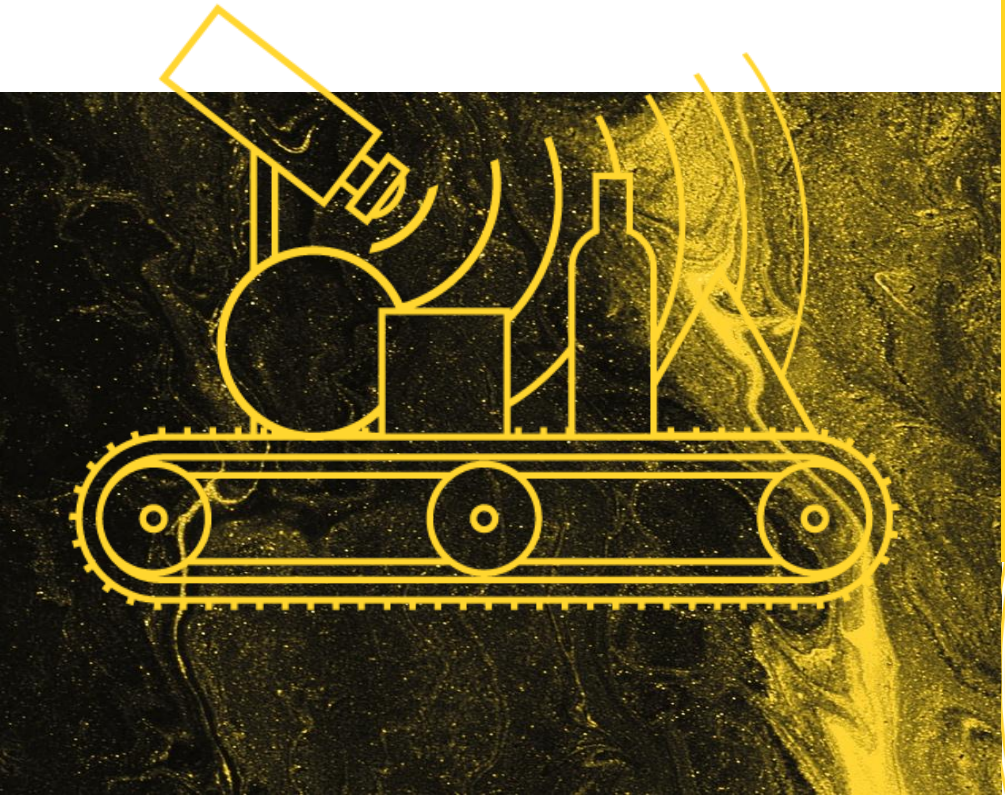
Protocol

OS I

Committee for Studying the Behaviour of Packaging in Sorting Centres (COCET)

Optical sorting test

PROTOCOL



WWW.COCET.FR

To contact us:

https://www.cocet.fr/home/nous-contacter/

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Introduction

COCET

The mission of the Committee for Studying the Behaviour of Packaging in Sorting Centres (COCET) is to help designers and decision-makers develop household packaging that can be sorted in French sorting centres. The committee includes various stakeholders in the value chain for sorting household packaging (Citeo, Tomra, Pellenc ST, Derichebourg Environnement, Sepur) and works on all types of household packaging (bottles, dispenser bottles, pots, films, cartons, bags, etc.) made of all kinds of materials, except glass. COCET's scope of action begins as soon as the packaging is placed in the yellow bin by the consumer and continues until it exits the sorting centre (including any additional sorting). The test protocols established by COCET are the result of work carried out with sorting industry stakeholders and a consensus on their representativeness.

This optical sorting test protocol was drawn up by COCET. It is representative of the most commonly used settings in France. This protocol is available to manufacturers who wish to replicate the optical sorting separation that takes place in French sorting centres. This stage makes it possible to separate packaging that mostly consists of (rigid and flexible) plastic, packaging that mostly consists of paper/cardboard, and graphic paper from selective collection, and to direct them to their respective recycling streams.

