

A SHIPPER'S GUIDE TO PACKAGING



Confidence Delivered.®



A SHIPPERS GUIDE TO PACKAGING

Shipper Responsibilities

Shippers are responsible for proper

- packaging
- marking and labeling
- descriptions on all shipper documentation

Shippers must follow all existing tariff and shipping regulations related to their product.

Proper Packaging

Introduction

Shipments must be properly packed to ensure damage-free transportation with ordinary care in handling. The proper packaging of goods for transportation requires a good understanding of the product and distribution environment. There are three essentials to any package:

- 1.) outer packaging
- 2.) inner packaging
- 3.) sealing method

Understanding and following these packaging guidelines can help ensure damage-free freight movement.

Hazards of Distribution

Below are the most common hazards present in freight transportation. These are “normal” hazards of distribution and therefore must always be considered when preparing a shipment for LTL transportation.

Punctures and Abrasion: Occurs when the package shifts or comes in contact with other packages or material handling equipment during transportation. They can also be the result of improper or insufficient internal packaging that does not prevent the contents from shifting.

Compression: Occurs when external forces are applied to the sides, faces or corners of a package. Stacking, shock, vibration, material handling equipment and tie-down straps all generate compression forces that may result in package or product damage. Proper packaging will prevent damage due to normal compression.

Environmental exposures: High and low humidity can result in condensation or corrosion, and it can greatly reduce the rigidity and compression resistance of paper-based products such as cardboard containers. Temperature extremes can range from sub zero to temps in excess of 100 degrees F and can dramatically affect the performance characteristics of packaging material. Other common environmental exposures include, but are not limited to, dirt, dust, odors and precipitation. If a product or package would be considered damaged if exposed to these hazards, the shipper must take extra measures to ensure the packaging can protect the shipment.

Shipment Handling: Proper cushioning can reduce damage caused by the shock incurred during handling and over the road transportation. It is important to note that shipments will most likely be handled with a forklift at some point during distribution. Proper packaging must protect the contents from the drops and impacts commonly associated with handling operations.

Shock: Occurs during handling and transportation as a result of impacts with mechanical handling or road conditions. Proper cushioning can reduce damage caused by shock. Most products will require some level of shock protection to prevent damage during normal handling and transportation.

Vibration: Is normal occurrence in over the road transportation. Proper cushioning can absorb and reduce the negative effects vibration can have on products.

The National Motor Freight Classification. (NMFC)

Integral to the National Motor Freight Classification (NMFC) are internationally recognized specifications, rules and requirements for the proper packaging of goods moving by motor carrier.

The packaging provisions in the NMFC fall into three basic categories:

1. General packaging definitions and specifications
2. Specifications for packages that have been approved expressly for the transportation of certain commodities
3. Performance-based packaging criteria

The general packaging definitions and specifications are for commonly used packages, such as bags, crates, drums and of course fiberboard boxes. These provisions are found in various rules within the NMFC and set requirements for the construction and integrity of the package. For instance, the Item 222 series of rules enumerates the requirements for fiberboard boxes, including size and weight limits, the strength of the fiberboard used, and the box manufacturer's certificate that must appear on all conforming boxes.

The NMFC also provides specifications for literally hundreds of packages that are authorized expressly for the transportation of certain commodities. These are essentially exceptions to the general packaging definitions and specifications, and each is assigned a unique package number. Through laboratory testing and/or actual test shipments, these numbered packages have been proven to offer adequate protection in the motor carrier environment for the transport of particular commodities.

Examples of package design requirements are:

- Item 222 Fiberboard Boxes
- Item 245 Crate Design Requirements
- Item 255 Drums
- Item 265 Pallets
- Item 258 Plastic Pails

These are only a few examples. Literally every package design is reviewed in the NMFC. Shippers are encouraged to refer to the NMFC for all packaging requirements.

General packaging requirements are addressed in Item 680. A summary includes:

Item 680 PACKING OR PACKAGING-GENERAL

Sec. 1. (a) The definitions of or specifications for packing requirements are named in: (1) Items 200 through 299, (2) numbered packages and (3) Note references.

The material and construction specifications therein are minimum requirements and must be observed.

Whether or not interior packing devices are a part of specific requirements, interior packing devices must be provided where such are necessary to afford adequate protection against damage to the contents of a container.

Articles or articles and necessary interior packing devices must reasonably occupy the full cubic capacity of the outer shipping container

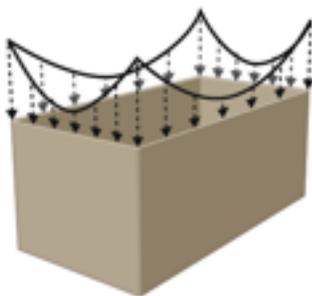
Sec. 7. (b) Articles in packages or shipping forms, as authorized in individual item descriptions, will be accepted when unitized or secured on lift truck skids, pallets or platforms meeting the requirements of Item 265. Unless otherwise provided, when in the specifications of numbered packages or in individual item descriptions articles are required to move on lift truck skids, pallets or platforms, such skids, pallets or platforms must meet the requirements of Item 265. Except where required in individual item descriptions, it is recommended that articles unitized or secured on lift truck skids, pallets or platforms not overhang the skid, pallet or platform deck.

