

PLASTICS PACKAGING

RECYCLABILITY BY DESIGN

An essential guide for all those involved in development,
design, marketing and procurement.

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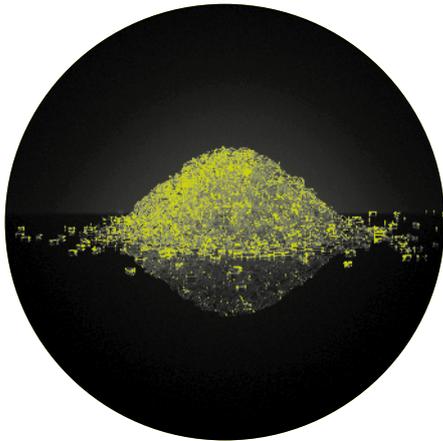


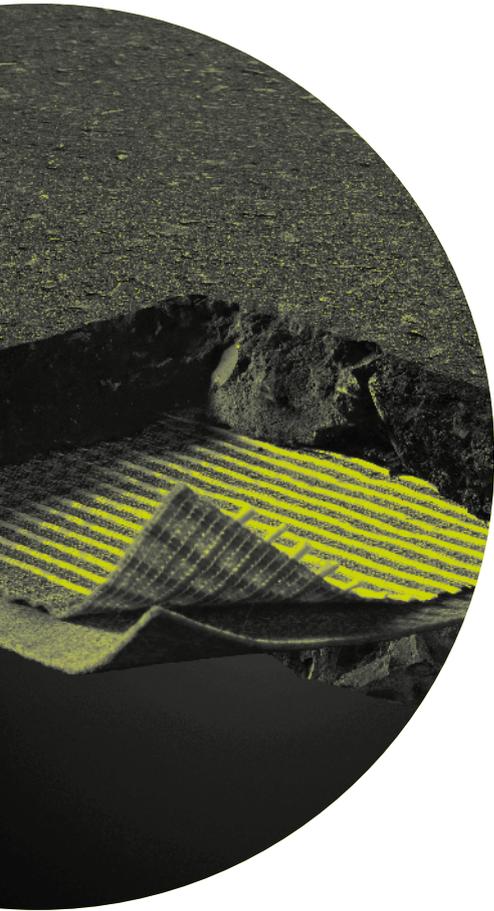
INTRODUCTION

These guidelines focus on the design of PET plastic packaging to facilitate recycling and represent a small but important aid for the journey to sustainable production and consumption in South Africa.

The advice contained in the document has been provided both to help users maintain the value of the post-used material resulting from the mechanical recycling of their packaging and to avoid significant interference with established recycling processes and material streams. This document does not attempt to provide a full strategic overview of all issues in plastic packaging recycling. PETCO acknowledges that guidance on designing for recyclability

is one component only of a larger sustainability challenge. There are wider issues of relevance, both in considering the overall environmental impact of differentiated packaging systems, and in developing efficient operational solutions to recycling and recovery of used plastic packaging. It is noted that continuing work will be required by many parties including designers, manufacturers, waste and resource management professionals and governments to address these developing issues. It is also important to note that since the packaging market is characterised by innovation, there are specific circumstances where the relationship of packaging production and recycling continues to develop.





AIMS OF “DESIGN FOR RECYCLING”:

The aim of this document is to encourage designers to consider recycling possibilities, provide guidelines for those wishing to make their packaging (more) recyclable and provide everyone with information to prevent their packaging inadvertently interfering with existing plastic recycling streams.

Pursuit of these aims must be proportionate. The guiding principle for any packaging design should be “fitness for purpose”. Thus the goal of improving the recyclability of the packaging cannot compromise product safety, functionality or general consumer acceptance and should positively contribute to an overall reduction in the environmental impact of the total product offering. Following these guidelines will also help companies demonstrate compliance linked to legislation (Waste Act 2009) and more generally, will aid demonstration of ‘due diligence.’

It will also ensure that societal expectations and company practices are matched and increase market share by promoting the environmental features of a product to the environmentally conscious consumers.

