Smart ILS:

Smart Isolation & Locking System

Welcome to Smart ILS, a smart isolation and lockout system designed to support a safer work environment. This presentation is intended for audiences who are new to Smart ILS. We will break down complex safety procedures into clear, easy-to-follow steps and show how they are applied in real operational settings.

Isolation and lockout is a critical safety procedure that protects workers' lives. Smart ILS digitises the traditional approach to make execution more consistent, safer, and more efficient.

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what it is and why it matters

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FAQ

“Do we really need LOTO? Can we skip it?”
“If paper-based procedures, why do we need a system?”

What is LOTO?

Key concept

LOTO is a hazardous energy control procedure. It means **isolating energy sources**, **securing the isolation with a lock**, and **clearly indicating "do not operate"** with a tag.

Why does LOTO matter?

- **Prevents unexpected start-up** — reduce accidents during maintenance and inspection
- **Controls hazardous energy release** — electrical, hydraulic, pneumatic, steam, etc.
- **Protects workers' lives** — a core safeguard against severe incidents
- **Supports compliance** — a standard safety control in regulated environments

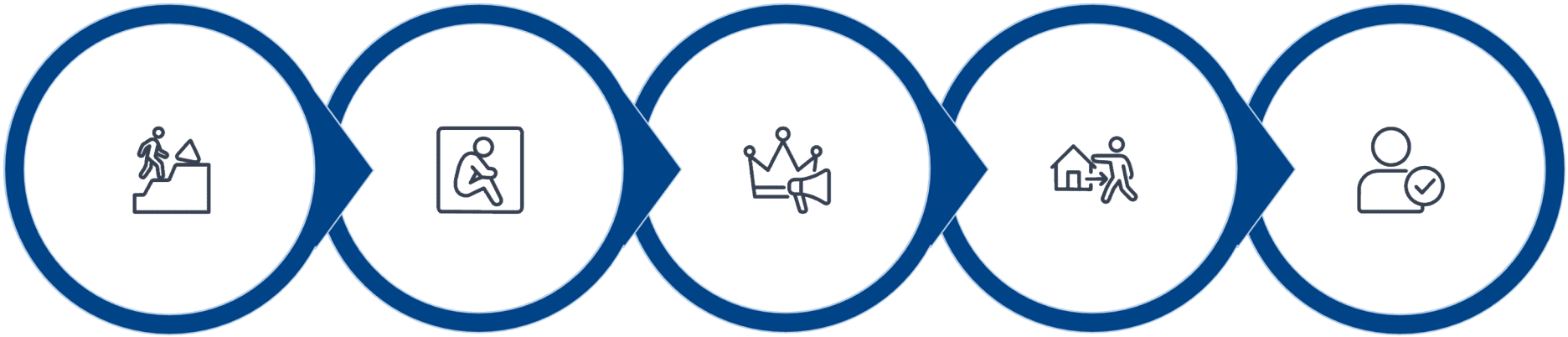
Applied correctly, LOTO enables safe, consistent maintenance

LOTO and ILS are related, but not the same:

- **LOTO** is the **hazardous energy control procedure**.
- **ILS (Isolation & Locking System) operationalises** LOTO through **Targets/Lock Points, RBAC/workflow, and audit-grade logs.**

Where LOTO Fits in the Safety Operating Model

LOTO is not a standalone procedure—it is a core component of the overall safety management system.
It is important to understand the end-to-end flow - from risk assessment through on-site execution to audit-ready evidence.



Risk Assessment | **Isolation Planning** | **Permit & Approval** | **Field Execution (LOTO)** | **Verification & Evidence**

Each step is interconnected, and LOTO is the key execution step that puts the planned safety controls into practice.
A digital system tracks and documents the entire process, providing robust, audit-ready proof.

Why LOTO Fails on Site

Unclear Definitions

It is often unclear **what exactly must be isolated** and **where the isolation boundary ends**.
Common confusion: *“Does this apply to the whole line, or only this piece of equipment?”*

Unclear Lock Locations

The most frequent on-site question is: *“Where do I lock it?”*
When there are multiple points—**breakers, valves, switches**—workers may be unsure which points are required.

Weak Approval & Responsibility Model

It can be unclear **who requests LOTO, who authorises it, and who is allowed to execute it**.
When accountability is ambiguous, the risk of unsafe decisions increases.

