



# How To Know If Your Paper Packaging Is Recyclable

*Introduction To Paper Packaging Recyclability Test Methods & Specifications*

Developed in partnership with:



**GUIDE**



**RECOVERY**

*GreenBlue is an environmental nonprofit dedicated to the sustainable use of materials in society. We bring together a diversity of stakeholders to encourage innovation and best practices to promote the creation of a more sustainable materials economy.*

*The Sustainable Packaging Coalition (SPC) is a membership-based collaborative that believes in the power of industry to make packaging more sustainable. We are the leading voice on sustainable packaging and we are passionate about the creation of packaging that is good for people + the environment. Our mission is to bring packaging sustainability stakeholders together to catalyze actionable improvements to packaging systems and lend an authoritative voice on issues related to packaging sustainability. The Sustainable Packaging Coalition is a trademark project of GreenBlue Org.*

## **How To Know If Your Paper Packaging Is Recyclable**

*Introduction To Paper Packaging Recyclability Test Methods And Specifications*

*January 2023*

*Version 1.0*

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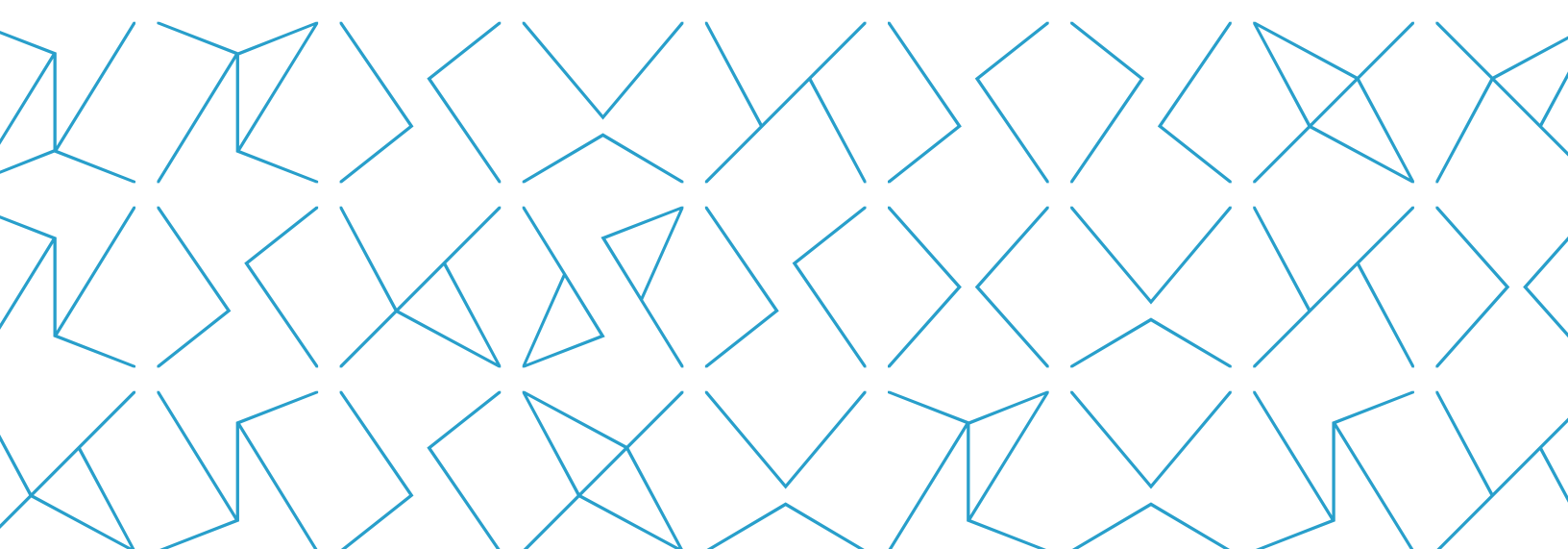
**SUSTAINABLE PACKAGING COALITION®**



**American Forest & Paper Association**



**FIBRE BOX ASSOCIATION®**





## INTRODUCTION

*In today's sustainability climate, many companies are evaluating the benefits of fiber-based packaging as an alternative to other materials. This is driving the development of innovative uses for fiber-based packaging in niches such as flexible packaging, for purposes including beverage containers, food packaging, and many more. Recyclability testing helps drive this innovation by providing guidance on what new fiber-based packaging will meet recyclability needs.*

*Likewise, innovative new technology and investments in paper mills and package manufacturing plants facilitate meeting the increased demand for fiber-based packaging. Recyclability testing helps connect the packaging that is being designed with the material needed to make new recycled products. Mixed paper, for example, is a source of fiber for recycled paper mills that has seen an increase in value and demand in the marketplace. Recyclability testing is a tool that helps the traditional recycling stream connect the dots from packaging design to processing and ultimately end markets.*





## WHAT MAKES A PACKAGE RECYCLABLE?

A package must pass efficiently through four key steps to be considered recyclable: collection, sortation, reprocessing, and end markets.<sup>1</sup> Collection is the infrastructure for collecting and transporting packaging for sorting. Sortation is separating packaging from other discarded materials and organizing the packaging material in bales, usually at a Material Recovery Facility (MRF). Reprocessing is when the bales of packaging are turned into new paper or board. And, finally, end markets are the demand for the paper or board to make new products.