Selecting Corrugated Fiberboard Boxes



Even though CFBs are the most common type of shipping container, many people do not understand the strengths and weaknesses of the package. Corrugated fiberboard can degrade over time, losing as much as 50 percent of its strength after sitting just six months. Humidity and moisture also cause major problems for this paper-based product. A relative humidity of 90 percent can weaken CFB by as much as 60 percent. Most CFBs do not maintain enough strength and integrity to be reused and should be thought of as single-use packages.

The greatest compression strength of CFB is within 1" of the edges created by two adjacent panels.



- The length of the dotted arrow is proportional to the load bearing ability at that point.

NMFC Item 222 addresses the requirements for CFBs.

Box makers' certificates (BMC) are typically found on the bottom flaps. The BMC states the maximum size (length + width + height) and the maximum weight the box can hold based on the material used to construct it. These size and weight limits have long been the minimum requirements cited by the

NMFC. The BMCs indicate the maximum size and the maximum weight allowed. Exceeding these limits could result in a damage claim being denied.

Box Maker's Certificate



Inner Packaging

NMFC Item 680 notes "Whether or not interior packing devices are a part of specific requirements, interior packing devices must be provided where such are necessary to afford adequate protection against damage to the contents of a container.

Articles or articles and necessary interior packing devices must reasonably occupy the full cubic capacity of the outer shipping container."

Many products are available to meet the NMFC requirements regarding inner packaging. Some examples are noted below. The shipper should carefully review their product and select the most effective inner packaging material.

Inner Packaging Materials



Bubble Wrap

Bubble wrap is a light and flexible packaging material made of low-density polyethylene, ideal to protect fragile and irregularly shaped products. This gives a very good surface protection and prevention against shocks. Bubble wrap can also be used to fill voids inside the shipping container.



Corrosion Protection Packaging Material

During storage and transport, non-treated metals can corrode. Corrosion is a result of oxidation or aggressive elements in the air. Traditional protection materials against corrosion such as oil, grease or paint are time and labor intensive and not environmentally friendly. VCI (Vapor corrosion inhibitor) technology protects untreated metal against corrosion/oxidation.



Foam Cushioning

When products need protection from vibrations and shocks, a wide range of different materials is available. Many packaging vendors can design foam cushioning specific to the needs of the product.



Honeycomb

Honeycomb is a packaging material consisting of kraft paper formed into continuous uniform hexagonal cells. Due to the wide range of applications, the honeycomb can be considered as both inner and outer packaging.



Loose Fill

Loose fill is a void filling and shock absorbing packaging material. Polystyrene is traditionally used as a raw material but loose fill can be made of different materials.

This packaging material is very flexible. It fills the empty spaces in the outer packaging and depending on the shape of the loose fill it can also protect against shock.



Paper Pad

Paper pad is a blocking, filling and wrapping material that is suitable for irregular shaped products and fragile parts. Also cushioning properties can be achieved depending on the system used.

Marking and Labeling Shipments



All freight must be properly labeled and marked.

Each piece must be legibly and durably marked with the name and address, including correct ZIP code of the shipper and consignee.

Handling and Precautionary Markings

Handling labels should be highly visible and, with few exceptions, on all sides of the package.

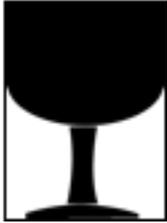
It is recommended that both pictorial markings and text be used for each of the special handling requirements. For a complete list of acceptable markings refer to NMFC item 682.

Below are a few examples of handling markings commonly used.

NMFC Item 682 - PICTORIAL PRECAUTIONARY MARKINGS

Symbols may be printed or adhered as a label. For prominence, such symbols may be within a border or have an opposing background color.

Fragile – Handle With Care



Up Arrows



Top Heavy



Keep Dry



Protect From Freezing

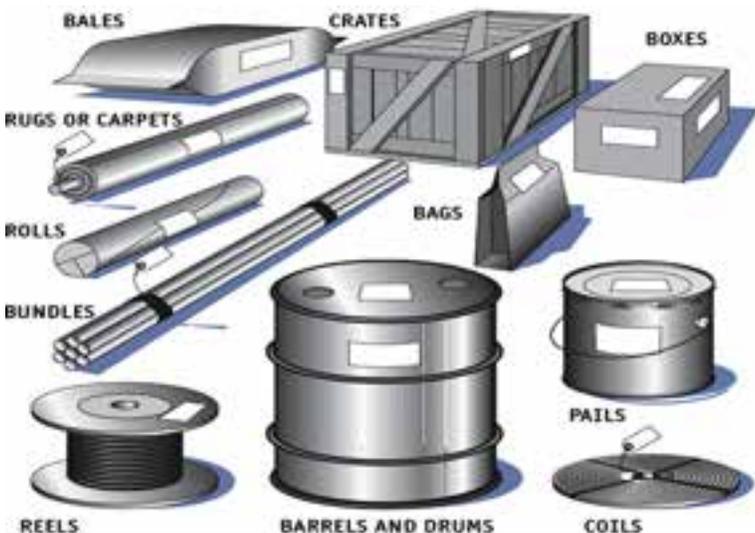


Labeling

Each piece must be legibly and durably marked with the name and address, including correct ZIP code of the shipper and consignee.

