RecyClass

SORTING EVALUATION PROTOCOL

FOR PLASTIC PACKAGING

STANDARD TESTING PRACTICE

VERSION 1.0

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RecyClass

CONTENT

RecyClass

GLOSSARY

PET	Polyethylene Terephthalate
PE	Polyethylene
LDPE	Low Density Polyethylene
HDPE	High Density Polyethylene
PP	Polypropylene
PS	Polystyrene
NIR	Near-Infrared

DISCLAIMER

"RecyClass is an initiative aiming at enhancing and evaluating the recyclability of plastic packaging through a technical perspective. The Sorting Protocol and the Recyclability Evaluation Protocols will promote recyclability by encouraging industry to test new plastic technologies, materials or product before market launch and giving advice and recommendations to the companies.

The Protocols are available for download in the Plastics Recyclers Europe and RecyClass websites. Companies providing plastic packaging concepts are encouraged to use them to self-assess the impact of their solutions on recyclability and highlight potential issues. **However, compliance to a RecyClass Protocol is not a replacement for an official assessment and may not be used as a marketing tool.**

All tests must follow the Protocols recommended by the RecyClass Technical Committees and/or the Certification Bodies recognized by RecyClass and must be conducted by an independent laboratory or facility approved by RecyClass which has no legal affiliation to the applicant.

More information is reported in the RecyClass Internal Procedures available in the *RecyClass website.*"

1. INTRODUCTION AND PURPOSE OF THE PROTOCOL

The "Sorting Evaluation Protocol" referred to in this document as "The Protocol" describes the methodology that may be followed by the Applicant at pilot or industrial scale in order to determine the sorting behaviour and the recycling stream of the tested packaging.

The Protocol evaluates the sorting behaviour of plastic packaging considering the following waste streams:

- PE flexibles,
- PP flexibles,
- Mixed plastics flexibles,
- PET bottles,
- PET trays,
- PP rigids,
- HDPE rigids,
- PS rigids,
- Mixed plastics rigids.

The Protocol considers the design issues as well that can misdirect the plastic packaging to the streams of ferro metals, drinking carboard, non-ferro metals or residues.

This document provides guidance on the tests methodology that shall be followed, including benchmark recommendations to guide the interpretation of the results.

2. SCOPE OF THE PROTOCOL

The scope of the Protocol covers any plastic packaging mainly made of PE, PP, PET or PS. Prior to initiating the evaluation, the Applicant is invited to review the RecyClass Design for Recycling Guidelines[1], Online Tool[2] and Recyclability Methodology[3] in order to verify that the packaging design will not mislead the sorting results.

The following packaging are covered by the scope of this Protocol:

1. Flexible films
2. Pouches
3. Bags
4. Bottles
5. Containers
6. Tubes
7. Pots
8. Cups
9. Trays

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1 Design for Recycling Guidelines available here

[2] RecyClass Online Tool available here

[3] Recyclability Methodology of RecyClass available here

The protocol provides guidance on the sorting parameters to apply in order to determine the recycling stream of the plastic packaging. Packaging containing predominantly different material than plastic or made of different plastic polymers than the ones listed above shall not refer to this Protocol and shall be separately considered to assess their sorting behaviour.

3. DISCLAIMER

The Protocol is created to represent as accurately as possible how the current European sorting facilities works at an industrial scale. The RecyClass Technical Committees reserve the right for further testing if necessary and the RecyClass Sorting Task Force to update the Protocol following new sorting practices.

Representative European sorting facilities are operating with the following steps:

- Sieve drum,
- Wind sifter,
- Magnet,
- Eddy current,
- Ballistic separation
- NIR detections.

Consequently, any other sorting innovation is not considered in the following Protocol and will not be considered until widely used.

4. TEST METHODOLOGY

This methodology aims to reproduce the representatives European sorting facilities by following the same steps and by applying similar parameters. The methodology described above shall be followed precisely and any modifications or problems must be noted during the testing phase.