While simple in theory each of these stages has its own complexities and challenges. Some questions include:

1. *How might we ensure access to recycling and how do we increase collection?*
2. *How might we design packaging so it can be easily sorted at the MRF? And how do we design MRFs so they can easily sort paper-based packaging?*
3. *How might we design packages so they are easier to reprocess?*
4. *How might we better understand demand drivers for recycled fibers?*

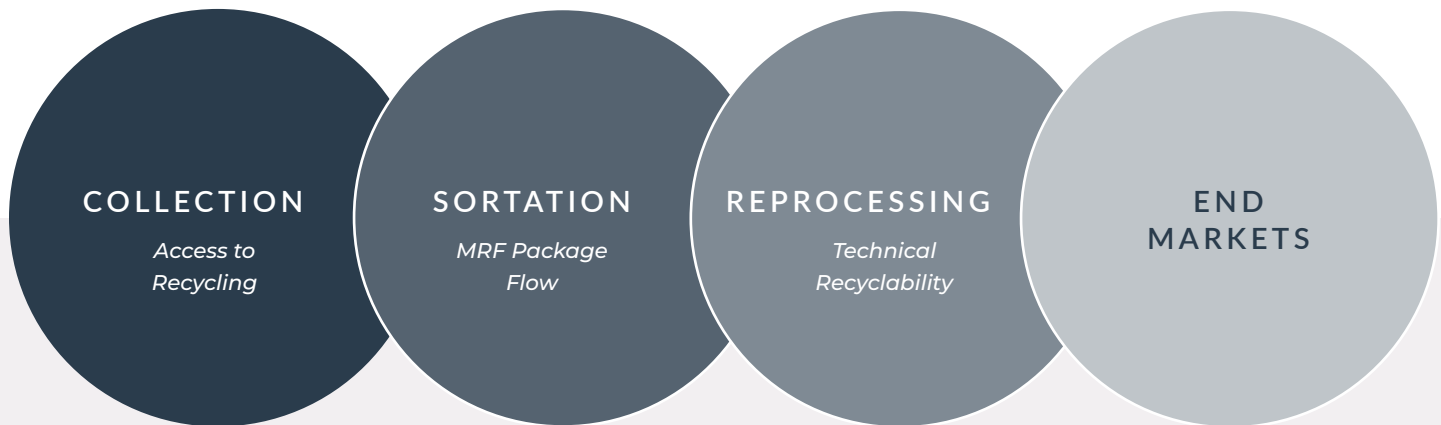


Figure 1: Four Stages of Recycling<sup>2</sup>

Remember, all four of these steps are required if a package is truly considered recyclable: collection, sortation, reprocessing, and end markets. The ultimate goal is to have packaging flow successfully through each of these four steps and be ready to be collected again. And thus, achieving a circular flow. For the purposes of this Introduction, we are focusing on step 3, reprocessing.

Laboratory and pilot testing can be used to determine the likelihood that a package will be successfully reprocessed and turned into new products by measuring several indicators, including: repulpability, fiber yield, and presence of contaminants. While collection, sortation and markets are important, the goal of this “Introduction to Recyclability Test Methods and Specifications” is to help provide a basic understanding of the reprocessing step of recyclability testing. This includes how testing works and how it can be used to help determine sustainable packaging decisions.

1. [how2recycle.info/guide](https://www.how2recycle.info/guide)  
 2. [how2recycle.info/guide](https://www.how2recycle.info/guide)

There are several efforts underway to update recyclability testing, test methods, and specifications for products that are not already part of the traditional recycling stream. For example, a collaborative effort between the Fibre Box Association (FBA) and American Forest & Paper Association (AF&PA) is currently underway to update the OCC-equivalent protocol and develop a new protocol for mixed paper. A working group of TAPPI is refining a recyclability test method first developed by TLMI.

The hope is that this background information can help bring more people into the discussions by answering fundamental questions about recyclability testing. And, maybe most importantly, leverage a collective understanding of recyclability testing to help drive the development of more recyclable packaging.

## KEY TERMS

**Recyclability** means the ability of a paper-based product to be recycled into new paper, paperboard, or other products. A paper-based product is recyclable if it can be collected, separated, or otherwise recovered from the waste stream through recycling programs for use in manufacturing or assembling another item.<sup>3</sup>

**Repulpability** is a procedure which determines whether paper packaging can undergo the operation of re-wetting and fiber separation for subsequent product formation.<sup>4</sup>

**Test Method** is a definitive procedure that produces a test result. The test method can be thought of as the “directions” or “how-to” guide for the testing process.<sup>5</sup>

**Traditional recycling streams** refers to paper-based packaging that are sorted at MRFs and recycled at paper mills on a routine basis. This paper-based packaging does not require testing or certification to be accepted into the recycling stream.

**Specification** refers to a set of documented requirements to be satisfied. The specification can be thought of as the intended results that can be measured, scored, or designated pass/fail.<sup>6</sup>

The **Fibre Box Association (FBA) Voluntary Protocol** and the **Confederation of European Paper Industries (CEPI) recyclability laboratory test method** describe the two most widely used test methods for recyclability testing of corrugated packaging or paper and board products in the United States and Europe, respectively.<sup>7</sup>

3. <https://www.afandpa.org/statistics-resources/afpa-design-guidance-recyclability>

4. [www.fibrebox.org](http://www.fibrebox.org)