Insufficient Evidence

Paper records can be **lost or falsified**.
After an incident, organisations often struggle to demonstrate that every required lock point was checked and locked.

Step 1: Define the Isolation Target

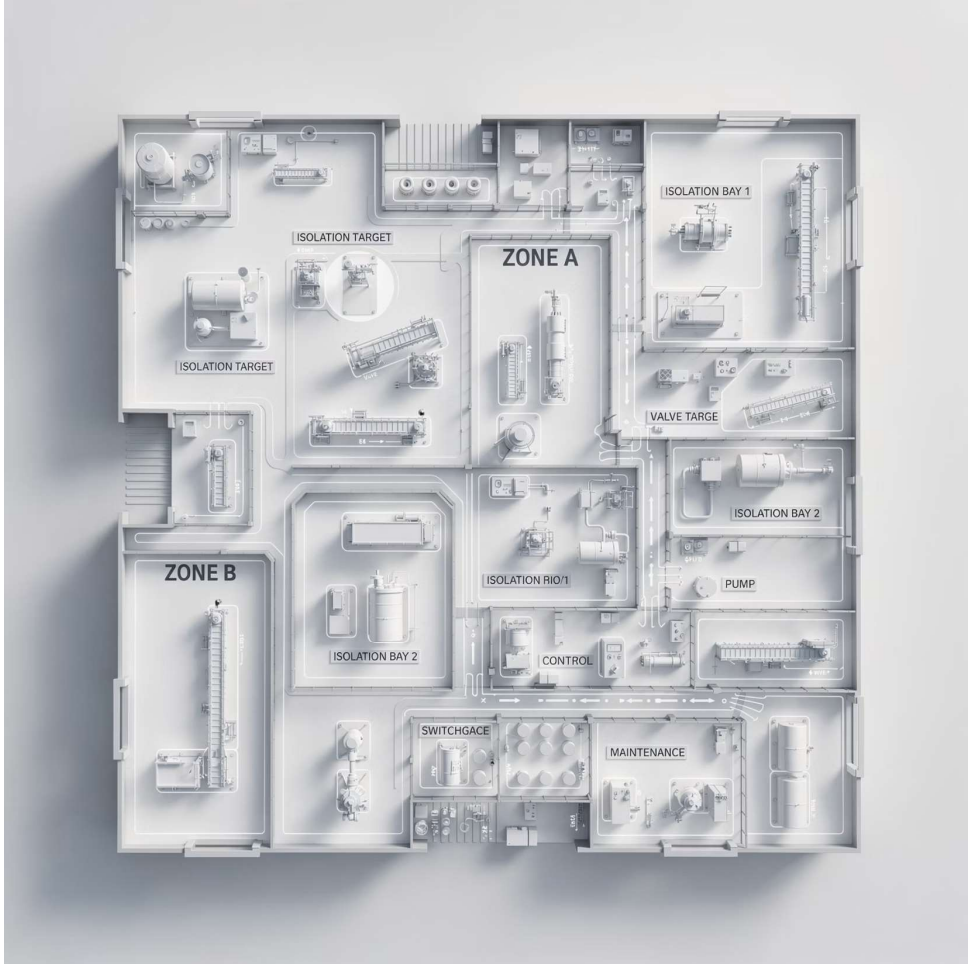
What is an Isolation Target?

An **Isolation Target** refers to the **asset or area** that must be controlled based on **risk assessment findings**.
It is a **logical management unit**, not a physical lock point.

Examples of Isolation Targets

- **Individual equipment** — Conveyor Belt #3, Press A-201
- **Production line** — Packaging Line (entire line), Assembly Line B
- **Process area** — Chemical Treatment Area, Boiler Room
- **Utilities** — Cooling Water System, Compressed Air System

Each Isolation Target is assigned a unique Lock Point ID (**ILS ID)**, making tracking and management easier.



Key point: An Isolation Target answers **"What are we managing?"**
It is defined from risk assessment findings, and a single target may be linked to **multiple lock points**.

Step 2: Define the Lock Points

- For each **Isolation Target**, define the **physical lock points.**
- A single target typically maps to **multiple lock points (1:N)**.

Electrical Isolation (Breakers and Panels)

Main power breaker,
Individual breakers in control panels,
MCC, Switches,etc.

Valves & Piping

Isolation valves,
safety valves ,
Drain/bleed valves,
Compressed air line valves, etc.