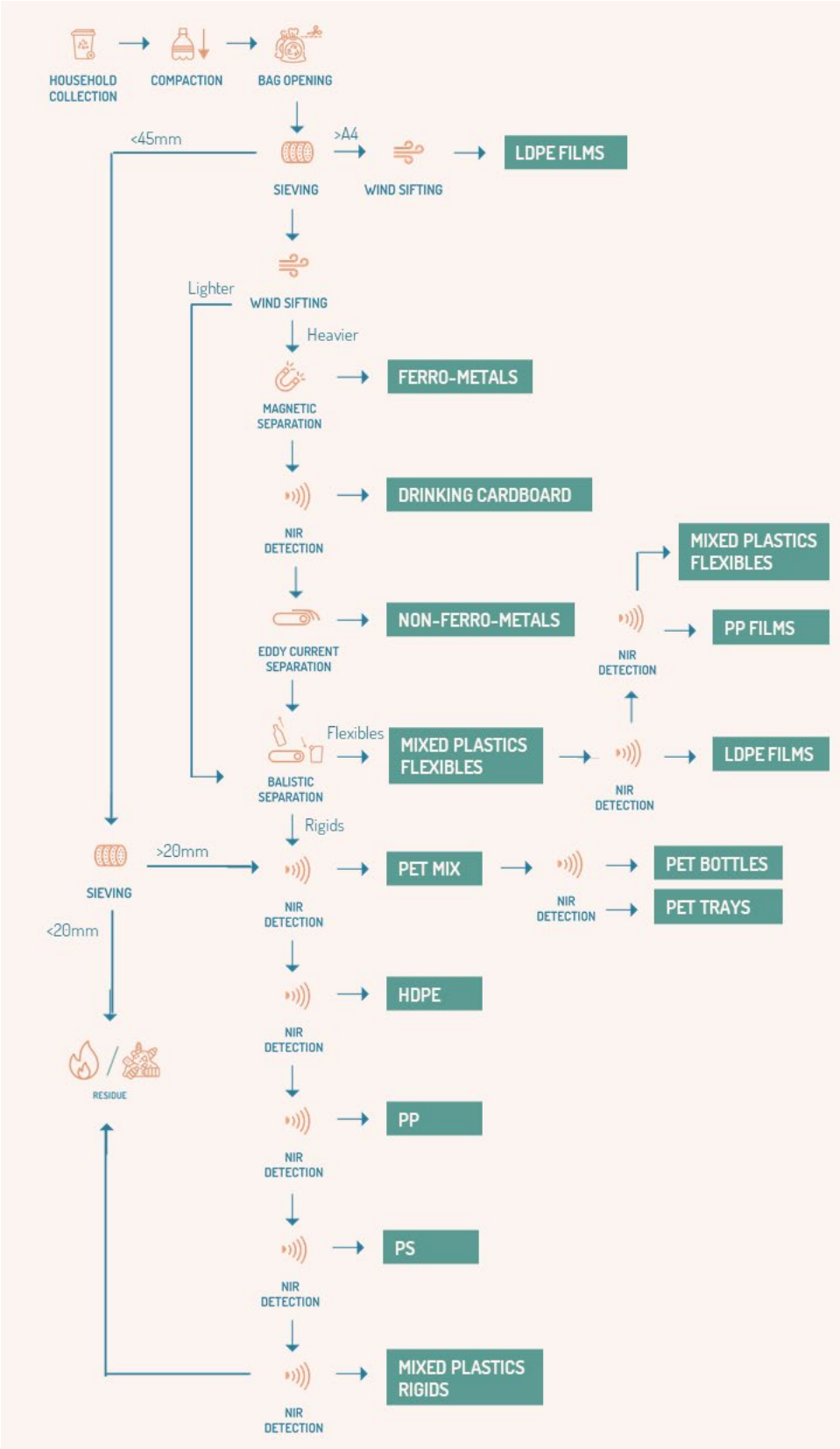
Line settings

The settings of the line for the trials must be representative of a European MRF sorting line. Any deviation from standard setting will have to be reported in the results.

A Sorting Evaluation Report compiling all the results obtained shall be prepared by the sorting centre to record the results. Any remarks during following the Protocol shall be also noted down.

