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Lock-Out Tag-Out (LOTO) procedure

1. 📝 **Preparation**

- **Identify equipment** to be serviced (e.g., SMT mounters, reflow ovens, laser welders, AOI systems, conveyors).

- **Determine energy sources**: electricity, pneumatic, hydraulic, thermal (e.g., ovens), and motion links.

- **Notify affected personnel** – operators, maintenance, QA teams, and production supervisors before shutdown.

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2. Shutdown & Isolation

- **Shutdown equipment** using standard procedures (e.g., software shutdown on factory PLC/IoT system).

- **Isolate all energy sources**:

  - Electrical: unplug, shut circuit breaker.

  - Pneumatic/Hydraulic: close valves and bleed pressure.

  - Thermal: cool down ovens or insulated components.

  - Mechanical: engage motion brakes or locks.

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3. Lock and Tag

- **Apply locking devices** at each energy isolation point to prevent inadvertent reactivation.

- **Tag each lock** clearly:

  - Equipment ID, name, date, technician contact, reason for lockout.

  - Tags must be visible and standardized (e.g., red lockout tags).

- **Each maintenance tech uses a unique lock and tag**, ensuring accountability.

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4. Stored Energy Control

- **Release or block residual energy**:
  - Drain capacitors, vent pneumatic lines, and apply mechanical blocks on moving parts.
  - Report and reset any remaining trace energy (hot, stored, reactive).

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5. Verification

- **Try to power the equipment** momentarily (or press "Start" button):
  - Equipment **must not energize** or move.
- **Verify zero energy state**:
  - Use meters, pressure gauges, and temperature sensors.
  - Attach verification documentation, confirming compliance.

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6. Maintenance/Service Work

- Only after **actual zero-energy confirmation** can technicians proceed.
- Keep **locks and tags in place for the entire service duration**.
- Use Hotayi's automated and traceability systems to **log service start, personnel, and task details**

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7. Restoration Process

- **Ensure all technicians are clear** and tools removed.
- **Inform affected personnel** before any energy reactivation.
- **Remove locks and tags** by the technician who applied them.
- **Restore energy sources** in reverse order:
  - Remove mechanical restraints, bleed-out pneumatic pressure, close vent valves.
  - Re-energize circuit breakers and re-engage energies carefully.

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- **Test equipment** through controlled trial operation.

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8. Documentation & Feedback

- **Log the entire LOTO event** into Hotayi's traceability and QMS (ISO 9001, IATF 16949, ISO 45001 compliant)

- **Evaluate and update procedures**:
    - Mark obsolete steps, and integrate new learnings via Hotayi's Smart Manufacturing (IoT sensors, analytics)

🔍 Alignment With Hotayi's Capabilities

1. **Smart integration & traceability**
   - Use IoT and sensor logs to confirm energy isolation and reactivation times.
   - Automatically attach maintenance events to component/item IDs during box-build or PCBA phases.

2. **Automation & elimination of pose steps**
   - Incorporate standardized LOTO blocks into automated systems (e.g., reflow oven software halts power after threshold).
   - Use conveyor interlocks to manage pneumatic/hydraulic release.

3. **Quality control and safety compliance**
   - Combine LOTO checklist with functional testing and AOI/X-ray inspections to ensure safe reactivation before box build.

4. **Continuous improvement & training**
   - Integrate LOTO into Hotayi's ISO 45001 safety training, yearly drills, and certification audits.
   - Leverage smart dashboards to analyze LOTO events and reduce future incidents.

✅ Summary: LOTO Quick Checklist

Step Action

1   Prepare – Identify equipment & notify personnel

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Step Action

2 Shutdown – Use standard sequence & isolate all energies

3 Lock & Tag – Unique locks, standard tags

4 Release Residual Energy – Drain, vent, block

5 Verify Zero Energy – Try activation, measure states

6 Maintain – Work under locked conditions

7 Restore – Communicate, remove locks, test run

8 Document & Improve – Log, review, refine via smart systems

This LOTO framework ensures **maximum safety, compliance, and efficiency**, perfectly aligned with Hotayi's smart manufacturing ethos and quality systems. Let me know if you'd like to customize any section for specific equipment or workflows!

