OPC DAY
FINLAND 2025
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OPC UA and Battery Passport

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FINNISH SOCIETY OF AUTOMATION
SUOMEN AUTOMAATIOSEURA RY

Agenda

1. **Introduction**
   Battery Production and Challenges

2. **EU Battery Passport**
   Battery Passport as early Case for Digital Product Passports

3. **The Role of OPC UA**
   From Shopfloor to Passport via OPC UA?

4. **Next**
   Summary, Takeaways and Call for Work

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Battery ecosystem in Europe – A great depression?

Rio Tinto Group to Stop Work at Serbia Lithium Project

Lilium's financial collapse triggers CustomCells insolvency at core German sites

Great dependence on China

Europe needs to accelerate battery production

Published:September 4, 2025 • 8:11 AM • by Claudia Scheele

Eramet and Suez suspend plans for battery recycling in France

Europe's battery makers seek a different growth path after Northvolt's collapse

Companies scaling down ambitions even as Europe is locked in race to reduce dependence on China

Relion Bat Circular starts up battery recycling plant in Meppen, Germany

Bookmark

Fluence to supply Leag's 4 GWh battery project, Europe's largest, in Germany

Germany gets applications for 661 GWh of BESS projects

Leuchtturm für Batterieforschung: ZSW liefert Kathodenmaterial für Tests

Contracts confirmed: EU funds five battery projects with 640 million euros

EU unveils 47 strategic critical raw material projects to bolster supply chain

Dürr and Partners Develop Dry Coating for Electrodes, Prepare for Industrial Pilot Projects

There is no black and white. The battery industry is developing forwards.
In addition to setbacks, there are also continually emerging opportunities and ideas evolving along the battery value chain.

Battery Production – A complex one

Electrode production

Dosing → Mixing → Coating & Drying → Calendering → Slitting → Vacuum drying

Cell assembly

- Separation / Winding → Stacking → Contacting / Contacting → Packaging → Electrolyte filling → Closing
- Separation → Stacking → Contacting → Packaging → Electrolyte filling → Closing
- Winding → Contacting → Packaging → Electrolyte filling → Closing

Cell finishing

Soaking →
- Formation → Degassing → Electrolyte Filling
- Formation → Degassing
- Formation

→ Aging & OCV → End-Of-Line Testing → Sorting & Packaging

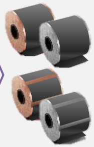
Battery Production – Fast Innovations & Knowledge Gaps

Electrode production

Dosing → Mixing → Calendering → Slitting → Vacuum drying

Dry Coating (Combining/obsoleting steps)

Laser Drying (80m less length)



Knowledge Gap?

Example: Milling	Battery Production?
Relevant Parameters *Widely known, machine vendors are also experts*	**Relevant Parameters** *Rough Views - Changing by recipe, vendor or person*
Cause Effect Relationships *Widely known, machine vendors are also experts*	**Cause Effect Relationships** *Widely unknown, challenge in coupling*

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Raw Materials Supply Chain

Critical raw materials

3 6,94 **Li** Lithium	27 58,93 **Co** Cobalt	28 58,69 **Ni** Nickel	25 54,94 **Mn** Manganese	6 12,01 **C** Carbon*

NMC-Cathode (Co, Ni, Mn)

Carbon*:
- Graphite Anode
- Conductive Additive

Abundant raw materials**

26 55,54 **Fe** Iron	13 26,98 **Al** Aluminium	29 63,55 **Cu** Copper

LFP-Cathode (Fe)

Current Collectors (Al, Cu)

*) in the form of natural graphite; **) Al and Cu considered „critical“ according to appendix II, EU-CRMA despite of natural abundancy

Battery Regulation: Development & General Information

Development process of the Battery Regulation

2006
September
Adoption of **Directive 2006/66/EC** on batteries and accumulators

2020
December
Commission proposal for a new regulation

2021
January
Entry into force ***BattG2*** (DE)

2022
March
Determination of the orientation (Council) and negotiating position (Parliament)

2023
August
Entry into force of **Regulation (EU) 2023/1542** on batteries and waste batteries

2024
February
Validity in EU member states

Objective of the regulation

Definition of battery systems
Categorization and differentiation of battery systems

Environmental impact
Minimizing the environmental impact of battery systems

Maximizing battery life
Improvement of the regulatory environment to extend battery life

Optimization of battery recycling
Regulation of the recycling market for battery systems

Novelties of the regulation

Battery categories
Redefining battery categories

Responsibility and law
Extended producer responsibility & requirements for repurposing

CO_2-Emissions
Mandatory information, performance classes, and limit values

Performance and aging data
Recording & sharing data about the battery life cycle

Recycling
Recycling rates & product-specific minimum recycled content

Battery Regulation: Key topics

- New Battery Categories
- CO_2-Footprint
- Minimum requirements for durability and performance
- Minimum recycled content
- Increases in collection rates
- Removability and interchangeability
- information requirements
- Conformity of batteries
- Compliance obligations of economic operators
- Due diligence obligations economic operators
- Manufacturer responsibility
- Management of used batteries
- Digital Battery Passport

[1] hesselmann service GmbH (2023)
[2] Europäische Union (2023).

