Comparative assessment of packaging reuse and standards

Packaging and Packaging Waste Regulation support

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Executive summary

This report provides a comparative assessment of three representative standards for reusable packaging: NTA 8515:2024 (HORECA), DIN SPEC 91510:2025 (Retail), and ISO 18616:2016 (Transport) to evaluate their alignment with the requirements and objectives of the European Packaging and Packaging Waste Regulation (EU) 2025/40 (PPWR).

The study aims to identify strengths, weaknesses, and opportunities for harmonisation of future reuse standards, focusing on criteria such as durability, hygiene, traceability, interoperability, and environmental verification. Each standard reflects solid sectoral expertise, from hygiene validation in DIN SPEC 91510 to mechanical robustness in ISO 18616 and systemic design coverage in NTA 8515. Yet, none provides a comprehensive framework that meets the PPWR combined technical, environmental, and data requirements.

Key gaps include the absence of quantified durability thresholds, life-cycle-based environmental verification, and unified digital traceability. Hygiene assurance is comparatively strong and could serve as a common baseline across sectors. However, interoperability, environmental measurability, and integrated testing remain fragmented.

The report proposes seven strategic priorities to guide future European standardisation: establishing quantified durability classes with consideration to secondary legislation of the PPWR, embedding life-cycle-based metrics, defining baseline hygiene protocols, ensuring physical and digital interoperability, developing a traceability architecture, supporting design for recyclability rules, and creating integrated test and verification frameworks.

Together, these priorities form a roadmap toward an integrated European reuse standard family that combines design integrity, operational assurance and system intelligence, enabling verifiable, scalable and environmentally credible reuse in line with the PPWR.

Context and purpose

The transition towards a circular economy in the European Union, as outlined in the European Green Deal and the Circular Economy Action Plan[1], relies partly on development of safe, interoperable, and verifiable reuse systems. This ambition is operationalised through the Packaging and Packaging Waste Regulation (PPWR), articles 11, 26, 27, 29 and Annex VI[2], which introduces binding reuse obligations and targets while defining technical criteria for reuse, including durability, hygiene, traceability, and minimum rotation requirements.

Standardisation provides the technical foundation for this transformation by defining design, cleaning, and verification protocols that enable packaging to circulate safely and repeatedly. However, the current standardisation landscape is fragmented, with varying scopes and definitions across sectors and national contexts.

This paper presents a comparative assessment of three representative standards that shape some European reuse practices:

- HORECA: NTA 8515:2024, Reusable cups – Design, material, cleaning and monitoring.
- Retail: DIN SPEC 91510:2025-04, Requirements for the hygienic reprocessing and reuse of reusable plastic packaging.
- Transport: ISO 18616:2016, Transport packaging – Reusable rigid plastic distribution boxes, Part 1 (General purpose application) and Part 2 (General specifications for testing).

The analysis identifies **sectoral strengths, cross-cutting gaps, and opportunities for harmonisation to** support PPWR implementation and guide future CEN – and potentially ISO – standard developments.

Analytical framework

The analysis draws on a set of criteria relevant to the implementation of reuse under the PPWR. These include scope, clarity and robustness of requirements, the presence of test and verification methods, and the extent to which they support interoperability, hygiene assurance, and environmental performance. The focus is on identifying good practices, structural gaps, and sector-specific strengths that could inform the development and/or review of European reuse standards, as well as international ones. The assessment is diagnostic: it does not aim to prescribe a fixed template, but rather to **support reflection on the elements that credible and verifiable reuse standard systems should contain.**

Comparative review and findings

A comparative assessment of the three standards reveals distinct strengths aligned with their sectoral use cases, yet also several critical gaps that hinder their broader environmental alignment and interoperability under the PPWR.

NTA 8515:2024 exhibits strength in taking a **systemic approach, addressing reuse conditions across design, operation, and hygiene monitoring.** It references dishwashing resistance tests (EN 12875-1) as a proxy for durability and aligns with hygiene standards (EN 17735). However, its weakness lies in the **absence of quantified reuse cycle thresholds or binding durability performance**. This limits the ability to demonstrate environmental benefit beyond compliance with hygiene and usability requirements.