Mechanical Isolation Devices

Safety gates,
protective covers/guards,
Energy isolation devices,
Physical blocking devices, etc.

1:N Relationship

One Isolation Target → multiple Lock Points

Assign Unique IDs

Assign a **Lock Point ID** to each lock point

Clear Location Identification

Label lock points for easy on-site identification.

Step 3: 1:1 Mapping of Smart Locks

1:1 Mapping for Complete Execution

Deploy **one Smart Lock per Lock Point**.
A **1:1 mapping** prevents missed steps and makes completion status **unambiguous**.

Benefits of Smart Locks

Real-time visibility

Instantly see which Lock Points are locked.

Authorised unlocking only

Only authorised users can unlock.

Automatic logging

Lock/unlock time and user details are recorded automatically.

Prevents omissions

The system automatically confirms that all required points are locked.

Full audit trail

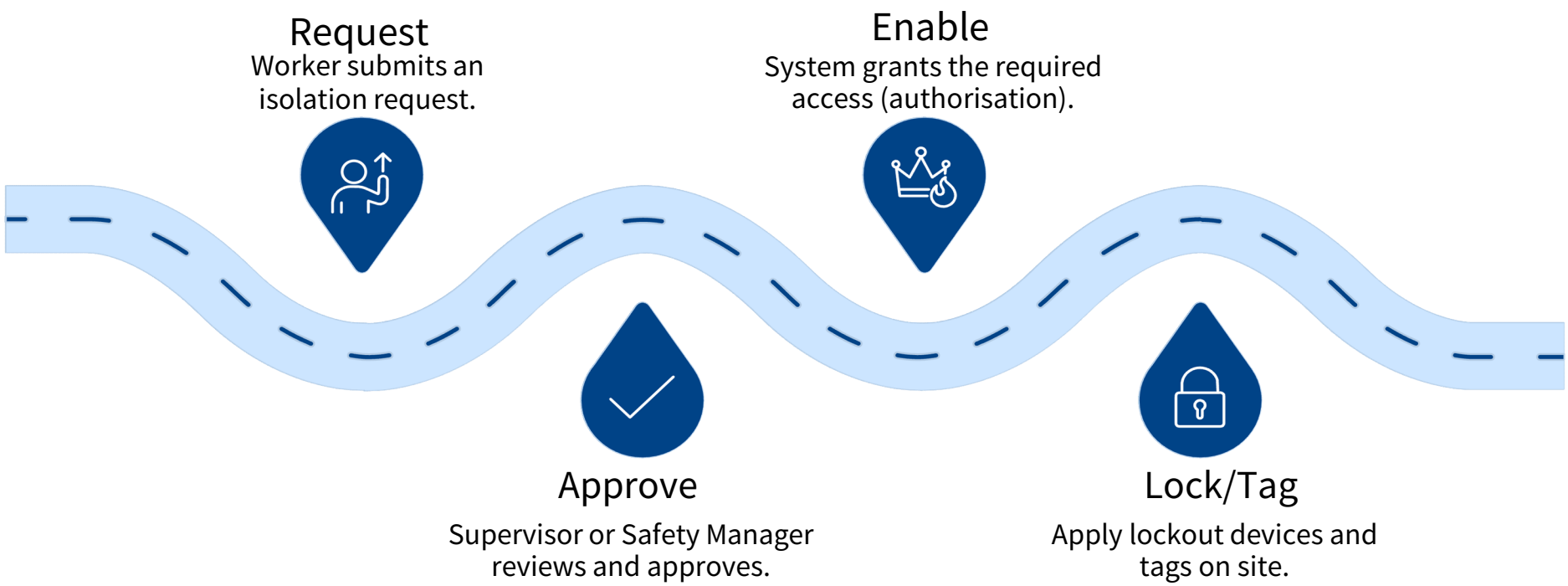
Who did what and when—digital evidence is preserved.

Data analytics

Analyse LOTO patterns to support continuous safety improvement.

Step 4: Role-Based Access Control (RBAC) and Workflow

- Clear roles and a step-by-step workflow ensure safe and consistent Lockout/Tagout (LOTO) execution.
- At each step, only authorised personnel can proceed—preventing unauthorised actions and omissed steps.



Request
Worker submits an isolation request.

1

2

Approve
Supervisor or Safety Manager reviews and approves.

Enable
System authorises Smart Lock use for designated users.

