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Reusable packaging system design – Specifications and recommendations

Part 3:
Digital

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RESOLVE

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Draft Standard

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Reusable Packaging System Design Standard: Digital

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Foreword

PR3 is a public-private partnership between corporate, government and NGO stakeholders that has created a standard for the design of reusable packaging systems and is testing it in collaborative demonstration projects. PR3's goal is to transform disconnected, proprietary, and small-scale reuse models into shared interoperable public-private systems. The standard is meant to integrate, de-risk, and support reuse initiatives globally.

PR3 founding partners, funders and advisors include Break Free from Plastic, Cisco, City of Seattle, Nestle, Plastic Solutions Fund, SAP, and The Ellen MacArthur Foundation.

This document was prepared by PR3 with input from its partners. It represents the views of PR3 only and does not indicate the views of any of PR3's partners.

This is a working draft document and is subject to change.

This edition (Version 1.3) cancels and replaces any previous editions.

A list and links to all parts in the PR3 Reusable Packaging System Design standard can be found on the PR3 website, see <https://www.pr3standards.org/the-pr3-standards>.

Any feedback or questions on this document should be directed to PR3 Technical Director at: <https://www.pr3standards.org/contact>

Introduction

Single-use packaging is a critical threat to human health and the environment. Research shows that reuse has the greatest potential to dramatically reduce plastic production, pollution, and greenhouse gas emissions, while reducing system costs, compared to other packaging waste interventions.

As reusable packaging systems have emerged in recent years, they have been designed independently and are mostly small-scale, disconnected, and proprietary. They each operate within their own systems for collection and reverse logistics. As more enter the market, they will sow confusion and inefficiencies for companies, workers, and consumers, and bump up against each other in their quest for scale.

PR3 established the Reusable Packaging System Design Standard with the goal of aligning these hundreds of disconnected reuse systems into a shared and interoperable reverse supply chain that offers more efficiencies, convenience, and affordability, and has the ability to truly scale. The standard offers to de-risk and support reuse initiatives globally.

This document represents the *digital* component of the standard. This component is a key foundation for enabling a system where diverse brands and companies can utilize shared container collection points, washing facilities and distribution channels – leading not just to scale, but also to enhanced efficiencies, equity, and environmental performance.

The intended users of this document are companies that manufacture or service reusable containers and/or container collection points. The document specifies data elements that are required for each container and collection point so that reuse service providers, such as collection and washing companies, can access and transfer data that informs reverse supply and redistribution routes. The standard will help ensure that all containers in the system can be properly and safely handled and returned for refilling. In addition, it will enable analyses that optimize logistics and transport routes, inform container design, and ensure social and environmental metrics are achieved.

This document is one of multiple parts that together make up the Reusable Packaging System Design Standard. Other parts include collection points, containers, incentives, labeling, reverse logistics and washing. A list and link to the latest versions of all parts in the standard can be found on the PR3 website, see <https://www.pr3standards.org>

Reusable packaging system design – Specifications and recommendations

Part 3: Digital

1 Scope

This document specifies minimum requirements for the digital components of reusable packaging systems.

It is applicable to reusable assets, including primary packaging containers such as cups, foodware, bottles, jars, etc. that meet [Part 2: Containers](#).

It is also applicable to asset collection points that meet [Part 1: Collection points](#).

Facilities that service reusable assets, such as warehouses, sorting facilities and washing facilities, will also find the instructions in this document useful as they build technology infrastructure to access and read data relevant to the services they provide.

This document is not applicable to secondary or tertiary packaging systems.

This document does not preempt any industry standards or local, regional or national regulations related to food or product safety, quality, packaging, labeling or other topics that are often included in product labeling or linked to digital labels such as barcodes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

RES-00X – Reusable Packaging System Design Standard – [Part 01: Collection points](#)

RES-001 – Reusable Packaging System Design Standard – [Part 02: Containers](#)

RES-00X – Reusable Packaging System Design Standard – [Part 04: Return incentives](#)

RES-003 – Reusable Packaging System Design Standard – [Part 05: Labeling](#)

RES-00X – Reusable Packaging System Design Standard – [Part 06: Reverse logistics](#)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in the [Glossary of Terms](#) and the following apply.

