

Recycle Check Rigid Plastic Packaging 2027

Background document



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Background document: Recycle Check – Rigid Plastic Packaging 2027

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The Recycle Checks are updated annually.

Check the [website](#) for the latest version.

Do you have any questions about a Recycle Check?

Please [contact](#) Verpact.

Verpact would like to thank trade associations, materials and packaging manufacturers, manufacturers and importers of packaged products, as well as sorters and recyclers, for their contributions to the development of the Recycle Checks.

Verpact has taken the utmost care in compiling this document. Should the document nevertheless contain an error or omission, we would be grateful if you could bring it to our attention.

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Part 1

Basic information

1.1 Introduction

Recycle Checks help companies assess the recyclability of packaging. This report examines the current situation in the Netherlands with regard to collection, sorting and recycling, and the extent to which recovered materials can be reused.

Recycle Checks have been published for packaging made of flexible and rigid plastics, glass, beverage cartons, metal and paper and cardboard up to the 2026 edition. They have been published since 2018. From the 2027 edition onwards, there will only be Recycle Checks for flexible and rigid plastic packaging, which – where necessary – will be updated annually*, in line with current developments in the packaging supply chain. The remaining Recycle Checks will no longer be published from the 2027 edition onwards and are therefore no longer up to date.

If packaging is assessed as 'optimally recyclable' in the Recycle Check for both rigid and flexible plastic packaging, companies can apply for fee modulation. Fee Modulation provides a discount on the waste management levy you pay to Verpact. The discount applies to recyclability, as well as to the use of recycled materials and bio-based drop-ins.

Are you obliged to pay a waste management levy to Verpact? Please check whether your packaging meets the [conditions for fee modulation](#).

The Recycle Checks apply to packaging that ends up in household waste or in similar waste streams, such as waste from the hospitality sector, offices, shops and service providers. Recycle Checks can also be applied to packaging collected via a deposit-return scheme. Commercial waste that is not comparable to household waste is usually collected by waste management companies under separate arrangements. Different quality requirements and design rules often apply in such cases.

The user is asked a short series of questions about the material and about packaging components that affect collection, sorting and recycling. Additional information is provided in the background document for each question.

At the end, the answer becomes clear: the packaging is optimally recyclable, reasonably recyclable, limited recyclable or non-recyclable. This format reflects how well a package fares throughout the recycling process and the extent to which the material can be reused.

It is important to note that the Recycle Check does not guarantee that packaging will actually be recycled, nor is it a comprehensive sustainability assessment. It is a practical tool for assessing recyclability.

Recyclability is one of the factors that determines the sustainability of packaging. Other steps in the so-called [R-ladder](#) can also help to reduce environmental pressure. Generally speaking, when it comes to packaging products, it is a matter of striking a balance between protecting the packaged product, the quantity and complexity of the packaging materials, and the effort required to recycle the material (and, where necessary, to separate the materials). This can actually increase the environmental impact. To acquire better insight into this, the [Sustainable Packaging Compass](#) can be used.

Packaging can also have implications further down the supply chain, such as the formation of microplastics and the presence of unintentionally added substances (NIAS), particularly in food-contact materials. Scientific research is currently being carried out into this.** Where possible, these new insights have been incorporated into this version of the Recycle Check. In the (near) future, we expect more research to be published, which will be included in future updates of the Recycle Check.

* Pending European legislation.

** European Commission: Directorate-General for Health and Food Safety, ICF, Etienne, J., Bradbury, I., Jaskiewicz, K. et al., Study on sustainability in the context of food contact materials (FCM) with a view to a possible revision of the FCM legislation – Final report, Publications Office of the European Union, 2025, <https://data.europa.eu/doi/10.2875/3789818>

1.1.1 The Recycle Check

The Recycle Check consists of two parts:

1

The Recycle Check online checklist for assessing the recyclability of packaging (good, reasonable, limited, non-recyclable).

The content of the Recycle Check was updated in September 2026.

Good recyclability	Reasonable	Limited	Non- recyclable
			

2

The background document, consisting of two parts:

Part 1: containing basic information on how to use the Recycle Check, definitions and key terms, and information about identifying disposable units. This section is the same for all documents.

Part 2: containing material-specific information on collection, sorting and recycling processes. This also contains instructions on how to test certain properties of packaging.

Each background document can also be used as a reference guide, providing guidelines on how to improve the recyclability of packaging. These documents are available for the following materials:

- Flexible plastic
- Rigid plastic

Part 2 can be found from [page 18](#).

1.1.2 Legislation

What legislation must you comply with regarding the recyclability of your packaging? And what else can you expect in the near future? Read more [here](#).

1.1.3 Food safety

Packaging may contain various chemical substances. When such packaging comes into contact with food, substances from the packaging may migrate into the food. This may pose risks to people's health. Some substances are banned (such as virtually all PFASs, for example), whilst others may be used subject to certain conditions (such as BPA, for example). Verpact offers a range of tools to help manufacturers and importers of packaging and packaged products assess their packaging materials in this regard. Please see the [food safety dossier](#).

1.1.4 Complex product-packaging combinations for recycling

There are two reasons why certain types of packaging make recycling more complicated:

- The packaging material causes problems in the process
- The product in the packaging causes problems in the process

Some of these product-packaging combinations must not be collected with household packaging waste because they can seriously disrupt the process.

There are also product-packaging combinations that are permitted in household waste and, where applicable, also in PMD, but which nevertheless pose risks during recycling.

These types of packaging are permitted because it is difficult for consumers to work out the correct disposal method. In practice, this means that such packaging ends up in the recycling streams anyway.

Materials that are NOT permitted in household packaging waste:

- **EPS (expanded polystyrene)** is difficult to process during sorting and recycling because the tiny static plastic beads cause a great deal of disruption. Small EPS packaging, such as cups and trays, should be put in the general waste. Large EPS crates and cushioning material must be taken to the local council's recycling

centre. In this case, the material can be further processed by a recycling company.

- There is no separate collection scheme for **wooden packaging**, such as a wine case. Small wooden packaging can be put in the general waste bin, whilst larger items must be taken to the local council's recycling centre.
- **Plastic (fruit) bags** often get caught in the machinery during sorting. As a result, they disrupt the sorting process. The nets must be disposed of with general waste.
- **Ceramics, stone and porcelain** are often mistakenly disposed of in the glass recycling bin by consumers, which disrupts the glass recycling process. These materials are not glass and are not collected as a separate stream in the Netherlands. They must be disposed of with general waste.

Packaging that IS permitted in household packaging waste, including PMD, but which does have an impact on recycling:

- **Household hazardous waste** consists of a specified list of waste substances classified as hazardous and generated in small quantities by households. These include, for example, certain cleaning products, methylated spirits and medicines. Empty packaging for medicines and household hazardous waste may be disposed of with household packaging waste, but if the packaging is not completely empty, it must be disposed of separately, together with its contents, at a recycling centre or a pharmacy.
- **Glue stick tubes** should preferably be taken to the recycling centre.

Milieu Centraal's [Waste Sorting Guide](#) is a tool to help consumers check which packaging belongs in which bin. You can check at www.verpact.nl/nl/pmd to see whether your packaging is permitted in the PMD stream.

1.2 Recyclability

1.2.1 Definition of recyclability

The aim of Verpact's Recycle Checks is to help companies make their packaging (more) circular. The Ellen MacArthur Foundation's vision lays the foundations for this:

'A circular economy is one that is restorative and regenerative by design and aims to ensure that products, components and materials retain their maximum utility and value at all times'

The Recycle Check provides companies with insight into the current status of a packaging item, and suggests ways to improve its recyclability based on the results.

Since the 2027 update, Recycle Check has been using the PPWR definition of recyclability as the basis for assessing recyclability. **Recyclability** means in this context that **packaging has been designed with material recycling in mind and, once it has become waste, can be collected separately, sorted and recycled in a way that allows the material to be reused instead of new raw materials.**

Compliance with the criteria can be assessed using the Recycle Checks. This involves assessing whether the disposable unit is recyclable or **not**, whereby the assessment *recyclable* is divided into the categories **good**, **reasonable** and **limited**. This is an evaluation of the disposable unit, which examines the likelihood of it operating optimally, taking into account the specific design of that disposable unit.

The assessment of **recyclability** does not guarantee that a packaging item will actually be recycled. The amount of packaging that must actually be recycled is set out in the **recycling target**: a statutory target relating to the quantity of material that, once placed on the market, must be collected, sorted and recycled. For most materials, a higher percentage of packaging – of that placed on the market in the Netherlands – must be recycled each year.

1.2.2 Categories of recyclable materials

The checklist distinguishes between three categories of recyclable items and one category of non-recyclable items. The lowest score on the checklist is decisive for the overall final assessment.

Recyclable

Good recyclability

All aspects of this packaging are optimised for recycling, which ensure 'good recyclability' according to the aforementioned definition by Recycle Check.

Reasonable recyclability

Refers to packaging that requires one further step than packaging with 'good recyclability'. These packaging items arrive at the recycler as a stream with a homogeneous composition, but something in their composition has a limited impact on the quality of the recycled material or on the effectiveness of the process. The ideal composition of this stream varies depending on the material and is explained for each material.

Limited recyclability

Refers to packaging that is only partially recyclable, for example because, during sorting, it ends up in a mixed stream (a mixture of various types of materials). The material remaining after recycling has a limited range of applications or because it contains components that (seriously) disrupt the recycling process and are difficult to remove.

Non-recyclable

Refers to packaging containing a **contaminant**. These are substances that seriously disrupt the recycling process and result in material streams being rejected.

1.3 Select the right Recycle Check

With the introduction of the PPWR, Europe is working towards a single, harmonized system for assessing packaging recyclability. Consequently, Verpact has adjusted the role of the Recycle Checks. From 2027 onwards, Recycle Checks will be available only for rigid and flexible plastic packaging.