3

4

Lock/Tag
Apply physical locks and attach tags at the equipment.

Verify
Confirm zero-energy state and perform required tests.

5

6

Work
Carry out maintenance work safely.

Release / Restore / Close
Remove locks/tags and restore the system to normal operation.

7

Step 5: Operations & Governance

Automated alerts · Audit-ready data · Rapid response · Incident prevention

Step-based alerts and automatic logging ensure full compliance—without missed steps.

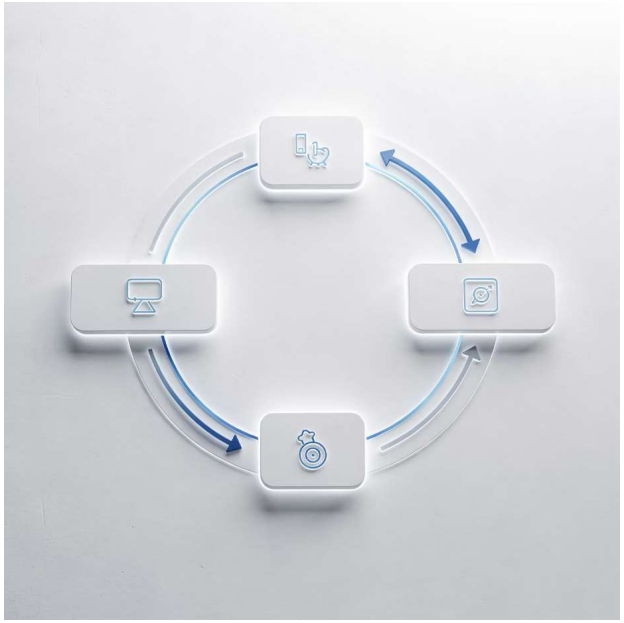
ILS Server – Workflow Engine

RBAC (Role-Based Access Control)

Only authorised users can perform assigned tasks.

Workflow

Request → Approve → Enable → Lock/Tag → Verify → Work → Close



Automated Alerts

- Auto alerts for approvals, delays, and errors
- Auto escalation to prevent missed steps

Audit-Ready Evidence

- Who / When / Where (ILS ID)
- What / Why + full decision trail (including exceptions)

Audit & Incident Response

- Instant reports and timelines
- Rapid impact assessment and containment

Safety Feedback & Prevention

- Root-cause analysis of repeats and delays
- Early warning signals → preventive actions

RBAC + Workflow = Alerts → Evidence → Response → Prevention

Running ILS vs Shutdown/Turnaround ILS

Smart ILS supports two operating scenarios. For rollout, we recommend starting with Running ILS to build experience, then expanding to Shutdown/Maintenance ILS.

Running ILS

Scope

Inspections and minor maintenance during normal operation

Policy complexity

Relatively simple approval steps and rules

Isolation scope

Specific equipment or a limited area

Setup effort

★★ Low — a good starting point

- Routine inspections and small-scale maintenance
- Fast approvals
- Minimal exception handling

Shutdown/Turnaround ILS

Scope

Large-scale work during planned shutdowns (turnarounds)

