Contents

1. Introduction

The e-waste processing machine at Hoskote was found to be non-operational due to deteriorated and unsafe electrical wiring. Over time, multiple wiring faults such as loose connections, exposed joints, and disorganized cable routing had developed, posing both operational inefficiencies and safety hazards.

To restore the machine to a safe and reliable working condition, a **complete rewiring and restoration** was undertaken. This included inspection, removal of faulty wiring, installation of new industrial-grade conductors, organization of power and control circuits, proper earthing, and functional testing.
The objective of this report is to provide a **step-by-step account of the rewiring work** performed, including safety precautions, materials used, detailed execution procedures, and test results. This ensures transparency of the work carried out, provides a reference for future maintenance, and formally certifies that the machine has been restored to working order.

2. Purpose and scope of work

2.1 Purpose

The primary purpose of this rewiring project was to restore safe and reliable operation of the e-waste processing machine. The previous wiring condition posed a risk of short-circuits, machine downtime, and electrical hazards. Through complete rewiring, the system has been modernized with proper cable sizing, organized routing, protective devices, and earthing in accordance with industrial safety practices.
This ensures:

- Safe operation for operators and maintenance staff.
- Reliable performance of motors, relays, and control circuits.
- Compliance with basic electrical safety standards.
- Reduced likelihood of breakdowns and fire hazards.

2.2 Scope of Work

The scope of this rewiring project included the following activities:

- Comprehensive inspection of existing wiring and identification of faults.
- Removal of damaged and unsafe wires, connectors, and terminals.
- Installation of new wiring for power, control, and earthing circuits.
- Replacement of defective relays, contactors, and protective components (if required).
- Cable routing and dressing for improved safety and accessibility.
- Labelling of wires and updating of terminal connections.
- Functional and safety testing, including insulation resistance, continuity, and load tests.
- Documentation of work performed, test results, and recommendations.

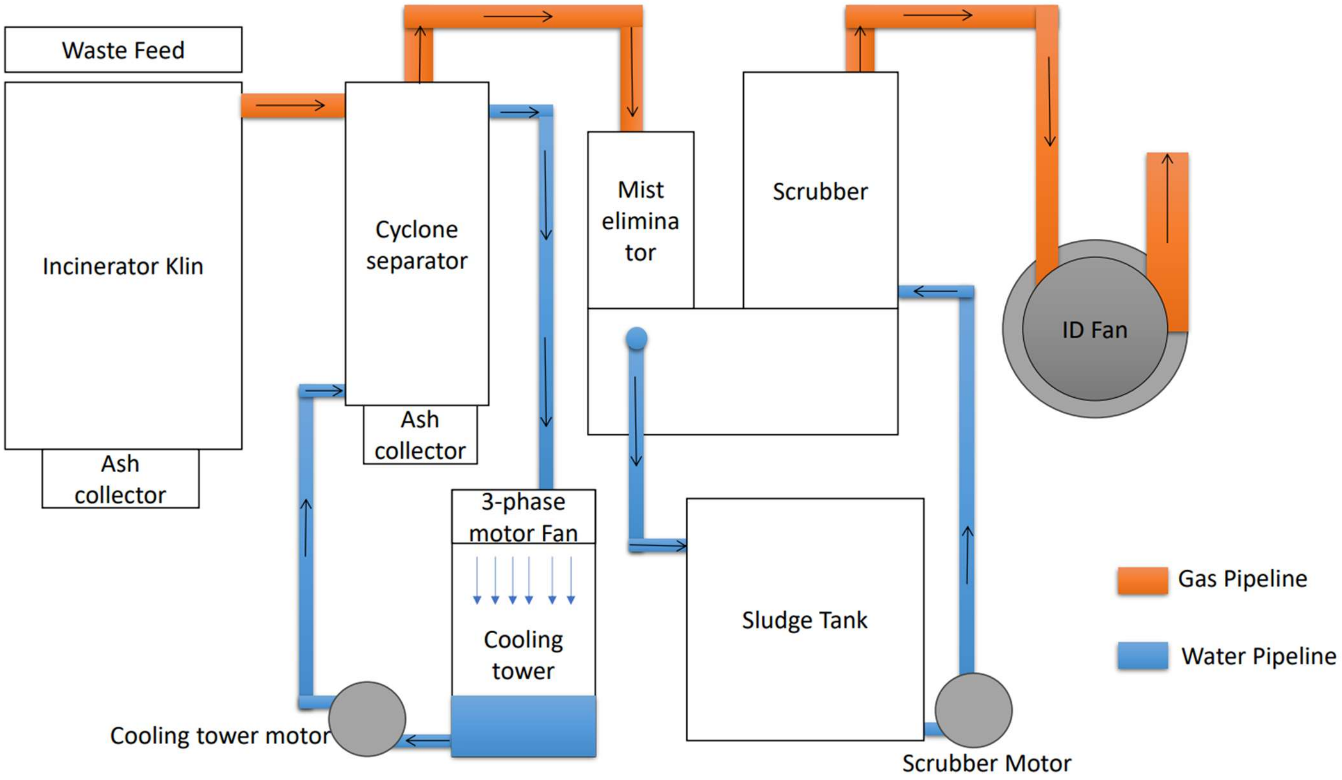
3. System Overview

3.1 Major Components

- Incinerator Kiln – Main chamber where e-waste is thermally processed.
- Waste Feed System – Supplies e-waste into the kiln in controlled amounts.