The shipper and consignee information on the cartons/freight, must match the shipper and consignee information on the bill of lading. Address markings should be located as shown in the examples below.

DOT hazardous material labels are required when shipping hazardous materials as specified by the DOT.



Confidence Delivered.®



Sealing

Sealing the package properly keeps the box intact and the contents secure inside.

Recommended Three-Strip Taping Method (H Taping Method)

- Use pressure-sensitive plastic tape at least 2" wide
- Distribute the tape evenly across flaps and seams, using the H taping method shown.
- Apply at least 3 strips of tape to the top and bottom sides of the carton.
- Tape across all seams and flaps.
- Rub the entire tape surface to ensure contact and adhesion



Non-packaging tapes such as masking tape, duct tape, cellophane and other such tapes should not be used as a substitute for quality box sealing tape.

Palletizing Cartons

Stacking and Palletizing

Pallet overhang, wide gaps between pallet boards (apertures), misalignments within a column stack and incorrect weight and size distribution all contribute to loss of container strength and poor palletization resulting in product damage.



Column Stack

A common misconception is that interlocking cartons on a pallet is a good practice and helps to stabilize the palletized load. Interlocking stacking can reduce the carton's top-to-bottom compression strength up to 50 percent. Therefore, column-stacking is the recommended method. Stack boxes in columns, corner-to-corner and edge-to-edge for the greatest stacking strength. The pallet can be stabilized and secured with banding or stretch-wrap.



Overhang

Cartons that overhang the pallet edge can have their compression strength reduced by as much as 32 percent. Overhang also exposes the packages to tears, punctures and impacts during normal handling and sorting operations.



Misaligned

Misaligning cartons can reduce the boxes' compression strength by as much as 30 percent.



Degrading

Long-term storage can degrade corrugated and other paper-based products. Cartons sitting in a warehouse can lose up to 50 percent of their strength.



High Humidity

Do not store corrugated or other paper-based packaging material in high humidity. A relative humidity of 90 percent could reduce the packages' resistance to compression by 60 percent.



Pyramid-Shaped Loads

Pyramid-shaped pallet loads are one of the biggest packaging problems confronting the transportation industry. Since pyramid pallet loads don't provide a level surface, the top cartons are exposed to potential damage from other shipments. A level surface will provide maximum strength and stability, and ensures that the load, to the extent practicable, will remain intact.



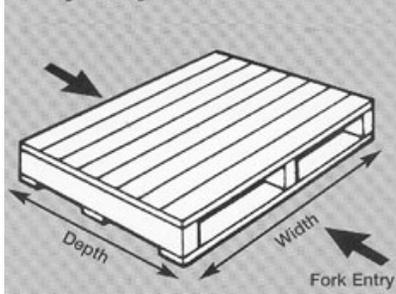
Pallets NMFC Item 265



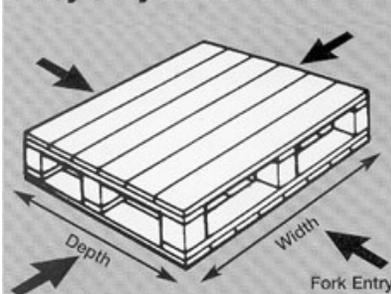
Pallets assist in the consolidation and handling of packages by allowing mechanical handling equipment to move shipments. Forklifts and pallet jacks are used to load and unload palletized product. A high quality pallet can greatly reduce damage associated with mechanical handling.

- Pallets should be large enough to accommodate the shipment without overhang. Anything overhanging the pallet edges will be subject to impacts than can result in punctures, abrasions and compression damage.
- Pallets with broken or missing parts must not be used.
- Any fasteners that protrude must be removed or resecured so they are flush or below the surface before loading packages on the pallet.
- Spacing between the deckboards should be as narrow as possible to ensure the corners of corrugated boxes are supported and not aligned over the gaps to prevent forklift damage from below.
- Know the rated capacity of the pallet and never exceed it.
- Bottom deckboards should always be used. They increase the strength and integrity of the pallet and can help stabilize the load during handing and transportation.
- Always use a four-way entry pallet.

2-Way Entry Pallet



4-Way Entry Pallet



A four-way entry pallet allows forklift access from all sides making it easier to load and handle. It also limits the pallets exposure to damage when carriers have to chisel under an edge of a pallet when there is no entry point available on sides or ends.