5. <https://www.astm.org/form-style-for-astm-stds.html>

6. <https://www.astm.org/form-style-for-astm-stds.html>

7. <https://www.fibrebox.org/>; <https://cepi.net/>



## WHAT IS THE GOAL OF RECYCLABILITY TESTING?

*The simple goal of recyclability testing is to predict if a package can be converted to usable fiber at paper mills without causing any operational problems. Providing a quick, reliable, repeatable and reproducible test of recycling has a number of important benefits throughout the supply chain. Board and paper producers can make production and composition choices to improve recycling. Packaging designers can use these results to inform their choices of materials and methods that will favor recycling. Labeling on packaging relies on recyclability testing as a tool for establishing new recycling streams to ensure truth in labeling and adhere to legal definitions and the conventions of established recycling streams. Brands can use recyclability to set and meet their circularity goals by selecting packaging most likely to be recycled.*





## HOW DOES PAPER RECYCLABILITY TESTING WORK?

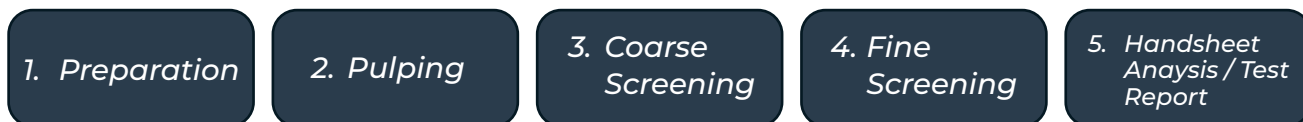
There are two key parts to recyclability testing: test method and result thresholds. The test method defines exactly how the testing procedure will be conducted to obtain reproduceable results. The specific result thresholds provide guidance for analysis of test results. For example, a test method could describe the method for determination of fiber yield, and results would indicate that if the yield is higher than a particular value, the material in question is recyclable. A combination of a sample preparation method, test method, given result thresholds, and process of submitting results for certification is often called a protocol.

There are many recyclability test methods that have been developed, e.g., Fibre Box Association (FBA)<sup>8</sup>, Confederation of European Paper Industries (CEPI)<sup>9</sup>, Tag and Label Manufacturers Association (TLMI)<sup>10</sup>, among others. Most of these methods have been developed based on collaborations with typical recycling facilities. And they are designed to represent the majority of mill operations. While each test method has differences (explained more in the FAQ), all of them generally consist of four main steps, (1) preparation, (2) repulping, (3) screening, and (4) analysis.

Samples are obtained during the first three stages and used for analysis. Typical measurements and observations include repulping residue, moisture content, reject mass, flake mass, visual appearance of handsheets, and stickies. Definitions of these measurements are included in the glossary.

Recyclability testing can provide an analysis of many key indicators but includes, at the very least, these six:

1. *Extent to which the fibers can be separated*
2. *Visual appearance when formed into sheets*
3. *Level of rejects from screening*
4. *Level of disrupting materials (i.e., adhesives, metals, plastic film)*
5. *Level of dissolved or colloidal solids resulting from non-paper components (optionally)*
6. *Strength(s), which vary depending on the intended end products.*



8. [www.fibrebox.org](http://www.fibrebox.org)

9. [www.cepi.org/wp-content/uploads/2021/02/REC-21-002.pdf](http://www.cepi.org/wp-content/uploads/2021/02/REC-21-002.pdf)

10. <https://tlmi.com/s/RCA-Laboratory-Testing-Protocol.pdf>

# THE PROCESS: STEP-BY-STEP

## STEP 1: SAMPLE PREPARATION

The first step in recyclability testing is to prepare a sample that is representative of the product for which a recyclability claim is being tested, and a control sample of known similar material already considered recyclable to which the test sample can be compared. To be representative, a test sample includes a quantity of material or product that is sufficient to carry out all the measurements indicated by the test method. This quantity is often determined by the equipment being used in the particular protocol. Specific minimum quantities and other sample preparation requirements are outlined in more detail in the table comparison. Samples are often prepared by shredding, cutting, or other size reduction methods.

## STEP 2: PULPING

In the pulping stage the test sample material is mixed with water and separated to a suspension of fibers in water. Major variables that are controlled include temperature, pH, consistency, and pulper design. The amount of the original material that remains as large pieces and is not fiber is often added to the coarse screen rejects, see the next step.

Adhesion and visual homogeneity tests may be conducted on handsheets made from the resulting pulp. Handsheets are made from the suspension of fibers in water. Each sheet is formed separately by draining the pulp suspension on a wire mesh. A handsheet is a paper circle or rectangle used for analysis and making measurements.

## STEP 3: COARSE SCREENING

Screening is the process of removing impurities and fibers that were not completely pulped. Coarse screening, which often uses holes, is the first stage in screening, and the materials that do not pass through the course screen are called course rejects. Some methods skip this step. Typical variables that are controlled include temperature, hole size, slurry agitation and screening time. The objective is to achieve fibers nearly free from rejects.<sup>11</sup> Please refer to Table 1 for more information

The dry mass of coarse rejects is a principal measurement which is often reported as a percentage. The specifications associated with several of the methods require that fiber yield, (the accepts) must be at least 80% fiber from the sample added to the pulper. Adhesion and visual homogeneity tests may be conducted on handsheets made from the accepts of the pulp.



*Shredded sample*



*Early in the pulping process*



*Testing screen*

11. <http://www.ecopaperloop.eu/outcome/2.3.2.a%20-%20Guideline%20Document-Recyclability-Engl.pdf>

## STEP 4: FINE SCREENING

Fine screening entails passing coarse screened pulp through another screen with smaller openings, typically slots. With slot widths only slightly larger than typical pulp fibers, fine screens are used by mills to remove most contaminants. Typical variables that are controlled include temperature, slot size, slurry agitation and screening time. Accepts from the fine screening are used to make handsheets that are submitted to a range of screen sizes and variety of tests. The measurements include mass of rejects, stickies, strengths, and visual homogeneity of handsheets.

