Standard Operating Procedure (SOP)

SOP for AI-Driven Quality Inspection in Manufacturing Assembly Lines

Purpose:

To enhance defect detection accuracy and reduce false rejections using AI-powered multi-agent systems integrating visual and textual data.

Scope:

Applies to all manufacturing assembly lines using AI-based quality control systems.

Responsibilities:

AI Engineering Team: Develop and maintain AI models and multi-agent architecture.

Quality Assurance (QA) Team: Provide annotated data, validate results, and oversee compliance.

Production Supervisors: Implement escalation procedures and provide feedback.

Compliance Officer: Ensure adherence to ISO and regulatory standards.

Procedure:

- Deploy Vision Inspection Agent to capture images and analyze for visible defects using trained CNNs (e.g., EfficientNet).
- Use Knowledge Retrieval Agent to refer to historical defect patterns and suggest root causes via Retrieval-Augmented Generation (RAG).
- Activate Supervisor Agent to handle ambiguous cases by escalating to human review with a summarized context.
- Employ Compliance Agent to cross-verify inspection results with standards like ISO/IEC 17025 and internal SOPs.
- Continuously collect feedback from human review to fine-tune anomaly detection and escalation thresholds.
- Generate weekly defect density reports with AI-recommended corrective actions for each production unit.

References:

ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories.

Internal QC manuals and defect troubleshooting SOPs.

Machine learning documentation for CNNs and RAG implementation.

Revision History:

Rev 1.0 - AI-driven inspection SOP introduced - 2025-05-13