The new EU Battery Regulation Timeline

February 2025

Declaration on Carbon Footprint (CF)
- Mandatory reporting for traction batteries

December 2025

Targets for recycling efficiency
- 75% for lead-acid batteries
- 65% for lithium batteries
- 80% for nickel-cadmium batteries
- 50% for other waste batteries

August 2026

Labeling »general information«
- All batteries must bear a label containing general information about batteries

Labeling »information on capacity«
- Rechargeable portable batteries, LV batteries and starter batteries must be labeled with capacity information

Labeling »information on the minimum operating time« and the indication »not rechargeable«

February 2027

- **Methodology for calculating and verifying the carbon footprint** and establishing the format for the carbon footprint declaration
- **Minimum electrochemical performance** and longevity for portable batteries

- Digital Battery Passport/QR Code

August 2031

Compulsory recycling content:
- 16% Co, 85% Pb, 6% Li, 6% Ni
- **Phasing-out** of non-rechargable portable batteries

August 2036

Compulsory recycling content:
- 26% Co, 85% Pb, 12% Li, 15% Ni

Battery Types in the Regulation

Portable Batteries

- encapsulated
- Can be held in the hand
- Mostly small battery types that are generally freely available on the market, e.g., AA (mignon), AAA (micro), 9-volt block, C (baby), D (mono), or button cell.
- **Not specifically designed for industrial use**

Industrial Battery

- Specifically for industrial use desinged
- Intended for reuse or recycling for industrial purposes after preparation
- Any other battery > 5kg that is not an LV battery, traction battery, or starter battery

starting, lighting and ignition battery

- Supplying electrical power to the starter motor, **lights, or ignition** of vehicles
- Can be used in vehicles, other means of transport, or machines **as a support system or replacement**

Traction Batteries (EV-Batterien)

- Provision of electrical energy for the **propulsion of hybrid or electric vehicles** in class L and with a weight > 25 kg
- Supply of electrical energy for the propulsion of hybrid or electric vehicles of classes M, N, O

LMT Batteries

- encapsulated
- Max. 25kg
- Traction of wheeled vehicles that are **powered exclusively by an electric motor or by a combination of motor and muscle power** (including type-approved vehicles of category L)
- No traction batteries

[1] Batteriegesetz (2023)
[2] Fraunhofer FFB (2024)

General Information

Specifications

Timeline	• 42 months after the EU Battery Regulation came into force • **18th February 2027**
Scope	• Batteries for light vehicles **(LMT)** • **Industrial batteries > 2 kWh** • Traction batteries (**EV-Batteries)**
Responsibility	• **Economic operator** (or an authorized representative) placing the battery on the market • Manufacturer or importer
Target Group	• The "general public" • "Public authorities, market surveillance authorities, Commission" • "Any natural or legal person who has a legitimate Interested in accessing and processing this information"

[1] Battery Pass consortium (2023)

Battery Passport Contents

Battery Pass

Battery ID: 0000001

General information

Manufacturing info (identity, place, date)

Battery category

Battery weight

Battery status

Labels and certifications
- Symbols and labels
- Declaration of conformity

Carbon footprint
- Carbon footprint
- Weblink to CF-study

Supply chain due diligence
- Due diligence report

Materials and composition
- Hazardous substances
- Battery chemistry

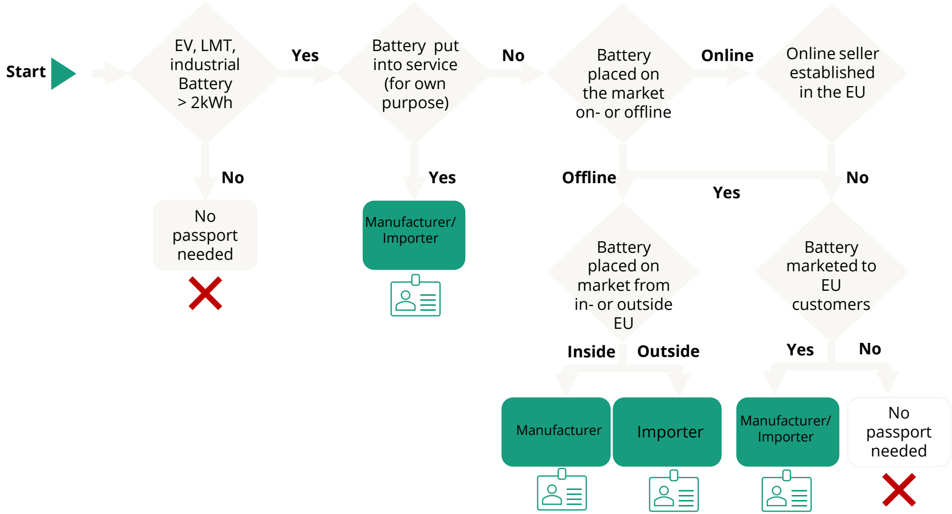
Circularity and resource efficiency
- Recycled content
- Manuals for removal