See below in Figure 1 a diagram where the flow of the methodology is described.

Figure 1: Methodology Diagram



4.1 SAMPLES SELECTION

For the purpose of the tests, the Applicant should provide at least the quantities of samples described in Table 1.

Table 1: Number of samples for testing

Type of packaging	Volume or dimension	Minimum Samples required
Rigid plastic bottles/container/tube	≥ 0,45 liter	50
Rigid plastic bottles/container/tube	< 0,45 liter	100
Rigid plastic tubes or trays	At least one side ≥ 10 cm	50
Rigid plastic tubes or trays	Sides < 10 cm	100
Flexible plastic packaging (film/pouch/bag)	At least one side ≥ 10 cm	50
Flexible plastic packaging (film/pouch/bag)	Sides < 10 cm	100

More packaging could be requested if necessary by the sorting centre. It is worth to point out that the packaging to be tested is not limited to one component but to the packaging as a whole. Therefore, the packaging has to be submitted to the sorting centre as placed on the market with labels, adhesives, closure system, liners, seals, valves, and any other component.

4.2 SAMPLES PREPARATION PROCEDURE

Household packaging waste enters the sorting process crushed and folded due to transportation and logistics. To get a representative situation, the protocol must simulate the compression and the friction of the process as typically caused by truck compression and transfer. However, it is noteworthy that consumer behaviours are not taken in consideration by the Protocol since the behaviours widely differ from each other and are not representative of the way the packaging is disposed of and collected. Indeed, the same packaging can be discarded by consumer as it is or flattened, depending on consumer behaviours, and/or based on brand or local authorities' recommendations, emptied and cleaned or containing partial residues. All packaging must be provided by the Applicant with their closure on.

The following steps should be considered by the sorting centre to prepare the samples for testing.

Procedure:

1. In case the certification body highlights issues with the product left (i.e., Easy to Empty index higher than 5 because of the packaging design or the product viscosity), the sorting centre must require the Applicant to provide filled samples. It is noteworthy that product left can have an impact on the packaging sorting behaviour.
2. In case of filled packaging are supplied, the packaging is emptied up to 10% product residues by weight. If not, step 2 is skipped.
3. Packaging is crushed by applying pressure (up to maximum 1/5 compression rate to simulate truck compression).

Pictures before contamination, after contamination, and after compression must be provided with the report.

In case of plastic packaging provided with unglued cellulose based decorations, to simulate in a close way realistic condition in terms of collection and transportation:

4. Store the emptied and crushed packaging in a collection bin for 1 week at environmental conditions.
5. After 7 days, mix the packaging and crush it once again.

Seven days is a typical period of time between the collection and the sorting for plastic packaging. During the 7 days fibers can absorb moisture and assume different behaviour.

Sample identification:

Pictures before collection and after collection, after contamination, after 1st and 2nd compression steps must be provided with the report.

4.3 CHECK DIMENSIONS

After the compression and friction simulation, spread out crumbled packaging (and/or separated components) on a surface:

- ✓ Is any of the 3 dimensions (width/height/depth) of the packaging or component(s) small enough to be rejected by the sieve drum (check 1: <20mm, check 2: <50mm)?
- ✓ Is the packaging larger than 30 cm?

If either of the above questions is answered with 'Yes', a **Sieve Drum** Test should be performed.

In all other cases it is assumed that the packaging will fall through the holes of the sieve drum and continues into the next sorting step.

4.3.1 SIEVE DRUM TEST

The Sieve Drum Test aims to eliminate small items that will fall through the holes of the sieve.

Procedure:

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is feeding the Sieve Drum.

*(*Depending on the number of samples provided, use 20 from 100 or 10 from 50 samples)*

- Count the number of samples passing on to the next sorting step.

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output.

Results of the Sieve drum test:

- ✓ Materials being discarded as too small, will end-up in the **RESIDUE fraction**.
- ✓ Materials being discarded as too large, will continue to the step "**The Wind Sifter**".
- ✓ Materials in between will also continue to the step "**The Wind Sifter**".