In all clauses, the following verbal forms are used:

- Requirements are indicated by “SHALL” or “SHALL NOT”
- Recommendations are indicated by “SHOULD” or “SHOULD NOT”
- Permission is indicated by “MAY” or “MAY NOT”

3.1

asset

container

piece of primary packaging, such as a bottle, cup, jar, or take-away food container, that is used to safely and hygienically deliver a good from a business to a consumer and is designed to be part of a reusable packaging ecosystem.

3.2

collection point

place of return for reusable assets

3.3

data element

piece of data record that is either required or optional for assets and collection points in the reuse ecosystem and accessible through a digital tag

3.4

data record

piece of data associated with an asset or collection point

3.5

reuse ecosystem

system for reusable containers/assets that provides collection, washing, and redistribution of the containers

4 Data elements

Note: With potentially millions of assets and collection points to account for, agreement on what data should be collected and how is essential for a reuse ecosystem to function. All the various stakeholders in a reuse ecosystem need to exchange data between their own systems, despite inevitable differences in their hardware and software solutions. Standardizing the data elements used by all stakeholders in the ecosystem will make collecting, sharing, and integrating data easier.

4.1 Collection points

Collection points SHALL incorporate a digital tag that embeds the data in Table 1.

Table 1 – Embedded data elements for collection points

<i>Name</i>	<i>Data Type</i>	<i>Description</i>
Collection Point ID	Alphanumeric	Unique identity of the collection point, assigned by the collection point owner/operator.
Company ID	Alphanumeric	Unique identity of the owner/operator of the collection point. Must be assigned by a country or a global body, such as GSI.
Company ID type	Validated options	Type of company ID, e.g. tax ID, GS1, etc.
Consumer URL	URL	This is the URL that a consumer will be directed to when scanning the label, I.e., in the case of a QR code.

Collection points SHALL incorporate a digital tag that has the ability to associate the collection point with the data in Table 2.

Data elements in Table 2 MAY be embedded directly in the digital tag.

Data elements in Table 2 MAY be accessible through an online data platform and not directly embedded in the digital tag.

Table 2 – Associated data elements for collection points

<i>Name</i>	<i>Data Type</i>	<i>Description</i>
Collection Point Location	Alphanumeric	Latitude and longitude of collection point installation
Collection Point Type	Validated Options	Type of collection point, e.g. passive bin, automated machine, staffed collection, etc.
Collection Jurisdiction	Validated Options	The jurisdiction in which the collection point is physically located, such as a country and/or state or province.

The digital tag SHALL be incorporated onto the collection point according to the specification in [Part 1: Collection points](#) and [Part 5: Labeling](#).

Digital tags MAY include additional data elements that are not listed in Table 1 or 2.

4.2 Assets

Assets SHALL incorporate a digital tag that embeds the data elements in Table 3.

Table 3 – Embedded data elements for assets

<i>Name</i>	<i>Data Type</i>	<i>Description</i>
Packaging ID	Alphanumeric	Unique name or ID of the packaging type, assigned by the asset owner. Can be a stock keeping unit (SKU), Global Trade Item Number (GTIN), Universal Product Code (UPC) or European Article Number (EAN), etc.
Company ID	Alphanumeric	Unique identity of the owner/operator of the collection point. Must be assigned by a country or a global body, such as GSI.
Company ID type	Validated options	Type of company ID, e.g. tax ID, GS1, etc.
Consumer URL	URL	This is the URL that a consumer will be directed to when scanning the label, i.e., in the case of a QR code.

Assets SHALL incorporate a digital tag that has the ability to associate the asset with the data in Table 4.

Data elements in Table 4 MAY be embedded in the digital tag.

Date elements in Table 4 MAY be accessible through an online database and not embedded in the digital tag.

Table 4 – Data elements to be accessible through digital tags on assets

<i>Name</i>	<i>Data Type</i>	<i>Description</i>
Cleaning Agent	Controlled List	Approved sanitizing solutions(s)
Cleaning Facility	Validated Options	Approved cleaning facilities for asset. If null, then refer to inventory connect. If null, then refer to Company ID/Location
Cleaning Method	Validated Options	Approved cleaning method for asset, e.g., washing, UV etc.