- Cyclone Separator – Separates larger particulate matter from flue gases.
- Scrubber – Neutralizes harmful gases and particulates using water/chemical solution.
- Mist Eliminator – Removes fine droplets and moisture from gas stream.
- Cooling Tower – Lowers the temperature of gases/water before discharge.
- Ash Collectors – Collect residual ash from combustion for disposal.
- ID (Induced Draft) Fan – Maintains negative pressure, drawing flue gases through the system.
- Sludge Tank – Collects slurry from the scrubber process.
- Motors (3-Phase) – Cooling tower pump.
- Gas and Water Pipelines – Support flow of fuel, gases, and cooling water.

3.2 Working Principle of the E-Waste Processing Machine



The e-waste processing machine is designed to handle electronic waste through thermal treatment and multi-stage gas cleaning. The process begins at the waste feed system, which ensures a controlled supply of e-waste into the incinerator kiln. Inside the kiln, waste is subjected to high temperatures that burn combustible materials and break down complex compounds. This stage produces two outputs — solid ash and flue gases. The ash is collected by the ash collectors positioned at appropriate points, preventing it from entering downstream systems.

The flue gases, which contain dust, particulates, and harmful gases, are directed into the cyclone separator. In this stage, centrifugal force separates heavier dust particles and unburnt matter from the gas stream. This reduces the load on the subsequent treatment units and ensures better overall efficiency. The gases then move to the scrubber unit, which plays a critical role in neutralizing toxic components. Here, the gases come in direct contact with water or chemical sprays that absorb acidic gases and trap fine particulates.

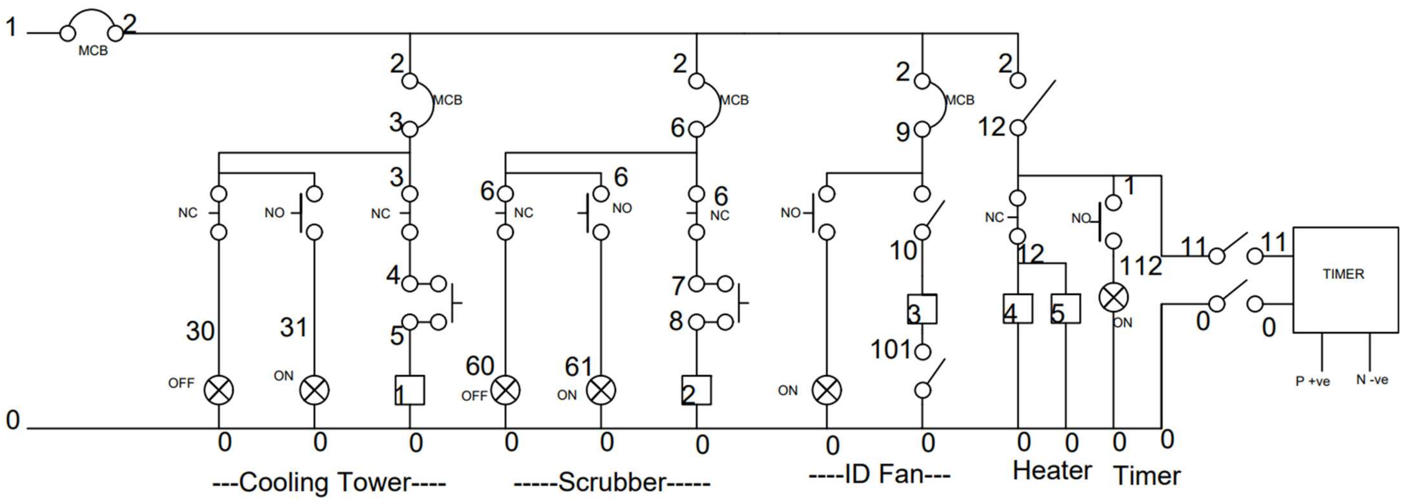
The waste solution generated in the scrubber is collected in the sludge tank for safe disposal or further treatment. After scrubbing, the gas stream still carries fine water droplets that must be removed before release. This is achieved in the mist eliminator, which filters out entrained droplets and ensures a drier gas flow. Following this, the gases enter the cooling tower, where their temperature is reduced to acceptable levels before final discharge. Cooling water, circulated by dedicated pumps and motors, supports this stage and maintains system balance.