DIN SPEC 91510:2025 provides a highly detailed operational framework for hygiene validation. Its prescriptive measures, including microbial limits and HACCP-based[i] control points, offer a **robust means to ensure safety in reuse**, which is critical for consumer confidence and regulatory compliance. Nevertheless, the standard **omits environmental performance** entirely. It does not define durability, rotation expectations, or minimum environmental benchmarks despite these being key to validating reuse's environmental justification over single-use alternatives.

ISO 18616:2016 focuses on mechanical reliability and logistics interoperability. It **provides durability assurance** through standardised testing of load resistance, drop stability, and deformation. These provisions support long-term reuse in demanding supply chains. However, the standard is **silent on washability, hygiene, or LCA-based performance indicators**. It also does not engage with traceability or reuse validation methods, such as rotation tracking.

i HACCP (Hazard Analysis and Critical Control Points) is a systematic, preventive approach to food safety that identifies, evaluates, and controls hazards that could compromise food hygiene and consumer health. See: European Commission – HACCP principles.

A common gap of these standards is the **lack of life-cycle-based verification and environmental measures**. None of the standards include LCA frameworks, nor do they quantify rotation thresholds necessary for environmental break-even compared to disposable alternatives. This absence creates a gap between technical performance and the policy mandate of the PPWR to demonstrate environmental benefit. Without harmonised metrics for durability, reuse counts, and carbon impact, packaging **cannot be verified for sustainable reuse at scale.**

Furthermore, **traceability is inconsistently addressed**. While ISO 18616 references GS1-compatible identifiers, there is no common digital architecture across the reuse industry for monitoring reuse cycles or enabling transparency for regulators and users. **Interoperability** is addressed in the transport sector, but it remains fragmented in consumer-facing applications.

In sum, the three standards offer complementary but incomplete frameworks. They collectively fail to provide a harmonised, measurable basis for implementing the PPWR's reuse objectives with environmental assurance at the core.

Consolidated overview of comparative review

Criteria	Good practice/ Ideal feature	Observed strengths in review	Key gaps
Durability and reuse thresholds.	Explicit minimum number of cycles tied to environmental break-even points.	ISO 18616 provides mechanical tests (load, drop); NTA 8515 references dishwasher resistance.	No standard quantifies a reuse threshold across sectors; durability interpreted qualitatively.
Environmental verification.	Harmonised LCA methodology; benchmarks for carbon, water, etc.	None include LCA while environmental criteria in NTA 8515 are descriptive.	Absence of standardised environmental metrics; no life cycle verification or similar.
Hygiene assurance.	Validated cleaning protocols, microbiological criteria, HACCP approach.	DIN spec 91510 is strong (process validation, microbiological limits); NTA 8515 references EN 17735.	Hygiene well covered and could be utilised as baseline for future standards.
Interoperability & design.	Common dimensions, stackability, shared identification.	ISO 18616 stipulates modular dimensions and GS1 identifiers.	Consumer/retail standards lack interoperability of form or identification and product variation.
Traceability & rotation tracking.	Item-level tracking, digital data, rotation logs.	NTA 8515 includes monitoring recommendations; ISO 18616 supports GS1 identifiers	No unified traceability architecture or rotation-count audit.
Material circularity/End-of-life.	Design for recyclability, monomaterial, additive limits, recycling pathways.	NTA 8515 mentions high-quality recycling; DIN SPEC encourages design for reprocessing.	Lack of recyclability spec, e.g. material, polymer type if plastics, barrier, colour, additives, labels and inks, adhesives.
Test and verification methods.	Joint test protocols that combine mechanical, hygiene, and environmental criteria.	ISO 18616 test methods; DIN spec hygiene validation protocols.	No integrated test standard combining multiple dimensions.