Wood Packages

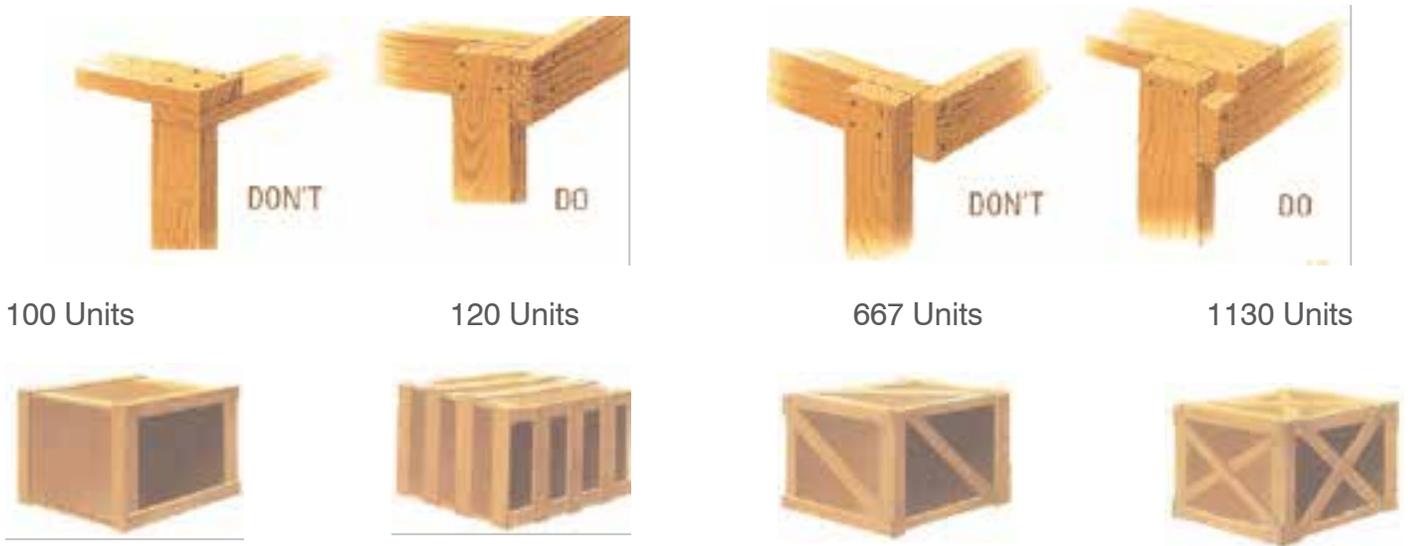
Crating shipments can help protect the product and allow for safe, damage-free transit if it is done properly using quality lumber.



- Always use interlocking corners when building crates.
- Do not locate fasteners in the end grain of wood, especially plywood. A fastener's resistance to pullout can be reduced by 35 percent when located in end grain rather than in the side or edge grain of a board.
- Use plywood not Oriented Strand Board (OSB), Medium Density Fiberboard (MDF) or Particleboard. Experience has shown these materials do not withstand the normal rigors of transportation as well as plywood.
- Knots cannot be larger than one-third of the surface they appear in. For example, a 3"-wide board should not have a knot that occupies more than 1" of space across the width of the board.
- Fasteners should not be located in knots or other defective areas of the wood.
- Use diagonal braces on each panel to increase the strength and integrity of the crate.

Corners and Diagonal Braces

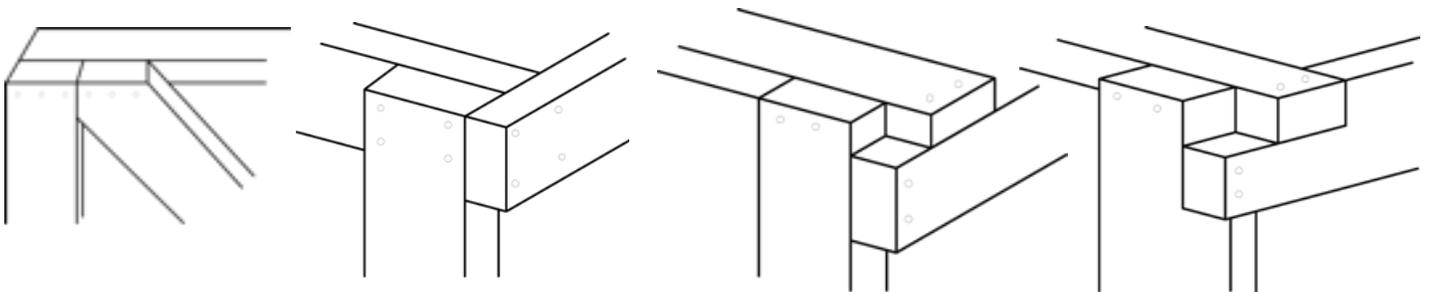
Diagonal braces have a dramatic effect on the strength of a crate. The graphics below illustrate the relative strength of four different designs. It is not the amount of wood used as much as how the wood is used.