## STEP 5: ANALYSIS OF HANDSHEET / TEST REPORT

The test results are collected in a report. This report can include a number of results, but almost always includes:

- *Reference to the standard being used*
- *Identification of equipment used, if options are allowed in the standard*
- *Description of the paper-based material*
- *Type of software/equipment used for image analysis*
- *Photographic documentation*
- *Results of test according to specification, including:*
  - *Flakes, residues and adhesives, etc. present*
  - *Dissolved and colloidal solids %*
  - *Pass/fail of the tests*
- *Name (and signature) of the test lab and responsible manager and date of the test*
- *Ash content*
- *Fiber yield as well as the accepts and/or rejects*
- *Handsheet observations*

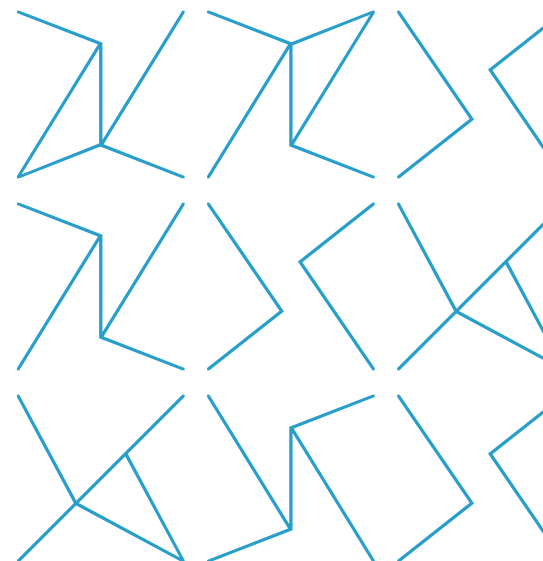
The test report may also include more information, any specific comments, and further documentation regarding the results. The minimum requirements for the technical data sheet to be provided to the laboratory according to the Cepi Recyclability Laboratory Test Method is included below. For more information on the FBA Voluntary Standard please contact [www.fibrebox.org](http://www.fibrebox.org) or visit the Voluntary Standard online.<sup>12</sup>



*Fine Screen Running*



*Pulp on handsheet mold*





## E) Technical data sheet

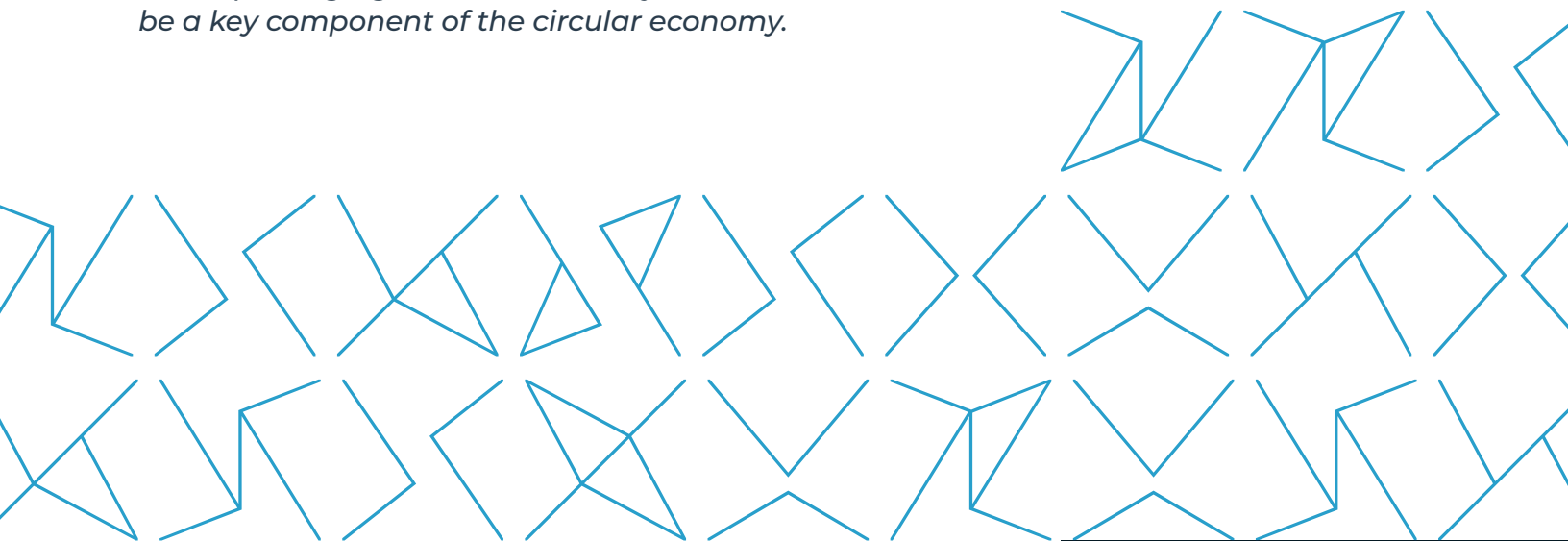
### MINIMUM REQUIREMENT FOR TECHNICAL DATA SHEET TO BE PROVIDED TO THE LABORATORY