4.4 THE WIND SIFTER

The Wind Sifter creates an upward facing airflow over the conveyor belt. This airflow sucks up the light-weight-materials and separates them from heavier material. The over-sized materials (which passed the sieve drum) will move to the dedicated Wind Sifter.

Procedure for over-sized materials (which passed the sieve drum):

- Feed samples* to the conveyor belt at the end of the Sieving Drum and prior to the dedicated Wind Sifter. Add the samples on the line whilst other packaging waste is on there as well.

*(*Depending on the number of samples provided, use 20 from 100 or 10 from 50 samples)*

- Observe and count the number of samples being sucked up by the Wind Sifter.

- Add more samples when the outcome is ambiguous.

Results of the Wind Sifter:

- ✓ Materials being sucked up by the Wind Sifter, will end-up in the **MIXED FILM fraction**.
- ✓ Materials not being sucked up by the Wind Sifter, will end-up in the **RESIDUE fraction**.

Procedure for other materials (which fell through the holes in the sieve drum):

- Determine the appropriate Wind Sifter (depending on size < or > 24 cm).

- Feed samples* to the conveyor belt after the wholes of the Sieving Drum and prior to the dedicated Wind Sifter. Add the samples to the line whilst other packaging waste is on there as well.

*(*Depending on the number of samples provided, use 20 from 100 or 10 from 50 samples)*

- Observe and count the number of samples being sucked up by the Wind Sifter.

- Add more samples when the outcome is ambiguous.

Results of the Wind Sifter:

- ✓ Materials > 24cm being sucked up by the Wind Sifter, will end-up in the **MIXED FILM fraction**.
- ✓ Materials < 24cm being sucked up by the Wind Sifter, will continue to the step "**The Ballistic Separation**".
- ✓ Materials over and under 24cm not being sucked up by the Wind Sifter, will continue to the step "**The Magnet**".

4.5 THE MAGNET

Materials falling through the holes in the Sieve Drum and not being separated by the Wind Sifter, go to the next step: the magnet. Based on the description in the required input data and sense-observation, the presence of ferro-metals in the packaging is checked:

1. If metals are found and are uncertain if it is ferro or non-ferro, a quick test on the packaging is done with a small hand-magnet.
2. If no ferro-metals have been reported or found with the magnet, the packaging will continue to the step "**NIR-Beverage Cardboards**".
3. Packaging containing ferro metals are run through the following procedure.

Procedure:

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the over-belt-magnet.

*(*Depending on the number of samples provided, use 20 from 100 or 10 from 50 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the Ferro-metals).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the Magnet:

- ✓ Materials sorted by the magnet, will end-up in the **FERRO-METAL fraction**.
- ✓ Materials not sorted by the magnet, will continue to the step "**NIR-Beverage Cardboards** ".

4.6 NIR-BEVERAGE CARDBOARDS

Materials that pass the magnet, continue to the next sorting step: the NIR for Beverage Cardboards. Based on the description in the required input data and sense-observation, the presence of cardboard in the packaging is checked:

1. If no cardboard has been reported or found in the packaging, the packaging will continue to the step "**Eddy Current**".
2. Packaging containing cardboard are run through the following procedure.

Procedure:

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the NIR for Beverage Cardboards.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the Beverage Cardboards).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

NIR program:

The NIR program used for the test must be the one referenced in the site accreditation. The program used should be reported in the results.

Results of the NIR-Beverage Cardboards:

- ✓ Indicate settings used with reference to the sorting program.
- ✓ Materials sorted by the NIR for Beverage Cardboards, will end-up in the **BEVERAGE CARDBOARDS fraction**.
- ✓ Materials not sorted by the NIR for Beverage Cardboards, will continue to the step "**Eddy Current"**.

4.7 EDDY CURRENT

Materials that are not sorted by the NIR for Beverage Cardboards, continue to the next sorting step: the Eddy Current. The goal of this step is to separate the packaging (components) made from (or containing) non-ferro-metals. Based on the description in the required input data and sense-observation, the presence of non-ferro-metals in the packaging is checked:

1. If no non-ferro-metals have been reported or visually identified, the packaging will continue to the step "**Ballistic Separation**".
2. Packaging containing or expected to contain non-ferro metals are run through the following procedure.