Version no.	Date	Description
I	May 2025	Initial version

I. Scope

The optical sorting test protocol should be prioritised for packaging where only detectability and discharge by material and/or colour are relevant. It applies to paper/cardboard and plastic packaging.

This protocol is more flexible to implement (logistics, test organisation) than tests conducted in a sorting centre (COCET Protocol CDT I). However, if the tested packaging is also likely to cause issues during other stages of the sorting process, additional tests in a sorting centre should be conducted.

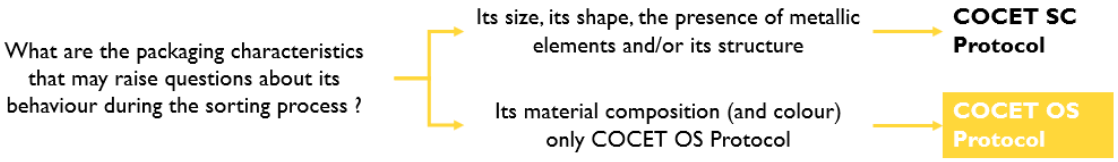

Figure 1 Determining the use of the COCET Protocol TO

Unlike the sorting centre test protocol, which allows the assessment of a packaging's behaviour throughout the entire sorting system, this protocol reflects only the **optical sorting process**. Therefore, it does not provide any indication of the packaging's overall behaviour in the sorting centre, nor of its recyclability during the recycling process in its designated stream.

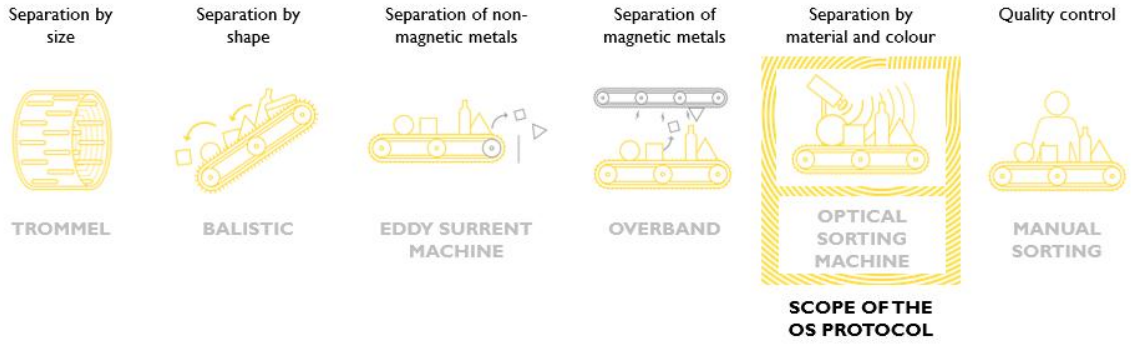

Figure 2 Scope of the COCET Protocol TO

II. Aims

This protocol can be used to assess whether packaging can be detected and properly discharged by the sorting machines in sorting centres. It does not assess its recyclability. It is available to manufacturers and marketers who wish to independently assess whether their packaging can be correctly sorted by optical sorting machines. Tests carried out by a manufacturer or marketer based on this protocol cannot be the subject of a specific COCET Notice. If desired, the Requester may share its results with COCET, which may decide to examine the sorting issue in a general notice, if necessary.

The tests should be carried out at the Pellenc ST and Tomra test centres to ensure the representativeness of the optical sorting equipment used in France. They should be performed in two stages with packaging first undergoing a static test before being submitted for a dynamic test if it meets the criteria of the first test.

- **Static analysis:** determine the capability of the optical sorting machine to detect the packaging and identify the material it is made of.

- **Dynamic analysis:** assess the efficiency on packaging detection and discharge through its target stream, when included in a standard household packaging waste stream.

COCET relies on the materials committees (COTREP, CEREC, ALUTREC, COTREM) to determine the target streams of each packaging tested.

III. Terms of reference

Any company (packaging manufacturer, marketer, producer, resin manufacturer, distributor, etc.) seeking to determine whether its packaging can be correctly sorted by optical sorting can use this protocol to perform testing.

Companies wishing to perform optical sorting tests shall be referred to hereafter as "**Requesters**".

