Austin's Top 10 Tips for Designing a Successful Packaging Line

Planning includes operator skills, right-sized equipment and package design

It's a long way from the processing line to the store shelf. How your package stacks up and holds up is critical to your success. Good packaging doesn't just happen; it's designed and delivered. And even a well-designed package requires a significant investment in quality equipment to fill, close, label and case the product, as well as a properly designed environment in which to operate the equipment efficiently.

Here are our Top 10 Tips for designing a successful packaging operation.

1. Design the package for end-user / manufacturing requirements

A well-designed package must achieve several goals simultaneously. First, it should protect the product from environmental factors that degrade product quality. Second, it should complement the use of the product. Third, it should present the product in a desirable and appealing fashion. Fourth, it has to survive the rigors of the distribution system. And finally, it has to maintain shelf life until the product is consumed. And the package has to balance performance in these areas with performance on your line. Sometimes great graphics, shapes and features have to give way to the practicality of what can be run.

There are basically three kinds of packages: primary, secondary and tertiary. The primary package is a single-serving or standard amount the product comes in. A secondary package is typically a carton or a case that encloses a bundle or grouping of primary containers. Tertiary packaging typically refers to pallets, slip-sheets and stretch wrap that deliver unit loads to a warehousing environment.

The major environmental factors that contribute to product degradation are light, oxygen, moisture and heat. Barrier properties in the primary package are critical to ensuring that the product is protected. Package design may influence how the product is dispensed and/or stored in the consumer's household. Whether the product is designed for multiple use dispensing or single-serve, package shape, closure, and re-sealability are all important factors to consider.

2. Select equipment that's efficient and flexible

It's rare to find dedicated packaging lines anymore. Most packaging operations are required to run multiple products and multiple sizes on a single production line. The biggest challenge is efficient changeover between products and sizes.

Look for equipment that is designed for "tool-less" changeover. Locking pins and detents, adjustable slides and automated devices are all worth the investment if they improve changeover performance. Fillers and sealing equipment can be designed with modular heads that "plug in" and "pull out" to improve changeover speed.

Modifying your CIP system to run a flush rather than a full-cycle cleaning helps speed the process as well if products are compatible and small amounts of carryover aren't objectionable.

3. Benefit from thinking "green" packaging

Momentum is building for widespread use of sustainable packaging materials. Packaging suppliers have been introducing various forms of biodegradable and recyclable plastics made from a variety of plants, mainly corn, based on projections that consumers and recycling regulations will drive demand for environmentally-friendly packaging . Feasibility studies are looking at biodegradable natural polymer products as an alternative to polyethylene terephthalate (PET). The sharp rise in the prices for petroleum, a major component of PET and other packaging plastics, has made bioplastics a competitive alternative.

Additionally, you should look for ways to reduce or recycle your packaging waste. By reducing corrugated usage or improving the recycled content of your corrugate, you've gone a long way to reducing your carbon footprint. As newer materials come along, convert to improve your overall sustainability rating. Also, provide space for bins to hold segregated waste materials for recycling purposes.

4. Purchase minimal equipment for maximum production

A great many packaging lines are designed with machines organized in an X-speed arrangement. This is an old approach that identifies the "critical" component of the line and defines the speed of components upstream and downstream of this component in terms of this critical speed. If you were to plot individual equipment speeds in the vertical direction along a horizontal line that represented product flow through the system, the speed curve would make an X-pattern.

While there was and continues to be merit in this type of design, there are more sophisticated and effective strategies for optimizing line performance. The largest drawback with the X-speed design is the tendency to oversize and overbuild the front and back ends of the line. Today's packaging lines are built with only a hint of the X-speed curve. Modern simulation techniques provide better accumulation methods and stop-start dynamics between components so equipment is more closely compatible in speed range.

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5. Save labor costs with good room layout

A smaller crew means more emphasis on communication and line-of-sight control. This factor is often overlooked in high-speed line designs. Operator response times are significantly improved if they can communicate both visually and verbally with each other, and if they can see upstream and downstream disturbances in product flow. Building layouts that include intervening walls and/or different operating floor levels work against operator efficiencies. Where walls must be installed, adequate windows should be provided. Radio and other two-way communication systems between operators have proven effective in multi-level operations.