Procedure:

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the Eddy Current. Make sure the materials are placed on the belt prior to the point at which they receive the electrostatic charge.

*(*Depending on the number of samples provided, use 20 from 100 or 10 from 50 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the non-ferro-metals).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the Eddy Current:

- ✓ Materials sorted by the Eddy Current, will end-up in the **NON-FERRO-METAL fraction**.
- ✓ Materials not sorted by the Eddy Current, will continue to the step "**Ballistic Separation**".

4.8 BALLISTIC SEPARATION

The Ballistic Separation aims to distinguish the rigid (or 3D) packaging from the flexible (or 2D) packaging. The materials passing step 6 will move into this process-step.

Procedure:

- Feed samples* to the ballistic separator. Add the samples whilst other packaging waste is on there as well.

*(*Depending on the number of samples provided, use 20 from 100 or 10 from 50 samples)*

- Count the number of samples moving up and moving down.

- Add more samples when the outcome is ambiguous.

Results of the Ballistic Separation:

- ✓ Materials moved up, will end-up in the **MIXED PLASTIC FLEXIBLES fraction**.
- ✓ Materials moved down, will continue to the step "**Static Test**".

4.9 STATIC TEST

Prior to running through the individual NIR-polymer-sorters, a static test with the material is performed.

Procedure:

- Use an empty NIR sorter and put a couple of samples on the non-rolling-conveyor-belt.

- Check at the screen as which type of polymer the packaging is identified by the NIR.

- Check different angles and different shaped (crushed) samples.

- Check if the identification also activates the air-nozzles.

- If the static test clearly identifies one type of polymer, continue to that specific sorting test: PET, PE, PP, PS, and mixed plastics.

4.10 NIR

The NIR programs used for the test must be the ones referenced in the site accreditation. The programs used will be reported in the results. The site certificates that the program used is representative of European MRFs standard settings.

4.10.1 NIR PET

Materials that pass continue to the next sorting step: the NIR for PET. Based on the description in the required input data and sense-observation, the presence of PET in the packaging is checked:

1. If no PET has been reported or found in this packaging, the packaging will continue to the step "**NIR PE**".
2. Packaging containing PET are run through the following procedure.

Procedure:

- Check the program used is compliant to the accreditation requirement.

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the NIR for PET.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the PET).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the NIR PET:

- ✓ Indicate settings used with reference to the sorting program. Any deviation from the reference program should be reported.
- ✓ Materials sorted by the NIR PET, will (depending on country and sorting facility) either end-up in the general **PET fraction** or pass on to the step "**PET-bottles or PET-trays**" for additional sorting in PET-trays and PET-bottles.
- ✓ Materials not sorted by the NIR PET, will continue to the step "**NIR PE**".

4.10.2 NIR PET-BOTTLES OR PET-TRAYS

Materials that were sorted as PET continues to the next sorting step: the separation of bottles from trays. The packaging is run through the following procedure.

Procedure:

- Check the program used is compliant to the accreditation requirement.

- Feed samples* to the conveyor belt with other packaging waste This should be the belt which is running towards the NIR for PET-bottle/tray separation.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples being sorted as PET-bottle (or, depending on the local situation, count the number of samples being sorted in the PET-trays).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the NIR PET-Bottles or PET-Trays:

- ✓ Indicate settings used with reference to the sorting program. Any deviation from the reference program should be reported.
- ✓ Materials sorted by the NIR PET-Bottles, will end-up in the **PET-BOTTLES fraction**.
- ✓ Materials sorted by the NIR PET-Trays, will end-up in the **PET-TRAYS fraction**.

4.10.3 NIR PE

Materials that pass continue to the next sorting step: the NIR for PE. Based on the description in the required input data and sense-observation, the presence of PE in the packaging is checked:

1. If no PE has been reported or found in this packaging, the packaging will continue to the step "**NIR PP**".
2. Packaging containing PE are run through the following procedure.

Procedure:

- Check the program used is compliant to the accreditation requirement.