Cleaning Temperature	Alphanumeric	Approved temperature range for cleaning
Cleaning Time	Alphanumeric	Approved sanitizing solution contact time for asset (minutes)
Discount Value	Numeric	Deposit value.
Reward Code	Alphanumeric	Text or code to be printed for discount or coupon. Null if incentive type is not “discount”
Reward Image	Image	Discount code or image to be printed for discount or coupon, e.g. barcode, QR code, or other.
Incentive Currency	String (ISO 4217)	If null, then refer to primary jurisdiction.
Incentive Jurisdiction	String (ISO 3166-1 Numeric), add additional state or regional strings	Jurisdiction(s) where incentive(s) are valid. If null, then global.
Incentive Type	Validated Options	Type of return incentive program: deposit, reward, fee, none. If null, then none.
Inventory Connect	Validated Options and/or URL	Digital routing ID to connect with asset owner’s inventory management software or database solution. If null, then refer to Company Location.
Return Value	Numeric	Return deposit value. If null, then refer to deposit value.
Secondary Packaging	Controlled List	Name/ID of secondary packaging for asset transport. If null, then no secondary packaging.

The digital tag SHALL be incorporated onto the asset according to the specification in [Part 2: Containers](#) and [Part 5: Labeling](#).

Digital tags MAY include additional data elements that are not listed in Table 3 or 4.

Note: Some optional data elements are provided in Annex A.

Note: PR3 does not require each asset to be assigned a unique identifier. Unique identifiers may be assigned to assets and would be included as optional additional data elements.

4.3 Companies and facilities that operate in the reuse ecosystem

Companies and facilities that operate in the reuse ecosystem SHALL have their identities recorded in the ecosystem using the data elements in Table 5.

Table 5 – Data elements for companies that operate in the reuse ecosystem

<i>Name</i>	<i>Data Type</i>	<i>Description</i>
Company Contact	Alphanumeric	Contact info for Company ID
Company ID	Alphanumeric	Unique identity of the owner/operator of the collection point. Must be assigned by a country or a global body, such as GS1.
Company ID type	Validated options	Type of company ID, e.g. tax ID, GS1, etc.
Company Name	Text	Name of the company
Company Location	Alphanumeric	Address or latitude/longitude of the company
Company Role	Validated Options	Role(s) of the company within the supply chain, e.g. asset owner, collection point owner, asset filler, cleaning facility, distribution company, etc.

5 Digital language for data transfer

Note: The data elements identified above need to be incorporated into a common language so that stakeholders throughout the reuse ecosystem can access, edit and transfer data associated with each asset and collection point. The data could be accessible via various labeling and scanning technologies, including one-dimensional barcodes, two-dimensional QR codes, and RFIDs. Redundancies may initially be needed to ensure certain functions, for example barcodes and QR *both* applied to each asset, at least in the near term until 2D scanning becomes more ubiquitous in retail and other locations.

Reuse ecosystems SHOULD utilize QR codes or other two-dimensional tagging and scanning technology, instead of one-dimensional technology, whenever possible.

Note: Global supply chains in general are transitioning from one-dimensional barcodes to two-dimensional QR codes and PR3 is working to align the data elements listed above with systems for product coding in forward supply routes.

Reuse ecosystems MAY adopt GS1 standards, especially where use of the Global Trade Item Number (GTIN) already exists, and as needed elsewhere.

Specifically, collection point data elements MAY be accommodated through use of the GS1 Global Location Number (GLN), which can provide a unique ID for each collection point that also includes the company ID and other data elements.

Specifically, asset data elements MAY be accommodated using a GS1 2D and Digital Link approach, which can embed the elements in Table 3 and point users to elements in Table 4.

Note: PR3 is developing more guidance on how practitioners can implement GS1 standards to meet the above data requirements and will publish that guidance in future versions.

5.3 Data Administration

An agency SHOULD be established to administer a central database of participants and contact info and to monitor for data compliance.

Note: Initially, local administrators, like Reuse Seattle, will coordinate data access. Ultimately, it may be necessary for national and international administrator(s) to align data platforms between cities and regions and administer data access and between companies and where containers move between jurisdictions.

Note: PR3 is developing a guidance document for system governance and administration.

Annex A

(Informative)

Optional data elements for assets

This section includes a table of data elements that are not required for participation in the reuse ecosystem, but companies may decide to include them anyway. They may enhance environmental accounting or user experience, or they may enable additional data analysis and system optimization. Certain of these data elements may be relevant to health and safety regulations and there is an ongoing effort to engage with stakeholders including GS1, US Food and Drug Administration, Smartlabel and others to potentially merge these data elements into one label or tag.

