Omni Channel Poly Bag Sortation

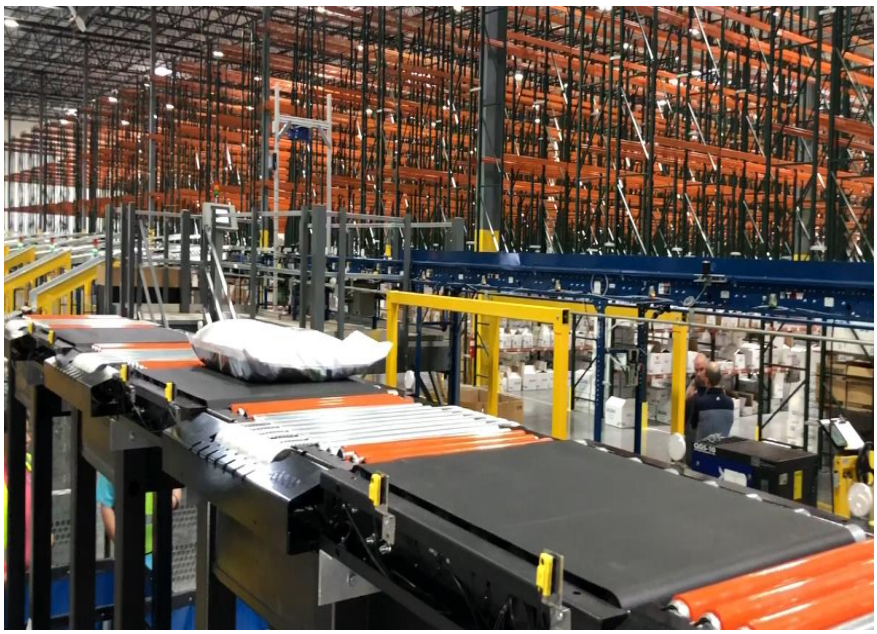
The unique and challenging physics of Poly Bags

And other non-rigid containers found in Order Fulfillment

By TRC Consulting & Robotica Inc™

It's important to understand the physics required for successful sortation of poly bags. Simply diverting a poly bag from a direction of flow to a sort point requires a force acting on the bag to move the bag to a chute or container. Sortation systems deliver this force to the poly bag by gravity, normal force and friction. Tilt tray and bomb bay style sorters use gravity very effectively to transfer bags from the main line. These sorters are very costly, large, heavily engineered, time consuming to install, space inefficient and inflexible.

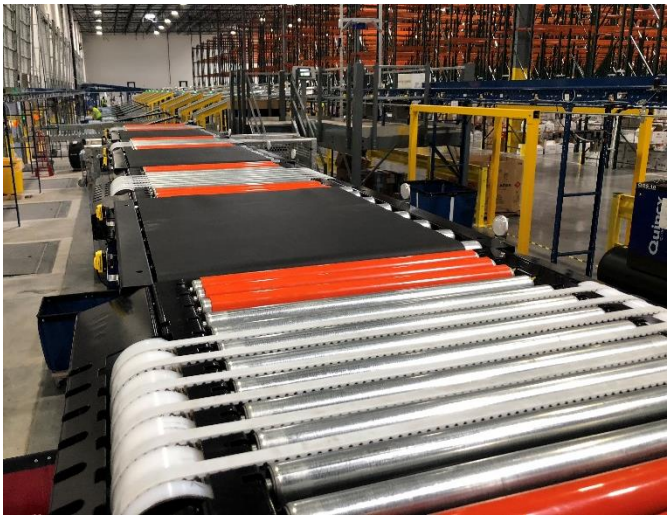
The Z1 eSort design and why its performance is superior for sorting Poly Bags...



Normal force sorters consist of shoe sorters, pushers and paddle sorters. Shoe sorters can be fast but are also costly, large, heavily engineered, time consuming to install, space inefficient and inflexible. Paddle sorters and pushers are low cost and have some flexibility, but are very limited in rate and cannot handle all poly bags. All normal force sorters require some level of rigidity and minimum height of the contents in the polybags to receive and handle the mechanical transfer force.

A Side by Side Comparison

The Z1 eSort and Intralox ARB both use friction to transfer bags from the main moving conveyor. The ARB can be scaled from small to large systems with medium throughput rates making it one of the closest comparative poly bag sorters to the Z1 eSort. There has been much fanfare about the ARB (Activated Roller Belt) technology, but a closer look, exposes the ARB limitations and details the Z1's superior performance handling poly bags for sortation.



Z1 eSort *on the left provides a better surface "grip" for sortation performance of Poly Bags over the* ***Intralox ARB*** *below with simplified mechanics.*

The force to move the bag is determined by the bags inertia and the drag on the bag resisting the motion. Friction is a combination of the **surface "grip" Coefficient of Friction (COF)** and the normal force acting on the surfaces (typically weight). The COF is dependent on the material and surface area in contact with the bag. Optimizing combinations of normal force and COF increases the friction and the force transferred to the bag.