NMFC Item 245 details design requirements for crates.

Item 245 DEFINITION OF OR SPECIFICATIONS FOR CRATES

Crates are containers constructed of members made of sawn wood or structural panels or metal with apertures between, or members made of sawn wood or structural panels or metal combined with fiberboard, securely nailed, bolted, screwed, riveted, welded, glued, dovetailed, or wired and stapled together, having sufficient strength to hold the article packed therein so as to protect it from damage when handled or transported with ordinary care. Crates must be constructed so as to protect contents on the sides, ends, tops and bottoms, and in such manner that the crate containing its contents may be taken into or out of the vehicle. Contents must be securely held within crates and no part shall protrude, unless otherwise provided in individual items. Surfaces liable to be damaged must be fully covered and protected. All moveable contents within the crate must be blocked and/or braced to prevent any shifting during transportation. Commodities with legs must be suspended away from all edges of the crate by at least one inch. If the weight of the commodity exceeds 500 pounds, a standard crate must be used instead of a wire bound crate.



Confidence Delivered.®



Wooden crates, other than wire bound crates, must be constructed as follows:

- 1) Lumber must be seasoned, reasonably sound, and free from cross grain and knots which would interfere with nailing or stapling, or knots which are greater than 1/3 the width of the lumber.
- 2) Crates must be constructed with outer framework consisting of upright and horizontal members and with additional diagonal upright and horizontal members where necessary to provide proper strength and rigidity.
- 3) Crates must be constructed with three-way locking corners, where members will be joined with nails or staples driven into side grain of joining members. Examples are shown below:
- 4) All joining crate members must be fastened by double nailing or stapling.
- 5) Crates must be designed and constructed with transverse cross-members at base sufficient in strength to protect underside of article from damage by mechanical handling equipment.
- 6) Structural panels, including plywood, oriented strand board (OSB), and wafer board, must be manufactured with exterior glue.

Pipes and Similar Freight: These types of shipments require special packaging to prevent damage to the product and to prevent the product from damaging or puncturing equipment or other cargo. The best packaging design is a wooden crate.



Pipe can be transported safely on properly constructed oversized pallets if the product is properly secured. The method illustrated below works for most pallet loads.

Any shipment where the product(s) can telescope away from the rest of the load will require end protection.

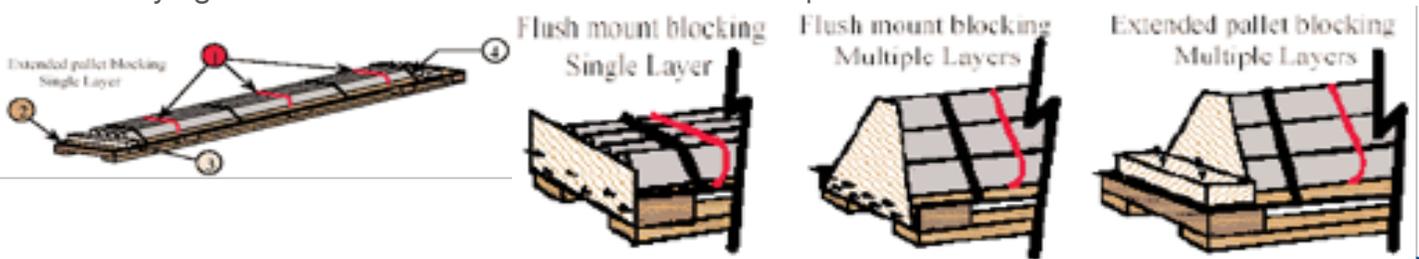
Examples include, but are not limited to, pipes, rods, tubing, antenna components, angle iron, steel or other heavy objects.

Bundle: Two or more articles bound together to form a single package or pack. Multiple bundles may also be combined to further unitize a load and ensure containment throughout distribution. This can be done with strapping or filament tape. Bundling increases the integrity of the load and can reduce loss and damage in the event the load becomes separated from the pallet during transportation and handling.

Pallet: The pallet must be elevated enough to allow for forklift access and aid in handling. The platform must elevate the entire load at least 6" from the ground and allow for forklift access from both sides and both ends. Long shipments will require a platform to run the entire length to allow for end blocking.

Blocking: Materials used in packing and loading to maintain shipments in a fixed position during transit by bracing them against the shipment. The most common material used for blocking is wood. The blocking is fastened to the pallet to prevent the load from shifting and keep the individual pieces from telescoping out from the end of the shipment.

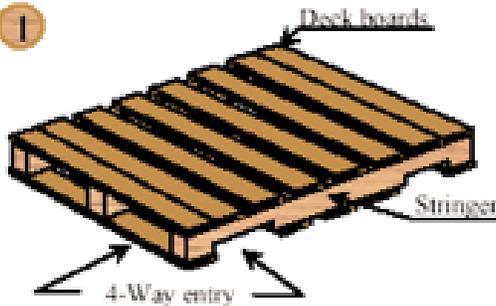
Securing: Use strapping material to secure the bundled load to the pallet. The strapping is designed to hold the shipment to the pallet and prevent it from coming out of the blocking. The strapping should fit securely against the bottom deckboards and not be exposed to the forklift blades.