Policy complexity

Complex, multi-step approvals and verification

Isolation scope

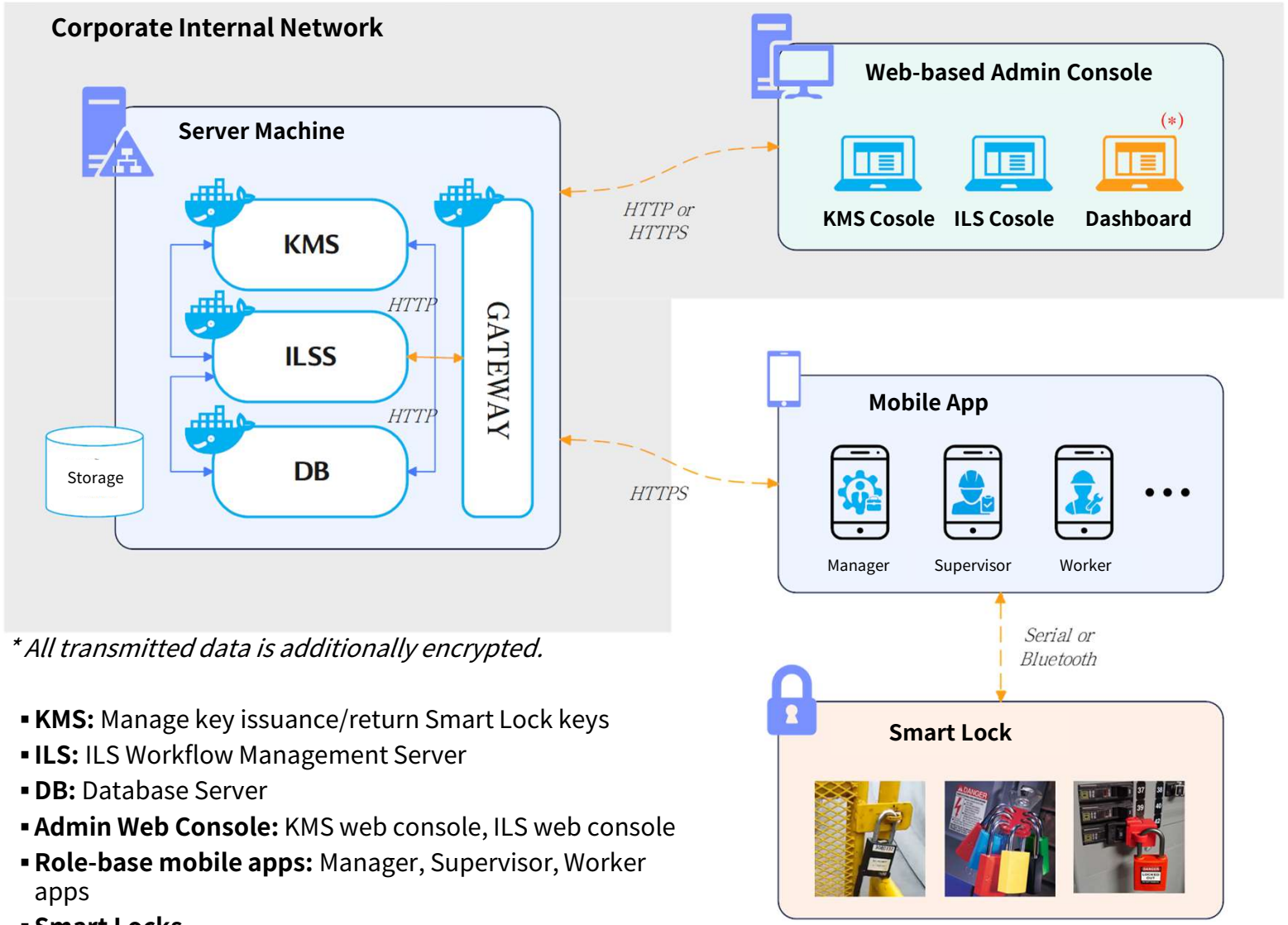
Entire line, full process area, or a plant/zone

Setup effort

★★★★ High — expand after building experience

- Major shutdown maintenance (TAR, Turnaround)
- Multiple approvers and complex workflows
- Handling diverse exception scenarios

Smart ILS Solution Architecture & Communication Flow



** All transmitted data is additionally encrypted.*

- **KMS:** Manage key issuance/return Smart Lock keys
- **ILS:** ILS Workflow Management Server
- **DB:** Database Server
- **Admin Web Console:** KMS web console, ILS web console
- **Role-base mobile apps:** Manager, Supervisor, Worker apps
- **Smart Locks**

Special Feature

VLock(Virtual Lock): Supervisor-Key Gate (ALL READY / ALL SAFE)

Controls supervisor key and system restore (READY/SAFE gate).

What is Vlock?

Auto-disables the supervisor key until READY/SAFE conditions are met.

All actions are logged.

Why is it needed?

Fixes common “people check” failures:

- Slow pre-job verification
- Restore while someone remains unconfirmed
- Handovers/shift changes/contractors → missed steps

→ VLock enforces this phase as a rule-based gate, reducing incident and dispute risk.

How does it work?

Policy-based gate for unlocking/restoration.

- **Not met:** key disabled
- **Met:** key enabled
- **Evidence:** Who/When/Where(ILS ID)/What/Why + exceptions

When is it most effective?

- Multi-person / multi-team work
- Critical close-out and “no one left behind” checks
- Large-scale shutdowns with repeated close-out checks

Business Value

Fewer incidents, faster close-out, lower downtime and dispute costs.

