SHRINK WRAPPING

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A Frain Industries Packaging Equipment Whitepaper

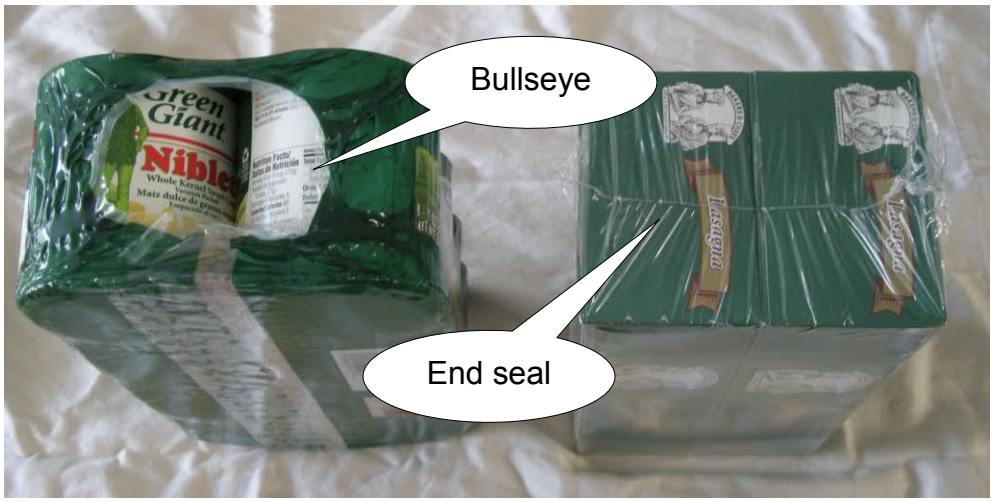
Strictly speaking, shrink wrapping is not considered “flexible packaging.”

However, wrapping does use flexible film and foil of various materials and combinations. Many of the general considerations for films discussed in previous whitepapers on Form-Fill-Seal and pouching machines will apply to wrapping machines as well.

The film used in shrink wrapping is a typically a single layer polyethylene or polypropylene though other plastics and multi-layer films can be used. It is manufactured so that on exposure to heat, it shrinks by about 30 to 80%. If multiple layers of shrink film are to be used, for example to bundle several shrink wrapped trays, the films must be selected so that they do not bind to each other when heated.

Shrink wrapping is sometimes used as the primary packaging. Some individual foods, soaps and other products may be wrapped directly. More commonly shrink wrapping is used as a secondary or tertiary packaging. An example of secondary use is shrink wrapped six-packs of beverage cans or 24 pack bundles of water.

Wrapping is also commonly used as a tertiary packaging such as overwrapping an individual carton or bundle of cartons. In the past, appearance of the tertiary packaging has not been considered critical important as the customer never saw it. The rise of club stores like Costco and Sam's Club has changed this. The 6 pack of canned corn is now the unit of sale in these stores and appearance has become critical to branding. Previously translucent grey film was fine since nobody outside of the stockroom was likely to see it. Now, glossy film with registered graphics is needed to catch the customer's eye using bullseye or end seal wrapping. This affects the choices of machinery that can be used.



Many products in the past were packaged in corrugated trays prior to shrink wrapping. This adds considerable cost to the product as well as an additional production step and machine. Higher performance films have allowed the reduction and elimination of corrugated board. This picture shows beverage cans in a corrugated tray of 24 cans and in a trayless wrap of 28 cans.

L-Bar Wrappers

L-bar wrappers, sometimes called L-bar sealers, take their name from the shape of the sealing bar. These wrappers can range from completely manual using a handheld sealing and cutting bar to fully automatic running at speeds up to 150ppm or more. One thing that sets the L-bar apart is that it uses a film which comes pre-folded from the film supplier.

The film is fed into the machine and the two layers held apart by guides in a loading section. The product or package is placed between the layers of film and the film and both are pulled forward into the seal area. An L-shaped sealing bar is pulled down, either by hand or automatically, and seals the longitudinal and trailing edges of the film and the leading edge of the next package. The sealing bar also cuts off excess side film and cuts the current and next package apart.

The L-bar sealer makes a complete, hermetic, trapping air inside the package. If not allowed to escape, this air will prevent the film from shrinking completely leaving a pillow-like package. To prevent this, the film must be perforated. One common way to do this is with a pin wheel which makes a series of holes as the film is pulled over it. Another is a heated element which cycles with film movement to make a single hole in each package.

The package, now wrapped on six sides, is conveyed through a heat tunnel where the film shrinks for a tight conformal wrap.

Advantages of the L-bar wrapper are simplicity and relatively low cost. The 6 sided, almost hermetic wrap is another advantage. When multiple product sizes are to be wrapped, this sealer can often handle them with no change in setup.