CONTEXT FOR DESIGN FOR RECYCLING

Climate change and sustainable development are two of the biggest issues facing society today. It is therefore increasingly important for companies to reduce the environmental impacts of products and services through their entire life cycle. Companies failing to address environmental performance in product design and development will find it increasingly difficult to compete in the global market. Packaging should be designed to satisfy technical, consumer and customer needs in a way that minimises environmental impact. This means, that amongst other things, packaging should be designed to use the minimum amount of resources for purpose and once it has completed its job, the scope for recovery maximised.

WHAT IS PETCO REQUESTING OF MANUFACTURERS OF PET PACKAGING?

PETCO has put these guidelines in place so that PET plastic packaging does not cause recycling issues. For existing plastics packaging, companies are asked to review their current portfolio against these recycling guidelines, highlight any aspects where the design could be improved and then implement changes as soon as possible, as the opportunity arises. For new packaging, companies are asked to integrate these guidelines into the design process at the start, to minimise cost and maximise the opportunity for compliance.

What follows is a summary of the issues to look out for.



1. PACKAGING FORM

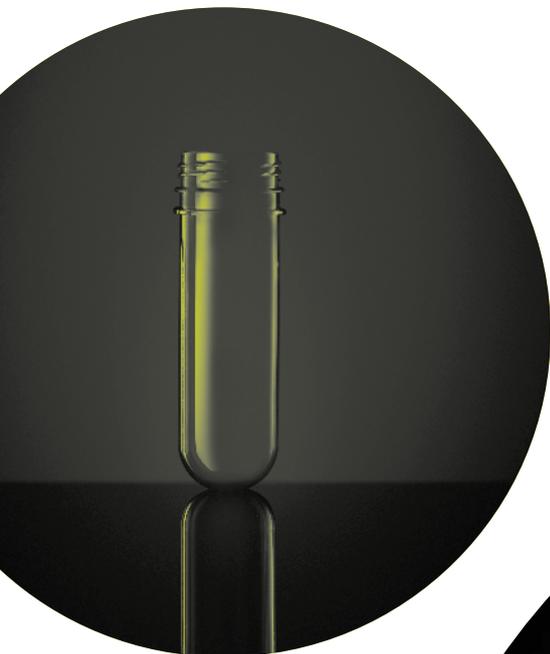
- Good packaging design can encourage reduction of content waste.
- For bottles, examples include wide necks (which also assist in washing the bottle at the recycler) or the ability to normally stand the bottle upside down with product settling at the neck, leading to minimal residue in the bottle upon disposal.



2. CHOOSING MATERIAL TYPE

Understanding the extent to which different polymers can be recycled together can improve design for recycling outcomes. The aim is to minimise the number of different plastics used, and to specify plastics that can be recycled together or easily separated in the recycling process. It is recognized, however, that to provide both the technical properties required and to satisfy user needs, sometimes a combination of different types of material is required:

- Under these circumstances, materials of different densities should be used to facilitate the separation of incompatible materials during mechanical shredding or crushing, or during the subsequent water-based washing process. Combinations of different types of plastic with the same density ranges should be avoided. PET is heavier than water and will sink.
- In the PET washing process, caps or labels manufactured from polypropylene (PP) or high-density polyethylene (HDPE) will float and can be easily removed.
- Fillers that change the density of the plastic should be avoided and/or their use minimised in general as they lower the quality of the recycled material.
- PVC contamination is a potentially major problem as the similar appearance and overlapping range of densities make the two polymers difficult to separate.
- The presence of very low levels of PVC (ca50-200ppm) in recycled PET results in measurable deterioration in chemical and physical properties and can render large amounts of PET useless for most recycling applications. For this reason, the use of PVC components of any kind with PET containers should be scrupulously avoided. These components generally include, but are not limited to closures, closure liners, labels, sleeves and safety seals.
- Use of PLA (a biodegradable material) with PET should be avoided as the polymers are incompatible and not readily separable (both have a density $> 1\text{g/cm}^3$). The presence of very low levels of PLA in PET causes haze and a deterioration of physical properties with the recycled PET. In addition, PLA causes processability problems in the drier as it melts at the drier temperature.