SECTION A - GENERAL DATA		UNIT
A1	Company name	text
A2	Product name	text
A3	Description of the material/product and its function	text
A4	Is it a base paper material or is it a finished product?	material/product
<b>SECTION B - PRODUCT DETAILS</b>		
<b>Fill section B only if it is a product</b>		
B1	Dimensions of the product Width and tolerance	mm
B2	Dimensions of the product Length and tolerance	mm
B3	Dimensions of the product Height and tolerance	mm
B4	Weight of the product (emptied if it is a packaging) and tolerance	g
B5	Is it a used product (e.g. is it a packaging already filled and then emptied)?	yes/no
<b>SECTION C - PAPER BASED MATERIAL DATA</b>		
<b>Fill section C if it is a material or if it is a product. Duplicate this section if the product is composed of more than one paper based material</b>		
C1	Composition and characteristics of the paper based material	Grammage and tolerance
C2	Composition and characteristics of the paper based material	Thickness and tolerance
C3	Composition and characteristics of the paper based material	µm
C4	Composition and characteristics of the paper based material	Presence of a coating
C5	Composition and characteristics of the paper based material	Presence of fillers
C6	Composition and characteristics of the paper based material	Presence of wet strength polymers
C7	Composition and characteristics of the paper based material	Presence of artificial fibres
C8	Composition and characteristics of the paper based material	Is it printed, varnished, lacquered, etc.?
C9	Composition and characteristics of the paper based material	Description of the material (e.g. PE, PLA, etc.)
C10	Composition and characteristics of the paper based material	Grammage and tolerance
C11	Composition and characteristics of the paper based material	Thickness and tolerance
C12	Composition and characteristics of the paper based material	Description of the material
C13	Composition and characteristics of the paper based material	Grammage and tolerance
C14	Composition and characteristics of the paper based material	Thickness and tolerance
C15	Composition and characteristics of the paper based material	Grammage
		µm
		Thickness
<b>SECTION D - GLUE</b>		
<b>Fill section D only if it is a material or a product. Duplicate this section if the product includes more than one glue</b>		
D1	Presence of glue, if any	text
D2	Describe the type of glue	text
D3	Describe the use of the glue	text
	Weight and tolerance of the glue	g
<b>SECTION E - NON-PAPER BASED COMPONENTS</b>		
<b>Fill section E only if it is a product. Duplicate this section if the product includes more than one non-paper based material</b>		
E1	Other non-paper components (e.g. staples, labels, handles, etc.)	text
E2	Describe the component	g
E3	Weight and tolerance of the component	yes/no
<b>SECTION F - OTHER REMARKS</b>		
F1	Other remarks	text
<b>SECTION G - DATE OF PRODUCTION</b>		
G1	Date of production of the sample provided to the laboratory	dd/mm/yyyy

View Full Technical Data Sheet

## KEY TAKEAWAYS

- 1. Recyclability testing can be a guide for how paper packaging is designed, evaluated, and labeled. A more engaged and collaborative supply chain working with a shared understanding of recyclability testing can have enormous benefits.*
- 2. All Material Recovery Facilities (MRFs) and paper recycling mills are built differently and are unique in their own ways. A test method is designed to be the best possible indicator of whether packaging can ultimately be recycled at a paper mill. Traditional streams have this collaborative aspect built into them.*
- 3. There are a number of efforts underway to update recyclability testing, test methods, and specifications for new and/or innovation applications. These are important developments as paper packaging evolves along with the technology available for sorting and reprocessing.*
- 4. Recyclability test methods in the United States and Europe differ to some degree and sometimes provide different thresholds resulting in different pass/fail results for the same paper package (see FAQ 3,7). More harmonized standards would benefit package designers and other stakeholders.*
- 5. While much of the paper packaging recyclability testing process is technical in nature, the outcome of this process is designed to facilitate use of the inherent benefits of fiber-based packaging: a renewable, recyclable resource that can be a key component of the circular economy.*



# FREQUENTLY ASKED QUESTIONS

## 1. WHAT ORGANIZATIONS HAVE DEVELOPED RECYCLABILITY PROTOCOLS?

**Confederation of European Paper Industries** (CEPI) is the European association representing the paper industry. CEPI offers a wide range of renewable and recyclable wood-based fiber solutions to EU citizens: from packaging to textile, hygiene and tissue products, printing and graphic papers as well as specialty papers, but also bio-chemicals for food and pharmaceuticals, bio-composites and bioenergy. CEPI's Harmonized European laboratory test method represents the paper manufacturing and converting industry jointguidance on paper-based packaging recyclability at the European and national level<sup>13</sup>

**Fibre Box Association** (FBA) is a non-profit trade association that represents North American corrugated packaging manufacturers and strives to grow, protect and enhance the overall well-being of the industry by providing member-valued programs and services. FBA, along with a joint committee including the American Forest & Paper Association (AF&PA), developed the FBA Voluntary Standard for repulpability and recyclability.<sup>14</sup>

**Papiertechnische Stiftung** (PTS) is the research and service institute of the German paper industry, supporting companies in the paper producing and processing sector as well as other sectors (e.g., energy, automotive, food) in the development and application of modern fiber-based solutions. PTS performs the Harmonized European test method and has developed two test methods, PTS-RH 021- Cat I tissue, graphic, and white paper; and PTS-RH 021:2012 Cat II for packaging products, OCC, paperboard, and brown papers.<sup>15</sup>

