B-WAY corporation

OPENHEAD PAIL STORAGE BULLETIN

Customer Document No. ETS-CD-1001

GENERAL INFO

Openhead containers made from high density polyethylene (HDPE) have been in use as industrial storage and shipping containers for several decades. These containers are designed to stack upon one another and to be stored for long periods of time. However, a few rules should be followed for maximum success in filling, capping, stacking, palletizing and storing polyethylene containers.

CHEMICAL COMPATIBILITY

HDPE, as with all of the olefin family of plastics, is considered inert to many chemicals and is therefore an ideal candidate for the manufacture of general purpose shipping and storage containers. There are, however, families of chemicals that will react with or permeate HDPE. Due to their chemical composition, the following products are generally incompatible with HDPE and should not be packaged in plastic containers:

This list is a guide only

Acetadehyde	Chlorinated Hydrocarbons	Methyl Bromide
Acetates	Chloroform	Methyl Chloride
Acetic Anhydride	Chlorosulfonic Acid	Methylene Chloride
Acetic Acid	Creosol	Mineral Spirits
Aliphatic Hydrocarbons	Cresylic Acid, 50%	
Aniline Chlorohydrate	Cyclohexanone	Napthalene
Aniline Hydrochloride		Nitric Acid
		Nitrobenzene
Benzaldehyde	Dichromate-Sulfuric Acid	
Benzene, Bensol	Dimethylamine	Oleum
Benzyl Chloride	Dioctyphthalate	Orange Oils
Bromine Water	D-Limonene	Paint Thinner
Butyric Acid	Formaldehyde	Petroleum Distillates
	Fuel Oil with H_2SO_4	Pine Oil
Camphor Oil		Propylene Dichloride
Carbon Disulfide	Iodine	Tetralin
Carbon Tetrachloride		Tuluol or Tuluene
Chloracetic Acid	Ketones (MEK, MIBK, etc.)	Turpentine
Chloral Hydrate		Xylene or Xylol

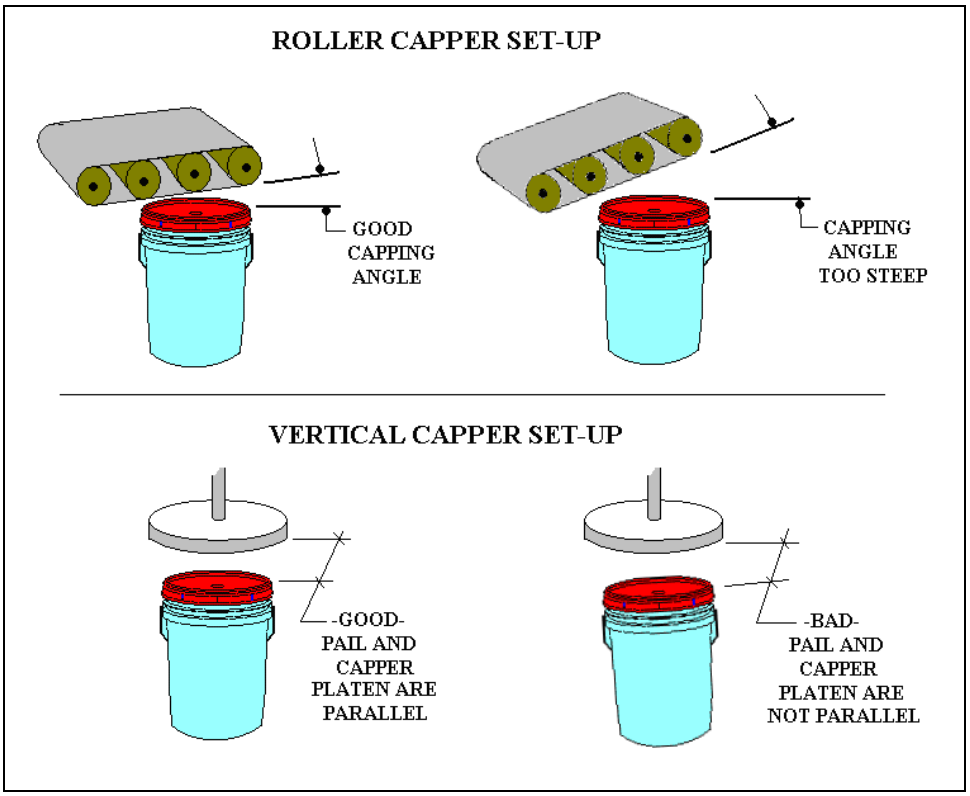
Please consult you sales person regarding these and any other packaging requirements as we may have a solution for you.

