

**Material and packaging  
specifications for beverage  
containers in the Infinitum deposit  
return system.**

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## Material and packaging specification

This document gives the specifications which all beverage containers in the Infinitem deposit return system must adhere to. The document serves as a guide for those who is applying for approval of containers, and is also appendix 2 to Infinitem's RVM Specifications describing what kind of containers the RVMs must be able to handle.

The specifications regulate materials used, thickness, physical shape and dimensions for beverage (and potentially other) containers. Other properties may also influence acceptance in the Infinitem system.

The purpose of the specifications is to ensure that all approved containers can be handled by the RVMs and Infinitem's depot IRVMs, that correct deposit can be paid, and that recycling of the container material is feasible. Containers in the Infinitem system must be designed to facilitate recycling of the container material. Refillable containers are not used in the Infinitem system.

The specifications must be adhered to by producers, fillers and importers when introducing new or changed containers or changing the content of them; and by RVM suppliers to ensure that RVMs are capable of handling the containers. The specifications are also used to assess existing containers in cases where problems have emerged.

Generally, aluminium cans and PET (polyethylene terephthalate) plastic bottles are the preferred materials in the Infinitem system. Some other materials are also accepted, sometimes in limited numbers; refer to details laid out in this document.

New materials and types of packaging may be introduced, refer to section i).

Producers, fillers and importers must always apply to Infinitem for approval of containers before a container can be accepted into the Infinitem system. Refer to section g) for details.

### **a) Metal containers - material specifications**

Pure aluminium cans, pure steel cans, as well as cans combining the two materials are allowed. Combined cans have to consist of steel body and aluminium lid / top (those cans will be defined as steel cans in the Infinitem System).

Cans which are thick plated and welded are not allowed. Cans shall be deep drawn. This is to ensure that the compactor in the RVM is able to handle the object; thick or rigid objects are generally difficult for the compactor. Metal containers may have alternative shapes, e.g. bottle shape. Compatibility with RVM compactors will be checked during the approval procedure.

Cans with a "widget" inside, a small plastic gas cartridge containing N<sub>2</sub> (or CO<sub>2</sub> or mixed gas), are generally allowed. However, such cans must be presented by the

producer/importer to Infinitum for special approval, as new unknown types may cause problems.

Cans will generally have print directly on the metal, but label or sleeve of paper or plastic is normally accepted. Label or sleeve material has to be specified in the approval procedure.

#### **b) Plastic bottles - material specifications**

Clear PET bottles; and coloured PET bottles except white, black, silver or shiny-pearly variations; are allowed. Bottles made of HDPE are accepted if the volume proportion of such material in the Infinitum system relative to PET material is acceptable; this is evaluated during the approval procedure. Limitations and/or penalties in the form of higher EPR cost (Extended Producer Responsibility cost, previously termed Administration fee) may occur for other than clear PET bottles. This is due to higher sorting costs in the return logistics and lower material value/poorer recyclability.

In general, all common PET bottle thicknesses are allowed including hot-fill bottles. As a general guide to determine accepted thickness the following calculation is used:

- For bottles with content up to 0.5 litres a maximum bottle weigh (without closure cap) of 0.8 grams per cl. bottle content.
- For bottles with content more than 0.5 litres a maximum weigh of 0.5 grams per cl. bottle content.

However, if part of the bottle is particularly thick or rigid, it may be rejected even when within the calculation guide above. This will depend on the specific approval test results for a given object, limited by the capacity of the RVM compacting device, and will be judged when bottles are tested by Infinitum and RVM suppliers for approval. Similarly, bottles with higher weight per cl. content than in the calculation guide may be approved if the RVM compacting device is able to handle them.

Accepting thicker bottles such as hot-fill is a requirement that was introduced in January 2017; as outlined in the main RVM Specifications document.

PET bottles should not be very thin. Very thin bottles deteriorate the recycling process. This will be assessed during the approval process as described in section g).

Our EPR cost may differentiate between clear, light blue and coloured bottles.