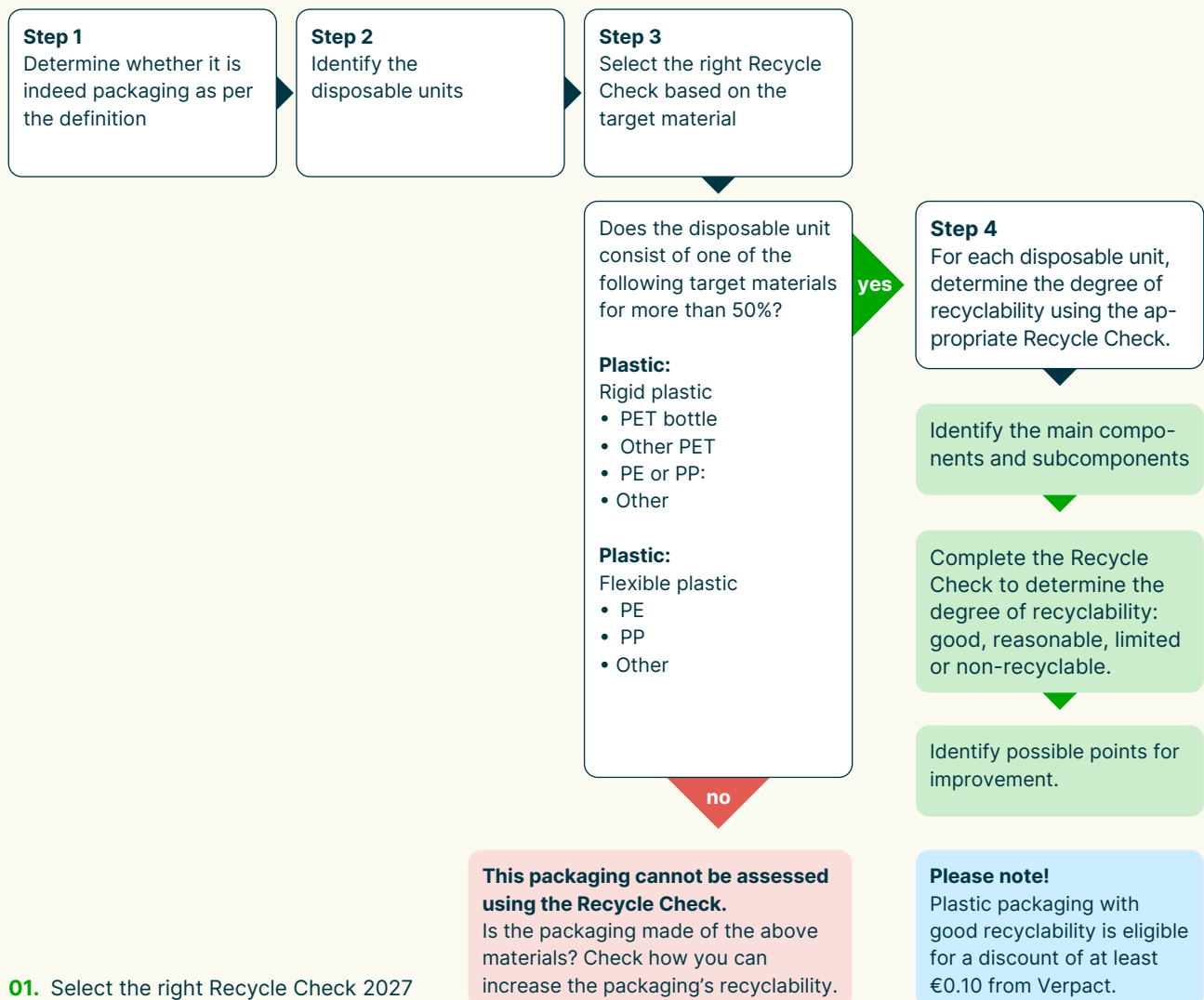
You can use these Recycle Checks to substantiate fee modulation for plastic packaging. This means you may be eligible for a discount on your waste management fee if the packaging proves to be highly recyclable. Read more on www.verpact.nl/recyclechecks

The Recycle Checks have been specifically developed to assess the recyclability of packaging. Packaging often consists of various components, possibly made of

different materials, which are disposed of by the user at different times. This affects the recyclability of the packaging. In order to assess recyclability, the Recycle Checks break down packaging into disposable units and then into a main component and subcomponents.

To determine which Recycle Check(s) need to be completed, it is important first to identify the disposable units that make up a piece of packaging, and then to categorise these by material. This chapter explains these terms and sets out the steps for choosing the right Recycle Check.

The steps are briefly summarised in the image below and explained in more detail in the sections that follow:



01. Select the right Recycle Check 2027

Step 1 Determine whether it is packaging

The Recycle Checks can only provide a reliable result for assessing **packaging**. It is therefore necessary to first check whether the item in question actually meets the definition of packaging. Verpact applies the [PPWR definition of packaging](#):

Packaging: “An item intended for the packaging, protection, handling, supply or presentation of products to another trader or to an end user.”

If in doubt as to whether something constitutes packaging, the (non-exhaustive) [Packaging Catalogue](#) on the Verpact website can be consulted.

Step 2 Identify the disposable units

Most packaging is discarded in its entirety after use. It is therefore considered a **single disposable unit**. Packaging that is not discarded or processed in its entirety but as separate individual components consists of **multiple disposable units**.

When assessing recyclability, it can make a significant difference whether different components or materials go through the sorting and recycling process together, or whether they are processed as separate units. In practice, it is often the case that some disposable components of the overall packaging are easily recyclable, whilst others are only recyclable to a reasonable or limited degree.

The starting point is the principle that each package consists of a single disposable unit, unless:

- the packaging consists of several unconnected components.
- part of the packaging must be permanently and completely removed in order to use the product.
- the packaging contains components, such as a lid, which can be detached by applying slight mechanical force

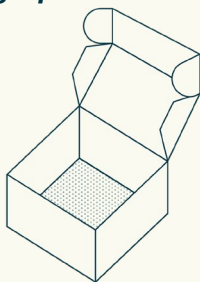
With some types of packaging, it is not always immediately clear whether one or more disposable units are involved. An assessment is then required to determine how many units the pack consists of. On the [next page](#), some examples are explained in detail.

Packaging consisting of a single disposable unit

- **Packaging consisting of a single piece made from one material.**

Example 1:

A cardboard box that is clean and dry can be discarded with waste paper.



A single disposable unit

- **Packaging with a secure closure.**

Example 2:

Glass containers with a clip-on closure are regarded as a single disposable unit because the clip permanently connects the main component and the closure. Nowadays, plastic bottles and beverage cartons often have a fixed closure as well.



A single disposable unit

- **Packaging with adhesive labels.**

Example 3:

Adhesive labels are regarded as subcomponents and are not individual disposable units. Nor is the cap an individual disposable part because it is generally screwed back on again and is now often attached to the bottle.



A single disposable unit

Packaging consisting of multiple disposable units

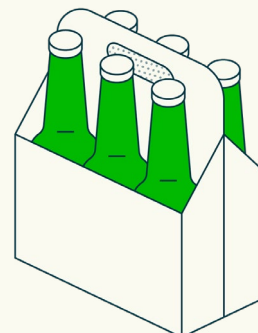
There are various categories of packaging that consist of multiple disposable units. To clarify this, some examples are given below. Step 3 explains in more detail how to select the right Recycle Check for each type of waste.

- **Packaging consisting of multiple unconnected components.**

The components are disposed of at different times.

Example 4:

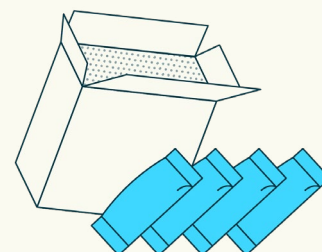
A cardboard tray for 6 small bottles. The cardboard tray and the bottles should each be disposed of in a different waste stream. The crown caps on the bottles also form individual disposable units. So this involves 13 disposable units, made from 3 different materials.



13 disposable units

Example 5:

A cardboard box containing 4 bars, each individually wrapped in plastic film. The user takes a bar out of the box at various times and in various places. The plastic film and the box are therefore discarded at different times and in different places, and must be assessed separately using a Recycle Check.



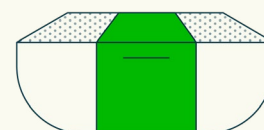
5 disposable units

- **Packaging containing a component that must be permanently and completely removed in order to use the product**

It must be possible to remove this component completely without the use of tools (such as scissors), without leaving any material residue behind.

Example 6:

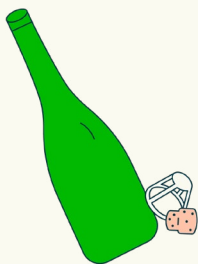
A cardboard sleeve around a plastic container. The sleeve must be removed in order to open the container and access the product.



Multiple disposable units

Example 7:

A (champagne) bottle with a cork and a muselet (a wire cage). These are three disposable components (bottle, cork and wire cage), each of which belongs in a different waste stream.



Multiple disposable units

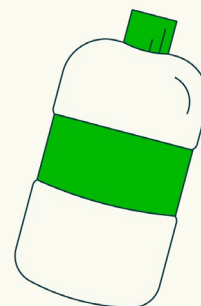
Further evaluation

There are also types of packaging consisting of multiple components, which may or may not form individual disposable units. Further assessment is required to determine which disposable components make up the packaging. Some examples are set out below.

- **Packaging containing a component that does not need to be removed, or does not need to be removed entirely, in order to use the product.**

Example 8:

A plastic vial with a paper sleeve, which is held in place, for example, by a tapered section in the vial. The sleeve is not glued to the bottle and does not need to be removed in order to use the product. The packaging and sleeve together form a single disposable unit, whereby the sleeve is considered a label.