**Tag and Label Manufacturers Institute** (TLMI) is a member-driven association strongly committed to providing business solutions that enhance the prosperity of its members and the narrow web tag, label, and packaging industries. TLMI manages the laboratory testing protocol for paper labels coated with Recycling Compatible Pressure Sensitive Adhesives (RCA) for the testing and qualification of post-consumer recycling compatible paper label products and pressure sensitive adhesives (PSA's) intended for use on paper-to-paper label products. By meeting the RCA specification, an adhesive supplier or converter can qualify either an adhesive or an adhesive-coated paper product as recycling compatible.<sup>16</sup>

## 2. WHO PROVIDES REPULPABILITY AND RECYCLABILITY TESTING?

There are many laboratories and pilot mills that are certified for testing by the organizations that develop and publish recyclability protocols (FBA, CEPI, etc.). The laboratories and pilot mills can be associated with academic institutions, technical associations, specialized labs, and paper mill and converting companies. For more information about labs certified to conduct recyclability testing, please reach out to the applicable organization (FBA, CEPI, PTS, etc.). For on-pack labeling organizations like How2Recycle, please reach out directly for a list of accepted protocols and vetted labs available for recyclability testing.<sup>17</sup>

13. <https://www.webctp.com/>

14. <https://www.cepi.org/>

15. <https://www.fibrebox.org/>

16. <https://www.ptspaper.de/de/>

17. <https://tlmi.com/>



### 3. WHAT ARE THE MAIN DIFFERENCES BETWEEN AVAILABLE TEST METHODS IN NORTH AMERICA AND EUROPE?

As shown in the Comparison Table and in the list below, there are differences between test methods in North America and Europe. The different test methods are designed to best simulate the industrial recycling processes in each of these two regions, as well as the different processes used to manufacture different types of paper. The divergences are often associated with the equipment and technology being used, which in turn influences what information is communicated in a final evaluation.

For more specific information, please reference the Comparison Table.



**NORTH AMERICA**



**EUROPE**

<p><b>SAMPLE MATERIAL &amp; EQUIPMENT</b></p>	<ul style="list-style-type: none"> <li>• Widely varying amounts of sample material</li> <li>• Require large sample sizes for a mix of table-top lab equipment and large-scale operating equipment</li> <li>• FBA protocol includes a reverse cleaner and no de-inking</li> </ul>	<ul style="list-style-type: none"> <li>• Use table-top lab equipment and therefore require a smaller sample size</li> <li>• PTS protocol for Cat. 1 includes deinking but no reverse cleaner</li> </ul>
<p><b>OPERATING CONDITIONS</b></p>	<ul style="list-style-type: none"> <li>• Every test method varies in temperature, pulper consistency, time in pulper, screen size, and various other conditions</li> </ul>	
<p><b>OPERATIONAL IMPACT</b></p>	<ul style="list-style-type: none"> <li>• Often evaluates operational impact during testing</li> </ul>	<ul style="list-style-type: none"> <li>• Often <b>DOES NOT</b> Evaluate operational impact during testing</li> </ul>
<p><i>*For instance, if the pressure screens must be dismantled during testing under the FBA OCC protocol, the material fails.</i></p>		
<p><b>PHYSICAL PROPERTIES</b></p>	<ul style="list-style-type: none"> <li>• Measure physical properties of paper made from the final accept pulp at the end of the process. FBA OCC method, burst strength, slide angle, and other properties are measured and compared to the control.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>DO NOT</b> Measure physical properties of paper made from the final accept pulp at the end of the process. FBA OCC method, burst strength, slide angle, and other properties are measured and compared to the control.</li> </ul>
<p><b>STICKIES</b></p>	<ul style="list-style-type: none"> <li>• European tests usually do not test screened pulp for stickies, rather the test is usually designed for fine screen rejects large in size which often excludes PSAs. Also, test conditions, temperature, and pressure are very different between the two regions.</li> </ul>	
<p><b>OPTICAL PROPERTIES</b></p>	<ul style="list-style-type: none"> <li>• Often evaluate color and brightness of the accepts vs. the control at the end of the testing process</li> </ul>	<ul style="list-style-type: none"> <li>• Assess optical homogeneities</li> </ul>
<p><b>YIELD</b></p>	<ul style="list-style-type: none"> <li>• FBA OCC-E test method measures yield as fine screen accepts / (rejects + accepts)</li> </ul>	<ul style="list-style-type: none"> <li>• PTS test methods measure yield as (initial material – rejects) / initial material</li> </ul>

## WHAT ARE THE MAIN DIFFERENCES BETWEEN AVAILABLE SPECIFICATIONS IN NORTH AMERICA AND EUROPE?

Specification systems, like test methods, also have important regional differences. The specification is the documented requirement to be satisfied (i.e., is this recyclable). In North America, most protocols use a Pass/Fail specification system. In Europe, ranking or grading specification systems are used. Due to the differences in the system and in the methods themselves, comparing results from the two continents can be difficult.

For more specific information, please reference the Comparison Table.