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the NIR for PE.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the PE).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the NIR PE:

- ✓ Indicate settings used with reference to the sorting program. Any deviation from the reference program should be reported.
- ✓ Materials sorted by the NIR PE, will end-up in the **PE fraction**.
- ✓ Materials not sorted by the NIR PE, will continue to the step "**NIR PP**".

4.10.4 NIR PP

Materials that pass continue to the next sorting step: the NIR for PP. Based on the description in the required input data and sense-observation, the presence of PP in the packaging is checked:

1. If no PP has been reported or found in this packaging, the packaging will continue to the step "**NIR PS**".
2. Packaging containing PP are run through the following procedure.

Procedure:

- Check the program used is compliant to the accreditation requirement.

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the NIR for PP.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the PP).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the NIR PP:

- ✓ Indicate settings used with reference to the sorting program. Any deviation from the reference program should be reported.
- ✓ Materials sorted by the NIR PP, will end-up in the **PP fraction**.
- ✓ Materials not sorted by the NIR PP, will continue to the step "**NIR PS**".

4.10.5 NIR PS

Materials that pass continue to the next sorting step: the NIR for PS. Based on the description in the required input data and sense-observation, the presence of PS in the packaging is checked:

1. If no PS has been reported or found in this packaging, the packaging will continue to the step "**NIR Mixed Plastics**".
2. Packaging containing PS are run through the following procedure.

Procedure:

- Check the program used is compliant to the accreditation requirement.

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the NIR for PS.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the PS).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the NIR PS:

- ✓ Indicate settings used with reference to the sorting program. Any deviation from the reference program should be reported.
- ✓ Materials sorted by the NIR PS, will end-up in the **PS fraction**.
- ✓ Materials not sorted by the NIR PS, will continue to the step "**NIR Mixed Plastics**".

4.10.6 NIR MIXED PLASTICS

Materials that pass continue to the next sorting step: the NIR for Mixed Plastics Rigids. Based on the description in the required input data and sense-observation, the presence of recognisable polymers in the packaging is checked. The packaging is run through the following procedure.

Procedure:

- Check the program used is compliant to the accreditation requirement.

- Feed samples* to the conveyor belt with other packaging waste. This should be the belt which is running towards the NIR for Mixed Plastics Rigids.

*(*Depending on the number of samples provided, use 50 from 100 samples)*

- Count the number of samples passing on to the next sorting step (or, depending on the local situation, count the number of samples being sorted in the Mixed Plastics Rigids).

- Add more samples when the outcome is ambiguous.

- At least two people are required for this test (one feeding the process, one analysing the output).

Results of the NIR Mixed Plastics:

- ✓ Indicate settings used with reference to the sorting program. Any deviation from the reference program should be reported.
- ✓ Materials sorted by the NIR Mixed Plastics, will end-up in the **MIXED PLASTICS RIGIDS fraction**.
- ✓ Materials not sorted by the NIR Mixed Plastics, will end-up in the **RESIDUE**.

4.11 MANUAL QUALITY INSPECTION

During the manual inspection, the quality is being improved, by removing unwanted material from the different automatically sorted material fractions.

Based on the product residue in the packaging (for instance silicone) or specifications of unwanted materials, manual removal of certain packaging is standard practise.

Procedure:

- Compare the product with quality inspection guidelines.

- Align the score of the automatic sorting tests with its manual correction.

4.12 REPORT CONTENT

The report should contain the following information:

- Reference to the Sorting Protocol.
- Description of the sorting facility: equipment and settings applied.
- A full and complete identification of the material tested with photographs.
- Description of the samples during each step.
- The photographs are welcome whenever useful for documenting specific situations.
- Details of any deviation from the test method, as well as any incident which may have influenced the results.
- Results & Discussion
- Conclusions, percentage of each fraction and recommendations (if any)
- Test figures. Use the tables below as reference.