A single disposable unit

Brief self-evaluation

Check whether a sleeve around a package comes loose

Some units of packaging feature a sleeve that is supposed to come off entirely when the packaging is compressed. This includes plastic cups with a perforated cardboard sleeve that is designed to detach when the packaging is compressed. There is a protocol to test whether cup and sleeve do detach from each other behave like independent disposable units. This is called the Pollution and Compression Protocol and is available on the [protocols page](#) on the website.

Cardboard sleeve

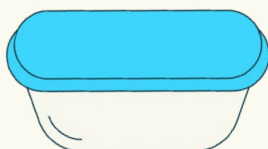
If plastic packaging comes with a cardboard sleeve around it that consumers do not undo, but which has been shown to come loose during collection and sorting, the sleeve and the package behave as individual disposable units. It must therefore be taken into account that in this case the cardboard sleeve will end up in the wrong sorting stream – that is, not with paper but with plastic, for example – and must therefore be considered non-recyclable.

- **Packaging containing components, such as a lid, which can be detached by applying slight mechanical force.**

There are types of packaging whose components become detached during the collection and sorting process, such as packaging with lids. These are therefore processed as individual units during the sorting stage.

Example 9:

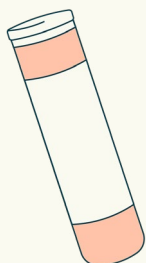
A tub of margarine with a lid. The lid detaches when slight mechanical force is applied and thus forms an individual disposable unit to be discarded during the sorting of packaging, even if the user has disposed of the entire item in the bag or bin.



Multiple disposable units

Example 10:

Cardboard tube with a plastic cap. The lid detaches when slight mechanical force is applied and is therefore deemed an individual disposable unit in the packaging sorting process, even if the user has placed it in the bag or bin as a single item.



Multiple disposable units

Example 12:

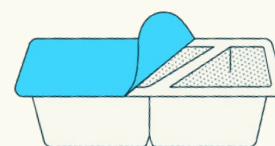
A tamper-evident seal on the neck of a jar or bottle with a diameter of up to 40 mm. The product cannot be used properly unless the film is first removed completely. 'In use' means that the product cannot be poured, spooned out or dispensed, depending on the intended use of the packaging. The cap and bottle together form a single disposable unit, whilst the seal forms an individual disposable unit.



Multiple disposable units

Example 13:

A plastic tray with a release liner that must be removed completely in order to use the tray's dispensing function.



Multiple disposable units

Example 14:

Cups, wide-necked containers and trays where the release liner does not need to be completely removed in order to use the product are also deemed a single disposable unit. The foil can even be used to reseal the packaging.



A single disposable unit

Brief self-evaluation

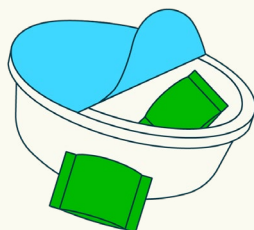
A simple test to check whether a clamp cover comes loose

You can test whether a lid detaches when slight mechanical force is applied by squeezing the empty packaging with the lid on. If the lid pops off completely, it is deemed an individual disposable unit.

- **Packaging containing various components, such as release liner**

Example 11:

Sachets or tubs containing ingredients, included in a pack of ready-made meal salads. These separate components are individual disposable units and are discarded as such after use.



Multiple disposable units

Brief self-evaluation

A simple test to check whether a release liner detaches

You can test whether a release liner detaches when slight mechanical force is applied by grabbing the open, empty packaging by the release liner and shaking it. If the foil comes away easily, it is deemed an individual disposable unit. At the start of the test, at least 25% of the release liner must still be attached to the rest of the packaging.

If the foil does not detach, or only partially, the release liner is deemed a component of the disposable unit to which it is attached and must therefore be taken into account when assessing the recyclability of that component.

If you are unsure whether a package consists of a single or multiple disposable units and the examples above do not provide clarity, please get in touch via the [Verpack contact page](#).

Step 3 Categorise the disposable units

With the Recycle Check, the aim is to complete an individual checklist for each item to be discarded. For each unit, determine the most common general and, where applicable, specific **material type** (see the list below) in order to categorise the unit. The type of material that accounts for at least 50% of the unit's weight determines the category. We also refer to this as the **target material**; see [Chapter 1.4](#).

If none of the types of material account for more than 50% of the disposable unit, the disposable unit cannot be assessed using a Recycle Check. The packaging should then be amended accordingly (see also section [1.1.2 on Legislation](#) in this document).

The types of material:

- **Rigid plastic**
 - PET bottle
 - Other PET products (including PET trays)
 - PE or PP:
 - Other rigid plastics
- **Flexible plastic**
 - PE
 - PP
 - Other flexible plastic

To illustrate this, some examples are set out below.

Example 15:

A hand soap container. The soap is packaged in a metal bottle with a plastic pump. The pump cannot be easily removed from the bottle. It is determined that a bottle with a pump constitutes a single disposable unit, as explained in step 2. In this case, only one checklist needs to be completed, whereby steel packaging should be selected because more than 50% of the disposable unit is made of steel.

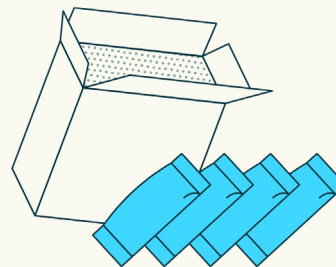


Hand soap packaging

Example 16:

A packet of muesli bars. The bars are individually wrapped in foil and come in packs of four in a box. As explained in step 2, it has been determined that this packaging consists of five disposable units: the box and the four foil wrappers. To assess the packaging, a checklist is completed for each disposable unit. In this case, a checklist for the cardboard box and a checklist for the flexible plastic foils are selected.

For several of the same disposable units, such as four identical sheets of foil, a single checklist is sufficient.



Multi-pack

If you are unsure which category a disposable unit falls into, please get in touch via the [Verpact contact page](#).

Step 4 Determine the degree of recyclability

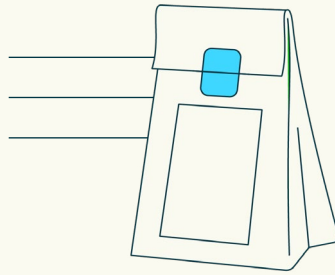
Once the right Recycle Check has been selected, the **main component** and any **subcomponents** must then be identified in order to assess the recyclability of the disposable unit.

The main component of a packaging is that which holds the product, and is usually the component that makes up most of the packaging's weight. Besides its main component, a disposable unit often also has one or more subcomponents. These are added components, such as labels and closures, which are processed along with the main component in the recycling process.

[The table on the following page](#) sets out several examples illustrating how to identify the main and subcomponents. Further information on this can be found in the material-specific background documents for each type of material.

02. Identify main and subcomponents

Subcomponent = tape
MAIN COMPONENT = box
Subcomponent = window

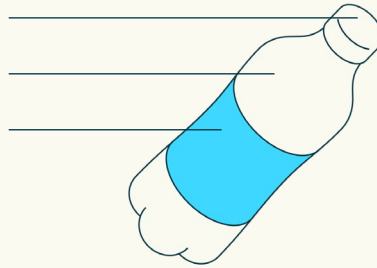


A single disposable unit

Example 1:

Box (main component)
with window and tape label
(subcomponents).

Subcomponent = closure
MAIN COMPONENT = bottle
Subcomponent = label

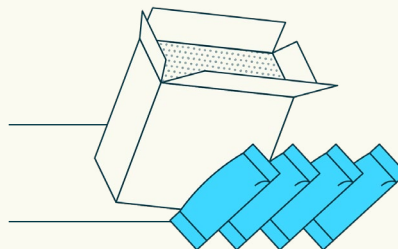


A single disposable unit

Example 2:

Vial (main component) with cap
and label (subcomponents).

MAIN COMPONENT = box
MAIN COMPONENT = wrappers



Five disposable units

Example 3:

Box (main component) containing
4 muesli bar wrappers (also main
components).

If you are unsure about the difference between the main component and subcomponents of the disposable unit, and the examples above do not provide clarity, please contact us via the [Verpact contact page](#).

1.4 Target material & secondary material

What is the target material?

Target material is the material that is ultimately to be recycled into a new raw material. Usually, this is **the material which makes up most of the weight** in the disposable unit, often the material of the **main component**.

Exception: if a subcomponent (such as a heavy steel cap) is heavier than the main component, then the subcomponent constitutes the target material.

If a subcomponent **is made of exactly the same material** as the main component (e.g. a paper label on a cardboard box or a PE cap on a PE bottle), then it is deemed part of the target material. Properties such as colour, additives and printing on these subcomponents must be taken into account in the assessment.

When does packaging contain sufficient target material?

The target material must make up at least 70% of the total weight of the disposable unit:

$$\text{Target material weight} / \text{Total weight of disposable unit} \times 100\% \geq 70$$

Secondary material

Materials that **are not the target material** constitute the secondary stream. These can affect the processability of the target material, but can also be recycled themselves if they are properly designed (design for recycling).

Example: returnable bottles made from PET with caps and labels made from PE or PP. The caps can be easily separated from the PET and can themselves be effectively recycled as a secondary stream.

In [Part 2](#) you will find the material-specific information relating to the checklist.

1.5 Checklist guide



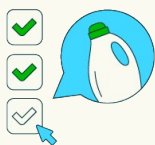
Step 1 Create a package

Open the Recycle Check dashboard, add a packaging item, enter some details about the packaging being assessed and click 'Save' at the bottom of the page.



Step 2 Create the disposable units of the packaging

Click on the play button labelled 'edit packaging'. Below the green button, you will find an explanation of how to identify disposable units. Next, add the disposable unit or units that make up the product-packaging combination. Each disposable unit of the packaging must be assessed individually.



Step 3 Complete the checklist

Next, work through the relevant checklist for each item to be disposed of by clicking on the 'Start checklist' play button. When you open the checklist, some general information is displayed, which you can close once you have read it. Links to further explanations for each material in the background document have been added to the questions.