FILL TEMPERATURE

The fill temperature of an HDPE container (ie: the temperature of product entering the container from the filling head) can affect that container's ability to withstand subsequent handling and can ultimately impact its load bearing capabilities. Hot filled containers are more easily deformed by high capping forces, and the vacuum seal that usually results from hot filling can cause sidewall buckling. BWAY's maximum recommended fill temperature for HDPE pails is 150ºF. Fill temperatures below 120ºF are preferred. When fill temperatures must exceed 150ºF for sterilization or product thinning purposes, please refer to BWAY's Hot Fill Bulletin # ETS-TB-1015 for special handling recommendations.

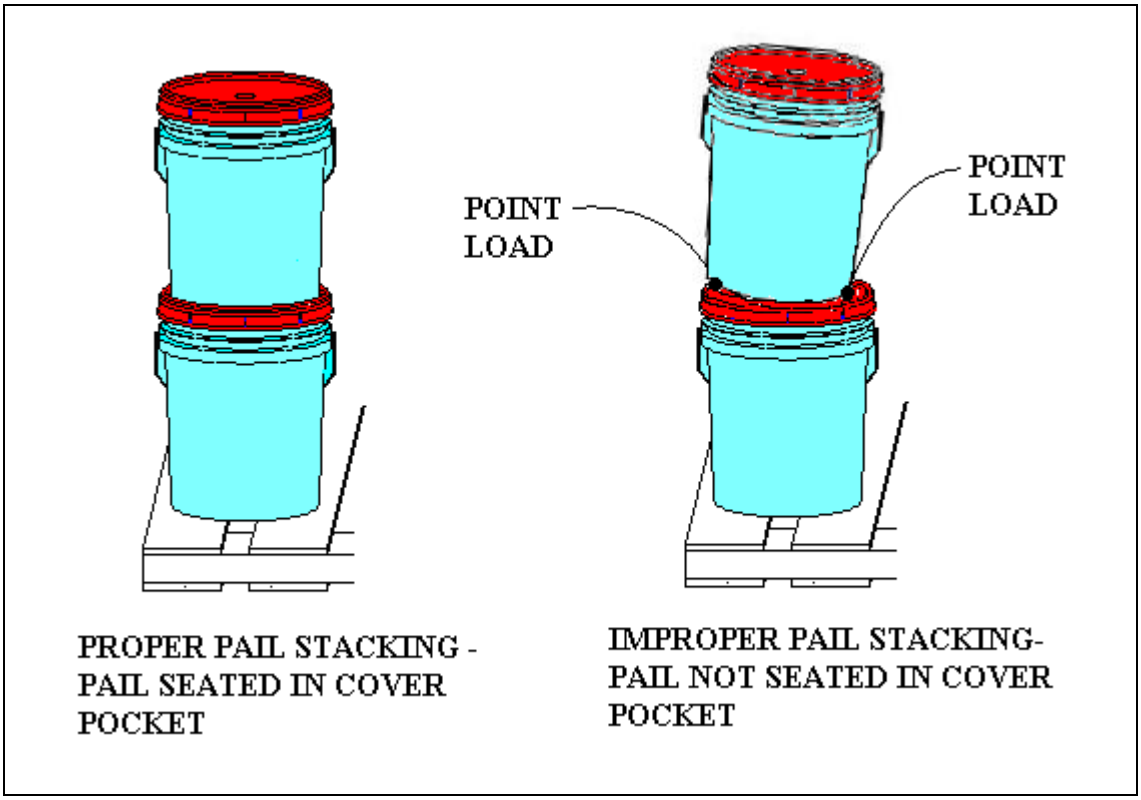
PAIL CAPPING

BWAY's line of HDPE openhead pails may be capped via most industry standard methods. These include vertical press capper, roller capper, and manual capping with a rubber mallet, although the latter is not generally recommended. Mechanical cappers (vertical, roller) should be set to apply only the minimum amount of force and stroke needed to fully install the cover onto the pail and not so much as to buckle the pail's sidewalls. A pre-buckled pail is more susceptible to failure during subsequent handling and storage. Roller cappers should be set at a very shallow angle so that the full capping surface is utilized to guide and install the cover. Vertical cappers should be mounted such that their capping platen is parallel to the pail top. Setting the cappers in this manner will ensure uniform capping pressure across the entire top of the pail.