These elements are taken primarily from Reath's [reuse.id standard](#), but whereas Reath.id may require some of them, they are all optional in PR3 reuse ecosystems.

Table 5 - Optional data elements for assets

<i>Element Name</i>	<i>Data Type</i>	<i>Description</i>	<i>Included in reuse.id?</i>
Activity Feed	Controlled List	Feed of activity/process steps logged against the asset (when Passport ID is available)	Yes
Activity Feed Sort Order	Text	The corresponding sequence to the values in the activity feed-controlled list (when Passport ID is available)	Yes
Activity Feed Timestamp	DateTime	Timestamp of each activity log entry (when Passport ID is available)	Yes
Additional Reference Code	Text	Any additional referencing that asset holds, e.g., batch code, expiration date, keg etc.	Yes
Allergens	Validated Options	Any known allergens contained or in contact with the asset	Yes
Asset Lost	Boolean	Alert asset owner that it has been too long since last scan (when Passport ID is available)	No
Auxiliary Material	Validated Options	The main material of an additional component, such as a bottle cap	Yes

Certification	Controlled List	Any relevant certification or manufacturing standard adhered to by the asset	Yes
Completed Cycles	Free Text	Calculated number of reuse cycles the asset has completed (when Passport ID is available)	Yes
Country Code	String (ISO 3166-1 Numeric)	Registered company country code	Yes
Country of Origin	String (ISO 3166-1 Numeric)	Where the asset was manufactured	Yes
Decommission Reason	Validated Options	If the asset has been decommissioned, the reason why (when Passport ID is available)	Yes
Dimensions	Text	The dimensions of the asset (in centimeters)	Yes
Industry	Validated Options	What industry is the asset servicing?	Yes
Lifecycle Status	Validated Options	Whether the asset is currently live or has it been decommissioned(when Passport ID is available)	Yes
Location Feed	Controlled List	Locations the asset has been logged at, corresponding to each entry in the activity feed (when Passport ID is available)	Yes
Location Feed Timestamp	Generated	Timestamp of each location log entry (when Passport ID is available)	Yes
Manufacturer	Text	Name of asset supplier	Yes
Packaging Type	String (ISO 21067-1:2016)	The type of packaging per ISO standard definitions	Yes
Passport/Unique ID	Generated	Unique numeric identifier of the asset	Yes
Postcode	Text	Registered company postcode	Yes

Primary Material	Validated Options	Primary material of the asset, e.g., glass, aluminum, PET, PP, etc.	Yes
Primary Material Percentage	Text	Percentage of asset that is the primary materials (by weight)	Yes
Product Category	String (GS1 GPC – Class)	Category of the overall product	Yes
Recycled Materials Country of Origin	String (ISO 3166-1 Numeric)	Where the recycled material is sourced (for environmental reporting)	Yes
Recycled Content	Numeric	Percent of primary material that is post-consumer recycled content	Yes
Reuse Model	Validated Options	Type of reuse model. i.e. Refill at home, refill on the go, return from home, return on the go	Yes
Tracker type	Validated Options	The type of tracking attached to the asset, e.g. QR, RFID, etc.	Yes
Unit cost	Numeric	Cost per unit of the asset	Yes
Volume	Numeric	The volume of the asset (in milliliters)	Yes
Weight	Numeric	Weight of the empty asset (in grams)	Yes

Annex B

(informative)

Reuse in inventory management and point-of-sale systems

Ideally, the data and technologies that help move reusable assets through the reverse supply chain should easily align with systems that currently move products through the forward supply chain and manage inventory for retailers and food service providers.

Supply chain professionals can choose from a broad range of software options for product distribution, inventory management, and sales. It is so far unclear whether/how these software options will expand to accommodate the reverse supply chain.

PR3 is working with stakeholders to develop guidelines for aligning data on forward and reverse supply chains and will revise this standard as more information becomes available.

As a start, one data element, “Inventory Connect”, is provided as a potential linkage to forward supply chain and inventory management systems. The data element has not yet been firmly envisioned, but is meant to hold the space for a future element that would redirect the system through a URL to an inventory management interface. The data element is meant to offer an opportunity for the reuse system to identify the most appropriate locations for asset distribution, E.g., which locations are in most need of cups or food containers.

