OEMs Can No Longer Absorb Battery Uncertainty – How the Digital Battery Passport Will Affect Warranty Risk and Defect Detection

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Executive Summary

Battery systems are a significant cost and risk factor for electric vehicles and industrial equipment. Historically, original equipment manufacturers (OEMs) have absorbed much of the uncertainty in battery performance through conservative design, warranty reserves, and post-market service processes. The Digital Battery Passport (DBP) requirement introduces structured, retrievable lifecycle data into the value chain. This data focus increases visibility into manufacturing variability, use-pattern effects, and early degradation signals. For OEMs, this reduces the ability to treat battery behaviour as latent uncertainty and shifts the emphasis toward earlier defect detection and process control. Over time, clearer visibility into performance data will affect warranty provisioning, supplier accountability, and manufacturing quality systems.

The Nature of Battery Uncertainty

Battery performance and durability vary for reasons that are partly technical and partly operational. Cell chemistry variability, pack assembly differences, thermal management, and use patterns all contribute to variation in State of Health (SoH), State of Safety (SoS) and State of Performance (SoP). Until recently, much of this variation was managed indirectly: conservative design margins,

warranty reserves, and reactive failure analysis. The move toward formalised lifecycle data exposes this uncertainty rather than obscures it.

Warranty Risk and Provisioning

In financial terms, OEM warranty provisioning for batteries typically involves setting aside a reserve based on statistical expectations of failure and degradation. For example, if an OEM sells 300,000 vehicles with a battery pack warranty over 8 years, and expects a 5% early degradation escape rate, that is 15,000 warranty exposures. If each case averages €2,000 in cost (diagnosis, replacement, logistics), the provision requirement is roughly €30 million.

This calculation depends on assumptions: degradation rates, failure modes, usage patterns. Those assumptions have been necessarily conservative because real-world data was incomplete. Warranty reserves absorb both known and unknown variability. The DBP changes this because it generates structured performance evidence at the pack and cell level. Over time, OEMs will be able to refine their assumptions with actual data rather than industry defaults or internal estimates.

When Uncertainty Becomes Data (therefore Visibility)

Under a DBP regime, structured performance indicators will be captured throughout the lifecycle – from manufacture through assembly, installation, operation and end-of-life. This data will make systematic patterns visible. Variability that was once hidden in aggregated warranty statistics will be traceable at the batch, module or even cell level.

For example, if a particular manufacturing lot of modules exhibits higher-than-average SoH decay within the first 12 months, DBP data can reveal that pattern sooner than warranty claim data alone. Early detection of such patterns allows for corrective action in the manufacturing process rather than absorbing cost through warranty.

This changes quality management logic. Instead of reacting to warranty claims, OEMs and suppliers can detect drift in performance indicators and initiate targeted root cause analysis.

Implications for Manufacturing and Quality Systems

From a manufacturing perspective, DBP data highlights several focal points:

- **Process variability**: Higher variability in key performance indicators (KPIs) becomes visible earlier
- **Supplier integration**: Data from upstream suppliers becomes integral to traceability and defect analysis
- **Cross-system consistency**: Harmonising data across MES (Manufacturing Execution Systems), ERP (Enterprise Resource Planning), and quality systems becomes necessary
- **Early signal detection**: Continuous performance data enables more refined statistical process control (SPC)

These elements are familiar in manufacturing improvement methodologies such as Six Sigma or Total Quality Management. What is new is that performance data – once only partially visible through warranty events – will be available continuously and in structured form. This affects how quality teams prioritise inspections, adjust process controls, and engage with suppliers.

Procurement and Supplier Accountability

The DBP also affects procurement strategy. Historically, battery suppliers were evaluated largely on cost, performance, and delivery. Where data from suppliers was incomplete, OEMs accepted that quality signals would emerge over time through warranty trends.

With DBPs, supplier data becomes part of the compliance and quality framework. Procurement must assess not only technical parameters but also data transparency, traceability and completeness. The metric becomes: can the supplier provide the data necessary for structured lifecycle performance evaluation?

If a supplier cannot provide this data, the OEM has fewer options than before. Incomplete data creates blind spots in quality visibility and warranty exposure. Contract terms will need to be adjusted to include data provision obligations, traceability requirements, and performance indicators that can be auditable.

Service Strategy and Field Diagnostics

Service and aftersales organisations will also see practical impacts. DBP data can support:

- More accurate failure diagnosis in the field
- Reduced unnecessary replacements
- Better alignment between service policies and actual performance indicators
- Improved root cause tracking

For example, rather than replacing a battery pack based on a general SoH threshold or a customer complaint, service technicians can consult DBP-derived signals that indicate whether a deviation reflects manufacturing variation, use conditions, or genuine defect.

Over time, this reduces service costs and improves customer experience, because decisions are grounded in structured evidence rather than heuristic thresholds.

Conclusion

The Digital Battery Passport does not change the technical reality of battery systems, but it changes the level of visibility surrounding them. Performance variation, degradation patterns and defect trends will be more consistently documented and easier to trace across manufacturing, integration and field use.

For OEMs, this means warranty risk can no longer be managed primarily through only conservative assumptions and financial buffers. Structured lifecycle data will support earlier detection of deviations, clearer supplier accountability and more precise provisioning decisions. In parallel, manufacturing and quality systems will need to integrate this data into routine process control and feedback mechanisms.

Over time, the organisations that align warranty management, procurement standards and manufacturing improvement around structured performance data are likely to see more stable cost profiles and fewer late-stage corrections. The impact is not sudden or dramatic. It is gradual and cumulative, reflecting the way disciplined quality systems typically evolve.

In this environment, the Digital Battery Passport becomes part of the broader operating model – not as an external reporting layer, but as a structured input into quality, risk and capital decisions.

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