Step 4 The final score

Once all the questions in the checklist have been answered, the 'Finish' button at the bottom of the list takes you to the summary page, which shows the final recyclability score for the disposable unit. Under the heading 'Final score', it shows how many questions on the checklist have already been completed. If, for example, it says 8/10, this means the checklist consists of ten questions and eight have been answered. Once the entire list has been completed, the ticked box will change colour to reflect the result of the checklist (**good**, **reasonable**, **limited** or **non-recyclable**). If the packaging consists of multiple disposable units, please proceed to the following checklist.

Please note: data is saved as you progress. If you close the checklist whilst you are halfway through it, you can continue at a later time from the same computer; the details you have already entered will remain available. You can only finalise the list on another computer if you download the entire portfolio (see step 5).



Step 5: Save and share results



You can export the results from the overview page to a PDF file using the 'Download PDF' button. If a packaging consists of multiple disposable units, the checklists for all units within each package are combined in a single PDF export.



Tip: You can download a blank Recycle Check by creating a packaging item and adding a disposable unit, but without starting the list. When the PDF is downloaded, the checklist appears as an empty list.

There is also the option to download the entire portfolio, comprising all the completed checklists, so that, for example, a colleague can upload the whole set to their computer. You can do this by clicking the 'Export packaging' button in the top right-hand corner of the dashboard. A .json file is downloaded. You can then import an entire set by clicking on 'Import packaging' and uploading the .json file here.



In some checklists, questions marked with this symbol are identified as complex. Here, it is more difficult to arrive at the correct score in one go (**good**, **reasonable**, **limited** or **non-recyclable**). In such cases, further investigation may lead to a higher degree of recyclability. For example, a test may need to be carried out to answer such a question. For this type of question, two scores are possible. Recycle Check automatically selects the lowest score. Following a positive test result, the higher score may then be ticked. It is important to have proof of a positive test result to hand. Where possible, a reference to an existing protocol is provided; in some cases, a protocol still needs to be developed. Updates on this can be found on the [protocols page](#).



Tip: First, answer all the questions and decide whether taking a test could improve your final score. Some of the criteria listed later in the checklist mean that a positive test result does not lead to an improvement in the final score of the check. For example, if it is a test relating to sortability and the disposable unit does not already score highly on recyclability. Of course, it may still be a good idea to carry out the test in order to gain a better understanding of this specific aspect.

E-learning courses

To find out more about recycling and sorting processes in the Netherlands, the following e-learning modules provide background information.

- [Recycling of packaging in the Netherlands](#)

Using specific real-life examples, this section provides insight into the collecting, sorting and recycling of various types of packaging. The e-learning module covers all types of packaging materials: rigid and flexible plastic, glass, metal, paper and cardboard.

- [Sorting and recycling processes for plastic packaging](#)

This more technical module has been developed as a follow-up to the e-learning module 'Recycling of packaging in the Netherlands'. This module gives a more detailed explanation of the basic techniques used in the sorting and recycling of plastic packaging. Among other things, the report examines the impact of packaging design on the various sorting and recycling processes.

Part 2

Rigid plastic packaging



2.1 Introduction

Part 2 of this document contains background information to support the Recycle Check for rigid plastic packaging.

Here is some further information about collection, sorting and recycling. Topics that are common to all materials have been grouped together in Part 1: Basic information and are the same in every background document. These are topics such as the definition of recyclability, how to choose and use the Recycle Check correctly and making packaging more sustainable. The Recycle Check for rigid plastic packaging is aligned with the Recycle Checks and guidelines of other countries and international organisations, such as Plastic Recyclers Europe ([RecyClass](#)), [PETcore Europe](#) and [European PET Bottle Platform \(EPBP\)](#).

2.2 Collection and sorting

Below are a number of definitions specifically intended for rigid plastic packaging.

Part 1 contains all the definitions that are important for carrying out a Recycle Check.

For an overview of all the terms mentioned in this document, please see the [Glossary of Packaging Terms](#) on the website.

2.2.1 Definition of rigid plastic packaging

This Recycle Check is intended solely for rigid plastic packaging. For more information on what a package is, see [Part 1, Chapter 1.3](#).

A rigid disposable unit refers to inflexible packaging that cannot be easily deformed or crumpled (even when empty).

Properties:

- The material used with these types of units is usually thicker than 180 µm;
- When empty and before it is filled, the packaging usually has the same shape as when it is filled.



03. Examples of rigid plastic packaging

2.2.2 Dimensions and shape of a disposable unit

In a sorting plant, disposable units are sorted by size. This takes place in a large rotating drum with holes of various sizes, which sifts through the packaging. In this way, components that are too small or too large for the sorting process are separated from the rest of the material. Disposable units that are too large or too small are usually not sent for recycling, even if their material composition is technically recyclable.

Smaller than 3 cm

Small disposable units, which can fall through a round opening with a diameter of 3 centimetres in the drum screen, are usually not recycled. This aggregate is very difficult to sort further and contains a lot of contaminants. Disposable units ≥ 3 centimetres are included in the waste stream for recycling.

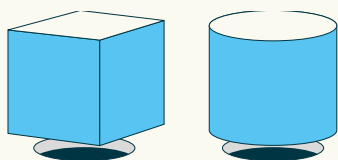
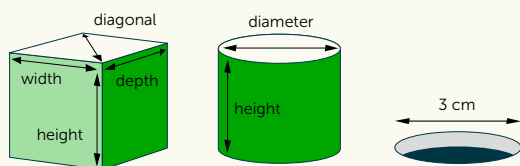
In some cases, the small aggregate is sorted a second time so that small components of good-quality raw materials, such as bottle caps, can still be recycled. A targeted search is carried out for parts that are easy to recycle. This makes it worthwhile to also consider the design of small disposable units.

Larger than 5 litres

If the volume of the packaged product exceeds 5 litres, the packaging is removed from the waste stream to be sorted and is usually not sent for recycling. However, this packaging can often be disposed of as commercial waste.

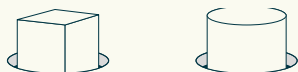
At some waste sorting facilities, particularly those that use post-sorting, the incoming waste stream is cut into smaller pieces. Packaging that is too large is then reduced to a size that can be sorted. This still happens on a small scale. Once this is implemented on a large scale, this Recycle Check will be updated accordingly.

05. Packaging volume



Sortable waste

Height, width, depth, diagonal and/or diameter greater than 3 cm



Non-sortable waste

Height, width, depth, diagonal and/or diameter smaller than 3 cm

A cylindrical or conical plastic container, such as a bottle or jar, can cause problems during sorting. During the sorting process, the packaging is transported along a conveyor belt, where it is scanned using near-infrared (NIR) technology and blown into the correct sorting stream by a stream of air.

Packaging with a cylindrical or conical shape can roll along the conveyor belt, and when blown off, it often flies off in all directions, meaning it does not end up in the correct sorting stream.

Much of the packaging is flattened during collection in what is known as a compactor lorry. This is very useful for the sorting process because it prevents packaging from rolling off the conveyor belt. However, there are some types of packaging that cannot be compressed together. This is particularly common with small containers holding less than 200ml. They must therefore be tested for compressibility.

In the case of cylindrical or conical packaging where the height is less than half the diameter, there is a high probability that the packaging will rest on its base or top on the conveyor belt, rather than rolling on its side. This makes it easier to sort.

TEST

whether or not a cylindrical or conical container is compressible:

Step onto the round side of an (empty) package and then step off it again.

1. If the packaging hasn't been flattened, or springs back into its round shape, then there's a good chance that the packaging will retain its round shape throughout the collection and sorting process. This packaging cannot then be sorted properly.
2. If the packaging can be flattened and does not spring back to its cylindrical shape, it will pass through the sorting process without any problems. Change the answer to this question in the checklist to 'optimal'.



If there is any doubt about the outcome of this test, the NTCP's [Pollution and Compression Protocol](#) can be used to simulate the collection and sorting stages.

Cylindrical/conical packaging

2.3 Points to consider regarding recyclability

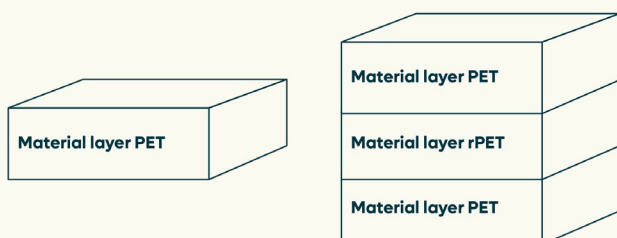
The composition of the material of the main component affects the recyclability of the disposable unit in question. The use of coatings, fillers and additives affects how the material can be processed by recyclers. This chapter describes the extent to which the main component of a package is recyclable.

This chapter explains the material composition and sets out what this means for recyclability. A distinction is made here between main components made of PET, PE or PP and other materials. The difference between mono and multi-materials is also explained.

2.3.1 Explanation of the material composition of the main component

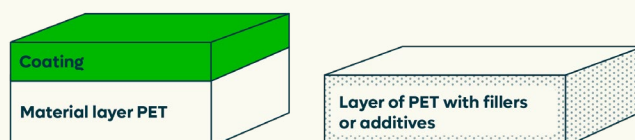
Mono-materials

Mono-materials are made from a single type of polymer. This may be a single layer of a particular polymer, or several layers of the same polymer (for example, two outer layers of virgin plastic with an intermediate layer of recycled plastic made from the same polymer).



06. Mono-material.

A mono-material does not contain layers of other materials. However, additions may have been made to the material, such as prints, coatings, adhesive layers, fillers or additives.