Reduces incidents and downtime, and speeds up close-out/restoration..

Enforces READY/SAFE. Logs every step for audit-ready evidence.

Special Feature

Advantages of Battery-Free Smart Locks

Battery-free smart locks operate reliably even in harsh industrial environments.
They are used in the same way as conventional LOTO padlocks—simple and familiar.

No battery required

No battery-related maintenance, charging, or replacement.

High reliability

Stable operation even in extreme temperatures, dust, and humidity.

Simple operation

Works like a standard LOTO padlock—no special training required.

Fewer interruptions

No battery depletion → fewer process interruptions or emergency cases.

Lower TCO

Reduced replacement costs and labour for battery management.

Environmentally friendly

No battery waste generated.

Note: Our smart locks are powered via **USB-C** from a user's mobile device, or via a **PECD** power source.
They are industrial LOTO padlocks for field use—not consumer smart gadgets.

Key Differentiators of Smart ILS

Smart ILS is not just a digital checklist.
Built for real industrial sites, it links risk assessment to smart locking, enforces company standards, and produces audit-ready evidence.

Field-Ready Design

End-to-end linkage: Risk assessment → Isolation targets → Lock point (ILS ID) → Smart lock

Enforces the Correct Procedure

Workflow + RBAC enforce the *actual process*—not just a checklist.

Verified Completion

1:1 mapping between lock points and smart locks prevents missed lock points.

Reliability-First Design

Battery-free industrial LOTO padlocks minimise exceptions and maintenance.

Audit-Ready by Default

Automatic structured logs: **Who / When / Where / What / Why**.

Scales to Contractors & Teams

Standard rules support coordination across **contractors and multiple work teams**.

Customer Value: What You Gain with Smart ILS

Smart ILS delivers measurable value in three core areas: safety, productivity, and compliance.
It is not just a technical solution—it is a strategic investment that strengthens safety culture across the organisation.

Enhanced Safety

- Prevents unexpected start-up/energisation incidents
- Ensures consistent LOTO execution
- Guides every step—reduces mistakes and missed steps
- Real-time monitoring reduces bypasses

Higher Productivity

- Clear lock/unlock completion reduces downtime
- **VLock** speeds up multi-worker checks and close-out
- Less rework from missed steps
- Real-time lock visibility improves coordination

Stronger Audit Readiness

- Automatic entry/exit and lock history for traceability
- Faster response to audits and regulators
- Less reliance on manual key management

Lower Operating Costs

- Less labour and higher operational efficiency
- Incident prevention reduces loss and insurance costs
- No battery maintenance vs battery-powered locks

Compliance Culture Built In

- Standardised procedures support compliance
- Training + real-time feedback build safety awareness
- Supports major incident prevention and response

FAQ: Frequently Asked Questions

Q1. "Can we skip LOTO?"

During maintenance/inspection, if there is any risk of unexpected start-up or stored energy release, **skipping LOTO greatly increases accident risk and legal liability.**

Why (Why it matters)

- **Stored energy** can cause serious incidents **in seconds** on site.
- In multi-team work and shift handovers, **judgement varies** and steps get missed without a control mechanism.
- If an incident occurs, **responsibility and compliance risk** expand quickly (audit/investigation).

So what? (Practical takeaway)

- LOTO is **not paperwork**—it is a **physical safety control** that prevents unexpected energisation.
- For high-risk equipment, treat LOTO as **mandatory operational control**, not optional guidance.

Q2. "Paper procedures work—why do we need a system?"

Paper can record steps, but **Smart ILS enforces the procedure through RBAC + workflow and produces audit-ready evidence.**

Why (3 key advantages)

- **Prevents mistakes:** without approval/authorisation (RBAC), key steps (Enable/Verify) cannot proceed.
- **Prevents bypasses:** exceptions require standardised reasons/approval/time—reducing informal workarounds.
- **Automatic evidence:** Who/When/Where(ILS ID)/What/Why logs are generated automatically—faster audits and incident response.

So what? (Cost & efficiency)

- Paper relies on people "doing it right." A system prevents steps from being skipped.
- Result: **less rework, faster close-out, lower incident response cost, and higher operational efficiency.**

Key message: LOTO is a mandatory control. Smart ILS makes it enforceable—without missed steps—and leaves audit-ready evidence automatically.

Smart ILS,
start strong, finish safe.

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