Table 2: Size sorting tests

Packaging reference	Packaging photo	Samples tested	>5cm Correctly sorted	<5cm Additional sieve	<5 and >2cm Re-enter process	<2cm Residue / Fines

Table 3: Dynamic tests

Packaging reference	Packaging photo	Samples tested	Wind Sifter (LDPE films)	Ferro-metals	Drinking Cardboard	Non-Ferro-metals

Packaging reference	Packaging photo	Samples tested	Ballistic separation		Flexible MPO		
			Flexibles	Rigids	PE flexibles	PP flexibles	Mixed plastic flexibles

Packaging reference	Packaging photo	Samples tested	PET		PE rigids	PP rigids	PS rigids	Mixed plastic rigids
			PET-Bottles	PET-Trays				

4.13 RESULTS INTERPRETATION

To guide the auditor in the results interpretation the sorting centre should apply the following rules:

- in case the packaging ends in the mix rigid or mix flexible streams, the test is failed. The packaging is considered disqualified for recyclability.

- in case the packaging ends in a polymer stream:

a) the test is failed, and the packaging is disqualified for recyclability in case the resin used for the packaging body and the stream do not correspond;

b) the test is passed in case more than 50% of the packaging ends in the stream corresponding to the resin used for the packaging body; in this case the following rules are applied by the auditor:

- ✓ **sorting efficiency higher than 80% and the rest not sorted (residues) or sorted in the mix streams**: the packaging is fully sortable and no penalties are applied; if more than 10% is sorted in another stream 1 class penalty is applied.
- ✓ **sorting efficiency lower than 80% but higher than 70%, with the rest not sorted (residues) or sorted in the mix streams**: the packaging is sortable with minor inefficiency and 1 class penalty is applied; if more than 10% is sorted in another streams 2 class penalties are applied.
- ✓ **sorting efficiency lower than 70% (but higher than 50%) with the rest not sorted (residues) or sorted in the mix streams**: the packaging is sortable but with low efficiency and 2 class penalties are applied.
- ✓ **sorting efficiency lower than 70% (but higher than 50%) with more than 10% contaminating another polymer stream**: the test is passed and 3 class penalties are applied.
- ✓ **sorting efficiency lower than 70% (but higher than 50%) with more than 20% contaminating another polymer stream**: the test is failed and the packaging is disqualified for recyclability.

Results will be summarized in one table, following the template below:

Pack. Descrip.	RecyClass grade	Compaction	Sieving	Wind sifting	Behaviour conveyor	Ballistic separation	Eddy current & non-ferrous	NIR	Final stream

The colour of the bow depends on the results of the test (red = fail; orange = some issues; green = passed).

In any case the sorting efficiency is lower than 50% the tests are failed, and the packaging is disqualified for recyclability.

The below table summarize the test results and should drive the applicant and the auditor in the interpretation of the results.

Table 4: Sorting efficiency results

Sorting efficiency	Contamination in another mono-stream	Test Results	Penalties (classes)	Penalties (rate)
≥ 80%	≤ 10%	Passed	-	-
≥ 80%	> 10%	Passed	-1	-10%
70-80%	≤ 10%	Passed	-1	-10%
70-80%	> 10%	Passed	-2	-30%
50-70%	≤ 10%	Passed	-2	-30%
50-70%	> 10%	Passed	-3	-50%
50-70%	> 20%	Failed	Disqualified	Disqualified
<50%	n.a.	Failed	Disqualified	Disqualified

RecyClass

ANNEX I

It is essential for certain types of packaging to be tested according to the RecyClass Sorting Protocol, as their design can affect either partially or fully the packaging sortability, leading to the losses of materials.

The packaging designed with the following characteristics[4] must be tested in order to determine the sensor-based sorting efficiency:

- Large labels (covering > 50% of the surface) made from a different polymer
- Full body sleeves
- Perforated full body sleeves
- Multi-layer structures (excluding PE/PP EVOH)
- Metallisation (excluding on the inside/in the middle layer)
- Non NIR detectable colours on the packaging (i.e., when dark colours used for internal layers)
- Different types of plastic used on front and back sides
- Different types of plastic (rigids and flexibles) used in the packaging
- Ferro magnetic components
- Round shape, very rigid and hard to compact

[4] *As reported in the RecyClass Recyclability Methodology*

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