Drum and Pail Shipments

Securing Drums to Pallets

1



Pallets

- Must be sturdy and strong enough to support the load. Hardwood lumber is recommended.
- No broken boards or protruding fasteners allowed.
- Minimize gaps between the deck boards.
- 4-way forklift entry

2



Single drum - top view

Corrugated Sheet

- Must be between drum and pallet decking.
- No piece should be smaller than the base of one drum.

3



Single drum - front view

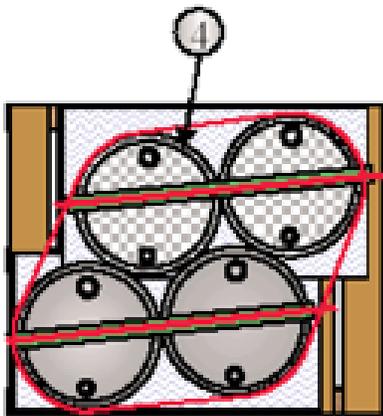
Banding cleats

- Secures the banding
- Prevents steel-on-steel contact and slipping.
- Spreads the force exerted by the strapping.



Confidence Delivered.®

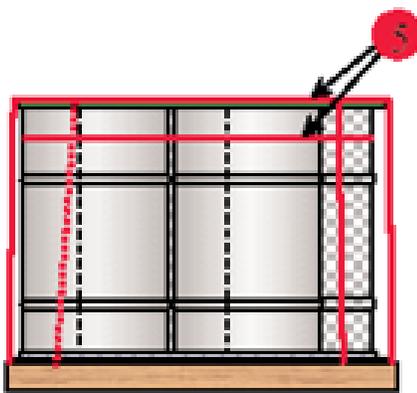




Multiple drums-top view

Loading the Drum

- Keep load as close to center as possible.
- Do not allow overhang.
- Multiple drums must be bundled tightly together using the least amount of pallet surface area as possible.



Multiple drums-front view

Strapping

- Steel strapping is preferred because it stretches very little.
- Strap multiple drums together first. This creates one unit that is easier to secure.
- Use banding cleats under the strapping and drum to distribute the load and prevent slipping. This is not required under the strap used to bundle multiple drums together.
- Keep strapping as close to the drum sides as possible. This limits the load shifting and protects the strapping from damage. This may require running the strapping between deck boards instead of out to the edge of the pallet.



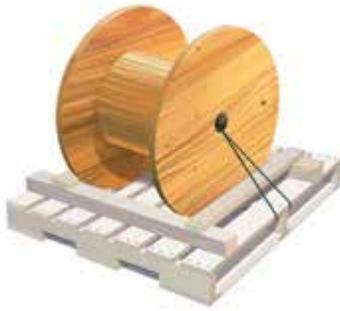
Securing Pails to Pallets

Securing pails to pallets allows carriers to handle them efficiently with forklifts and gives the ability to easily block and secure them during transit.

Spools and Reels

Securing Spools and Reels

Handling issues: These items can roll and shift during transportation due to their shape. They are hard to lift and move without damaging the edge or rim. Some products packaged on spools and reels can only be handled in the vertical orientation without the product being damaged. Spools and reels should be secured to a forkable platform for transportation.



Blocking

Materials used to keep objects in a fixed position during transportation and handling. The most common blocking material is wood. The blocking should be placed tightly against the object being secured to prevent any and all movement. Metal strapping will help to hold the reel in the “cradle”.



Transit Cases

If you are shipping transit cases with caster wheels, they must be palletized.

- Remove the wheels or use traditional blocking methods to prevent movement on the skid.
- If the wheels are not removed, the pallet deck must be solid to prevent wheels from falling through the slats and being damaged by the forklift

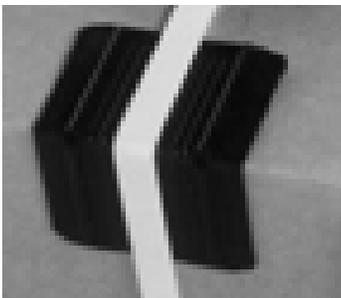
Banding and Stretchwrapping

Typically, any damage during transit to palletized corrugated boxes occurs because the shipment was improperly stacked, bundled or secured for transport. This is a particular issue with retail goods such as TVs and DVD players. If there is cosmetic carton damage, the customer is likely to assume the contents are also damaged.



Load Protectors and Edge Boards

Top and bottom load-protector pads (corrugated pad/tray) help reduce damage to top and bottom layers of your shipment. They also help distribute the weight of top loaded freight. Bottom load protectors provide a level surface and help keep boxes from slipping into the gap between the boards on the pallet. Corner or edge boards should run the full length of the stack to help stabilize the load, increase vertical stacking strength and reduce damage to box edges that make up the load corners.



