

Tips:

How to stabilize and protect your pallet loads

The quality controls you apply to your processing and bagging steps aren't worth a darn if your bag doesn't survive the trip to your customer. This tip describes methods of protecting your pallet load to ensure your customer receives a top-quality bagged product.

All the bin-level-controlled silos, computer-controlled reactors and conveyors, automatic form-fill-seal bagging machines, and high-tech quality control measures in the world won't ensure that your product gets safely to your customer if you don't protect it on the pallet.

There are three common ways to protect your bagged products on pallets: stretch-wrapping, shrink-wrapping, and stretch-hooding. These methods turn your pallet load into a secure, stable, easily handled unit load that's protected during shipping and storage. See Table I for a detailed comparison of the methods.

Stretch-wrapping

Stretch-wrapping is the most popular and economical way to stabilize and provide some protection to pallet

loads. Stretch-wrapping equipment dispenses a flat sheet of plastic film (often with multiple layers and an adhesive between the layers) from a large roll, stretches the film, and then wraps it in one of various patterns around the pallet load. If the bags are extremely lightweight, a platen can be lowered onto the top layer of bags to hold them in place and keep the film and centrifugal force from pulling the bags off the pallet.

The pallet can rotate on a turntable while the film roll moves only up and down, or the film roll can spin around the stationary pallet. The latter is more practical with an extremely

heavy pallet load. Most of the resulting unit load's stability is in the form of horizontal force; little or no vertical force is applied because typically only a narrow strip of film is laid over the load's top.

Stretch-wrapping's benefits are simplicity and low cost. Depending on the strength and quantity of film you use, this method adds only about \$0.60 to \$0.90 in material cost to each load. For a better idea of cost, let's look at how annual stretch-wrapping costs for an example bagging line vary according to how much the film is stretched. If you stretch-wrap ten 48-by-48-by-60-inch pallet loads per hour for one shift

per day (2,000 h/y) using a typical spiral wrap pattern and pay \$35 for a 20 inch by 5,000-foot roll of plastic film: annual costs will depend on how much the film is stretched:

- \$20,618 for 10 percent stretch.
- \$16,200 for 40 percent stretch.
- \$10,800 for 110 percent stretch.
- \$6,400 for 250 percent stretch.
- \$5,200 for 350 percent stretch.

Table I
Comparison of three unitizing methods

Factor	Stretch-wrapping	Shrink-wrapping	Stretch-hooding
Production rate (based on wrapping a 1.10-ton, 31-by-47-by-59-inch pallet load)	Relatively high; up to 110 pallets/h depending on wrapping pattern and load	High; up to 300 pallets/h, depending on automation level	Relatively high; up to 120 pallets/h
Heat applied	None required	Requires gas or electric power to apply heat during shrinking	None required
Film preprinting	Film can't be preprinted, but label can be applied to finished load	Film is well-suited to preprinting	Film is well-suited to preprinting
Film thickness	Thin film prestretched up to 350 percent can be used	Very thin (down to 40-micron) film can be used	Very thin (down to 40-micron) film can be used
Film recyclability	Conventional multilayer film is difficult to recycle; polyethylene film can be recycled	100 percent recyclable	100 percent recyclable
Approximate film cost	\$2.54 per kilogram	\$1.55 per kilogram	\$1.80 per kilogram
Moisture-proofing and dust-proofing	Not moisture-proof but protects against dust	Moisture- and dust-proof	Moisture- and dust-proof
Load type	Uneven and widely different loads can be wrapped	Uneven and widely different loads can be shrink-wrapped to create evenly sized and distributed loads	One film roll covers limited range of pallet circumferences, but most equipment can handle two rolls
Load transport stability	Provides transport stability for light, stable loads	Provides transport stability for heavy, less stable loads	Provides transport stability for heavy, less stable loads
Load visibility	Load can't always be clearly seen through film	Film is fairly transparent or transparent so load typically can be clearly seen	Film is transparent so load can be clearly seen unless opaque film is required for sun protection
Horizontal and vertical forces	Film applies mainly horizontal forces	Film applies both horizontal and vertical forces	Film applies both horizontal and vertical forces

Stretch-wrapping can also accommodate pallet loads of uneven shapes and widely varying sizes. But the method has some disadvantages too:

- The stretch-wrapped unit load's top is unprotected and can actually trap moisture on the bags. One remedy is placing a polyethylene top sheet over the load before stretch-wrapping, but this requires additional machinery, floor space, and material, adds only minimal protection, and increases the unit load's cost. Another stretch-wrapping method is palletless wrapping: A unit load is placed on a sheet of cardboard rather than a pallet; the top layer of bags isn't arranged in a full layer, but rather in two rows with spaces between the rows. The load is wrapped around the sides, top, and bottom and flipped so the partial top layer becomes the bottom. The spaces between the bags allow a forklift truck to lift and move the unit load. This protects the bags better than conventional stretch-wrapping but doesn't provide absolute protection. It also requires very sophisticated equipment.
- Stretch-wrapping costs can be higher than necessary and difficult to track if the operator is poorly skilled and uses too much film. And even when too much film is used, the unit load still isn't protected because of the load's open top.
- Stretch-wrapping is time-consuming and has the lowest production rate of most pallet-protection methods.
- Stretch-wrapping film is slightly adhesive and tends to attract dust, typically making it difficult to recycle. One option is polyethylene film, which attracts less dust and is easier to recycle.
- Stretch-wrapping shouldn't be used for a unit load that will be stored outdoors because the load has inadequate moisture and dust protection.