7. Mono-material with additives

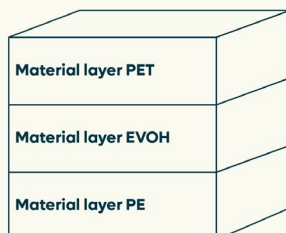
Multi-materials

Multi-material packaging consists of different materials, which are joined together by gluing, co-extrusion or lamination. These may be supplemented with extras, such as printing. The layers cannot be separated, or it is very difficult to do so. Multi-materials can take various forms:

- Multi-material products consisting of layers of different plastics, for example combinations of PET and PE

Multi-material products made from different plastics affect the recycling process, because these materials cannot be separated from each other. In that case, a combination of different plastics is introduced into the recycling process, making it more difficult to predict how this will affect the material properties of the recycled product. With mono-material, this is easier

to predict. In some combinations of multiple materials, the properties of the plastics differ so greatly that they cannot be processed together, such as combinations of PET and PE.

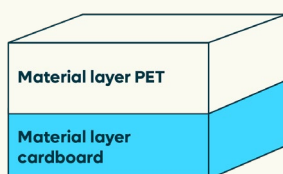


08. Multi-materials

- **Multi-materials consisting of a combination of plastic layers and layers of a different polymer**

Examples of this include packaging made from combinations of PP and a layer of cardboard, such as that used for frozen vegetables. The Recycle Check to be used for this purpose depends on which material makes up the largest proportion of the packaging (for further information, see Part 1, Chapter 3).

The properties of these composite materials are usually so different that it is difficult to process them together in the recycling process.



09. Combination of multi-materials

Layers of material

A material layer is a separate layer within a package that consists of a single main material or type of polymer.

This layer:

- It is usually more than 1 micrometre thick ($1 \mu\text{m} = 10^{-6} \text{ m}$).
- Is applied to films by co-extrusion or lamination.
- In the case of injection-moulded packaging, multiple layers can be formed during multi-shot injection moulding or co-extrusion.
- Forms a functional layer of material in its own right.
- Is often used as a barrier layer or structural component in packaging.

Coatings

A coating is a layer applied to the surface of a material.

Properties:

- It is usually a few nanometres thick ($\text{nm} = 10^{-9} \text{ m}$).
- Does not form an independent layer of material.
- Is often used as a sealing layer, print or surface treatment.
- May consist of metallised materials, adhesive layers or lacquers.
- Example: a thin sealant coating on a tray to secure a cover film.

Fillers and additives

Fillers and additives are added to plastics to give them specific properties. In the Recycle Check, we distinguish between:

- Fillers and additives that are necessary for the workability of the raw material or packaging material, such as *stabilisers*, antioxidants and solvents, and substances that do not alter the density of the material. These additives do not interfere with the recycling process.
- Fillers that have a significant impact on the density or properties of the material, such as minerals (e.g. lime or talc for barrier properties), fibres (e.g. from paper, grass or glass for reinforcement), mica (for a pearlescent effect for decorative purposes), metal flakes (for a metallic effect for decorative purposes) and iron oxide (terracotta colour for decorative purposes). These additives are not always plastics themselves and have different properties, such as melting behaviour. This difference in properties makes the recycling process more difficult, for example because melt filters become blocked. The properties of the recycled material may also be affected, making it less suitable as a raw material for producing new packaging or products.

Barriers

Barriers are added to a plastic to make the material less permeable, for example to moisture, oxygen, aromas or light. They can be applied as a coating, a layer or as additives within the material. Examples of barrier layers include EVOH, SiOX, AlOX and metallised aluminium. The additives themselves are not always plastics and have different properties, such as melting behaviour. This difference in properties makes the recycling process more difficult, for example because melt filters become blocked. The properties of the recycled material may also be affected, making it less suitable as a raw material for producing new packaging or products from it.

2.3.2 Effect of material composition on recycling

Main components made from mono PET, PE and PP without additives, which are optimally recyclable. If the main component is PET, PE or PP in its pure, mono-material form, without any additions such as coatings, barriers or additives, it can be assumed that these will not interfere with the recycling process. In plastic sorting plants, packaging is first sorted by shape (flexible or rigid), by material type (plastic, metal, beverage cartons) and then by type of plastic. The rigid plastic packaging is sorted into PP, (HD)PE and PET based on the identification of the main component for each type of plastic. Drop-ins such as Bio-PE, Bio-PP and Bio-PET (in which only part of the PET molecule is bio-based) also fall into this category. These have the same molecular structure as PE, PP and PET respectively.

Other plastics

Plastic packaging that retains its shape but is not made from PE, PP or PET is sorted into a mixed waste stream. These do not fall within the definition of easily recyclable packaging. Examples of these include polycarbonate (PC), polystyrene (PS) and polylactic acid (PLA, also known as polylactic acid). The proportion of these materials in the total household waste stream is relatively small. It is difficult to sort and recycle them cost effectively, which is why this is not done on a large scale.

Biodegradable or compostable disposable units

Disposable units containing compostable plastics can have a significant impact on recyclability, even if they end up in the mixed waste stream.

For more information, please read the factsheets on bio-based and biodegradable packaging. Because it is difficult for consumers to distinguish them from standard plastics, they are nevertheless permitted in the PMD.

Under the PPWR, certain types of packaging must be compostable by 2028. These must be disposed of via the organic waste bin. This refers to tea bags and coffee pods (as defined in the legislation: a permeable bag containing tea, coffee or other beverages, or a single-use item that contains tea, coffee or another beverage and becomes soft after use, and which is intended to be used and disposed of together with the product). In addition, fruit stickers must be compostable. From 12 August 2026, tea bags and coffee pods will also fall within the definition of packaging. Other types of packaging are not permitted in the organic waste bin.

Oxo-degradable

Oxo-degradable (or oxo-biodegradable) plastics contain additives which, when exposed to ultraviolet light and oxygen, break down into tiny pieces of plastic (microplastics). These additives can be added to all plastics.

Oxo-degradable plastics are mainly used in bags and pouches, and sometimes also in rigid plastic applications. If oxo-degradable plastics end up in recycling streams, they compromise the quality of the recycled plastic. This makes it a contaminant.

In accordance with the [2014 Packaging Management Decree](#), oxo-degradable packaging is prohibited in the Netherlands. The European Union has banned the use of oxo-degradable materials in packaging with effect from 3 July 2021.

PVC, PVDC and BADGE-based additives

Additives to the main component, such as layers of additives and coatings, are difficult to detect and cannot be separated from the main material. They are then recycled along with the PET, PE or PP, and have an impact on the process and the quality of the recycled material. A number of additives have a significant impact on recycling and are described in detail here.

PVC, PVDC (Polyvinylchloride and Polyvinylidene Chloride)

PVC is not often used as the main component in combination with PET, PE or PP. Due to its excellent barrier properties, PvdC is sometimes used as a barrier layer. It is difficult to remove during the recycling process and causes an undesirable chemical reaction. The formation of hydrochloric acid causes damage to the recycling equipment. Benzene may also form. This is a harmful substance that poses a problem in relation to contact with foodstuffs.

BADGE-based additives (Bisphenol A Diglycidyl Ether)

BADGE-based additives that end up in the PET recycling stream can break down during the melting process and lead to BPA contamination of rPET. This is a harmful substance that poses a problem in relation to contact with food.

Elastomers, silicones and other rubber-like materials

Packaging containing components made from elastomers, silicones, acrylates and other rubber-like plastics may cause problems during the recycling process. This also applies if the contents of the packaging contain silicone.

Elastomers and silicones, acrylates and other rubber-like plastics are used for components where elasticity, resilience and tensile strength are important. They are also used in packaging as anti-slip material or for thermal insulation. Once recycled, these materials cause imperfections and defects in the product made from recycled material.

Another form of silicone may be added to the material during the production of packaging, as slip additives, to adjust the friction factor and thereby make the material easier to process. This is not considered a component of the packaging, but as an aid to the production and filling of packaging. This does not disrupt the recycling process and is not classified as a contaminant.

In the case of elastomers, an exception is made for TPO (thermoplastic olefin, based on PE or PP). TPO is a specific type of TPE (thermoplastic elastomer) that has only a limited impact on the recycling of PE and PP.

PETG

PETG is a type of PET in which the glycol has been modified. The modified glycol is the main component of a packaging material ensures that the material crystallises less. During the washing and drying stage of the recycling process, the modified glycol causes the material to become soft and sticky. This causes blockages in the system further down the line, which disrupts the recycling of PET. The presence of PETG in recycled PET can also lead to defects in the end product. This applies to both transparent and coloured PET.

PETG is used to produce precisely moulded PET bottles, jars and blister packs.

PETG is also used in full-body sleeves. As these sleeves are removed during the recycling process, they are not classified as contaminants.

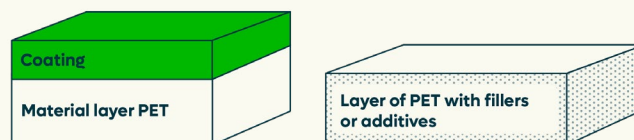
CPET

During the production of CPET, crystallinity is maximised in order to achieve better heat resistance. Additives are also frequently added to thermoforming applications to increase the crystallisation rate and to achieve a uniform colour. This causes unwanted discolouration in transparent recycled PET. The material can, however, be easily processed within the coloured PET stream.

How barriers, fillers and additives affect density

All materials have a basic density. Plastics such as PP and PE, for example, float on water (density $< 1 \text{ g/cm}^3$). Plastics such as PET, PS and PLA sink in water (density $> 1 \text{ g/cm}^3$). This property is put to good use in the separation process at the recycling plant, by means of what are known as sink-float tanks. In these tanks, PE and PET can be easily separated from each other.

However, when gas bubbles are added to PET (a process also known as 'foaming'), for example, the density changes and the PET may start to float. In that case, the sink-float stage will no longer work properly and the PET will end up in the wrong material stream. In this example, the foamed PET then contaminates the PE stream. PE and PP can, in fact, be made denser by adding large amounts of talc or lime, and consequently sink. In turn, PE and PP contaminate the PET stream.



