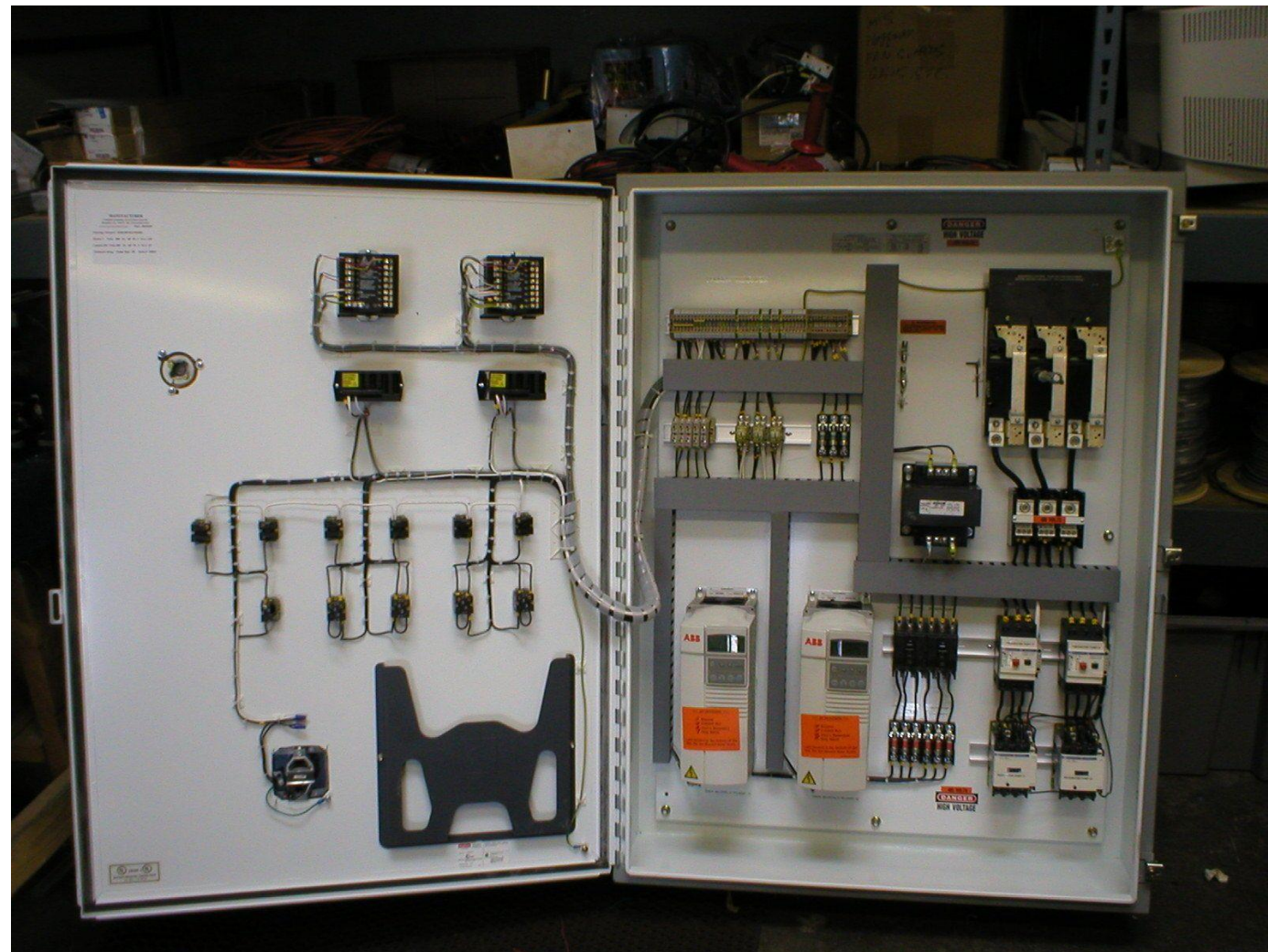




Control Panels

- ❑ Control panels are custom-built for waste management machinery and may include various switches, indicators, and displays.
- ❑ Control panels serve as the interface between operators and the machinery's electrical systems. They enable operators to start, stop, and monitor equipment.
- ❑ Control panels receive input from sensors, switches, and operators. They send commands to motors, actuators, and other components, coordinating the equipment's functions.

Control Panel



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