The test centres operated by Pellenc ST and Tomra, approved by COCET and capable of applying this testing protocol, will hereafter be referred to as the "**OS Manufacturers**" (Optical Sorter Manufacturers).

IV. Packaging eligible for testing

To ensure the tests reflect the operational conditions of French sorting centres, the packaging should comply with the parameters listed below. If not, COCET reserves the right to review the analysis and interpretation of the results.

Eligibility criteria for the packaging to be tested

1. The packaging should be household packaging as sorted by the consumer, consisting of all elements that may remain attached at the time of sorting after the product has been consumed, as defined in Citeo's recyclability methodology[1].
   The packaging to be tested consists of a main element specifically sorted by the consumer and any associated elements. A definition of "main" and "associated" elements, and an illustrative list of elements generally considered as main or associated elements are provided in the recyclability methodology.

   Please note: associated elements on their own (caps, lids, labels, sleeves) cannot be tested according to this protocol.
2. All types of packaging mostly consisting of plastic or paper/cardboard (bottles & dispenser bottles, trays, pots, cartons, bags, films, pouches, cards, etc.) are eligible.
3. Packaging may be new or used but should be emptied of its contents.
4. Packaging should be shaped to resemble packaging waste, meaning at least compacted and/or crumpled to replicate the compaction stage during collection by truck.

V. Procedure for Requesters

Stage 1: Contact COCET

The Requester contacts COCET via the contact page on COCET's website, describing its request with the help of the document in **Annexe 1**. If the Requester wishes to test the detectability of several packaging types (different materials, plastic resins, dimensions, thicknesses, shapes, etc.), it should inform COCET of this, specifying all the types of packaging it wishes to test. After reviewing the request, COCET will respond to the Requester indicating the number of tests that need to be performed.

Stage 2: Contact the OS Manufacturers

Once the test request has been validated and **Annexe I** has been submitted, COCET will provide the Requester with the contact details of the OS Manufacturers in order to discuss the financial and logistical arrangements. The budget and schedule for carrying out the tests will be provided by OS Manufacturers.

Stage 3: Prepare the test samples

After a test date has been confirmed, the Requester should submit test samples to the OS Manufacturers.

[1]Recyclability methodology: https://tree.citeo.com/en/

	Packaging to be tested
Static test	5 identical packaging
Dynamic test	100 identical packaging

Table 1 Number of samples to submit to test the packaging

Please note for flexible packaging tests, the density of the standard stream (film stream) is relatively low (compared to the density of a stream of hollow containers, or of flat materials containing films and fibrous packaging). Introducing a large number of flexible samples to be tested can significantly destabilise the standard film stream. To account for this effect, the OS Manufacturers may reduce the number of samples introduced at the time of testing to adapt to the density of the standard stream used. However, the number of flexible samples introduced should not be less than 50.

The samples should be sent separately to both OS Manufacturers. **Annexe 2** should be completed and attached to each parcel and also emailed to the OS Manufacturers prior to the samples being sent. We recommend sending the samples at least 10 days prior to testing.

VI. Performance of tests

A. Preparing the optical sorting machines

Both the equipment used in the test centres to carry out the tests and the machine settings are as representative as possible of those currently used in sorting centres in France and have been defined with COCET. Any change in settings by the OS Manufacturers shall be notified and approved in advance with COCET.

Please note:

• The aim is to perform tests that are as representative as possible of procedures in modern French sorting centres in normal operating conditions.

• The machine settings should be fixed and identical for each test, for the same standard stream. They may be readjusted when changing the standard stream.

B. Performance of static tests

The aim of this stage is to determine whether the optical sorting machine is able to detect the packaging and identify its constituent material, i.e. the target material (specified in **Annexe 3**).

The method

The tested samples are placed under the optical sensor so that it can read the different sides that may be presented to the optical sorting machine in the sorting centre.

Results

The result is **conclusive** if the following two points are checked:

- The packaging is detected by the optical sorting machine
- The material identified corresponds to the target material of the packaging

In this case, the test can proceed, and dynamic tests should be conducted.