Even small deviations from clear PET can result in a bottle being classified as light blue or coloured; refer to the limitation details outlined on page 4. Consult Infinitum for advice in this matter.

Bottle material with metallic colours (containing metallic pigments) is not allowed.

PET and other plastics material requirements

Please refer to the following table showing allowed and not allowed materials:

<b>Object</b>	<b>Clear PET</b>	<b>Coloured PET</b>	<b>HDPE</b>	<b>Not allowed</b>
<i>Bottle material</i>	PET	PET	HDPE, LDPE, PE	PLA, PVC, PS, PETG, PEN, PEF
<i>Colour</i>	Transparent, light blue transparent.	All colours, less those not allowed.	All colours.	White, black, silver and shiny-pearly colours. Metallic colours or metallic additives. In PET TiO <sub>2</sub> or Carbon Black.
<i>Barriers</i>	Not allowed (exceptions exists).	Allowed to some extent, must be applied for.	Not allowed (exceptions exists).	EVOH, PVDC, PEN
<i>Label and sleeve material</i>	Most materials with density < 1 g/cm <sup>3</sup> (e.g., OPP, EPS, PE, PP, light/foam PET).			Density >= 1 g/cm <sup>3</sup> (e.g. PVC, PS, PET, PETG, OPS, PLA). Metallic materials. Non-laminated paper.
<i>Ink (label print)</i>	According to EulPA guideline.			Water soluble inks, inks on EulPA <sup>1</sup> exclusion list, inks with heavy metal content.
<i>Glue</i>	Water/alkaline soluble at 65°C			Re-activating glues.
<i>Closure cap/valve</i>	PE, PP, metal crown.	PE, PP, PET, metal crown.	PE, PP, PET, metal crown.	Metal screw-on caps.
<i>Liner</i>	PE, EVA, TPE			PVC, silicon, metal.

Note: all containers in the Infinitum system must be applied for. Refer to section g).

If you are uncertain about your container meeting the requirements, please contact Infinitum for advice.

**Detailed requirements for plastic bottles**

**Transparent vs. light blue colour in clear PET**

To be accepted in the clear PET bottle category, a light blue bottle will have to adhere to the following limits in a spectrometric L-test.

Colour corridors for reflection measurement (light blue must be inside these limits):

- L = max. 92.0 to min. 72.0
- a = max. -1.5 to min. -2.5
- b = max. - 1.5 to min. -2.5

Values are based on the Konica Minolta CM-5 photo-spectrometer testing procedure.

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<sup>1</sup> Exclusion list + lower limits for certain metals. Also refer to [http://www.eupia.org/uploads/tx\\_edm/2016-11-17\\_Exclusion\\_Policy\\_for\\_Printing\\_Inks\\_and\\_Related\\_Products\\_3rd\\_ed\\_corrige\\_Dec2018.pdf](http://www.eupia.org/uploads/tx_edm/2016-11-17_Exclusion_Policy_for_Printing_Inks_and_Related_Products_3rd_ed_corrige_Dec2018.pdf)

## Degree of greyness in clear PET

To be accepted in the clear PET bottle category, a bottle will have to adhere to certain maximum grey shades and darkness in the material.

Degree of greyness is measured as Haze and colour darkness as reflection, using the Konica Minolta CM-5 photo-spectrometer testing procedure on a 0,5 mm layer. The bottle will have to adhere to these values to be acceptable as clear PET:

Haze (ASTM-D1003):	max. 4.00
Colour L:	min. 93.0
Colour a:	min. – 0.7
Colour b:	max. 2.0

## Amount of recycled material in clear PET

A high proportion of recycled clear PET used in the production of new bottles reduces the environmental impact (such as energy consumption and CO<sub>2</sub> emissions) and is in this respect beneficial, but does on the other hand increase the risk of greyness in the material as specified above. With a very high proportion of recycled material and high recycling rates, recycled PET will be re-used many times and thus increase the risk of greyness.