10. PET material layer with fillers

The impact of an additive may vary depending on the main component. Tests have shown that PE and PP packaging containing EVOH can be recycled effectively under certain conditions. However, EVOH is not suitable for PET packaging, because it causes the recycled material to discolour.

2.3.3 Colour of the main component

Plastic packaging to which no colourants have been added has more potential uses after recycling than coloured varieties. The colourless, transparent packaging can be recycled into new transparent packaging. Once recycled, white packaging can be turned into new packaging in a wide range of bright colours. Colourless and white materials can therefore often be recycled over several cycles and reused for new packaging.

The main component can be coloured by mixing a colourant into the material (master batch). These colours may affect sortability and recyclability. To help determine whether packaging is white or transparent, Verpact has produced a guide in collaboration with FieldLab Circular Packaging. The colour guide is available on the [resources page](#).

Coloured PET, PE or PP

If coloured plastics are mixed with uncoloured plastics, the material will discolour. Once material has discoloured, it can no longer be restored to a colourless or transparent state using standard mechanical recycling techniques. This means there are fewer potential applications for this material.

There is an exception for very light blue PET bottles, which are mainly used for water. These can be recycled together with colourless, transparent PET. Since the amendment to the Packaging Management Decree (1 July 2021), these bottles have been subject to the

deposit scheme and are now rarely found in household waste.

PE and PP are also increasingly being sorted by colour during the recycling process. The coloured material is still processed and sold on a large scale. For this reason – unlike with PET – no distinction is yet made between the recyclability ratings of uncoloured and coloured materials.

Opaque PET

Opaque PET does not let light through. It is often coloured white using, for example, titanium dioxide, calcium oxide, calcium carbonate or tin oxide as a colouring agent. In large quantities, these colourants can disrupt the recycling process.

Opaque PET is rarely used in the Netherlands. In France, it is widely used for light-sensitive products, such as dairy products. The colouring causes cloudiness and discolouration of the rPET. It is therefore preferable to use transparent PET. In France, opaque PET is sorted and recycled separately, because this type of packaging is more common there.

Key components containing carbon black

The most commonly used sorting technique uses Near-Infrared (NIR) scanners. The type of plastic is determined by measuring the spectrum of the reflected infrared light. In the case of packaging coloured black by carbon black (soot), the infrared light beam is not reflected properly, but is absorbed. Carbon black is a widely used and inexpensive colourant for black and dark-coloured packaging. The reflection cannot then be 'read' by the NIR scanner. The type of plastic is therefore not detected and the disposable unit is not sorted, or not sorted properly. This is particularly true if the material of the main component is coloured throughout. However, the risk of sorting errors is often high if the product is printed in black, if a black intermediate layer is used, or if a large part of the surface is covered with a black printed label or sleeve.

A (small) black cap or lid on a disposable unit and black text on labels do not affect detection, as the NIR scanner essentially scans the main component of the packaging. Because there remains sufficient area available for the NIR scanner to scan, and as most of the target material is usually found in the main component, this does not pose any problems.

TIP

One advantage of black packaging is that it can easily incorporate recycled material. Carbon black is a cheap colourant, so it doesn't matter what colour the recycled material was originally. However, it is unlikely that the packaging will be sorted correctly in the next cycle and then recycled. Packaging in a colour other than black is more likely to be sorted correctly. And it is therefore more likely that the packaging in question will be recycled. If black is required for packaging, use as much recycled material as possible.



Some sorting plants are able to detect plastic containing carbon black, but are not yet able to sort it by material type. Because the type of plastic cannot be identified, it ends up in the mixed waste stream. There are alternative black colourants that have less of an impact on sortability, but there is still a risk of sorting errors. Furthermore, the black colour has a significant impact on the colour of the recycled material, which consequently makes it less versatile.

2.3.4 Future developments

In future, packaging will increasingly be sorted by colour. There are already some interesting examples of manufacturers who have packaging of a very specific colour sorted separately, so that it can be used to make new packaging of almost the same colour. Various organisations are also investigating the extent to which barriers, fillers and additives affect recyclability. The Design Guidelines for the PPWR will clearly specify which barriers and additions are permitted and under what conditions. As soon as more information is available, it will be published on the website.

Work is underway to enable the sorting of specific types of packaging using markings or codes on the packaging, or with the aid of AI. This allows, for example, specific colours or non-food packaging to be sorted into a separate stream. Such techniques are used to facilitate the recycling process.

2.4 Printing, labels and sleeves

Labels, sleeves and printing can affect the recyclability of the disposable unit in the following two ways:

Impact on sortability

First and foremost, the size of the label or sleeve affects how easily it can be sorted. Where there is a high degree of coverage and a label or sleeve covers all or most of the material of the disposable unit, it is more difficult to determine the type of material of the main component. Depending on the type of material used for the label or sleeve, the sorter may be unable to sort the item into the correct material stream, meaning it will ultimately not end up at the correct recycling facility.

Impact on recyclability

Once it reaches the recycling facility, the type of material used for the label or sleeve again affects its recyclability. Certain combinations of materials for the main component and the label or sleeve are more difficult – or, conversely, easier – to separate from each other. When materials are included in the recycling process, not all of them have the same impact on recycling quality. For example: paper from labels is a major problem in plastics recycling and should therefore be avoided as far as possible. In certain cases, this also applies to inks used in direct printing. If these inks are recycled along with the rest, they can also have a significant impact on the quality of the recycled material.

The extent to which labels, sleeves or direct printing affect both sorting and recycling is determined step by step in the Recycle Check.

2.4.1 Effect of printing, labels or sleeves on sortability

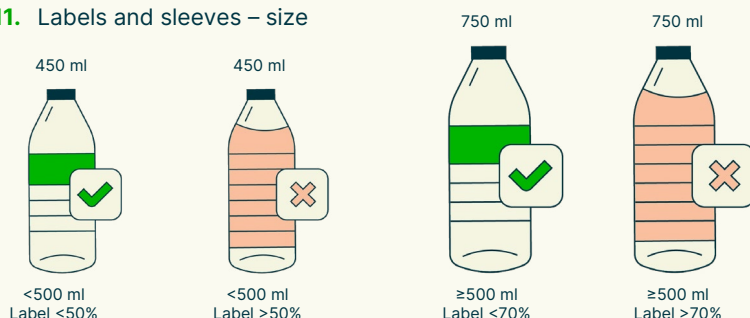
Small labels and sleeves are easy to sort

Small labels or sleeves do not affect the sortability of the main component. Near Infrared (NIR) scanners are used to identify the material of the main component. If the labels or sleeves are too large and made of a different material to the main component, a sorting system may not always recognise the material of the main component. During sorting, the packaging may end up in the wrong material stream.

The figure below shows the percentage of the main component that may be covered by the label or sleeve (the coverage ratio), whilst still allowing the NIR scanner to recognise the material of the main component.

- If the contents of the packaging are less than 500 ml, the label or sleeve may cover no more than 50% of the surface area.
- If the contents of the packaging are greater than or equal to 500 ml, the label or sleeve may cover no more than 70% of the surface area.

11. Labels and sleeves – size





12. Labels and sleeves

When determining the coverage of a label or sleeve, you should consider the side of the packaging on which the majority of the label is visible.



TIP

The National Test Centre for Circular Plastics has developed a handy tool for determining the size of labels and sleeves in relation to the main component. In this context, the side of the disposable unit that is most covered is always taken into account. Click [here](#) to go to the tool.

Sortability of large labels and sleeves

The National Test Centre for Circular Plastics (NTCP) and FieldLab Circular Packaging have carried out extensive testing to determine the extent to which large labels and sleeves can be sorted and recycled. It follows that, in the following situations, a disposable unit with a large label or sleeve can be sorted **correctly**:

- **A label or sleeve made of the same material as the main component** is correctly identified, and the main component is sorted into the correct stream and sent to the appropriate recycler.
- **A label or sleeve that must be completely removed in order to access the product** is an individual disposable unit. In this case, the material will not disrupt the sortability of the main component.
- **A label or sleeve is made from PET, PS, PE or PP and does not have a light-blocking barrier.** Tests have shown that NIR scanners are able to accurately identify the main component of the material through these sleeves, enabling it to be sorted effectively.
- **These are labels or sleeves made from a single material with a maximum thickness of 120 µm (0.12 mm).**
- **This involves direct printing.** Direct printing does not affect sortability (with the exception of large areas printed with carbon black ink).

In the following situations, labels or sleeves **disrupt** the sortability of a disposable unit:

- **The material used for the label or sleeve consists of plastics other than PET(G), PS, PE or PP**
Other plastics have not yet been thoroughly

investigated, and it is not yet known to what extent NIR scanners can accurately determine the main component of the material through these sleeves.

- **The colour of the material used for the label or sleeve and/or large areas of the print contain carbon black.**
A large area covered in carbon black is difficult to scan in the sorting plant. This often leads to sorting errors.
- **There is a shiny metallic layer covering large parts of the surface.**
A large, shiny surface with a high degree of coverage (see Figure 13) is difficult to scan in the sorting plant.
- **Layers have been applied that are impervious to light.**
Large labels and sleeves with impermeable light barriers, such as paper labels, interlayers of carbon black or metallisation, make it impossible for the sorting system to identify the main component of the material, leading to sorting errors.

2.4.2 Impact of labels, sleeves or printing on recyclability

For the recyclability of disposable units with labels, sleeves or direct printing which must be easily sorted, they must meet one of the following criteria:

- 1 The materials used for labels or sleeves must be separable from the main component, or**
- 2 The materials used for labels, sleeves or direct printing, including their adhesive bonding, must be recyclable together with the material of the main component.**

Recyclers strongly favour the option of removing labels and sleeves. This ensures that the inks, along with the labels, are removed from the target material. Inks can affect the recycling process and the final quality of the recycled material. If labels or sleeves can be separated from the main component, it is preferable that this separate stream can itself be processed into a new raw material (Chapter 6 discusses in detail the role of any adhesives in the removability of labels or sleeves).