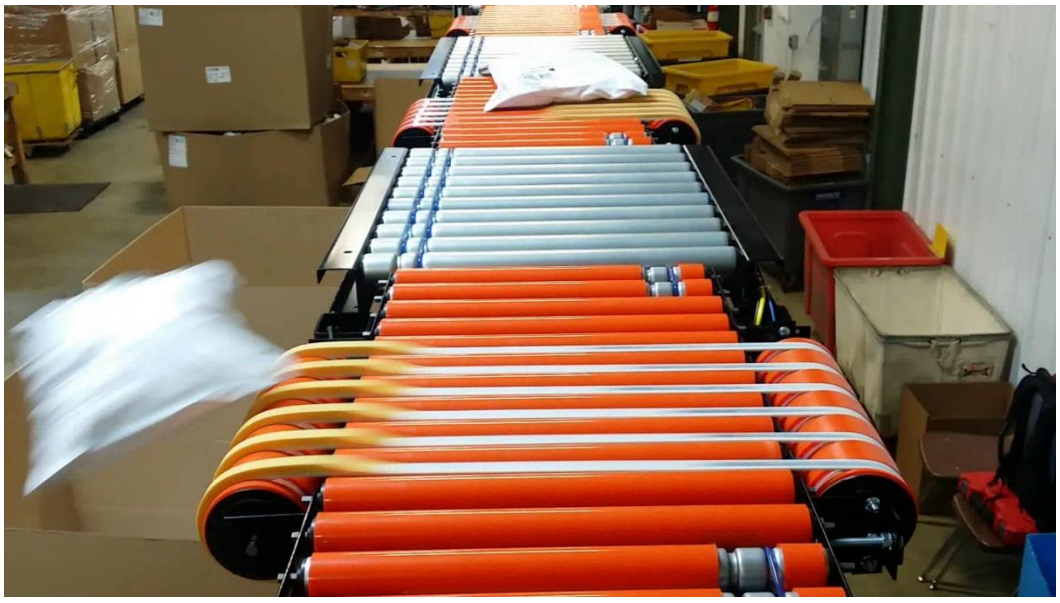
Control issues aside, the primary reason for unsuccessful bags sorts is insufficient friction to drive the bag off the conveyor before the bag is carried past the sort point. Transfer force must usually overcome the drag from the bag moving over a conveying surface, inertia of the bag, and mechanical interference. Many sortation system manufacturers will limit the minimum weight of the polybag package in order to have enough normal force.

The challenge with handling polybags is generating enough friction and therefore force to overcome forces holding the bag on the conveying surface. A cross belt sorter overcomes this challenge by conveying the transfer mechanism holding the bag (e.g.). ARB is a long continuous "chain" conveyor surface carrying small rollers that are actuated by stationary motors at sort positions in the conveyor bed. ARB sorters activate rollers in the chain to carry off the bag as the chain is moving.

Competing Conveyor Forces Need to be Eliminated

ARB transfer rollers only spin and do not lift the polybag. This design relies on product in the bag (or the bag itself) to be rigid enough to bridge across the rollers in a uniform distributed fashion and only make contact with the very top of ARB rollers surface. This rigidity is required to minimize the poly bags contact with the base conveyor "chain" surface surrounding the ARB rollers that doesn't move and serves to anchor uneven soft sided bags in place. If the poly bag has any sag between the rollers the force imparted by the rollers must overcome the **competing force** from contact with the base conveyor or "chain" surface. Any drag from this surface "chain" can inhibit the transfer of the poly bag and cause it to miss the assigned sort chute or hang up. This inaccurate sort is often not tracked in the ARB system because the configuration of the photo eye in the ARB can only be a single beam across one side of divert chute for confirmation. The Z1 eSort utilizes a photo eye array set up on all four sides of the sort zone that confirm the poly bags' exit from the sort zone. Once again, the simple design and configuration of the Z1 eSorter delivers the best poly bag tracking entering and exiting the sort zone, thus providing a more accurate poly bag sortation system.

The Z1 lifts bags from the conveying surface dramatically reducing drag on the poly bag during transfer and ensuring a positive, accurate sort.



The Z1 transfer(s) lift the Poly Bag(s) and eliminate forward movement and its forces on the Poly Bag. The ARB / conveyor roller design does not do this because of the conveyor "chain" surface drive that moves the entire ARB belt downstream maintains some contact with the poly bag. The Z1 lifting motion disengages the bag from the forward motion of the conveyor rollers to ensure proper accurate sortation. Furthermore, the Z1 controls logic will also interrupt forward motion of the downstream conveyor roller to stop forward motion of the bag at the sort point, thus eliminating any competing forces to inhibit the poly bag from its true sort direction. This happens without slowing progress of the bags upstream. Therefore, very liquid poly bags that are not flat and rigid can be sorted accurately and efficiently.

