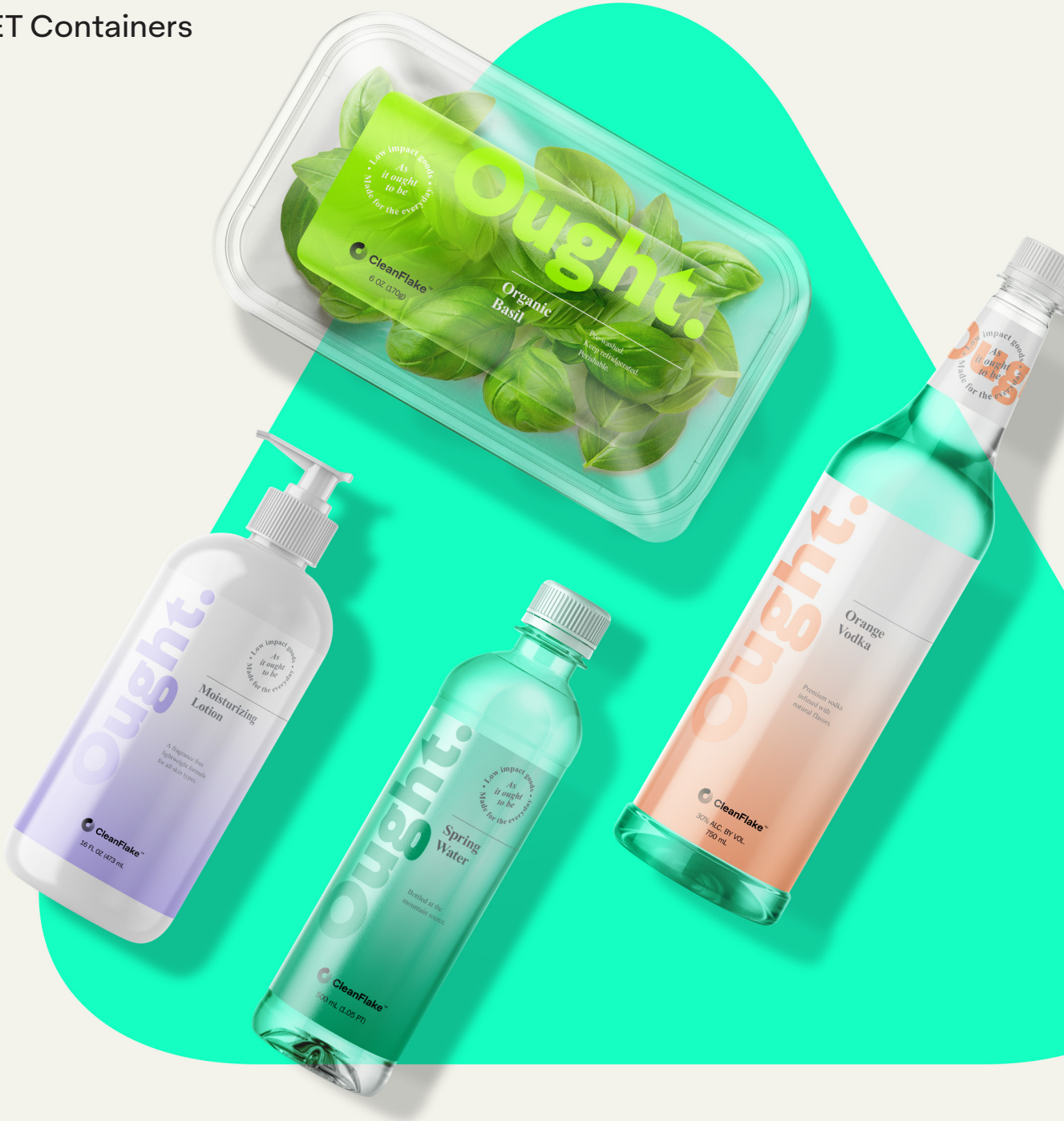
AD CleanFlake™ Technical Guide

Labeling PET Containers

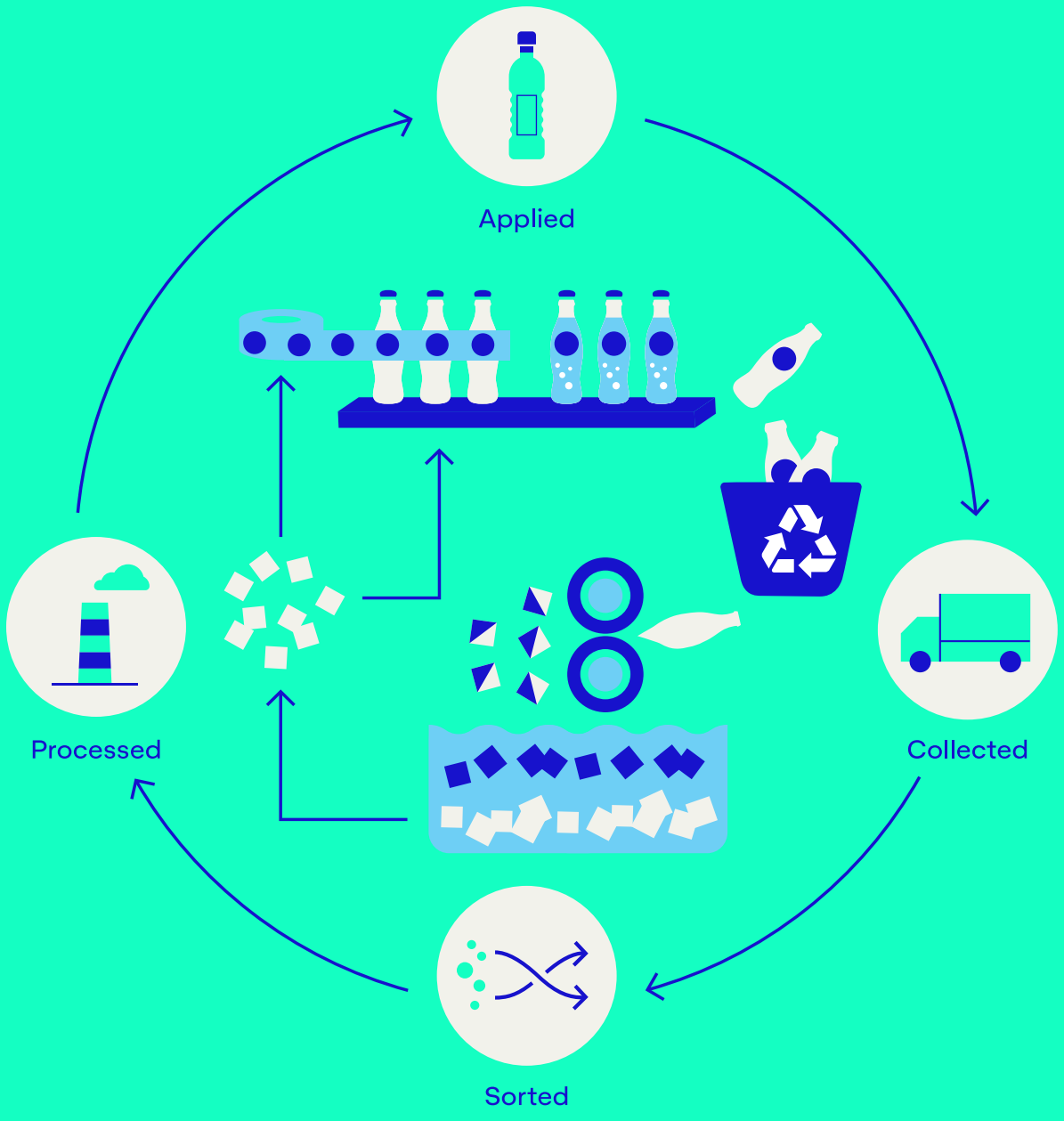


AVERY DENNISON

About AD CleanFlake™ Technology

Recycled PET (rPET) is a valuable and sustainable material, which can be recycled multiple times into new packaging. However, the challenge lies in eliminating contamination from the recycling stream. The AD CleanFlake™ Portfolio of labeling solutions significantly improves the rPET yield in the recycling process while maintaining the shelf appeal that pressure-sensitive labels are known for.
AD CleanFlake™ technology enables pressure-sensitive label materials to separate from PET containers during the recycling process, leaving no adhesive residue on the PET flake. AD CleanFlake™ is available globally and meets the highest standards of compliance in each region.

