

Size Sorting in the Plastics Recycling Process

1. **Background:** Small plastic packaging items or components, including bottles, jars and containers, may be designed for recyclability considering most attributes but may not actually get recycled in modern MRF processing systems due entirely to their size. Items with two dimensions less than two inches (2") are likely to pass through sorting screens in MRFs that are designed to separate other contaminants. These screens are designed to do one of two things – separate small contaminants and direct them to waste, or separate pieces of broken glass and direct them to the glass stream. Small plastic items unfortunately become collateral damage in this process.

One of the first steps in the MRF process is glass removal. This is accomplished by impacting the entire mixed material stream with hammers or other tools to break the glass. The material then passes over a screen where the broken glass falls through the openings. Items that pass through the screen are processed through the glass system and lost to other material recovery systems. The material retained on the screen proceeds through the rest of the material recovery process.

In addition to separating glass, up-front screening is designed to protect sensitive MRF equipment from damaging items such as rocks, metal objects, and similar unwanted objects. It is also designed as an initial quality check for identifying and discarding small bits of wet paper, cigarette butts, food scraps, and other heavy small items that can interfere with sorting in the latter stages of processing as well as cause safety and health concerns.

If a small plastic item avoids being discarded by MRF screens, and is correctly sorted by polymer later in the process, it may reach the plastic reclaiming facility and get recycled. However, this condition is not typical.

2. **Technologies:** MRFs employ various technologies to sort incoming commingled materials. Small items are generally missed by up-front manual sortation focused on objects that are too large, so they move on to the mechanical screening processes.

MRFs use shaker screens, star screens, trommels, and air screens at various points in the process. These technologies are designed to sort:

- Broken glass from other materials;
- Light from heavy;
- Large from small;
- Two-dimensional from three-dimensional

Star screens, for example, sort flat items, primarily paper (2-dimensional) from cylindrical items, primarily containers (3-dimensional). Star screens employ rotating discs positioned at specific distances

along a number of fixed shafts, upon which paper items travel forward and upward while smaller items pass between. The star screen can be inclined so 3 dimensional items such as containers fall backwards. Trommels, rotating drums with holes in the walls, can be used to separate small potential contaminants.



Trommel Screen



Star Screen

Other screening technologies are used to separate contaminants from the recycling stream, but the effect of these technologies is to separate potentially recyclable, smaller sized, bottles and containers from the stream, and direct them to the discards, or to streams of other recyclables from which they will eventually be discarded as contaminants.

The APR Size Sorting Potential Test: The APR has developed a test, [SORT-S-02 Evaluation of Size Sorting Potential for Articles with Two Dimensions less than Two Inches](#), designed to evaluate whether a plastic article will correctly pass over a lab scale average sized glass screen that performs similarly to that used in production facilities. Good results in this screening test indicate that a plastic article has the potential to be sorted well in production conditions. Poor results indicate that an improvement in plastic product design is desirable to promote recovery.

DOCUMENT VERSION HISTORY

Version	Publication Date	Summary of Revisions
1	July 20, 2018	Original
2	August 30, 2024	Change name of protocol from RES-SORT-03 to RES-SORT-02 and added hyperlink for SORT-S-02; Updated hyperlinks to match new website