3. MATERIAL IDENTIFICATION



To facilitate the visual identification of plastic types during manual separation, major plastic components (container, caps, and lids) should carry a material identifier.

- The symbol should be shown clearly and ideally moulded into the container or in the case of films, lightly and repeatedly printed across the material.
- For consistency, material identifiers should generally be embossed on the base of a container. Exceptionally, the identifier can be located close to the base or printed on the label.

4.

COMPOSITE MATERIALS / BARRIER LAYERS

1. Where a composite material is necessary consideration should be given to the use of thin layers (e.g. nylon, vapour deposition).
2. Lightweight plastic laminates (especially those of thickness <100 microns) are not cost-effective to recycle.
3. EVOH can be acceptable. However, the specific requirements for acceptability are not generally achievable by recyclers and recovery rates of the PET would be low. This view is reflected in Europe and the USA and hence EVOH as a potential barrier material with PET is not recommended at this time.
4. Clear plasma coatings in general cause no recycling issues, although use of high levels of carbon should be avoided.
5. Other external coatings (e.g. O₂ or CO₂ barriers) can cause issues. To be acceptable the barrier needs to flake off the PET and be efficiently removed during reprocessing.
6. Alternatively, where performance enhancing barrier layers are used which could interfere with current recycling, for example in PET beer bottles, it is important to ensure that the container is easily distinguished and sorted from conventional PET bottles.

5.

ADDITIVES

- Inclusion of nucleating agents, hazing agents, fluorescers, scavengers and other additives for visual and technical effects should be examined on a case by case basis for their impact on the overall plastic recycling stream.
- Such additives which cause the PET to discolour and /or haze should be avoided unless means are readily and economically available to minimise their effect.

6. COLOUR OF PLASTIC

- Coloured plastic material has a much lower economic value than non-pigmented plastic.
- Designers are encouraged to consider alternatives (e.g. sleeves), if colour is necessary.
- Avoid direct printing onto PET.
- May interfere with automated sorting machinery that uses NIR spectroscopy to identify the nature of the plastic.

7.

CLOSURES / CLOSURE LINERS / CAP SLEEVES / SEALS

- Ideally should all be recyclable themselves.
- No PET closures on PET bottles, ideally PP/HDPE.
- Avoid metal caps – difficult and costly to remove.

8.

LABELS AND ADHESIVES

- Adhesive use and surface coverage should be minimised.
- Sleeves and safety seals should be designed to completely detach from the container or else they become contaminants.
- Water soluble at 60 - 80°C and hot melt alkali soluble adhesives are those of choice.
- Paper labels are not ideal and paper labels on plastic film represent a significant problem to conventional recycling.
- Labels should not delaminate in the washing process. Polyethylene and polypropylene are preferred label materials.
- Foil safety seals that leave remnants of foil and / or adhesive should be avoided.
- Use of paper labels, metallised / foil labels on film represents a significant problem to conventional recycling. These labels are costly to remove, increase contamination and, if left, significantly devalue the quality of the collected material.
- Deposition techniques that provide a very thin layer of metal (only atoms deep) are acceptable however and are the method of choice to provide a metallised effect on labels.

9. INKS

- Heavy metal inks should not be used for printing as they may contaminate the recovered plastic.
- Inks that would dye the wash solution should be avoided as this may discolour the recovered plastic diminishing its value.

10. OTHER COMPONENTS

- Use of other components of a different material (e.g. pour spouts, handles) is discouraged as they may reduce base resin yield and increase separation costs. When required compatible materials (preferably unpigmented) should be used.
- Use of RFID's on bottles labels or closures is discouraged.

11. CLOSING THE LOOP

Designers should consider the possibility of including recycled plastics in their packaging for both environmental and commercial reasons. The specification of recycled materials in the design of new products supports the recovery of plastics by providing a market for reprocessed material. Other advantages include a potential cost saving, marketing benefits and reduced environmental impact.

12.

TYPE II ISO 14021 1999 SELF DECLARED ENVIRONMENTAL CLAIMS

ISO (International Organization for Standardization) is the world's largest developer and publisher of International Standards.