Recycling PET with AD CleanFlake™



In the second step, PET bottles and containers are sorted and washed to help reduce contamination. For PET recycling to work, there are a few main requirements the decoration or label must follow:

- Decoration allows for the PET bottle to be detected (<50 or 70% of the surface)
- Overall Density less than 1.00 g/cm3 (label+ink)
- Wash temperatures >65 degrees C
- Ink + adhesive stay on label (regional differences)

Converting AD CleanFlake™ Adhesive Technology

Converting

AD CleanFlake™ exhibits low ooze/bleeding resulting in little to no adhesive build up within the press or die cavities. When evaluating die cutting performance on a PET liner, a faint impression of each die cavity will be observed, which ensures appropriate die cutting through the adhesive to the liner.

AD CleanFlake™ Adhesive technology offers good converting performance at speeds in excess of 500+ FPM.

Note: Inconsistent die cutting and lack of impressions on the liner lead to adhesive ooze in the finished press roll and subsequently lead to 'Back Label Transfer' on converted rolls.

Inks

Inks typically have density less than 1 g/cm3 and will contribute to the increase of the total label density. To ensure residue-free separation between the label and the PET flake, as well as the floatation of the label, the final label construction, including graphic, face material and adhesive, must have a total density of less than 1 g/cm3. Based on typical ink density, Avery Dennison can provide you with a calculation to indicate an estimated final density of the printed label.

In addition, the inks and varnish need to remain on the label during the wash. Based on current regional testing*, we can recommend per printing technology:

- UV inkjet - no varnish necessary*
- UV Flexo - varnish/over lamination recommended
- Toner - varnish/over lamination recommended
- Water-based flexo - not accepted by APR (can be tested with over lamination)

* Brands, inks may differ by region, testing is always recommended/testing emulating APR or EPBP can be conducted in Avery Dennison lab

Varnishes

A varnish may be used in place of an overlaminating film, but only after thorough testing to confirm the inks cannot be separated from the base label during the recycling process and that the ink will not stain the PET flake.

Overlaminating Films

Overlaminating films are typically needed to protect the ink during the recycling process. Water-based ink systems are prone to staining of the PET flake, even when used with an overlaminating film. PP films are recommended, as they have a total density of less than 1 g/cm3. With recent market developments, there are over lamination films available as thin as 20-30 micron, both with PSA and available for adhesive application on press.

Metallized

Metal foil, metalized and metallic printed labels require testing to determine the appropriate APR recyclability category. Previously, the APR only recognized metallized labels under two square inches as complying with its critical guidance for HDPE and PET recycling. It was believed that larger metallized labels would cause a plastic bottle to be rejected by a recycler's metal detection hardware. The results of a new 2023 study confirm that metallized films can be a total of 30 square inches or below and be recognized in existing recycling streams. Avery Dennison metallized films with AD CleanFlake technology have been recognized for PET and HDPE recycling. Labels above 30 square inches require further testing. EPBP/PRE considers metallized labels detrimental to the recycling process. Using a metallized face usually results in reduction of RecyClass rating, e.g. from class B to class C when moving from a clear/white to a metallized face using the same adhesive.

Application

For beverage applications, the appropriate Air Knife System & Heat Tunnel should be situated as close to the label applicator as possible. This is to remove any over-spill and condensation from the body and shoulders of the container, with the desired goal being a dry bottle prior to labeling. There will be no change to applicator settings or wipe down mechanisms compared to general purpose adhesives on film labels with a similar liner supplied by Avery Dennison.