Otherwise, the test is **inconclusive**: the packaging is not correctly identified by the optical sorting machine and will not be properly discharged in the sorting centre. There is no point in conducting dynamic tests.

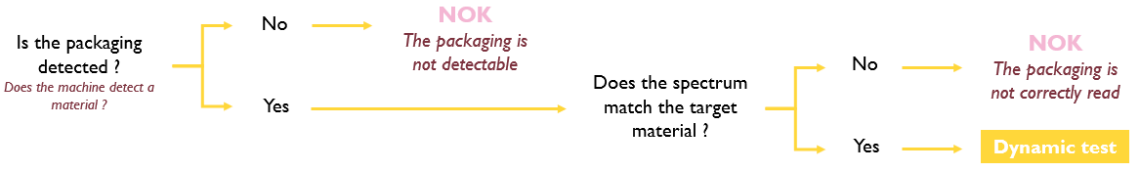

Figure 3 Assessment of static test results

C. Preparing the standard stream from a sorting centre

For the dynamic tests, COCET will provide the OS Manufacturers with a stream of packaging waste from selective collection. This stream will be called the "standard stream".

Each standard stream should be characterised (cf. **Annexe 3**). These characterisations should be included in the report.

D. Performance of dynamic tests

The aim of this stage is to assess the sortability of packaging under realistic conditions. The mixed packaging to be tested is introduced into a standard stream from a sorting centre, and the machine settings applied ensure that optical sorting is representative of procedures used in French sorting centres.

The lab sorting setup uses machine settings that replicate the conditions found in French sorting centres.

Depending on the type of packaging to be tested, the variables to be adjusted are:

- The standard stream type
- The sorting operation (machine setting for discharging the material) performed to identify the material (NIR), or the material and the colour (NIR+VIS)

The method

Please refer to **Annexe 4** for the choice of sorting operation to perform.

The SO Manufacturer introduces the standard stream onto the lab sorting setup until the desired nominal flow rate is reached.

100 samples of the packaging to be tested are injected into the standard stream: they are introduced gradually to ensure a uniform distribution of the samples within the packaging stream.

Please note: for flexible plastic samples, the number of samples to be injected is between 50 and 100 in order to limit the dilution of the stream. The operators will assess this criterion while the test is being conducted. The actual number of samples injected should be specified in the report if it differs from 100.

The sorting operation, defined according to the packaging to be tested, is configured (cf. **Annexe 4**). The packaging items are discharged towards their target stream.

VII. Results and analysis

A. Calculation method and measurements

At the end of the dynamic test, two output streams are characterised:

- Discharged stream (positive fraction)
- Non-discharged stream (negative fraction)

Measurements and counts should be carried out to calculate the purity and sorting performance (or capture rate of the tested sample).

Calculating the purity

The purity corresponds to the proportion of packaging made of the target material in the fraction discharged compared to the total packaging discharged in that fraction. It should be calculated for each standard stream and each sorting operation performed. It helps ensure compliance with current standard parameters.

$$Purity\ (\%) = \frac{Weight\ of\ the\ target\ material's packaging\ in\ the\ ejected\ fraction}{Total\ weight\ of\ the\ ejected\ fraction} \times 100$$

- If purity > 90%, the standard parameters are considered met and the test results are valid.
- If purity < 90%, one or more of the parameters may be faulty (standard stream, sorting operation). If possible, the parameters should be checked and corrected, and the dynamic test should be repeated following these corrections to achieve a satisfactory purity level (> 90%). Otherwise, the elements affecting purity should be clearly mentioned in the report (photos, weight of the elements, etc.)

Please note: purity remains the same as long as the standard stream and the sorting operation remain unchanged. As such, there is no need to recalculate it each time if multiple tests are conducted. However, if the sorting operation is modified or the standard stream is different, it should be recalculated.

Calculating the sorting performance or capture rate

The number of packaging items tested is counted both in the discharged stream and the non-discharged stream.