This particular standard is where a claim made by the claimant itself, i.e. not certified by an independent third party. Twelve selected claims are addressed in this standard:

RECYCLABLE;
RECYCLED CONTENT;
REDUCED RESOURCE USE;
RECOVERED ENERGY;
WASTE REDUCTION;
REDUCED ENERGY CONSUMPTION;
REDUCED WATER CONSUMPTION;
EXTENDED LIFE PRODUCT;
REUSABLE AND REFILLABLE;
DESIGNED FOR DISASSEMBLY;
COMPOSTABLE AND DEGRADABLE.

SUMMARY

- Design PET containers with the recycling process in mind
- Sustainable recycling starts with a recyclable bottle
- Include rPET in your packaging
- Stimulate transparency for a recyclable bottle

YOUR INPUT PLEASE

We would like to publish locally relevant case studies as far as design for PET recycling is concerned? Please could you email us any stories that you have in this respect: membership@petco.co.za

To download the “Design For Recycling” Workshop power point presentation, click on http://www.petco.co.za/ag3nt/system/about_petco_07_media.php

QUICK GUIDE¹

		YES	CONDITIONAL	NO
BODY	Material	PET		PLA/PVC/PET-G
	Colour	Clear/light-blue/green	Other transparent colours	Opaque ² / fluorescent
	Barrier / Coatings		External Coating / PA-3 layers (eg.MXD6 3 layers / clear plasma coating	EVOH / PA monolayer blends
	Additives	PE / PP / OPP / EPS (density <1g/cm ³) / foamed PET / foamed PET-G	O ² scavengers / UV stabiliser / AA blockers / Nanocomposites	
CLOSURE	Caps	PP ³ / HDPE / LDPE		Steel / aluminium / PS / PVC / thermosets
	Liner	HDPE / PE / PP		PVC / EVA with aluminium
	Seals	PE / PP / OPP / EPS / foamed PET	Silicone ⁴ (density <1g / cm ³)	PVC / aluminium / silicone (density ≥1cm ³)
DECORATION	Direct Printing	Production or expiry date		Other direct printing ⁵
	Labels	HDPE / MDPE / KKDPE / PPOPP / EPS (density<1g / cm ³ / paper ⁶)		PVC / PS (density>1g / cm ³ / PET / metallised labels ⁷)
	Sleeves (inc. Tamper Resistance)	PE / PP / OPP / EPS (density<1g/cm ³)	PET	PVC / full body sleeves / PS (density>1g / cm ³) / PET-G / foamed PET-G
	Glue	No adhesive on body/ water-soluble adhesive or alkali		Adhesive not removed in water or alkali at 80 °C
	Ink	EuPIA good manufacturing practices		Inks that bleed and dye wash solution
OTHER COMPONENTS			HDPE / PP / uncoloured PET	PVC / RFID / non-plastic

¹ Courtesy of www.recoup.org

² Provided metalisation is 'light' metal detectors should not be triggered and recyclate acceptable.

³ PP caps are very much preferred over PE caps in USA as there is a good market for this secondary PP material stream.

⁴ Provided density is <1 g/cm³ and it has been demonstrated that cap liner does not cause any issue in conventional PET recycling facilities.

⁵ Main issue is when recycling back into bottles. Less of an issue when recyclate being reprocessed into fibre. In general fibre production is not affected with up to 500 ppm TiO₂ and mica present (average particle size less than 50microns). TiO₂ and mica-based opacifying master batches, however, significantly disrupt PET recycling into strapping and bottle applications. Opaque bottles containing these master batches are systematically removed by recyclers from the part of the coloured stream intended for strapping and bottle applications.

⁶ Acceptable provided firstly they are attached using water soluble adhesives and are not coated in a manner that prevents separation and removal during reprocessing

⁷ Experience from Mexico indicates that direct printing (generally black) at present it is not acceptable: It is very difficult to fully remove ink pigment (generally black), resulting in pinholing during reprocessing and residual solvent can also leads to yellowing.

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