- Clean, dry bottle – minor humidity on the bottle will cause water whitening of the label which should disappear within 24 hours, but larger wet areas would cause the water whitening to remain. The clarity of the adhesive is very good on dry PET bottles, but where there are water droplets or excessive condensation on the PET bottles, the adhesive can become cloudy and give a milky appearance. Since the adhesive will turn white when there is water entrapment (droplets) behind the label, it is best to have bottles / containers as dry as possible prior to labeling.
- Label applicators should be clean and free of any residue, a scheduled maintenance should be set up to drive production efficiencies.
- Appropriate peel tip radius should be used, ie. film V paper.
- Peel tip angles on the applicator are typically set at 10° – 20° angles to the container.
- Ensure adequate wipe down on label to release any entrapped air/moisture during label application - wipers for film constructions to be used vs. paper.
- For the AD CleanFlake™ Clear on PET constructions, detectors are needed on the application machine for clear-on-clear film labels
- Product can be dispensed at 200+ units per minute.

Compliance with local recycling

In most of the world, recycling guidelines are evolving and collection systems are still in their early stages. Navigating this complex chain can be confusing, but AD CleanFlake™ makes complying worldwide simpler as it is designed to work seamlessly with standard PET recycling processes. Listed below is a quick overview of the main regional requirements currently available.

North America

It is often a delicate balance to conform to Association of Plastic Recyclers (APR) guidelines while maintaining critical ink, coating, design and selection requirements. AD CleanFlake adhesive technology passes the APR Critical Guidance, which recognizes those who have met both the criteria of the APR Design® Guide, as well as the strictest criteria identified in the Guidance Documents.

- It is recommended to test ink systems for suitability with the APR guidelines without negatively impacting the converting and finished label quality
- UV based inks provide the best chance of meeting the APR requirements*
- In addition to the choice of substrate, ink systems should be tested for suitability with Design Guidelines, without negatively impacting conversion or finished label quality. To ensure residue-free separation between the label and the PET flake, the final (print+label+adhesive) layer must have a total density of less than 1.0 g/cm3 at ambient temperatures.
- Because PET bottles and containers can vary with respect to ease of recyclability, specific application testing to assure performance is highly recommended.

Korea

CleanFlake meets the Ministry of Environment regulation from December 2019 for “Acceptable grade” for labeling of PET packages. Following their protocol, the label is required to wash off more than 97% under the conditions (80°C, 2% NaOH, within 10mins) and be hand-removable.

Japan

Recycling regulations in Japan require labels to be easy to remove by hand, leaving no adhesive residue on PET bottle substrate. The face film must have a density less than 1 and the label must separate without residue in 85°C hot water washing 15min, or NaOH 1.5% 85°C solution washing 15min.

EMENA

Europe has one of the most stringent and complex regulation settings of all, with Plastic Recyclers Europe (PRE), European PET Bottle Platform (EPBP), Petcore, and collection systems in the Nordics all playing a part in qualifying protocols and regulations. The main differences between approvals are driven by pack type and washing temperatures.

- PRE is a pan-EU initiative consolidating different guidelines, certification and test methods through the RecyClass tool, an online tool for evaluation of the recycling class of a final package. To receive the certification, an official request will be reviewed by the PRE technical committee. Testing would usually be directed through EPBP or Petcore
- EPBP issues the design guidelines and certifying recyclability of PET bottles.
- Petcore issues the design guidelines and certifying recyclability of other PET packages, e.g. trays
- Returpack (SE), Infinitum (NO), Palpa (FI) issues the design guidelines and manages the acceptance of packages to deposit-return systems in Nordic countries.

AD CleanFlake meets the design guidelines from PRE, EPBP, and from Petcore, which place specific emphasis on raising the output of rPET. It is also approved in the Nordics until February 2021. To ensure residue-free separation between the label and the PET flake the final label including graphic, face material and adhesive must separate from the flake during washing, leave no residue and have a total density of less than 1.0g/cm3. The ink, varnishes and other materials from the label should not contaminate the water.

PRE and APR, the US counterpart, are working in close collaboration to evaluate the differences in recycling practices and testing protocols, but also to recognize certifications from each other.

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