The specific impact of labels, sleeves and printing on recyclability by type of main component

PET packaging with.....

...PE/PP labels/sleeves

PE and PP labels or sleeves (with a density of $<1 \text{ g/cm}^3$) are preferable to PET main components, as they can be easily separated using a sink-float technique. PET sinks, whilst PE and PP float in water. The labels and sleeves removed from the main component in this way can themselves be processed into new raw material as a polyolefin blend (a PO blend of PE and PP).

...labels/sleeves containing PVC, PVDC, PC or PS with BADGE-based coatings and varnish layers

These substances have a density of $>1 \text{ g/cm}^3$, and are difficult to separate from the PET of the main component using sink-float techniques. The recycler also uses other techniques, such as a zigzag wind shifter, to separate these materials from the rigid PET. However, there remains a risk that they will not be removed sufficiently and may lead to the formation of harmful substances such as BPA or benzene.

- **PVC and PVDC (Polyvinylchloride and Polyvinylidene Chloride)**

PVC is still used in shrink films and sleeves. Due to its excellent barrier properties, PvdC is often used as a barrier layer.

They are difficult to remove during the recycling process and cause an undesirable chemical reaction. The formation of hydrochloric acid causes damage to the recycling equipment. Benzene may also form. This is a harmful substance that poses a problem in relation to contact with foodstuffs.

- **PS labels and sleeves with BADGE-based coatings (Bisphenol A Diglycidyl Ether)**

Due to their density, PS labels are difficult to separate from PET. Sometimes these labels are treated with BADGE-based coatings. These are BPA-based epoxy coatings. If residues of these coatings end up in the PET recycling stream, they can break down during the melting process and lead to BPA contamination of rPET. This is a harmful substance that poses a problem in relation to contact with food.

...labels/sleeves made from other plastics

Labels and sleeves made from plastics other than PE or PP with a density of $<1 \text{ g/cm}^3$ may be effectively removed using sink-float techniques, but the removed label material is then difficult to recycle as a secondary stream, as these materials do not mix well with the polyolefins of which removed labels and sleeves are primarily composed.

...foamed labels

Injecting gas bubbles (foaming) into plastic to achieve a

different texture results in a difference in density. This may affect the sink-float process. Foamed PET is easier to separate from the main PET component. However, foamed labels make the secondary stream less easily recyclable due to the combination of PET and PE/PP.

...direct printing

Printing directly onto PET packaging is detrimental to its recyclability. If PET packaging is printed on directly, the inks are carried through the recycling process. These inks cause the transparent material to discolour. An exception is made for the direct printing of a (small!) best-before date (THT or TGT). This applies provided that this text is printed directly onto the PET, i.e. without a solid-colour printed background.

PE/PP packaging with...

...labels/sleeves made of PE/PP

PE and PP labels or sleeves (with a density of $<1 \text{ g/cm}^3$) are preferable for main components made of PE and PP. A label made of the same material as the main component is no problem. The recycler will separate the material from labels and sleeves as much as possible, so that the material from the main component can be recycled as purely as possible, free from ink. The stream of PE and PP labels and sleeves can also be processed further. In PE and PP recycling, a small amount of PE can be processed along with the PP stream, and PP along with the PE stream, from the labels. However, PP in the PE stream is more problematic and should be minimised as far as possible.

... in-mould labels

In-mould labels are applied to the packaging within the injection mould and become integrated with the material of the main component. This means that no adhesive is required. This usually involves PP labels on PP packaging, but can also be done with other plastics. The result is similar to directly printed packaging made entirely from PP. When determining recyclability, an in-mould label must be assessed as part of the main component, and not as a removable label. In-mould labels containing non-plastic layers or any fillers or additives must therefore be assessed as part of the main component containing these additions. In this case, the print is classified as direct printing.

There are also removable in-mould labels. These are assessed in the same way as removable labels. This means that, in this case, removability must also be demonstrated using the test in accordance with the releasability [test protocol](#).

...direct printing

If a large area of the packaging is printed with colours containing carbon black, this may affect the sortability of the packaging. The same restrictions apply here as for large black labels (see section 4.1). The inks used in the printing process can affect the recyclability and quality

of the recycled material. Inks can react and result in the presence of undesirable substances in the recycled material. Because directly printed packaging can be processed within the coloured stream as dimensionally stable PE and PP packaging, and as PE and PP are not yet recycled on a large scale in a food-safe manner, they are still permitted. Section 4.3 on 'future developments' states that we expect the regulations governing direct printing to become stricter.

As mentioned in the tip at the end of this chapter: use as little ink as possible and avoid large areas of dark and black colours.

...foamed labels

Injecting gas bubbles to achieve a different texture – a process known as foaming a plastic – results in a difference in density. This can have an effect during the sink-float process; it makes it more difficult to separate the foamed PET from the PE or PP of the main component.

...labels/sleeves made from other plastics

Labels and sleeves made from materials such as PS, PETG and PLA with a density greater than $>1\text{g/cm}^3$ sink in the floating zinc bath and can therefore be easily separated from the PE or PP of the main component. If traces of these polymers do remain in the main component, this could have adverse effects on the chemical composition of the recycled material. Furthermore, these materials make the secondary stream (which is not a target material for the recycler) less easily recyclable, because they do not mix well with the polyolefins of which the removed subcomponents are primarily composed.



TIPS

- Minimise the use of inks, particularly those based on nitrocellulose.
- Ensure that the inks, labels and sleeves can be separated from the main component material.
- Do not use bleeding inks. Inks that dissolve in the wash water may settle on the substrate during drying, which can cause discolouration.
- Use inks that comply with the EuPIA guidelines.*
- For direct information on the main component, Laser Coding is the preferred method.

* Inks that comply with the EuPIA guidelines ensure that fewer harmful substances end up in the waste stream after de-inking. The EuPIA guidelines do not indicate to what extent inks can be effectively separated from the materials.

For further information, please refer to the [Factsheet on Inks – printing on packaging](#).

2.4.3 Future developments

The raw materials used in subcomponents, such as labels and sleeves, are being given increasing weight in the assessment of packaging recyclability. The focus is shifting from removing unwanted materials to safeguard the main component, to using materials from subcomponents which can themselves be recycled as much as possible as a secondary stream. The secondary stream plays an important role in achieving the recycling targets for plastic packaging materials.

Inks have a major impact on recycling quality. They can disrupt the process by causing foaming and gel formation. They also contribute to NIAS (Non-Intentionally Added Substances), which pose a safety risk to contact-sensitive materials. These are materials that may be used for packaging food, or products intended for use on the skin, such as creams or ointments. A great deal of research is being carried out into the recyclability of printed plastics. It is likely that this will lead to stricter regulations or design guidelines.

There is a growing focus on the adhesive bonding of labels and sleeves. It plays an important role in the removal of unwanted materials during the recycling of the target material. Further information on the impact of adhesives can be found in Chapter 6.

2.5 Closures and other subcomponents

The rule of thumb when it comes to recycling is always: anything that hasn't been added doesn't need to be removed.

2.5.1 General factors

Fittings and subcomponents containing substances such as PVC, PVDC, PET-G, PC, PBT, POM, silicones and/or elastomers

Both rigid and flexible closures and subcomponents with a density of $>1 \text{ g/cm}^3$ are difficult to separate from the PET of the main component using sink-float techniques. These materials often form a small part of a subcomponent, which means they cannot be detected even using NIR. When subjected to PET, some of these substances can lead to the formation of harmful substances such as BPA or benzene.

PVC and PVDC (Polyvinylchloride and Polyvinylidene Chloride)

PVC is still used as a liner in caps, as well as in shrink wrap, sleeves and tamper-evident components. Due to its excellent barrier properties, PvdC is often used as a barrier layer.

They are difficult to remove during the recycling process and cause an undesirable chemical reaction. The formation of hydrochloric acid causes damage to the recycling equipment. Benzene may also form. This is a harmful substance that poses a problem in relation to contact with foodstuffs.

PC (Polycarbonate)

PC (polycarbonate) is not only used for reusable packaging, but also for packaging components such as sleeves, decorative parts and dispensing systems for PET, PE and PP packaging.

If PC enters the PET recycling stream and is thermally degraded during extrusion, BPA may be produced. This is a harmful substance that poses a problem in relation to contact with food.

POM (Polyoxymethylene)

POM is used, amongst other things, for balls and seals in the springs of aerosol cans. If this material enters

the PET recycling stream, it may undergo thermal degradation, releasing formaldehyde, which is also a harmful substance when it comes into contact with food.

BADGE-based coatings (Bisphenol A Diglycidyl Ether)

BADGE-based coatings are BPA-based epoxy coatings. If residues of these coatings end up in the PET recycling stream, they can break down during the melting process and lead to BPA contamination of rPET. This is a harmful substance that poses a problem in relation to contact with foodstuffs

Silicones and/or elastomers

Elastomers and silicones, acrylates and other rubber-like plastics are used for components where elasticity, resilience and tensile strength are important. They are found in subcomponents as part of closures, valves and dosing systems. For example: a silicone membrane may be fitted inside the cap of a squeeze bottle to ensure the product is dispensed accurately. If these silicone components end up in the recycling process, they disrupt it. Elastomers generally cause various types of damage, such as irregularities and defects, to the surface of a product made from recycled plastic.

TPO

An exception is made for the use of a TPO (thermoplastic olefin, based on PE or PP) component, such as a dispensing valve in a PE or PP cap on a PET bottle. The cap can be easily separated from the target material, PET, in a sink-float process. TPO is a specific type of TPE (thermoplastic elastomer) that has only a limited impact on the recycling of PE and PP.

PET packaging with.....