Banding

Banding is typically used to secure the bundled load to the pallet. You should band corrugated stacks on each side as shown. As a general rule, keep the banding close to the load to avoid exposure, damage or breakage. Band Cleats or strap protectors will prevent the banding from crushing the edge of the cardboard boxes or edge protectors.



Stretchwrap

For complete protection during long distance shipping a pallet needs to be unitized – wrapped top to bottom. Bagged goods, boxes goods, canned and bottled good are good applications



Bags

Add a solid bottom cushion or load protector (corrugated pad/ tray) to help prevent puncture, and use the interlock stacking method to help guard against products shifting during transit. All bags must stay well within the pallet perimeter. Cushion the outside of bags with cardboard.

Wrapping Techniques

Unitization techniques include x-wrapping, wrapping low and cross-top wrapping. A combination of these tried and tested techniques can protect a palletized shipment from falling apart during over the road transit.

X-wrapping keeps the pallet tight, helping to prevent load shift and gives extra support to heavy loads. The technique pulls the load from diagonal corners, locking the freight to the pallet. This makes the freight and the pallet one unit.

Method: Anchor the stretch film to the bottom of the pallet by sliding it between the load and the pallet (diagram 1).

Then pull the film diagonally up to the top corner of the load (diagram 2)

Bring the film down and catch it on the diagonal pallet corner (diagram 3). Once the film is caught on the pallet, bring it diagonally up to the top of the load. (diagram 4). Then bring the film down diagonally to the next pallet corner (diagram 5). Repeat as needed to assure the load is safely secured to the pallet. To complete the X pattern on the remaining two corners, skip a top corner and take the film along the bottom of the pallet (diagram 6). After catching the film on the pallet, proceed diagonally up to the next top corner (diagram 7.) Continuing this process on the remaining corners forms an X pattern on all four sides of the pallet, securely holding the freight during transit.

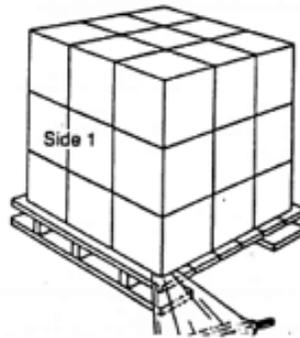


Diagram 1: Anchor film to pallet.

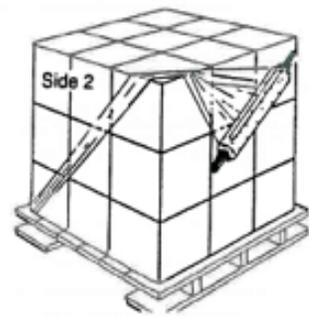


Diagram 2: Pull roll diagonally up to top of pallet.

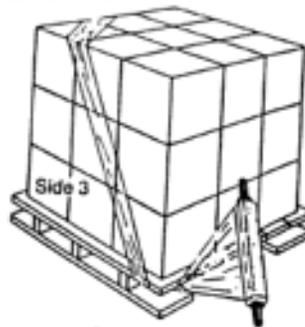


Diagram 3: Pull roll diagonally up to top of pallet.



Diagram 4: Pull roll down and catch on pallet.



Diagram 5: Pull roll down and catch on pallet.

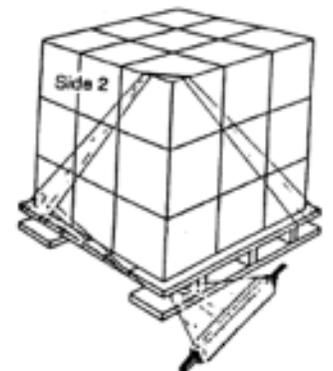


Diagram 6: Skip going up to top of pallet and go across bottom, catching on next corner.

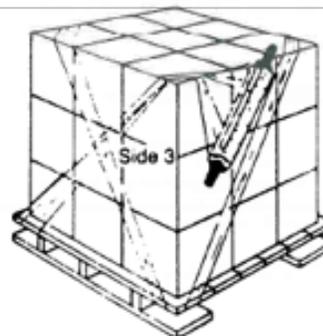


Diagram 7: Continue the process.

Cross Top Wrapping

Cross top wrapping pulls the top of the palletized load together and provides additional stabilization during transit. Cross top wrapping also provided additional security. Freight cannot be pilfered without showing obvious signs of tampering during transit.

Method: Pull the stretch wrap diagonally across the top of the pallet, holding the roll tight. (diagram 1). Once the wrap is over the top corner, dip the roll below the next corner (diagram 2). Raise the roll over the following corner (diagram 3) and dip it below the next corner. Continue this process, each time moving toward the center of the pallet until the top complete wrapped (diagram 4)

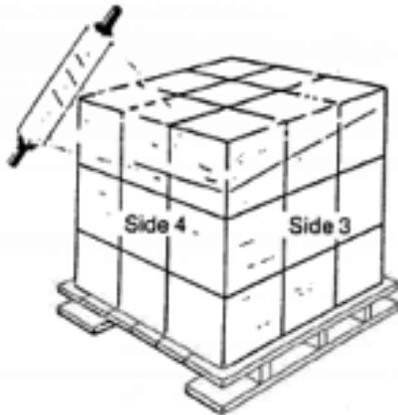


Diagram 1: Pull film diagonally across top corner.