- Number of samples found in the discharged stream: *No. samp. tested target stream*
- Number of samples found in the non-discharged stream: *No. samp. tested discharge.*

The results of this categorisation are used to determine the sorting performance or capture rate (CR) of the tested packaging:

$$CR\ (\%) = \frac{No.samp.tested\ target\ stream}{No.samp.tested\ target\ stream + No.samp.tested\ reject.}\ x\ 100$$

Please note: for ease of measurement, the "number of samples" could be replaced by the "weight of samples" for all the measurements to be performed to calculate the CR.

B. Success criteria

To qualify the packaging as "well sorted", the following success criteria should be met, both at TOMRA and PELLENC:

- The routing of the packaging during the optical sorting process is **acceptable** if:
  - CR ≥ 80% AND
  - Purity ≥ 90%
- Failing this, the routing of the packaging during the optical sorting process is **unacceptable**.

VIII. Test report

To help the Requester understand the results, each OS Manufacturer will prepare a test report specifying the following elements:

- Test date
- Details of the equipment used, the settings applied, and the standard stream used
- Characterisation of the standard stream(s) used
- A description of the samples received and tested, including photographs. If several batches of samples have been tested, descriptions and results for each batch of samples should be presented separately in the report
- The number of samples and procedures for each test
- The report should include the following statements:
  - "Tests have been conducted in accordance with the COCET test protocol – Assessment of packaging detectability in optical sorting processes – VI".
  - "This report does not, in itself, constitute a COCET notice or a notice regarding the recyclability of the tested packaging."

OS Manufacturers undertake to adhere to the entire protocol and indicate any deviations from it in the test report.

The test report will be sent to the Requester and will not systematically be the subject of a COCET notice. If the Requester wishes to submit the results to COCET for information, COCET will assess the relevance of issuing a general notice based on the tests conducted.

Annexe 1 COCET sorting test request form

Company	
First name, last name	
Position	
Email	
Telephone number	

IMAGE
OF
THE PACKAGING

DESCRIPTION OF THE PACKAGING TO BE TESTED

Packaging type	
Trade name/Reference number	
Targeted sorting issue	
Thickness	
Packaging dimensions	
Materials (exact composition of each material)	
Details of static analyses (number of elements, number of sides)	
Volume marketed	

REQUESTER'S UNDERTAKINGS

☐ **I HEREBY CONFIRM THE FOLLOWING:**

- I wish to conduct tests in accordance with the standard protocol set out by COCET.
- I confirm that tests will be conducted on the premises of the two OS Manufacturers (Pellenc ST and Tomra).
- **I agree to bear the entire cost of testing, which I will arrange directly with the OS Manufacturers.**
- **I agree that the results will be sent to COCET for information.**

COMPANY STAMP Date: Last name, first name and signature:

Annexe 2 : Document to be completed and attached to each package of samples

Purpose of testing	COCET optical sorting protocol
Requester	
Company	
First name, last name	
Contact OS manufacturer	
Test date	… / … / ……
Reference number of the sample and target material	
What should be done with the samples after testing?	☐ Please do not return samples. ☐ Please return samples after testing. The return address is: - Surname: - Street: - Postcode/city: - Country:

Annexe 3 Standard stream characterisation grid

The characterisation provides a detailed view of the composition of the standard streams used. It distinguishes between the different categories of packaging of interest, which vary depending on the standard stream, and provides an overview of the contaminants present (categorised as "Others"). The measurements taken are expressed in weight (g or kg) and may also be reported as proportions (%).

Please note: only packaging and graphic paper, as defined in Citeo's specifications, are included in the categories listed below. Products other than packaging or paper found in the standard streams will be classified under the "Others" category.

Packaging and graphic paper categories for standard stream characterisation:

Hollow (or 3D) container stream

Packaging categories	Weight (g or kg) and %
Rigid PE	
Rigid PP	
Rigid PS	
Clear and blue PET bottles and dispenser bottles	
Coloured/opaque (excl. blue) PET bottles and dispenser bottles	
Clear PET pots and trays	
Coloured PET pots and trays	
Cartons (LPC)	
Flexible plastic packaging	
Metal packaging	
Others (other categories of packaging, paper, other products, residues)	