**NORTH AMERICA**



**EUROPE**

<b>YIELD</b>	<ul style="list-style-type: none"> <li>Due to the different specification systems described above, the same package can be rated as recyclable under some European protocols while failing recyclability testing in North America.</li> </ul>	
	<p><i>*For example, an OCC product with a 75% yield could be ranked “Yellow” (Recyclable but needs design change) under the European CEPI protocol while the same product would fail the North American FBA OCC yield specification.</i></p>	
<b>OPERATIONAL IMPACT &amp; PHYSICAL PROPERTIES</b>	<ul style="list-style-type: none"> <li>Because European protocols do not test for operational impact or physical properties, specifications do not exist for comparison to North American protocols.</li> </ul>	
<b>STICKIES</b>	<ul style="list-style-type: none"> <li>Specifications more stringent on products that show a high sticky count during testing</li> </ul>	<ul style="list-style-type: none"> <li>Specifications more lenient on products that show a high sticky count during testing</li> </ul>
	<ul style="list-style-type: none"> <li>Test conditions, temperature, and pressure are very different between the two regions</li> </ul>	
<b>OPTICAL PROPERTIES</b>	<ul style="list-style-type: none"> <li>Because each protocol evaluates different optical properties, if they evaluate them at all, specifications are difficult to compare.</li> </ul>	

## WHAT ARE THE NEW TEST METHODS AND SPECIFICATIONS BEING DEVELOPED IN NORTH AMERICA?

There are a few recyclability test methods for paper-based packaging being developed or updated in North America today. This reflects several industry trends, including more companies moving from disposable plastic to fiber-based packaging and as a result, new and innovative packaging being developed. Equally, the demand for more recovered paper-based packaging has fueled increased demand for recovered mixed paper in North American markets. And effects of the China import ban prompted investment and innovations in paper manufacturing which in turn have facilitated the use of recovered mixed paper.

More specifically, the FBA and AF&PA are currently working to update the OCC-equivalent protocol, and in conjunction, are developing a Mixed Paper protocol for use with paper products more likely to sort into mixed paper bales in MRFs. The current timing for this OCC-protocol to be finalized is during the first half of 2023.

A TAPPI working group has also been formed to create a Recyclability Test Method. Starting with the TLMI RCA test method, modifications will provide reproducible results for yield and stickies removal. A draft method has been circulated and is currently being considered by cooperators. An initial round of repeatability testing, using reference materials, will be completed in the first quarter of 2023, with a release of a provisional method. Because the process of approving an official test method is complex, the final method will likely be released in 2024.

# RECYCLABILITY PROTOCOLS TABLES

Table 14.1

GENERAL INFORMATION				
Protocol	Region	Target Stream	Sample Needed	Specification System
<i>FBA OCC - Repulpability</i>	<i>N. America</i>	<i>OCC</i>	<i>200g</i>	<i>Pass/Fail</i>
<i>FBA OCC - Recyclability</i>	<i>N. America</i>	<i>OCC</i>	<i>&gt;100lb (Based on size of pulper at lab)</i>	<i>Pass/Fail</i>
<i>TLMI</i>	<i>N. America</i>	<i>Mixed Paper</i>	<i>360g</i>	<i>Pass/Fail</i>
<i>CPI</i>	<i>EU</i>	<i>Various</i>	<i>50g</i>	<i>Grading (A+, A, B or C)</i>
<i>PTS CAT I</i>	<i>EU</i>	<i>Graphic Print Products</i>	<i>800g</i>	<i>Green (recyclable), Yellow (recyclable but needs design change), Red (not recyclable)</i>
<i>PTS CAT II</i>	<i>EU</i>	<i>OCC &amp; SBS</i>	<i>250g</i>	<i>Green (recyclable), Yellow (recyclable but needs design change), Red (not recyclable)</i>

Table 14.2

TEST METHOD					
Protocol	Yield	Operational Impact	Physical Properties	Stickies	Optical Properties
<i>FBA OCC - Repulpability</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>No</i>
<i>FBA OCC - Recyclability</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>
<i>TLMI</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>
<i>CPI</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
<i>PTS CAT I</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
<i>PTS CAT II</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>



# RECYCLABILITY PROTOCOLS TABLES

Table 15.1

SPECIFICATION (TO PASS)					
Protocol	Yield (Accepts)	Operational Impact	Physical Properties	Stickies	Optical Properties
<i>FBA OCC - Repulpability</i>	>85% based on dry fiber charge to pulper	No cleaning needed for screens during test and no visible "deposition" or disintegrator or pulper	N/A	N/A	N/A
<i>FBA OCC - Recyclability</i>	>85% based on dry fiber charge to pulper	No cleaning needed for screens during test and no visible "deposition" or disintegrator or pulper	Yes	Yes	N/A
<i>TLMI</i>	N/A	N/A	N/A	<10 PPM	N/A
<i>CPI</i>	>98%, >90%, >80%, >60%	N/A	N/A	<2.5, <10, <20, <50 (mm <sup>2</sup> /kg)	Absent, medium, weak (see visual below)
<i>PTS CAT I</i>	Green >95%	N/A	N/A	Green: none, Yellow: slight damage from adhesion test	Green: none, Yellow: slight optical inhomogenities
<i>PTS CAT II</i>	Green >80%, Yellow >50%	N/A	N/A	Green: none, Yellow: slight damage from adhesion test	Green: none, Yellow: slight optical inhomogenities

Please note that the SBS-E protocol is not included in this comparison because the protocol is not publicly available. The SBS-E protocol was developed by Western Michigan University and is similar to the OCC-E method with a few differences such as testing against an SBS control and the addition of brightness and color comparison testing.