To ensure continuous movement of gases through all these stages, an induced draft (ID) fan, powered by a three-phase motor, maintains the necessary negative pressure across the system. This prevents backflow, controls emissions, and guarantees that the flue gases are steadily drawn through each treatment unit until they exit safely. Alongside, auxiliary three-phase motors operate the cooling tower and scrubber systems, while a network of gas and water pipelines provides the necessary inputs for combustion and treatment processes.

In summary, the working principle of the machine revolves around incineration for waste destruction, multi-stage gas cleaning for pollutant removal, and controlled exhaust handling for environmental safety. The combination of ash collection, dust removal, scrubbing, mist elimination, cooling, and forced draft ensures that harmful by-products of e-waste combustion are effectively neutralized before release into the atmosphere.

4. Single Line Diagram (SLD)

The Single Line Diagram (SLD) of the E-waste processing machine illustrates how electrical power is distributed, protected, and controlled for various subsystems.



4.1 Incoming Supply and Main Protection

- The machine is fed by a main MCB rated at 63 A, which acts as the primary protection device.
- This breaker ensures that the entire system is safeguarded against short circuits or excessive current at the incoming point.

4.2 Branch Protection

- From the main MCB, the supply is distributed into several branch circuits, each protected by individual MCBs.
- Cooling Tower Motor, Scrubber Motor, and ID Fan Motor each have an MCB rated at 16 A. These ratings are appropriate for medium-power 3-phase induction motors used in these auxiliary systems.
- The Heater branch is protected by a 32 A MCB, as heating elements typically draw higher continuous current compared to motors.

4.3 Contactors and Control Circuits

- Each branch has a dedicated contactor for switching, with contactor coils rated for 32 A.
- The control circuit uses NO (Normally Open) and NC (Normally Closed) contacts to implement interlocks, ensuring motors and heaters only operate under safe conditions.
- A timer relay is included in the heater circuit to control its operation sequence, preventing premature heating before fans and scrubbers are active.
- The P (+ve) and N (–ve) control lines shown represent the supply powering these contactor coils, pushbuttons, and safety interlocks.

4.4 Load Distribution and Functionality

- Cooling Tower Motor (16 A MCB + 32 A contactor): Provides circulation of cooling water.
- Scrubber Motor (16 A MCB + 32 A contactor): Operates pumps/fans to spray water and neutralize gases.
- ID Fan Motor (16 A MCB + 32 A contactor): Maintains draft through the incinerator and ensures exhaust flow.
- Heater (32 A MCB + 32 A contactor): Provides necessary heating for the incineration process, activated through the timer relay for controlled operation.

4.5 System Coordination

- The 63 A main MCB protects the overall installation.
- The branch MCBs (16 A & 32 A) provide selective protection for individual equipment, so a fault in one subsystem does not affect the others.
- Contactors and interlocks ensure sequential operation and safety shutdown in case of abnormal conditions.

5. Step-by-Step Operating Sequence

The following sequence explains how the machine is energized and how each subsystem operates in the correct order to ensure safe and reliable functioning:

5.1 Power Initialization

1. The operator first switches ON the Main MCB (63 A), which energizes the entire system and makes power available to all branch circuits.
2. Branch MCBs are checked to ensure they are in the OFF position before sequential startup.

5.2 Subsystem Energization

1. Cooling Tower Motor (16 A MCB + 32 A Contactor):
   - The Cooling Tower MCB is switched ON.
   - The 32 A contactor closes when the control pushbutton is pressed.

   - This starts circulation of cooling water, preparing the system for downstream gas cooling.

2. Scrubber Motor (16 A MCB + 32 A Contactor):
   - The Scrubber MCB is then turned ON.
   - The motor is energized via its dedicated contactor, starting the scrubber pumps/fans.
   - This ensures the scrubber is active before combustion gases flow through.

3. Induced Draft (ID) Fan Motor (16 A MCB + 32 A Contactor):
   - The ID Fan MCB is switched ON.
   - The fan motor is engaged through its contactor to establish negative pressure inside the incinerator system.
   - This draft ensures a steady flow of gases through all cleaning stages.

4. Heater Circuit (32 A MCB + 32 A Contactor + Timer):
   - Finally, the Heater MCB is turned ON.
   - The heater contactor is interlocked with a **timer relay**, which delays energization until the cooling tower, scrubber, and ID fan are all running.
   - This prevents unsafe heating before exhaust treatment systems are operational.

5.3 Normal Running Condition

- With all circuits energized, the **waste feed system** supplies e-waste to the incinerator kiln.
- The heater raises the kiln temperature, initiating combustion.
- The ID fan maintains draft, scrubber neutralizes gases, and cooling tower reduces exhaust temperature.
- Ash is collected, and cleaned gases are released safely.

5.4 Shutdown Sequence

1. Heater is switched OFF first (through timer and interlocks).
2. Waste feed is stopped.
3. ID fan continues briefly to clear gases.
4. Scrubber and cooling tower motors are turned OFF after gases are cleared.
5. Finally, the Main MCB is switched OFF to fully isolate the system.