Priorities for reuse standards in support of the PPWR

The comparative overview demonstrates that while the current standards ecosystem captures essential technical and hygiene requirements, it remains fragmented in scope, terminology, and verification. Each document contributes valuable sector-specific practice whether through mechanical testing, validated cleaning, or monitoring guidance, but none provides a complete, cross-sector framework that meets the PPWR full set of criteria for durability, traceability, and environmental performance. It should be acknowledged that **sectoral reuse standards may require specific recommendations** applicable only within certain domains (e.g. reusable transport packaging), while it should be sought to secure compatible future reuse standards across sectors.

The following section translates these analytical insights into strategic priorities for future European standardisation, identifying **how existing sectoral strengths can be consolidated into a coherent and outcome-based family of reuse standards**.

Quantified durability and reuse thresholds

Durability and reuse thresholds are the foundation of credible environmental performance. At present, durability is referenced qualitatively in NTA 8515 and indirectly addressed through mechanical testing in ISO 18616, but no standard defines a **quantifiable threshold for the number of reuse cycles required**.

Future standards must consider the criteria that will be defined through the secondary legislation of the PPWR, expressed as a minimum verified number of use cycles or similar. Verification could rely on harmonised endurance testing combining dishwashing resistance, impact tolerance, and visual degradation scoring.

Embedding a declared "minimum intended rotations" will enable policymakers to link environmental outcomes to performance evidence and ensure that "false reuse"[3] does not happen.

Life-cycle-based environmental measurability

Environmental credibility depends on demonstrable life cycle benefits. None of the reviewed standards includes environmental verification mechanisms or life cycle reporting methods. To align with the PPWR's approach, **future standards should integrate life cycle data and benchmarking requirements**.

Rather than prescribing a single LCA model, standards should define the **minimum dataset necessary for life cycle assessment**, covering wash-cycle energy and water use, toxicity (such as pollutants e.g. detergent residues from washing, microplastics release and PFAS), transport distance, loss rates, and material recovery outcomes. This dataset can feed harmonised European benchmarks for per-use carbon and water intensity. The UP Scorecard[ii] can be instrumental for this dataset as it covers GHG emissions, water use, plastic pollution, toxicity, as well as sustainable sourcing and recoverability.

Incorporating such parameters will make environmental verification auditable and comparable, allowing operators and regulators to confirm that reuse consistently outperforms single-use packaging under realistic conditions.

ii The UP Scorecard measures commonly used foodware and food packaging materials with a single yardstick through scores for plastic pollution, chemicals of concern, climate, water use, sustainable sourcing, and recoverability.

Baseline hygiene requirements across sectors

Hygiene assurance remains the strongest element in the current landscape, with DIN SPEC 91510 offering validated cleaning protocols and microbiological limits, and NTA 8515 referencing key European hygiene standards. However, **hygiene should be thought as a baseline requirement for all reuse systems built for food-contact.**

Future cross-sector standards should establish a common hygiene framework grounded in HACCP principles, EN 17735, and microbiological verification. This could include validation frequency, sampling plans, and acceptance criteria proportionate to product risk. Hygiene assurance could also be integrated with environmental metrics so that water, energy, and detergent use are tracked alongside cleaning efficacy, ensuring that sanitary integrity does not come at excessive environmental cost. It should be developed throughout the life cycle of reusable packaging, including for collection, storage, transport, shipping and distribution, reconditioning and redistribution, and more generally logistics, including reverse logistics[iii]. The PR3 Standard on Systems Operation and Performance[4], currently in the finalisation process, can be assessed for this purpose.

Such harmonisation will provide consistent consumer protection while supporting transparent trade-offs between cleanliness and sustainability performance.

System-level interoperability and harmonisation

Interoperability both, physical and digital, is a precondition for scaling reuse systems. ISO 18616 already provides modular footprints and identification principles, yet consumer and retail packaging standards lack equivalent design coherence. The absence of aligned dimensions, stacking logic, and identifier principles restricts pooling efficiency and cross-operator reuse.