6. Improve performance goals with filling accuracy/reliability

On many lines, especially those that use volumetric filling methods, a check-weigher is installed immediately after the closing system. This device weighs each individual filled container and ensures that the container weight is within tolerance. Heavily overweight or, more importantly, underweight containers are rejected and a signal is sent to the operator to adjust filler performance accordingly.

A statistical weigher incorporates several small scales and buckets arranged in a circular pattern that may be discharged under computer control. The basic approach is to size the buckets appropriately to handle about 1/3 to 1/6 of the total desired product weight. A computer program looks at the weights in the individual buckets and selects that combination of buckets which gives the closest approximation to the target weight.

Most often, statistical weighers are mounted above some type of flexible pouch machine. There are applications where large, open containers may be run on indexing conveyors under the discharge of the statistical weighers. For products like salty snacks, nuts, and piece candy, the statistical weigher can reduce product overfill down to parts of a gram, providing considerable cost savings versus other filling methods.

7. Inspect packages to ensure product safety

If metal detection is used, it oftentimes is employed prior to labeling and case packing. Two types of metal detection equipment are currently in use. The first uses a combination magnetic/RF field to detect the presence of metal particles. Iron-bearing or ferrous materials are easily detected; non-magnetic materials such as aluminum, stainless steel and brass are more difficult to track.

Low-level X-ray radiation technology has recently become more affordable. In this approach, individual containers are X-rayed and a background level of transmitted radiation is established.

Just as in medical X-ray imagery, the display shows a ghost black-white image of the container. Since metal particles are typically much denser than food particles and glass and plastic are typically much lighter, these defects will show up as darker or lighter spots on the image. High speed image resolution analysis has made X-ray density measurement a reliable method for checking contaminants, even through metal containers.

8. Consider closing and sealing in package design

Various closing mechanisms including cappers, lidders, seamers, sewing machines and heat-sealable foils may be employed depending upon the product and type of container.

Your closing system has to balance the need for tight, leak proof seal integrity with ease of opening and dispensing. Think about the twist-off cap on beverage bottles or the pop-top can as examples. On some packages, simply substituting a reworked closure system is all that's required. On other packages, the package has to be completely re-designed to incorporate the closing features and this often means redesigning your closing systems.

One of the biggest challenges is the change in the physical and mechanical properties as we move to more sustainable packaging materials. Some of these changes, while improving or reducing the environmental impact of packaging, can cause reliability and runability issues on the manufacturing floor.

9. Drive operations with automation and training

Operator requirements, control system complexity, and the availability and adequacy of training programs should all be considered from the beginning of the design process.
Recent advances in automation, control, and changeover tooling have all tended to reduce the need for operators to baby-sit packaging machinery. However, we're still a long-way from the "lights out" factory of the future much heralded in the early 1980s.

While there have been significant improvements in automation and control systems over the years, it ultimately comes down to competent, trained and motivated operators and line personnel. The design of the packaging line cannot be solely focused on equipment selection and throughput. You have to consider the demands your "flexible packaging line" places on the operators, too.

Your operators can no longer learn a single job skill and hone it to perfection. Rather they have to learn to adapt to differing job requirements and conditions. Training programs focused on relieving anxiety and explaining how requirements change during different product runs are important.

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10. Ensure shipping integrity from start to finish

Efficient systems for grouping, bundling and stacking product for shipment are critical to successful operations. A system tailored to handle the primary package while delivering protection against abrasion, puncture, crushing and dropping damage is a critical part of the mix. And, while it's possible to make an outer container that's impervious to these challenges, it's always a tradeoff between protection and easy-opening features that improve product acceptance.

The Austin Food and Beverage Group is experienced in both the art *and* science of packaging system designs. Contact us today and we can help you design a cost-effective and efficient system that delivers reliability and safety.

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