NOTE: *An exceptional and unique feature of the Z1 and all eSorters, is the ability to accumulate product on the sorter as required to ensure all sorts are accurately completed and confirmed while maintaining the integrity of all other poly bags or parcels in-line behind them. A Photo Eye "light array" on all four sides of the Z1 track poly bags through the sort zone and confirm completed sorts.*

Getting a Grip on Poly Bags

The transfer rollers in the ARB design that impart the transfer force on the bags are made from an injection molding process that leaves the finished materials hard and smooth and limit the grip of COF. There is also a specific relationship with the slip required and wear characteristics between the ARB and the underlying roller conveyor driving the ARB that further limits the grip or COF of the roller material further reducing the torque in the ARB in contact with the poly bag.

Sideview of Z1 eSorter in action: Lifting, and positively sorting a soft sided poly bag, while briefly pausing the forward rollers to eliminate any opposing force on the Poly Bag…

In contrast the Z1 material that contacts the poly bag surface for sort transfer only contacts the poly bag (not a conveyor drive bed as the ARB design has to) and therefore the surface can be **optimized for the maximum grip** with poly bags based on polyethylene surfaces with various softer textured surfaces.

Entire System Designs are Negatively Impacted because of ARB Technology

ARB system transfers have no choice but to slowdown to counteract the competing forces, reducing the chain speed and or **widening the chute opening and increasing the distance between the sort points and the gap between each poly bag to reduce errors**. The affect is a reduced sort rate and accuracy for individual unit poly bag(s), fewer sort points within a given area and a larger more expensive system design than must now compensate for a few product items and not the majority of the products being sorted.

Additionally, ARB systems must overcome their transfer slowdown by reducing the width of the belt to let gravity complete the transfer process. The narrowed conveying surface limits the range of product(s) that can be handled and puts pressure on the induction process (poly bag loading / induction) to be perfect. Every poly bag loaded must be perfectly centered which can slow down the manual induction process, requiring more loading stations and more labor personnel.

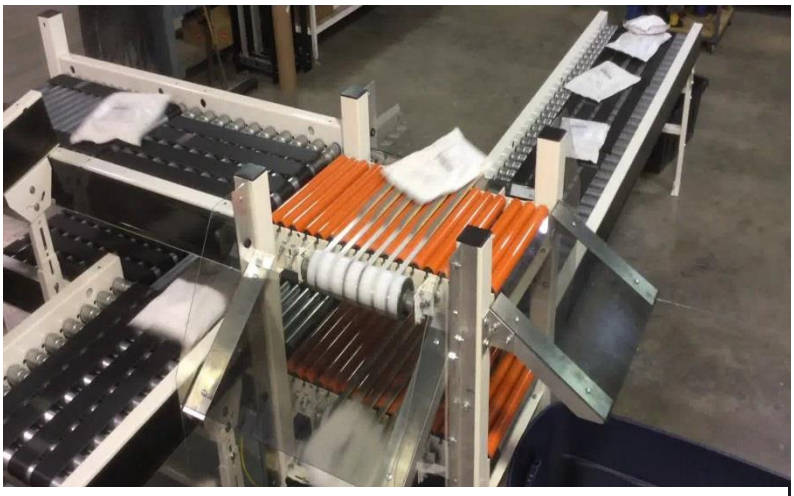
Less Contact Means Less Transfer Force

ARB transfer rollers are small in diameter to effectively fit into the conveyor chain. The small diameter has a small contact area to the poly bags. Less contact area means less transfer force imparted on the poly bag. **The Z1 eSort uses large wide flat transfer belts, providing substantially more contact area by comparison and eliminating surface "chain" drag.**

TGW Mod-Sort

Z1 Superior Grip – Provides a Positive, Accurate and Economical Sorter

It can be argued the Z1 superior grip is excessive for contact surface and controlled forward movement, but when you consider not all bags act the same. ***Small light weight bags with small rounded items*** **inside offer very little friction** for consistent and positive sorting action. Large heavy bags that tend to flow can drag severely. The Z1 transfer generates superior transfer forces while eliminating competing forces to handle packages other sortation systems can't, but the Z1 does not stop here…



Because of the Z1 eSorters Accuracy and tracking ability: Stacked configurations can be implemented for Shipping-Zone Skipping Systems.

The Z1 design provides a most positive and accurate poly bag sorter in the market and does so at **the most competitive price** in the MHE industry. Polybags are tracked into and out of every sort point. In the case where a bag does not transfer within the typical time of several hundred milliseconds, the Z1 will hold the bag at that sort point and make additional attempts to move the bag into the correct container. Z1 will not advance bags scheduled for sortation past the sort point to make sure packages do not end up in the wrong place or lost. If the bag will not clear into the container manual intervention will be called to that location to clear the bag. Restart will continue the sort process without need for clearing or moving package other than the trouble zone.

The Z1's Accuracy and ability to handle a wide variety of products make it a key component of complete order fulfillment systems *(see left)* ***for Omni-channel companies sorting Poly Bags, Parcels and boxes.***

TRC Consulting

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