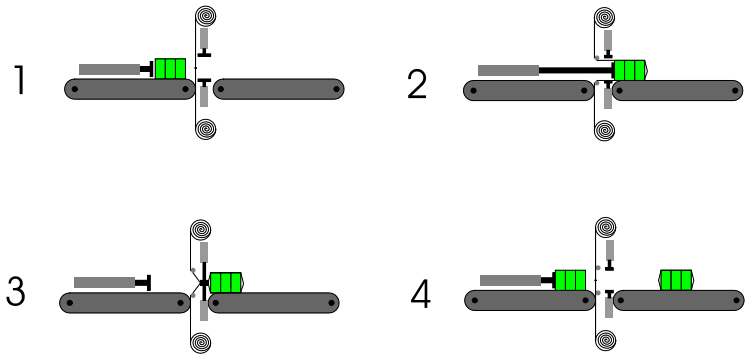
Double-Roll Wrappers

Double-roll wrappers are the most common type used in consumer goods packaging. As the name implies, they use 2 rolls of film for wrapping, one above and one below the product. The ends of the film are welded together forming a wall or curtain.

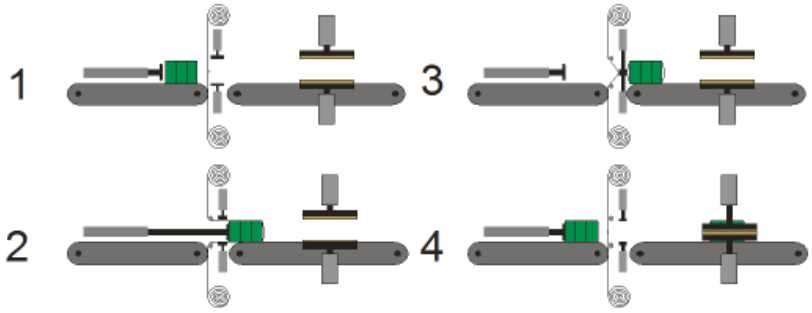
The product is accumulated and collated in front of the curtain. Once a complete group is assembled, it is pushed through the curtain. As it pushes through, the film unwinds from the rolls and envelopes the front, top and bottom of the bundle. Spring-loaded dancer rolls maintain a constant film tension. Generally the force of the product being pushed through the curtain is sufficient to pull the film off the rolls. In some instances, when the package is wide or long i.e.; large film rolls, powered film unwind systems may be used.

Once the bundle has been pushed through the film curtains, the upper and lower sealing jaws close, welding the film behind the bundle, cutting it and welding the film ends to reform the curtain. These 3 functions are performed in a single “pinch” of the jaws.

The bundle is now contained in a sleeve of film, closed on 4 sides and open on each end. It passes to a heat tunnel where the film is shrunk tightly to the bundle. The open sides also shrink around the end of the bundle preventing the product from falling out. As the open sides shrink, they form an open “bullseye” at each end of the bundle. This size of this bullseye will be larger or smaller depending on how wide the film was relative to the bundle. To hold the bundle together, it needs to shrink around the edges of the bundle but the center opening can be fairly large. Or a wider film can be used to minimize the bullseye for maximum protection. In some cases, a very wide film may be used to eliminate the bullseye completely. This provides almost the physical equivalent of a complete 6-sided wrap, but the appearance may be considered unsightly.



If a true a full 6-sided wrap is required, side sealing bars can be added after the initial 4-sided wrap. These are 2 pairs of sealing jaws, one on each end of the bundle. The bundle pauses at the jaws and they close, sealing the ends of the film together and, generally, cutting off any excess. When fully sealed in this way, a means for escape of trapped air must be provided to allow the film to shrink conformally and avoid the pillow effect mentioned earlier.



If higher speeds are required, some machines will have 2 pairs of rolls, side by side. This configuration operates the same as described above except that there are 2 bundles being wrapped on each cycle.

The wrapper described above is intermittent motion. Double-roll wrappers are also available with continuous motion for higher speed. In these machines the film curtain and sealing jaw move with the product. Speeds to 40-60 wraps per minute and more are achievable.