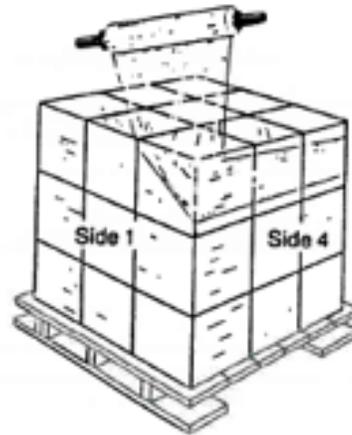


Diagram 2: Dip below next corner, catching film on corner.

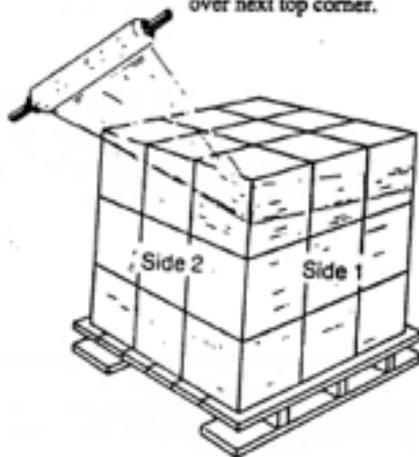


Diagram 3: Pull film diagonally over next top corner.

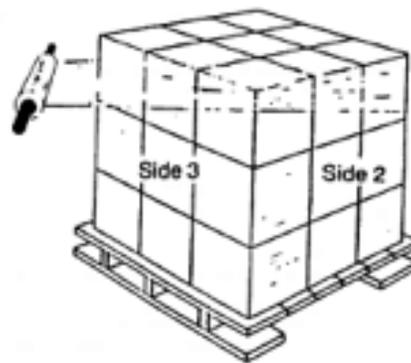


Diagram 4: Pattern obtained by continuing process.

Once the palletized load is secured to the pallet and top crossed – the pallet can be stabilized by simply wrapping the sides of the load.

Method: slide the end of the film between two boxes or secure it to the pallet and pull the film up diagonally to start top banding. (diagrams 1 and 2)

Pull the film tightly around the upper portion of the pallet and wrap it tightly around the corner. Pull it tight and tear. (diagram 3 and 4).

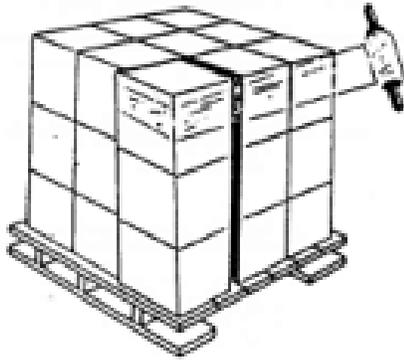


Diagram 1: Slip film between boxes

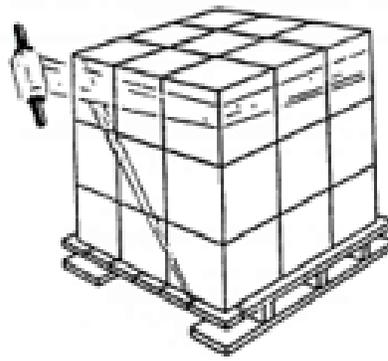


Diagram 2: Tie to the pallet and pull film up diagonally.

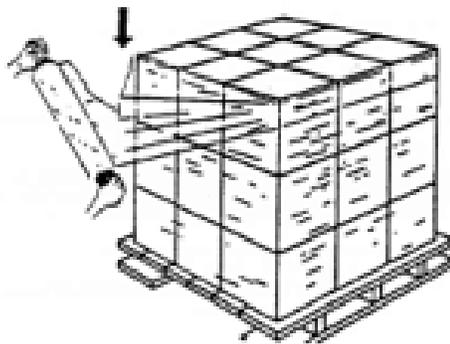


Diagram 3: Pull the film tightly around the top of the pallet.

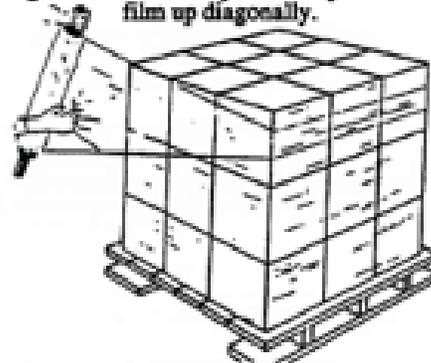


Diagram 4: Poke finger through film to tear it.

Pallets moving the LTL environment should even tiered and flat topped. In LTL transportation, many different commodities are co-loaded and stacked. A “pyramid” shaped pallet is subject to damage.