Furthermore, when regarding the Infinitum system as a bottle-to-bottle loop, there is a limit to the amount of recycled material available for production of new bottles. This limit depends on the deposit rate for material recovery in the DRS, and yield in the recycling process. Currently, this implies that in the Norwegian market on average around 85% of the clear PET volume put to market will be available as recycled raw material for new clear PET bottles. Higher recycled content is not sustainable in a bottle-to-bottle loop, and is as such not according to circular economy principles.

Hence, both the risk of greyness and the need for a sustainable system limit the use of recycled material that can be used in new bottles.

Currently, the regulation of degree of greyness is sufficient to manage this balance. Infinitum will however follow the situation closely and may consider more explicit regulations of recycled content. The purpose is to have a system which allows maximum recycled content used in new clear PET bottles, while at the same time maintaining high material quality and ensuring a sustainable system.

## Barriers

Barriers in clear PET and HDPE are generally not allowed. However, certain barriers and UV-blockers have been tested and may be accepted. Contact Infinitum for information about such barriers.

For coloured PET the tolerance for barriers are higher. Contact Infinitem for information about such barriers.

### **Label requirements**

The density of the label/sleeve must be such that it is floating in water (density must be  $< 1 \text{ g/cm}^3$ ).

Paper labels are in general not permitted. However laminated paper label (without fibre loss) may be allowed if the relative proportion of such labels in the Infinitem system is sufficiently low. This is evaluated during the approval procedure.

Bottle-to-bottle recycling documentation is needed when applying for other materials than listed in the table on page 4.

### **Label vs. sleeve**

If surface of label/sleeve covers less than 75 % of bottle surface area, it is regarded as a “small” label/sleeve. If equal or more than 75 % it is regarded as “large”.

In terms of material approval, there is no difference between large or small label/sleeve. But different EPR cost may apply as “large” is sorted as coloured.

### **Ink (label and sleeve print)**

Water soluble inks (“bleeding ink”), inks containing heavy metals, or bleed labels are not accepted. Ink must not increase density of label/sleeve to  $> 1 \text{ g/cm}^3$ .

Direct print on bottle is not accepted (“tattooed” bottles).

Inks have to be within the EuIPA guidelines, except for heavy metal content which is forbidden regardless of the EuIPA guidelines.

### **Glue and adhesive for labels**

Glue or adhesives are not used on sleeves. Sleeves wrap around and enclose the bottle, eliminating the need for glue/adhesive.

The bottle must complete its cycle from production until received in the RVM without losing its label; therefore the glue must be strong.

Glue or adhesive must be completely soluble (miscible) in water, or water with 1 % NaOH alkaline solution, at 65° C. Glue is allowed to not dissolve but may remain on

the label, provided the label wash of the bottle in the water or alkaline solution; and provided glue does not re-activate, re-tack or agglomerate.

Generally, glues that re-activate, re-tack or agglomerate are not allowed. Infitum has defined a test procedure to determine if glue can be approved. Consult Infitum.

### **Closure cap, closure valve and liner**

Refer to table on page 4. Liners made of silicon is generally not accepted, but may be approved if silicon has low density (floating in water) and is coloured; and volume (number of units put to market) is low. Any silicon content must be specified in application procedure.

Other material that is documented recyclable may be approved by Infitum.

Peel of aluminium film and seal may be accepted if documented that it separates from the bottle when it is opened (as a metal crown cap will do).

### **c) Type of content**

Certain types of content may harm the recycling process, even if only small residual amounts are left in the container when being returned. Infitum therefore needs to assess and approve / disapprove a container depending on the content it will be used for.

Generally, these content types are not allowed:

1. Chemical substances not intended for human consumption. Organic, high-viscosity cleaning liquids may be exempt.
2. Liquids with a high content of fats or oils. E.g. some milk products, most cooking oils.

Documentation on the type of content used may be required by Infitum as part of the approval process, including volume (number of annual container units) forecasts.