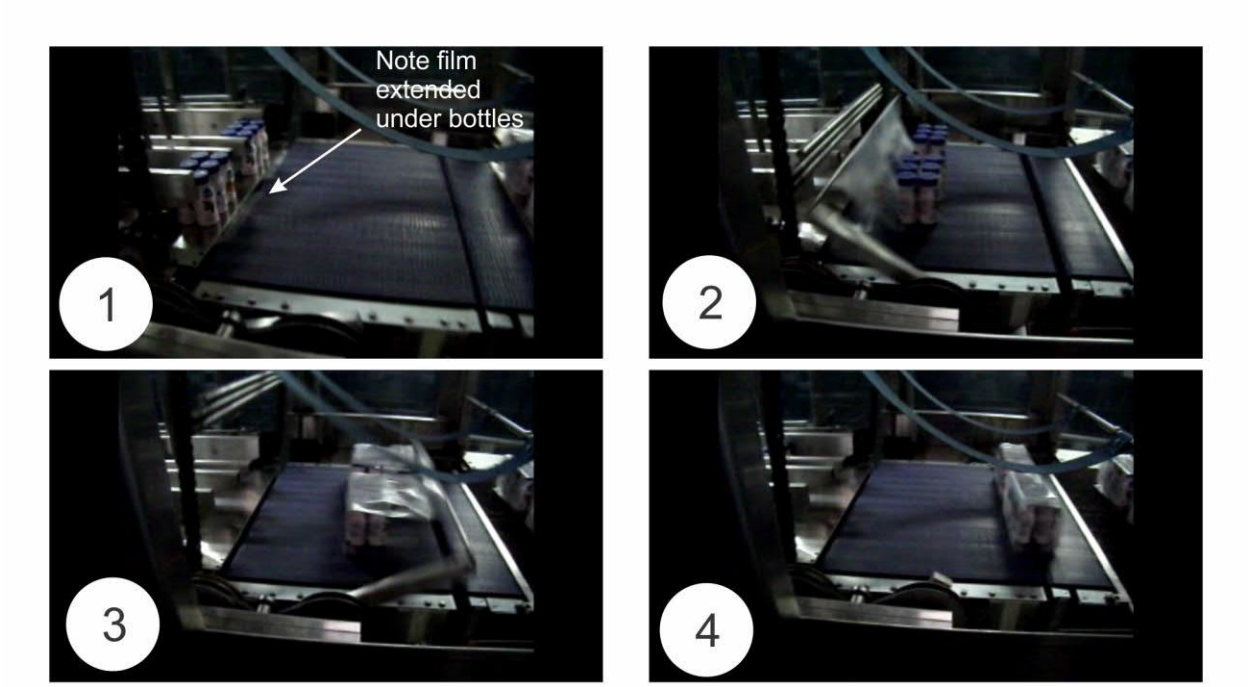
Single-Roll Wrapper

In food and beverage packaging, as well as some other operations, higher speeds will be required. A canning line running 2,000 cans per minute into a 24 pack tray will need a wrapper that can run more than 80 trays per minute.

Another consideration is that more and more packages are using the film as the shelf packaging. Graphics identifying and selling the bundle will be needed in these cases. Double-roll wrappers generally cannot run in registration and must run unprinted or continuously printed film.

Single-roll wrappers can run continuous motion at high speeds and in registration.

The single-roll wrapper generally has the film roll under the machine. Products are collated at the machine infeed and fed from the infeed conveyor to the wrapping conveyor. As the product feeds in, the film is dispensed in synchronization with the products so that the end of the film is approximately centered under the bottom of the bundle. A cutter blade cuts the film to length. An arm carries the cut film up and over the products, over the leading end of the product bundle and down into a gap between the wrapping conveyor and the heat-tunnel conveyor. As the products pass over the gap between the wrapping conveyor and onto the shrink tunnel conveyor, this leading edge of the film is folded under the bundle, overlapping the trailing edge of the film and enveloping the products on 4 sides. The wrapped bundle enters the shrink tunnel where heat under the conveyor welds the film overlap together as the film is shrunk. The final bundle has a bullseye as on the double-roll wrap.



Heat Tunnels

After the product has been wrapped, the film must be shrunk by applying heat. This is usually done in a tunnel lined with electric heaters. In some cases steam may be used but, because the moisture can damage labels and board, this is not common.

The film shrinkage is a function of the time the package stays in the tunnel, determined by conveyor speed and by the intensity of the heating elements. This combination is critical since too much heat applied to the film can cause it to over shrink. This can crush some products like cartons or lightweight water bottles. It can also cause the film to tear in some cases. Too little heat will not shrink the film sufficiently to provide a tight conformal wrap. This can be critical in the case of, say, 24 water bottles. If they are wrapped with a big bullseye, bottles can fall out when the consumer picks up the package in the store. In general, as little heat as possible should be used for optimal shrinkage.

Uniformity of the heat is also important. If not uniform on all sides, it can cause the film to shrink unevenly. This can lead to misshapen graphics or general uneven appearance of the final package.

Conclusion

Shrink wrapping has a number of advantages over alternatives. These include cost, simplicity of machinery, reduction of raw material inventory bulk and it is environmentally friendly.

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