One flexible solution for enabling access to different databases in a shared logistics infrastructure is Open Database Connectivity (ODBC), a standard application programming interface (API) for accessing database management systems. The ODBC standard is widely available and allows for interoperability.

Custom third-party software using ODBC (or another suitable solution) may need to be written to handle communication between a central data administrator and the various supply chain software systems employed by reuse partners. Reuse partners need not share data among each other. Rather, partners need to prepare the data output from their inventory and/or point-of-sale systems in such a way that it can be transmitted, stored, and updated as needed in a central database. Operation decisions (e.g. when and @where to transport assets) can be made based on the data in this central database.[5]

Annex C (Informative)

Security

A Cloud Service Provider (CSP, such as Amazon, Microsoft, Google, Alibaba, or IBM) will provide a built-in security solution to ensure reusable data is encrypted both *in transit*, that is, while it is actively moving from network to network or from local storage to network storage, and *at rest*, in the database. It should be noted that security protocols should be solved at the level of the CSP, not built into the hardware (i.e. a scanner).

The goal of shared logistics infrastructure extends to data management. To minimize risk, practitioners in the reuse ecosystem should adopt the National Institute of Standards and Technology's privacy framework. The NIST Privacy Framework is a flexible, cost-effective set of guidelines and practices to unify cybersecurity efforts.

The question of who owns the data associated with the reuse ecosystem is important, but it is not a technology decision. Data ownership should be guided by business and sales goals. Companies involved in the reuse ecosystem will likely want to maintain some data as private or shared, for example, gross assets sold or checked out. This data could be shared generically, without identifying the specific asset owner or service provider.

Blockchain technology could be a future option for data transactions and storage across all or part of the reuse ecosystem. It is attractive due to its ability to provide transparency, security, and stability. Ethereum was explored as a turnkey solution for interfacing with the blockchain ecosystem, however, as of this writing in early July 2021, implementation is cost-prohibitive. On the other hand, more affordable or eco-friendly blockchain options would require significant software development time. For a pilot expected to launch in early 2022, use of blockchain for data storage or management is not a viable option.

Annex D (Informative)

Protocols to Inform Logistics

D.1 Principle

Participants in the reuse ecosystem must have a common understanding of how they want to carry out the process of collecting, sorting, and redistributing reusable packaging. To accomplish this process, PR3 employs use cases to define *who* is needed and *what* they will do. Use cases define requirements, but do not specify implementation.

D.2 Participants

Table 6 lists participants in the reuse ecosystem that are relevant to the use cases.

Table 6 – Participants in the Reuse Ecosystem

<i>Participant Type</i>	<i>Description</i>
Consumer	Individual user (Business-to-Consumer, B2C)
Consumer goods company	Business that fills assets at a manufacturing site, e.g., Nestle, Danone, Pepsico.
Retailer	Business that sells filled assets as consumer goods, e.g., supermarkets, convenience stores.
Food service company	Business that fills assets at point of sale, e.g. cafes, restaurants, convenience stores.
Logistics company	Business involved in moving assets through the reuse supply route, including collecting, sorting, aggregating and/or transporting assets. E.g. the company that collects assets from collection points; the company that sorts and aggregates assets at a recovery facility; the company that redistributes assets to cleaning or filling sites.
Manufacturer	Business that manufactures and sells new assets, e.g., Amcor, Berry, etc.
Washing company	Business that cleans assets according to the approved method
Asset owner	The owner of the asset, e.g. this could be an FMCG company, an industry group that owns/services an asset pool, or a reuse service provider like Vessel or Loop.

D.3 Use cases

Figure 2 illustrates the use cycle of an asset and 15 Use Cases that can occur within the cycle. The Use Cases are each described in Table 06. For each Use Case, the primary participant(s) is identified, and the action is described. Any data element that are required to perform the action are also listed.