Performance and durability
- Capacity, energy, power, SoH
- Lifetime in years and cycles

Required Data
- A total of **90** mandatory **data attributes**
- clustered into **7 categories**
- List of n**egative events**

[1] Battery Pass consortium (2023)

Definition of Operator



Economic Operator

Responsibility lies with the economic operator (manufacturer or importer) **placing a battery on the market** or **putting it into service**.

Manufacturer:

Any natural or legal person:

- Manufacturing a battery
- Has a battery designed or manufactured and sells it under its own name/ trademark OR puts it into service for its on purpose

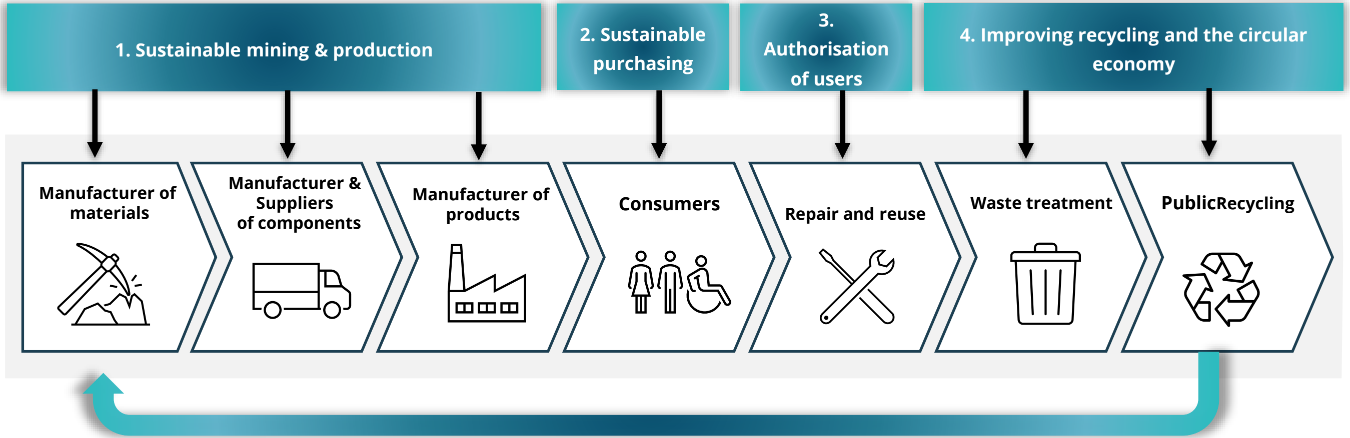
Importer:

Any natural or legal person established within the Union:

- *Placing a battery on the market from a third country*

[1] Battery Pass consortium (2023)

Aim and Areas of application



Return to the cycle

[1] VDI/VDE (2021) [2] RMIS (2021).

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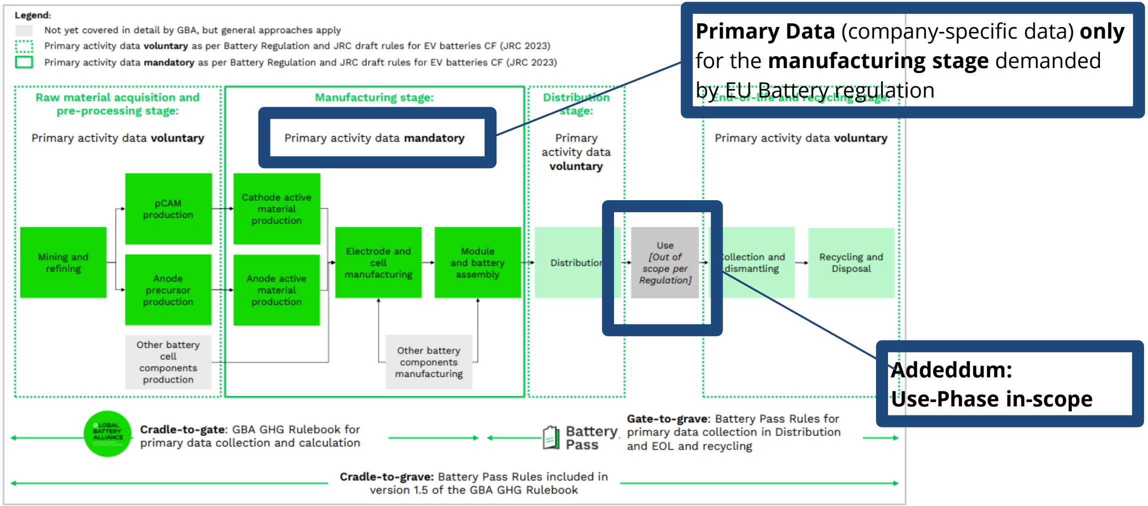
Requirements for battery regulation