Shrink-wrapping

Shrink-wrapping provides somewhat greater stability to the unit loads while greatly increasing moisture and dust protection. Thus the method is often used for loads that will be shipped overseas. Shrink-wrapping stabilizes the unit load by applying both horizontal and vertical forces.

For shrink-wrapping, an operator or an applicator (dispensing) machine slips a bag made of thermoplastic film over the pallet load, and then heat is applied to shrink the film over the load. Depending on the production rate required, heat can be applied in several ways:

- An operator can walk around the stationary load while aiming a handheld electric hot-air gun (similar to a hair dryer) or a more powerful propane heat gun at the load to shrink the film. This method is suitable for low production rates.
- The pallet load can be placed by a forklift truck under a bell- or box-shaped heated enclosure that's suspended from the ceiling and lowered over the pallet load; the heated enclosure shrinks the wrap and then is lifted up so the load can be removed by the forklift. The method is suitable for relatively low production rates. The enclosure must be constantly heated, so the method requires a lot of energy.
- The pallet load can be automatically moved on a roller conveyor through a heated tunnel with doors at either end; the tunnel is constantly hot and the film on the

pallet load shrinks as it passes through the tunnel. The method is suited to high production rates. Significant heat is lost when the tunnel doors open, making this the most energy-intensive method.

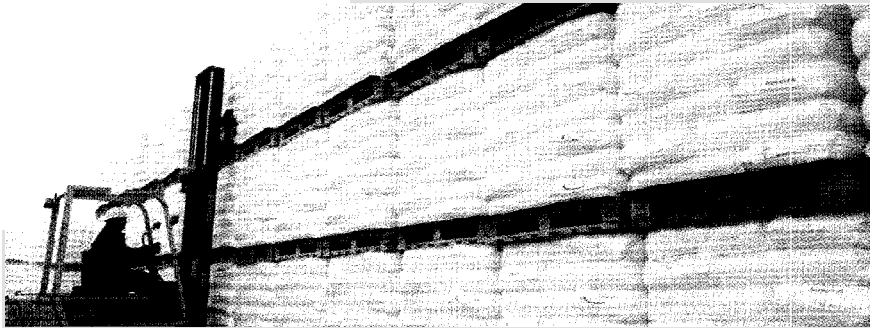
- The pallet load can be automatically moved on a roller conveyor to a gas or electric square heat frame (or ring) that is suspended above the conveyor and, when the pallet load is in place, ignites into small flames and lowers around the load. The heat from the flames quickly shrinks the film as the ring moves down over the load. The method is suitable for high production rates. Because the flames are extinguished between pallet loads, the method requires less energy than the heated enclosure or tunnel methods.

Shrink-wrapping can stabilize heavy, uneven loads and loads of widely different sizes. But the method also has some drawbacks:

- The high heat required to shrink the film can create a safety hazard for workers.
- Creating the heat for shrinking the film consumes a lot of energy and raises the unit load's cost.
- Some heat-sensitive products can be damaged by the shrink-wrapping heat.

Stretch-hooding

Stretch-hooding creates a stable unit load and effectively protects it from moisture and dust as well as shrink-wrapping does, and the method is comparable in unit cost to stretch-wrapping. Both horizontal and vertical forces stabilize the stretch-hooded unit load.



These stable, stretch-hooded unit loads of bagged dry product stack neatly and securely and are well-protected for outdoor storage.

Stretch-hooding requires a machine that forms a bag from a roll of tubular, gusseted, recyclable polyethylene film. Depending on the automation level, the method can also require other pieces of equipment. The pallet load is typically automatically conveyed to the bag-forming machine, which dispenses the film from the roll, opens it, and gathers it up before stretching it to a length that covers the pallet load and overlaps the pallet bottom. Then a heat bar melts, seals, and cuts the film at the load's top, forming a hood over the load.

For maximum protection, a plastic (rather than cardboard) slipsheet with rounded (rather than square) corners and dimensions $\frac{1}{2}$ -inch larger than the pallet can be placed on the pallet below the bottom bag layer. The hood is then pulled past the slipsheet, and the film's memory causes the film to return to its original form so the hood now fits tightly over the load. The slipsheet prevents moisture from drifting up from below the pallet. Some stretch-hooding equipment can automatically sense the pallet load size and dispense film from either of two rolls to accommodate loads of different sizes without requiring manual film-roll changeouts.

The stretch-hooded load's moisture and dust protection provides benefits not only for you but for your customers. Your customers can receive full rather than partial truck or railcar shipments of the unit loads because they can often store the loads outdoors. And you may be able to make longer production runs of rarely ordered product grades because you

may not have to store the unit loads inside your warehouse to protect them. However, long-term outdoor storage of stretch-hooded unit loads has led to a different problem: sun-bleaching of bag labels in the unit loads. As a result, many stretch-hooding operations have switched to using opaque film.

Like shrink-wrapping, stretch-hooding can provide superior moisture and dust protection as well as stabilize heavy, uneven loads and those of widely different sizes. But stretch-hooding has some disadvantages too:

- One roll of film will cover a limited range of pallet circumferences. However, two rolls can be used with most stretch-hooding equipment to handle a greater range.
- The equipment has a higher capital cost than stretch-wrapping or shrink-wrapping equipment and, because of the number of moving parts, can require more maintenance than the other equipment.

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For further reading

Find more information on protecting pallet loads in articles listed under "Bagging and packaging" in *Powder and Bulk Engineering's* comprehensive "Index to articles" (in the December 1998 issue and on *PBE's* Web site, www.powderbulk.com).