### **d) Physical dimensions and shape**

The general limitation for shape and dimensions of the containers will be defined by the Reverse Vending Machines and Infitum's depot machines (Industrial RVMs). Minimum and maximum sizes (diameter and length) are given in the following table.

Infitum will test the feasibility of all new beverage containers as described in section g). Hence, there may be exemptions to the following dimensions guide:

## Container dimensions

### *Cans and plastic bottles:*

- |                                    |   |                 |
|------------------------------------|---|-----------------|
| - Diameter:                        | minimum: 45 mm,   | maximum: 130 mm |
| - Height:                          | minimum: 100 mm   | maximum: 370 mm |
| - Diameter must not exceed height. |   |                 |
| - Volume:                          | 125 - 4900 ml (provided dimension requirements are fulfilled) |                 |

Dimensions of non-round objects are measured at their maximum, i.e. using the dimensions for a virtual cylinder that most closely fits outside the non-cylinder object when it is lying on its side. Height is measured without closure cap.

## Required shape

### General

The general limitation for shape, measures and dimensions of the containers is defined by the reverse vending machines (RVMs). Each bottle, with an undamaged and correctly designed barcode (see section for bar code design below) must generally be readable in all currently installed RVMs (including industrial RVMs).

However, Infinitum may exempt certain containers with properties that can pose problems for some RVMs, in cooperation with the RVM suppliers. This will be done if only a limited number of old RVMs are unable to handle the container in question.

### Ability to roll not a requirement

Beverage containers need not be round and need not be able to roll. Infinitum's RVM Specifications now states that the RVM must be able to read barcode and recognise container type without depending on the object being round. This is a requirement that was introduced in January 2018; as outlined in the main RVM Specifications document. Machines already in the market will be allowed until replaced by new models, hence the exemption mentioned above.

Note: the specifications do not require that objects may be placed in any orientation when being fed to the RVM; hence it is acceptable that the RVM requires objects being placed in a certain manner by the user (e.g. with barcode facing up). However, Infinitum recommends that RVMs allows maximum flexibility for how objects should be placed by the user.

## **e) Deposit symbol and bar-code position and specifications**

The deposit symbol and bar-code size and position must follow the guidelines found on [www.infinitum.no](http://www.infinitum.no).

The bar-code can be either EAN-code (EAN-13 or EAN-8) or UPC-code. All codes must also be registered in GS1 and approved by them (the international body allocating and maintaining the codes), refer to [www.gs1.no](http://www.gs1.no).

Generally, the barcode size should adhere to this minimum format:

Factor	EAN-13	EAN-8	UPC-A	UPC-E
	Width x height in mm			
0.8	29,8 x 20,7	21,4 x 17,0	29,8 x 20,7	21,4 x 17,0
1.0	37,3 x 25,9	26,7 x 21,3	37,3 x 25,9	26,7 x 21,3

Infinitem recommends using factor 1.0. Factor 0.8 is a minimum.

Width and height is measured inclusive of bars and numbers in the graphical barcode design, but exclusive any area outside such graphics. An empty “noise-free” zone of 3 mm, i.e. a decoration- and text-free area, must be found at each end of the barcode (i.e. to the left and right of the barcode bars’ reading direction). This area is not counted in the width and height measurements above. Without a “noise-free” zone recognition in the RVM may fail.

Barcode should be placed on an even part of the container, with as few shape-irregularities as possible.

For technical requirements of print, contrast, colour and size, please refer to GS1. The bar code must follow the requirements set for automated reading systems. Bar Codes must also comply with ISO/IEC 15416 “Bar code print quality test specification for linear symbols” for quality measures, contrast and readability.

In cases where the same bar-code is used in different markets (“international/standard codes”) there will be a risk that containers sold outside Norway without Norwegian deposit, will be taken to Norway and deposit claimed. In such cases Infinitem will assess the risk involved. A separate agreement will have to be made, and compensation may have to be paid by the producer / importer.