Source: [Battery Passport Content Guidance / DIN DKE SPEC 99100 - acatech]

Current Challenges and Policy Demands

Resolve Regulatory Uncertainties:

- Quickly finalize data attribute **standardization and key definitions** for the technical system

Support Additional Use Cases:

- Establish the battery passport as **a B2B tool** by endorsing a "**beyond regulation**" section for data aggregation and insights

Facilitate Implementation for SMEs:

- Create **clarity** and support, ensuring **interoperability and collaboration** between science and industry to ease the implementation process

High Fixed Costs:

- Over **90%** of implementation tasks are **fixed costs,** primarily due to software development, which is largely independent of battery sales volume → This poses potential **challenges**, especially for **SMEs**

Data Management Efforts:

- More than **50%** of total implementation effort stems from **data management tasks**
- A lack of automation in this area could lead to significant challenges if not addressed.

Impact of Inaction: Delays in addressing these regulatory uncertainties could significantly diminish the value opportunities presented by the battery passport.

Source: The Battery Pass Consortium [2024]

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State of Interoperability

High Innovation Frequence of Equipment and Recipes
→ No long-term-fixation

Low Level of known Cause-Effect Relationships
→ No fixed parameter set

Recycling for scarce materials upcoming
→ Interaction along Supply Chain needed

External Regulation
→ But no defined standard

»Normal Modern« Production Requirements
→ Matching different worlds

Interoperability is the key

OPC UA to the rescue!

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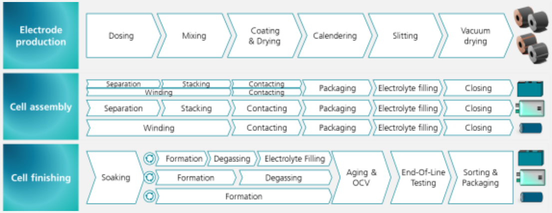
Cases of Interoperability

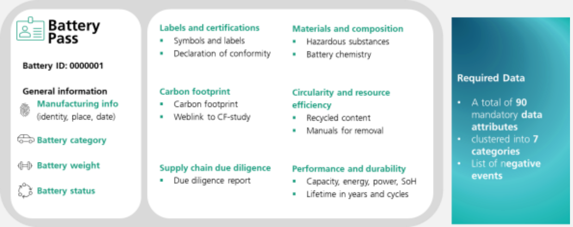
Battery Production



- Focus on machine and vendor level
- Take into account Battery specifics
- Harmonize and Reuse (!) existing standards

➔ Working Group active, First draft available

Battery Passport



- Focus on system and production level
- Take into account ongoing specifications and domains
- Avoid creating new Battery Passport - interoperate!

➔ Working Group started end of November

AWS BECKHOFF Microsoft OPC FOUNDATION PROSYS OPC STERIS Valmet FORWARD Wapice

Battery Passport Solutions

Current and Upcoming Developments

(And many more)

Technology Stack in Use

- REST
- AAS (multiple submodels)
- RDF
- Turtle
- OWL
- JSON-LD
- OPC UA
- GS1 EPCIS
- …

Key-Takeaway

Multiple Solutions will be available for users and companies

No one-fits-all solution in sight

OPC UA with information models can **ensure the interoperability** serving **as backbone for the Battery Passport**

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Recap:

- Battery Cell Production has challenges
- Battery Passport set, but no fixed standard
- OPC UA to ensure interoperability of solutions

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JWG »Battery Solutions« Scope

Focus and Goals

- Battery Market is growing fast
- Digital Solutions like Battery Passport arise – the interoperability is key challenge
- Task: Identify relevant solutions, that require interoperability
- Goal: Create an interoperability Layer using OPC UA

Starting with technical approach

Not in Scope

- No competing solutions or data handling platforms
- Smallest case-specific solutions
- Legal Consultation for regulations

Ingestion via poll and Mails

Approach and Work of JWG

Case 1: Battery Passport

Case 2: ???

Continuously:

Ingestion and Evaluation

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