Managing Equipment Maintenance and Safe Work Procedures

🔧 **1. Equipment Inventory & Maintenance Scheduling**

- **Register all major assets** (SMT mounters, reflow ovens, selective solder machines, CMMs, X-Ray, ovens, etc.)—as listed on your Capabilities page hotayi.com.

- **Define maintenance types**:
    - *Preventive* (routine cleaning, calibration, part lubrication)
    - *Corrective* (post-failure repairs)
    - *Predictive* (anomaly detection via sensors/fault logs)

- **Set schedules**: daily, weekly, monthly, and annual inspections with logs for each machine (e.g., PCB routers, vapor soldering) to ensure traceability and compliance.

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📌 **2. Traceability & Procedure Documentation**

- Leverage your existing traceability system in PCBA processes hotayi.com to monitor parts, consumables, and maintenance records.

- Create **standardized maintenance forms**: equipment ID, task description, date, technician, and next due date.

🛠️ **3. Lockout/Tagout (LOTO) & Hazard Control**

- **Implement LOTO protocols** before maintenance—de-energizing electrical and pneumatic systems.

- Use signage and tags during service to prevent accidental energization.

- Conduct a **hazard assessment** ahead of routine and especially hot work activities, to identify risks like moving parts, entrapment, or hot surfaces hotayi.com.

🧰 **4. Safe Work Procedures**

- **Isolation and Immobilization**: Park on level surfaces, apply brakes, shut down systems, place chocks and tags .

- **Lifting & Hoisting**: Use cranes/lifts per manufacturer specs; ensure blocking is secure before mechanical work .

- **Hot Work** (e.g., spot/laser welding):

    o Create a **designated or controlled hot-work area** with 10–35 ft clearance, fire-resistant screens/blankets, and ventilation .

    o Require a **hot-work permit**, fire watch during and 30 min after completion .

- **Electrical tasks**: Only qualified staff work on de-energized circuits; maintain safe clearances per voltage .

🧰 **5. Personal Protective Equipment (PPE)**

- **Core PPE**: Hard hats, safety glasses, steel-toe boots, gloves, hearing protection—aligned with PCB assembly lines and hot zones .

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- **Specialty gear**: Face shields for solder or spot welding; arc-rated gear, respirators for fume removal during hot work .

- **Respiratory fit-testing & training**: Annual and fit-specific, followed by seal checks and maintenance .

👷 6. Training & Competency

- Provide **initial and annual refreshers** in LOTO, electrical safety, hot work procedures, PPE usage, and hazard recognition .

- Maintain **certificates & records** for traceability.

- Train personnel on safe operations of specific equipment (e.g., SMT mounter, reflow oven, X-ray).

🧫 7. Housekeeping & Workspace Safety

- Enforce **5S practices** to keep workspaces clean—clear floors, organized tools, no debris around sensitive machines.

- Implement **spill cleanup protocols** before machine servicing .

- Post daily checklists for area inspections.

🚨 8. Emergency Preparedness & Incident Management

- Ensure **fire extinguishers** near hot work areas and train staff on their use .

- Grant **"Stop-Work Authority"** to any technician spotting unsafe conditions .

- Use structured **incident reporting**: immediate notification, investigation, root cause, corrective/preventive actions, records retention .

🧪 9. Hazard Communication

- Use **SDS/safety data sheets** for all chemicals in conformal coating or underfill processes.

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- Ensure labeling, container management, and store SDS binders accessible to all employees

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🔄 10. Performance Review & Continuous Improvement

- Hold **monthly safety reviews**, audit maintenance logs, near-misses, and hot-work permits.

- Apply **PDCA (Plan-Do-Check-Act)** cycle: refine SLAs, SOPs, and controls based on findings.

- Update procedures when equipment changes or standards evolve.

✅ Summary Table

Procedure Area	Key Action
Equipment Maintenance	Scheduled logs using traceability; preventive/predictive measures
Lockout/Tagout	Strict de-energization with visual tagging before work
Safe Work Procedures	Immobilization, lifting, hot work, electrical safety
PPE	Job-specific gear + respiratory fit/testing
Training & Competency	Initial + annual refreshers with certification
Housekeeping	Daily 5S inspections, spill control
Emergency Response	Extinguishers, stop-work authority, incident reporting
Hazard Communication	SDS availability, proper labels
Review & Improvement	Monthly audits, data-driven updates