Figure 2 – Asset Use Cycle and Use Cases

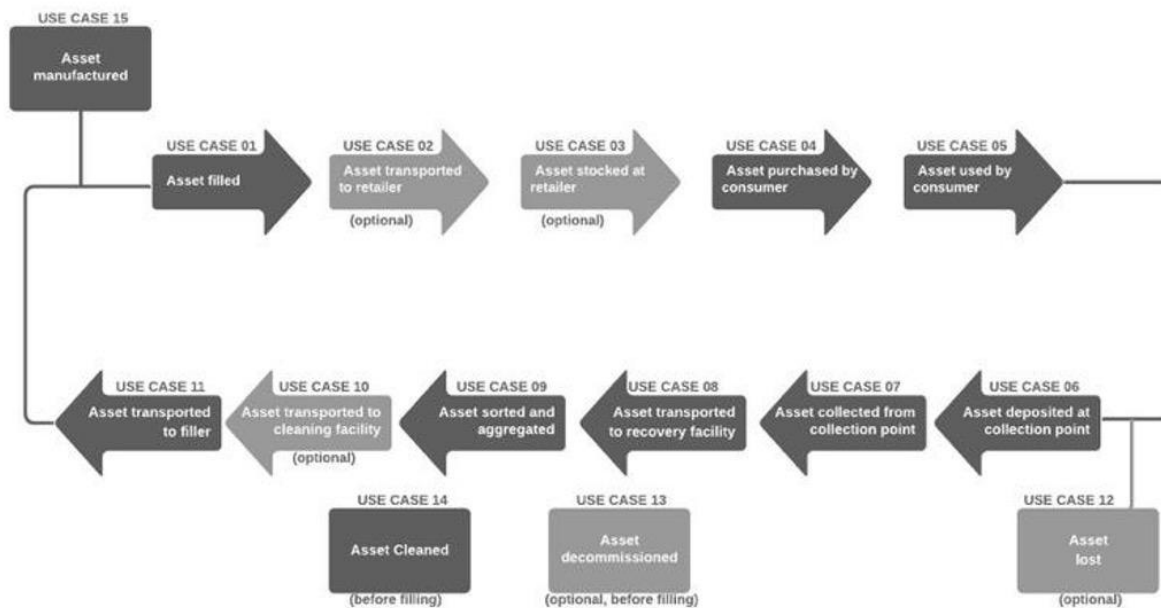


Table 6 – Use case descriptions

<i>Use Case</i>	<i>Primary Participant(s)</i>	<i>Mandatory Data Element(s)</i>	<i>Action(s)</i>
01	Consumer goods company Manufacturer	ALL Table 2 OPTIONAL Table 4	Either the consumer goods company, the manufacturer or the asset owner creates a label for the asset that includes all elements in Table 2 and optional elements in Table 4
02	Consumer goods company Food service company Asset owner	Inventory Connect	Company may use inventory connect to determine forward distribution to retail and food service locations

03	Retailer	NA	
04	Retailer Food service company Consumer	NA	Optional data elements might be triggered, for example to assign an asset's unique ID to a consumer
05	Consumer	Consumer URL	Consumer may scan asset label to be directed to a website with product and/or packaging information
06	Consumer	Collection Point ID Company Name(s) Company Role Incentive Rate Incentive Type Packaging Name	Consumer scans asset label to operate the collection point and receive incentive. Collection point can track number/name of assets collected.
07	Logistics company	Collection Point ID Collection Point Location Company Name(s) Company Role Packaging Name	Logistics company can log the number/name/location where assets are collected in order to enable environmental and labor accounting.
08	Logistics company	NA	
09	Logistics company	Company Name Company Role Packaging Name Secondary Packaging	Logistics company uses the company and packaging names to properly sort assets and insert into secondary packaging if applicable
10	Logistics company	Company Name(s) Company Location Company Role Inventory Connect	Logistics company uses the cleaning facility name and location (if null, then Inventory Connect or Company Location) to transport to cleaning facility
11	Logistics company	Inventory Connect Company Location Company Role	Logistics or washing company uses Inventory Connect or Company Location to transport to filling location

12	Asset owner	Company Name Company Role Packaging Name	Asset owner uses count of assets to determine how many were lost on an annual basis
13	Logistics company Washing company Consumer goods company Retailer Food service company	Packaging Name Company Contact Company Name Company Role	Companies report information on decommissioned assets to the asset owner
14	Washing company	Cleaning Agent Cleaning Method Cleaning Temperature Cleaning Time	Washing company or consumer goods company uses data from these elements to determine cleaning cycle for assets
15	Manufacturer	ALL Table 2 OPTIONAL Table 4	In certain circumstances, the asset manufacturer may be required to create a label for the asset that includes all elements in Table 2 and optional elements in Table 4

Bibliography