## GLOSSARY OF TERMS

**Adhesive:** means any product that is used to bond one surface to another by attachment. Adhesive bonding is a process that adheres two surfaces permanently together by application of an adhesive material. There is a wide variety of adhesives available, the specific variety for a particular end-use being dictated primarily by cost, the nature of the substrate, and the specific end-use requirements. There are three general classes of adhesive: water-based, hot-melt, and solvent-based.<sup>18</sup>

**Ash Content:** describes the inorganic content after incineration (525 °C) of the solid stock material which passes the coarse screening step.

**Bleaching:** any process that chemically modifies pulp to increase its brightness. The principal pulp bleaching agents are chlorine dioxide, hypochlorite, peroxide, chlorite, oxygen and ozone.

**Deinking:** Process used to remove printing inks and and achieve a bright final pulp. Deinking consists of two stages: 1) detachment of inks form the fibers in the pulper, usually with the help of chemical additives (sodium hydroxide, sodium silicate, hydrogen peroxide, soap); and 2) separation of detached ink particles by deinking (in flotation cells or in certain cased in washers).

**Deflaking:** Process used to separate fiber bundles (“flakes”) into individual fibers and refiners to develop mechanical properties.

**Fiber-on-fiber yield (Fibre Box Association):** the amount of fiber that remains after the processing action, expressed as a percentage of the fiber present in the material to be tested.<sup>19</sup>

**Handsheets:** are sheets made from a suspension of fibers in water in an operation, whereby each sheet is formed separately by draining the pulp suspension on a stationary sheet mold.

**Pulping:** A process that extracts fibrous material, cellulose, from wood or other raw material as a prelude to papermaking. The purpose of pulping is to liberate cellulose fibers from other chemicals and impurities in the wood (or other fibrous source).<sup>20</sup>

**Recyclability:** Design, manufacture, and converting or paper- and board-based products in such a way as to enable a high quality recycling of fibers and minerals in a manufacturing process in compliance -- where appropriate -- with current standards in the community: as a minimum, recyclability requires that sufficient information is exchanged for appropriate risk.

18. <http://printwiki.org/Adhesive>

19. [www.fibrebox.org](http://www.fibrebox.org)

20. <http://printwiki.org/Pulping>

**Recyclable (Fibre Box Association):** means used paper, including in-plant and post-consumer waste paper and paperboard, which is capable of being processed into new paper or paperboard using the process defined in this standard management and safe re-use of fibers.

**Repulpable (FBA definition):** Repulpable means the test material that can undergo the operation of re-wetting and fiberizing for subsequent sheet formation, using the process defined in the FBA Voluntary Standard standard.

**Screening (Fine):** used most often after coarse screening to determine the fine reject present in the accept after the coarse screening.

**Screening (Coarse):** used to separate large and difficult to disintegrate paper parts as well as large non-paper product materials. The objective is to achieve a nearly fiber free reject.

**Specification:** A specification often refers to a set of documented requirements to be satisfied by a material, design, product, or service. A specification is often a type of technical standard. They often refer to particular documents, and/or particular information within them.[1] These can be numerical values or observations that are chosen to allow interpretation of the results of test methods (i.e. pass/fail thresholds). The word specification is broadly defined as “to state explicitly or in detail” or “to be specific”. Specifications may be written by standards setting, industry groups, or certifying organizations.

**Stickies:** adhesives that are not recycling-compatible and do not dissolve in water, but rather fragment into smaller particles during the repulping process. These particles—known as “stickies”—deform under heat and pressure, making them difficult to screen or filter out of the pulp. Stickies can become lodged on papermaking equipment or even in the paper itself, often causing serious damage to both.

**Test Method:** A definitive procedure that produces a test result. Examples of test methods include, but are not limited to: identification, measurement, and evaluation of one or more qualities, characteristics, or properties. In order to ensure accurate and relevant test results, a test method should be “explicit, unambiguous, and experimentally feasible.”, as well as being effective and reproducible.[1] Test methods are often written by standards setting organizations.

## RESOURCES AND CITATIONS

The resources below provided extensive background and information for much of the Introduction. Readers can use the following resources to delve deeper into the recyclability testing and best practices.

- [\*Guideline Document: Recyclability of Paper Based Products, EcoPaperloop, December 2014\*](#)
- [\*CIRCULARITY BY DESIGN GUIDELINE FOR FIBRE-BASED PACKAGING, 4EVERGREEN ALLIANCE, March 2022\*](#)
- [\*AF&PA Design Guidance for Recyclability: 2021, American Forest & Paper Association, Version 1.1, Last Update March 2021\*](#)
- [\*Cepi Recyclability Laboratory Test Method, Confederation of European Paper Industries, Version 1, December 2020\*](#)
- [\*Fibre Box Association, Voluntary Standard For Repulping and Recycling Corrugated Fiberboard Treated to Improve Its Performance in the Presence of Water and Water Vapor, FBA, August 2013\*](#)
- [\*The How2Recycle Guide to Recyclability, GreenBlue, Originally published April 2020. Last updated July 2021\*](#)
- [\*The How2Recycle Guide to Future Recyclability, GreenBlue, Published April 7, 2020\*](#)
- [\*Glossary of Waste Prevention Terms, CalRecycle, Copyright © 2023 State of California\*](#)
- [\*Adhesives for the Paper Packaging Industry: An Overview, Open Journal of Polymer Chemistry, Vol.12 No.2, May 2022\*](#)
- [\*Form and Style for ASTM Standards, ASTM International, September 2022\*](#)
- [\*RCA Laboratory Testing Protocol For Paper Labels Coated With Recycling Compatible Pressure Sensitive Adhesives, Tag & Label Manufacturers Institute \(TLMI\)\*](#)





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