...material based on PE and/or PP with a density of <1 g/cm³

These subcomponents are made of materials other than the dimensionally stable PET used in the main component. They must be separated from the main component during the sorting and recycling process. This is the simplest method for subcomponents made of PP or PE. If the removed subcomponents are collected, a secondary stream is created. In the case of PP and PE materials, this secondary stream can still be sold profitably by the PET recycler.

...other plastics such as PET or PE and/or PP with a density of >1 g/cm³

Materials with a density of more than 1 g/cm³ are more difficult to separate from the PET that makes up the main component. The recycler does have other techniques for separating these materials from rigid PET, but there remains a high risk that any inks or materials foreign to PET present may disrupt the recycling process. Alternative plastics cannot, therefore, be processed effectively by the recycler handling the secondary stream, which consists largely of PE and PP.

...PET snap-on lids

PET snap-on lids are not permanently attached to the main component. There is a very high likelihood that the lids will become detached from the main body during collection and sorting. In this case, a snap-on lid functions as a separate, disposable unit and should therefore be assessed as such. This means that if it is printed on, the ink used in the printing process will cause the colourless, transparent PET to discolour (see Part 1, Chapter 3).

PE/PP packaging with...

...material based on PE and/or PP with a density of <1 g/cm³

These subcomponents are made of materials other than the dimensionally stable PET used in the main component. They must be separated from the main component during the sorting and recycling process. This is the simplest method for subcomponents made of PP or PE. If the removed subcomponents are collected, a secondary stream is created. In the case of PP and PE materials, this secondary stream can still be sold profitably by the PET recycler.

...other plastics such as PET, PS, PC or PE and/or PP with a density >1 g/cm³

In the recycling of rigid PE and PP packaging, several process steps are designed to separate subcomponents, such as caps, pumps and cover films, from the main component. The materials in this category have a different density to PE and PP and can therefore be easily separated. However, the secondary stream generated by this is difficult to process further.

2.5.2 Future developments

The raw materials used in subcomponents are increasingly being taken into account when assessing the recyclability of packaging. The focus is shifting from removing unwanted materials to safeguard the main component, to using materials for subcomponents which can themselves be recycled as much as possible as a secondary stream. Adhesives are also playing an increasingly important role in this regard. We are also learning more and more about the impact of adhesives and inks on recycling. Further information on the impact of adhesives can be found in Chapter 6.

2.6 Adhesive bonding of labels, sleeves or other components

2.6.1 The impact of glued subcomponents and labels on recycling

Disposable units without adhesive-bonded components are fully recyclable. In the case of adhesive-bonded labels, sleeves or other subcomponents, an assessment must be made of the extent to which the adhesive affects the recyclability of the main component. It is not only the adhesive itself, but also the material of the components and the inks used that play a part in this.

Key factors:

- **Removability:** Subcomponents must be separated from the main component during the recycling process.
- **Dischargeability:** Any residual adhesive must be disposed of together with the subcomponents. Solvent-based adhesives that re-bond should be avoided.
- **Compatibility:** If subcomponents are recycled, the adhesive must not compromise the quality of the recycled material.

A great deal of research is being carried out into the impact of adhesives on plastics recycling. Claims regarding recyclability must therefore be substantiated by testing. The Recycle Check focuses on the removability of subcomponents, including adhesive.

2.6.2 Adhesive bonding of labels to plastic components

After sorting, the waste is cold- and/or hot-washed, shredded and cleaned with water and detergents. These steps are intended, amongst other things, to ensure that labels and flexible subcomponents, including adhesives, become detached and can be removed from the rigid main component. This also applies to labels on rigid subcomponents made of the same material as the main component, as these are also recycled.

It is essential that any adhesive residue does not re-adhere whilst drying. Adhesives that cannot be effectively removed, such as solvent-based and heat-seal adhesives, disrupt the recycling process and should be avoided.

2.6.3 Labels on cover films and non-standard subcomponents

Labels on cover films or subcomponents made of a material other than the main component do not need to be soluble or washable, as they are separated together with those components. However, it is important that these labels are made of polyolefins (PE/PP), so that they remain recyclable in the secondary stream.

2.6.4 Assessment framework for adhesive bonding to PET components

For PET components, removability is assessed in accordance with the EPBP protocol. Further information is available on the [Verpact protocols page](#).

Assessment steps for a PET main component

Adhesive bonding of subcomponents such as labels, sleeves and closures. If the steps described here are not followed, the adhesive bond is, by default, assessed as reasonably recyclable:

- Step 1** Use the specification to determine the composition of the main component, the label and the adhesive.
- Step 2** Check with RecyClass to see whether your label supplier or the adhesive used has been approved in accordance with the RecyClass or EPBP protocol.
- Step 3** If not, have the adhesive bond strength tested in accordance with the RecyClass or EPBP protocol.
- Step 4** If the test result is positive, change the answer to your question in the checklist to 'optimally recyclable'.

Assessment steps for a PE and PP main component

Adhesive bonding of labels and flexible subcomponents. If the steps described here are not followed, the adhesive bond is, by default, assessed as reasonably recyclable:

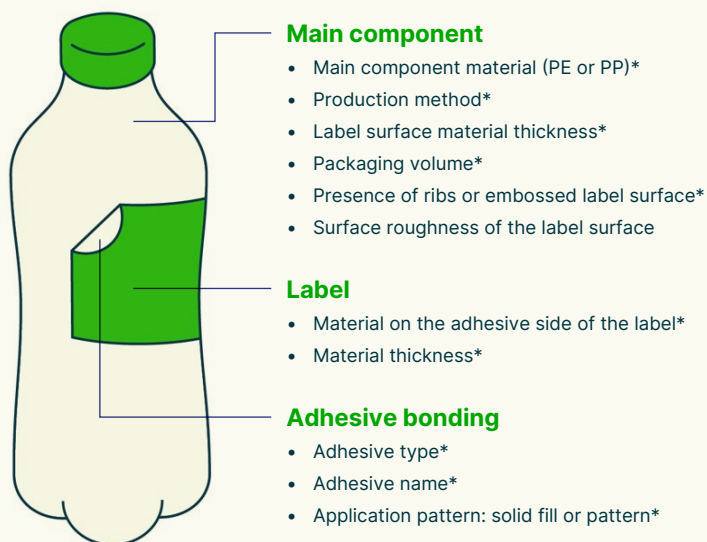
- Step 1** Step 1 Determine, on the basis of the specification, the composition of the main component, the label and the adhesive bond.
- Step 2** Determine the critical parameters for the main component, label and adhesive bond (shown in Table X)
- Step 3** Use the link on the protocols page to check whether components with the same critical parameters have already been approved.
- Step 4** If not, have the adhesive bonding tested by the NTCP or via RecyClass, or check the [protocols page](#) to see if any alternative testing bodies are listed.
- Step 5** Only if the test result is positive may the assessment of the question in the checklist be changed to *optimally recyclable*.

2.6.5 Assessment framework for adhesive bonding with PE or PP as the main component

The removability of labels and flexible components on PE and PP components must be assessed using Verpact's [label removal protocol or that of RecyClass](#). **Further information is available on the Verpact protocols page.**

Unlike with PET components, several critical parameters have been identified for PE and PP components which, in addition to the label material and type of adhesive, affect removability. When assessing whether, for the purposes of removal, reference can be made to a combination that has previously tested positive, all critical parameters must match exactly. If one or more of the parameters differs, the combination must be tested in accordance with the protocol.

13. Overview of critical parameters



* Marked parameters are critical and must be included in the test results.

Unmarked parameters are optional, but help to provide information about the removability of labels.

2.6.6 Coordination with RecyClass

To avoid duplication of effort and an unnecessary testing burden, Verpact has agreed with RecyClass that a positive test result obtained using the RecyClass protocol will also be valid for Verpact from 2027 onwards. For both the Verpact and RecyClass protocols, all critical parameters must match. This harmonisation will enable test procedures to be organised more efficiently. The most up-to-date guidelines on this subject can be found on the protocols page of the Verpact website.

Internationally, there are various bodies that issue certificates confirming the recyclability of packaging. However, it is not clear to what extent these protocols correspond to the protocol used by Verpact in the Recycle Check. For this reason, these protocols are not recognised as assessments for the Recycle Check.

2.6.7 Future developments

Verpact aims to harmonise its protocols internationally as far as possible. This is also in keeping with the nature of the PPWR. It is expected that, from 2028 onwards, European protocols will be published alongside the PPWR design guidelines. It is not yet clear to what extent these protocols differ from the Verpact and RecyClass protocols.

2.7 Additional sources of information

Relevant organisations and links

- [Verpact](#)
- [Protocols for the Recycle Check](#)
- [Fee Modulation Plastic 2.0](#)
- [Glossary](#)
- [Resources for Recycle Checks and Fee Modulation](#)
- [Weggooiwijzer disposal guide](#)

Checks and guidelines:

- [RecyClass](#)
is a partnership between recyclers and provides various tools for assessing the recyclability of plastic packaging in the European market. As well as an online tool, they publish test results and provide guidelines on design for recycling.
- [Ceflex](#)
A collaborative initiative representing the entire flexible packaging value chain.
- [Circpack](#)
Veolia's research institute, where packaging can be tested and optimised. The Veolia sorting facilities can be used for this purpose.
- [Citeo](#)
French producer responsibility organisation.
- [Cotrep](#)
French institute that draws up 'design for recycling' guidelines for plastic packaging.
- [Cyclos-HTP](#)
German institute which can test and certify packaging materials, amongst other things.
- [EPBP](#)
Establishes design for recycling guidelines for PET bottles.
- [FH Vienna campus](#)
Also carries out an annual recycling audit for the Austrian market.
- [Fost Plus](#)
Belgian producer responsibility organisation.
- [NTCP](#)
The National Test Centre Circular Plastics (NTCP) has a pilot sorting line and washing facilities that can be used to simulate sorting and washing processes. Here, it is possible to investigate how these processes and packaging concepts can be optimised.

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