Future standards should adopt **design references across packaging categories and mandate the use of standardised identifiers for all reusable items**. **Harmonised physical and digital interfaces** will reduce cost, facilitate automated handling, and enable interoperability between reuse operators within a specific sector, and between sectors equally.

This approach transforms reuse from isolated pilots into an **integrated European infrastructure** capable of supporting large-scale circular logistics.

Digital traceability and rotation tracking

Traceability is central to regulatory compliance, quality control, and environmental accounting. While NTA 8515 mentions monitoring and ISO 18616 accommodates machine-readable IDs, no common framework yet exists for rotation counting, data retention, and audit transparency.

Future standards should define a **digital traceability architecture** that links item or batch identifiers to cleaning, inspection, and reuse events. A minimal dataset should include item ID, number of rotations, last cleaning batch, and status (active, retired, or lost). Such data enable **automated calculation of rotation averages, loss rates, and environmental performance, which support reuse systems**.

Integrating traceability into documentation would allow authorities to verify both safety and environmental impact without imposing parallel reporting systems, strengthening enforcement under the PPWR.

iii "Reverse logistics [aims at] facilitating transfer of the packaging from the end users back to the system participants", according to the PPWR Annex VI Part A (2).

Material circularity and end-of-life integrity

Although existing standards encourage recyclability, they lack specific design rules that guarantee high-quality material recovery. Future standards could require design-for-recycling parameters such as monomaterial construction, limitations on pigments and additives, considering the state-of-the-art recycling processes available at scale. For food-contact applications, compatibility with established food-grade recycling streams should be ensured.

Each material family should include a reference reusability and recyclability test or declaration procedure confirming that the packaging can re-enter a closed loop system[iv] without quality loss. For this purpose, upcoming EU secondary legislation on packaging recyclability from the PPWR should be considered. This ensures that reuse systems remain consistent with the circular economy principle that end-of-life value is retained after multiple rotations.

Integrated test and verification framework for reusable packaging

Current verification is fragmented: ISO 18616 tests mechanical strength, DIN SPEC 91510 validates hygiene, and environmental impacts are untested. To enable coherent assessment, future standards should move towards **integrated test protocols combining mechanical durability, cleaning effectiveness, and environmental verification**.

A harmonised testing regime could specify combined durability-wash-hygiene cycles, monitored under controlled conditions, with metrics for structural integrity, microbiological safety, and cumulative resource use. Results would feed into the durability declaration, hygiene validation, and life cycle dataset simultaneously, reducing duplication and aligning evidence across regulatory domains.

Conclusion: Towards an integrated standardisation framework

Together, these priorities define a practical roadmap for a future European reuse standard family. The priorities can be understood as three interlocking layers:

- **Design and material integrity** ensure products are durable, cleanable, and recyclable by design.
- **Operational assurance** validating logistics and reverse logistics, washing, inspection, reconditioning and redistribution and monitoring through consistent verification methods.
- **System intelligence** enabling traceability, data collection, and environmental reporting for transparent accountability.

By anchoring new standards in measurable durability, verifiable hygiene, interoperable design, and traceable performance for reusable packaging, **the European Standardisation System can deliver the technical foundation** that the PPWR and European reuse-system providers require.

References

[1] European Commission. Communication: *A new Circular Economy Action Plan For a cleaner and more competitive Europe* (2020). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0098

[2] Official Journal of the European Union. *Regulation (EU) 2025/40 on packaging and packaging waste* (2025). https://eur-lex.europa.eu/eli/reg/2025/40/oj/eng

[3] ECOS. *Disclaimer: A product is not reusable just because it can be washed* (2023). https://ecostandard.org/news_events/disclaimer-a-product-is-not-reusable-just-because-it-can-be-washed/

[4] PR3. *RES-005: Systems operations & performance* [In development]. https://www.pr3standards.org/the-pr3-standards

iv Defined by the PPWR Annex VI (b) as "a re-use system in which reusable packaging is circulated by a system operator or a co-operating group of system participants without the change of the ownership of packaging".