The container may have at most two bar-codes registered to GS1, but only one of them should be present in Infinitem’s data record used for identification by the RVM. Each individual barcode must still fulfil the general barcode requirements.

The label or sleeve with the bar-code and deposit-mark must follow the container until returned through the RVM. Tear off sections, e.g. for marketing reasons, is only accepted if a section with bar-code and deposit-mark remains on the container.

**f) Tilt angle**

The readability of the barcode in the RVM will generally deteriorate if the barcode is non-parallel with the RVM orientation. Therefore, when a bottle rests on its surface, the bar code on the bottle must be presented with a tilt angle relative to this surface

plane of maximum 30 degrees (360° system). This improved angle acceptance is a requirement that was introduced in January 2018; as outlined in the main RVM Specifications document.

When an object is allowed to tilt, it will rise higher from its resting surface than its diameter. Therefore, a tilt angle higher than a few degrees may influence the maximum dimensions allowed (refer to section d) above). Similarly, the length-height ratio limit of 1:1 set in the table in section d) (“diameter must not exceed height”) may for some objects have to be considerably higher in order to keep the object within the tilt limit.

The tilt angle measurement and the corresponding maximum dimensions will depend on individual testing by the RVM suppliers, and must be approved by Infinitum.

#### **g) Application procedure for containers**

Producers, fillers and importers must apply to Infinitum for approval of containers before a container can be accepted into the Infinitum system. The application must be registered at least 6 - 8 weeks (depending on type of container) before the product enters the market, and must be accompanied with the documentation required (refer to section h)). Applicants must be a member of the Infinitum deposit system, and must use the online registration made available at [www.infinitum.no](http://www.infinitum.no) for the application procedure.

For containers that differ substantially from previous containers by e.g. shape, thickness or material; suppliers are strongly recommended to involve Infinitum as early as possible in the product development process. Contact Infinitum for details regarding sample presentation. If the application reveals that material, glue or other properties needs special investigation, the application procedure will require more time.

Infinitum involves RVM suppliers in the approval procedure, to ensure that products / containers being applied for will be handled satisfactorily by the RVMs.

#### **h) Documentation**

The applicant shall present documentation for the material used (bottle, cap, label, glue etc.). Applicants can request such documentation from the packaging manufacturer. Data-sheets with specifications are required by the recycling industry, to ensure safe and efficient recycling. The applicant shall also present documentation on the dimensions, and if requested by Infinitum documentation of the type of content that will be filled in the container.

**i) Introduction of new beverage container properties and new material types**

Other types of beverage containers than those currently listed in this document may be introduced as follows:

1. By application. A producer or importer may apply for approval of a container with deviating material- or physical properties. In finitum may approve such containers with limitations; e.g. a limit on the number of containers allowed in the market.
2. By generally approving a new container type, introduced by In finitum. Examples are containers of a new material (e.g. glass bottles) or dimension (e.g. smaller size). In such cases, In finitum will work with the producers/importers and the RVM suppliers to ensure compatibility, and if needed plan an introduction timeline. Generally approved new containers will be available for all producers, and will have no limitations on numbers accepted in the market.

**j) List of abbreviations**

DRS	Deposit return system
EPS	Expanded polystyrene
EuPIA	The European Printing Ink Association
EVA	Ethylene-vinyl acetate
EVOH	Ethylene vinyl alcohol
HDPE	High-density polyethylene
IRVM	Industrial reverse vending machine (depot RVMs)
NIR	Near Infrared
OPP	Oriented Polypropylene
OPS	Oriented polystyrene
PA	Polyamide, nylon
PE	Polyethylene/polyethene
PEF	Polyethylene furanoate
PEN	Polyethylene naphthalate
PET	Polyethylene terephthalate
PETG	Polyethylene terephthalate glycol-modified
PLA	Polylactic acid
PO	Polyolefin
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
PVDC	Polyvinylidene chloride
RVM	Reverse vending machine (used to return containers and claim deposit)
TPE	Thermoplastic elastomers