Fibrous flat (or 2D) materials stream

Packaging categories	Weight (g or kg) and %
Flexible PE, PP, laminated	
Fibrous (NLPC)	
NM	
Others (other categories of packaging, other products, residues)	

Flexible flat (or 2D) materials stream (films, flexible materials)

Packaging categories	Weight (g or kg) and %
Flexible PE	
Flexible PP	
Flexible composites	
Others (other categories of packaging, paper, other products, residues)	

Annexe 4 Test parameters according to the tested packaging

The **target stream** is defined in consultation with the technical committees (COTREP, CEREC, ALUTREC, etc.). We refer to a "packaging that is compatible with its target stream" when its composition is compatible with the material's recycling process, and it does not contaminate or disrupt that stream.

To identify the target stream of a packaging item to be tested, it is necessary to determine which packaging family it belongs to, based on its majority material (material > 50% by weight).

Please note: the protocol does not apply to a packaging item that has no majority material or does not belong to one of the material families listed below.

Packaging family	Description	Target stream	Standard stream	Sorting operation
Fibrous materials				
Laminated paper/cardboard (LPC) packaging	Packaging where paper and cardboard make up over 50% of its weight and at least one of its paper/cardboard sides is completely covered with another material (includes coatings and varnishes applied to surfaces): - which is closely bound or glued in such a way that the packaging has to be recycled using a specific process, OR - the proportion of which is over 15% of the weight of the paper/cardboard material carrying it.[2] Example: cartons	LPC and NLPC	3D/hollow containers	LPC

[2]CEREC Guide https://www.cerec-emballages.fr/content/uploads/2022/06/220610-brochure-cerec-lowdef.pdf

Non-laminated paper/cardboard (NLPC) packaging	Paper/cardboard packaging which does not fall into the laminated paper and cardboard category and whose paper and cardboard content is greater than 50% belongs to the non-laminated paper and cardboard (NLPC) category.[1] Examples: cardboard box, paper bag	LPC and NLPC	Fibrous 2D/flat materials	NLPC
Graphic paper	The notion of "graphic paper" applies to all types of paper weighing less than 224 g/m.[3] Examples: brochures, catalogues, magazines, newspapers, envelopes, posters, user manuals, decorative paper, receipts, tickets, etc.	NM	Fibrous 2D/flat materials	NM
Plastic				
Clear/blue PET bottles or dispenser bottles (B&DB)	Clear/blue bottles or dispenser bottles consisting of more than 50% PET by weight	Clear PET bottles and dispenser bottles	3D/hollow containers	Clear PET B&DB (NIR, VIS)
Coloured, transparent and opaque (excl. blue) PET bottles or dispenser bottles	Coloured/opaque bottles or dispenser bottles consisting of more than 50% PET by weight	Coloured PET bottles and dispenser bottles	3D/hollow containers	Coloured PET B&DB (NIR, VIS)
Rigid PE packaging	Packaging consisting of more than 50% rigid PE by weight	Rigid PE and PP	3D/hollow containers	Rigid PE/PP (NIR)

[3]https://www.citeo.com/faq-la-rep-papiers-graphiques

Rigid PP packaging	Packaging consisting of more than 50% rigid PP by weight	Rigid PE and PP	3D/hollow containers	Rigid PE/PP (NIR)
Rigid PS packaging	Packaging consisting of more than 50% rigid PS by weight	Rigid PS	3D/hollow containers	Rigid PS (NIR)
Rigid, single and multi-layer clear PET packaging	Packaging (other than bottles or dispenser bottles) consisting of more than 50% rigid PET by weight	Clear PET tray	3D/hollow containers	PET tray (NIR, VIS)
Flexible PE packaging	Flexible packaging consisting of more than 50% LDPE, HDPE, BOPE or OPE resin, etc. and which may lose its shape when filling the product.	Flexible development stream	Flexible 2D/flat materials, films	Flexible PE, flexible PP, flexible PE/PP (NIR)
Flexible PP packaging	Flexible packaging consisting of more than 50% PP, BOPP or OPP resin, etc. and which may lose its shape when filling the product.			
Composite flexible PE/PP packaging	Flexible packaging consisting of more than 50% PP resin associated with PE.			