

Implementation of an Automated Soldering System to Reduce Misfiring in IPL Hair Removal Handsets



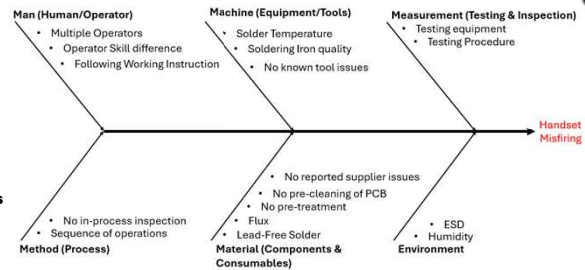
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1. Problem Statement

- IPL handsets experiencing misfiring during End-of-Line (EOL) testing
- Manual soldering identified as the primary cause of process variation
- Soldering inconsistency reducing product quality and manufacturing reliability
- Misfiring creating significant quality and safety concerns Average of 88 handset failures per week
- Annual cost of poor-quality exceeding £204,000
- Production failure rate recorded at 0.29%

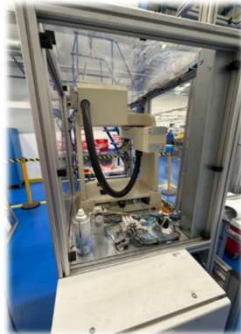
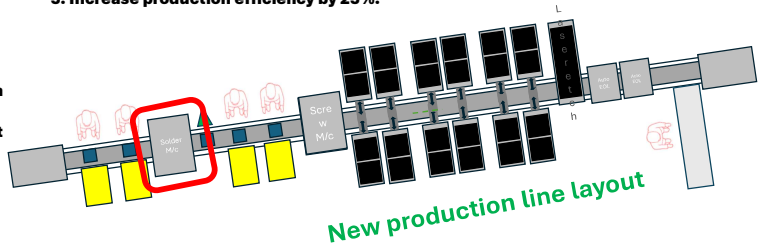


2. Aim & Objectives

- Aim** - Integrate a PLC-controlled automated soldering system into the IPL production line to reduce handset misfiring, improve manufacturing consistency, and increase production efficiency.
- Objectives**
 - Remove manual soldering operations.
 - Reduce the number of devices reworked per year by 75%.
 - Reduce the annual cost of poor quality associated with soldering issues by 75%.
 - Increase product quality.
 - Increase production efficiency by 25%.

3. System Design

- PLC-controlled automated soldering system integrated into existing IPL production line
- System designed to improve soldering consistency, traceability, and production efficiency
- Integration included conveyors, RFID tracking, sensors, PLC control, and solder robot communication
- Safety interlocks and guarding implemented to comply with industrial safety standards
- Functional Requirements
 - PLC Control
 - Synchronisation with conveyor
 - Product and Pallet traceability
 - Safety Interlocks and machine guarding



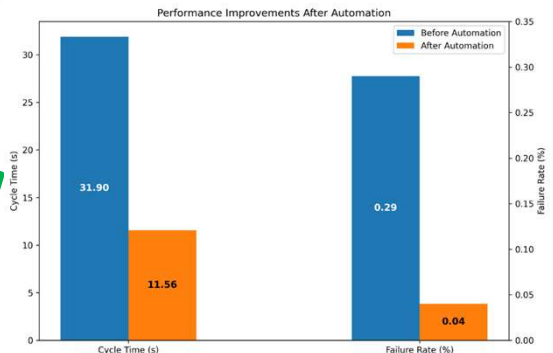
4. Implementation

- Existing solder robot refurbished and integrated into production line
- Electrical panel restored, rewired, and tested
- Mechanical components cleaned, lubricated, and repaired
- Omron PLC integrated to control conveyors, sensors, and solder robot
- Sequential PLC logic developed for automated process control
- Sensor inputs and actuator outputs configured and validated
- Conveyor and stopper systems synchronised with solder robot
- RFID traceability integrated into manufacturing process
- Safety interlocks and guarding implemented for safe operation
- HMI developed for operator monitoring and fault indication
- Functional power, PLC I/O, and system sequence testing completed
- Robot movement and overall system operation successfully validated

5. Results & Evaluation

- Cycle time reduced from 31.9s to 11.56s
- Production efficiency increased by 26.49%
- Failure rate reduced from 0.29% to 0.04%
- Misfiring failures reduced by 86.2%
- Rework operations reduced by 100%
- Cost of poor quality reduced by 81.26%
- Manual soldering process successfully eliminated
- Automated soldering improved process consistency and reliability
- PLC integration improved system control and traceability
- System achieved all major project objectives
- Refurbished robot reduced implementation cost
- Automated system demonstrated reliable industrial operation
- Project provides scalable solution for future manufacturing improvements

86.2% FAILURE REDUCTION
63.8% FASTER CYCLE TIME
81.26% LOWER COPQ
100% REWORK REDUCTION



6. Conclusion & Future Work

CONCLUSION:

- PLC-controlled automated soldering system successfully integrated into the IPL production line
- Manual soldering variation significantly reduced through automation
- Production efficiency, product quality, and process consistency improved
- Failure rate reduced by 86.2% through controlled soldering operations
- Automated system improved traceability and reduced manufacturing defects
- Refurbishment of existing equipment reduced implementation cost while maintaining performance

FUTURE WORK:

- Further optimise PLC sequence timings
- Expand process traceability and data logging capabilities
- Improve HMI diagnostics and fault reporting
- Continue long-term monitoring of production performance
- Investigate integration of additional automated manufacturing stages