PAIL STACKING

BWAY's openhead pails and covers are specifically designed to nest into one another for stacking, with the pocket in the center of the cover providing a clearance fit with the pail bottom. This clearance is designed to provide an easy-to-hit stacking target while also minimizing lateral motion of the stacked pails. The former accommodates various automated and manual stacking methods, while the latter maximizes the stability of palletized loads. It is important that the bottoms of stacked pails be fully located and centered in the cover pocket of the container below. Otherwise, point loading will occur that can result in pail or cover failure.



Individual containers can be stacked up to three high. Containers can be stacked six high if a sheet of 3/8" plywood is used between the third and fourth tier.

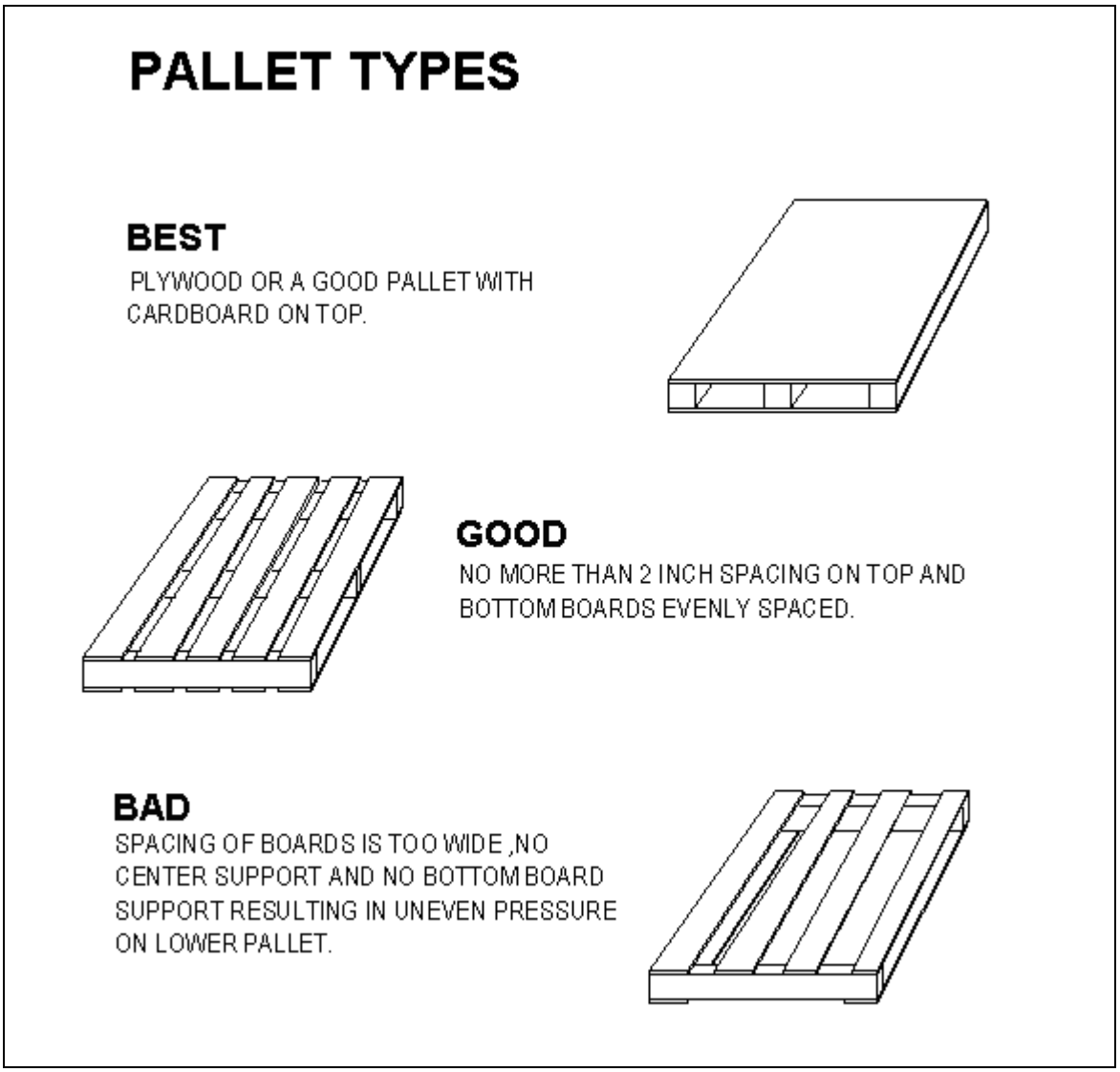
PALLET SELECTION:

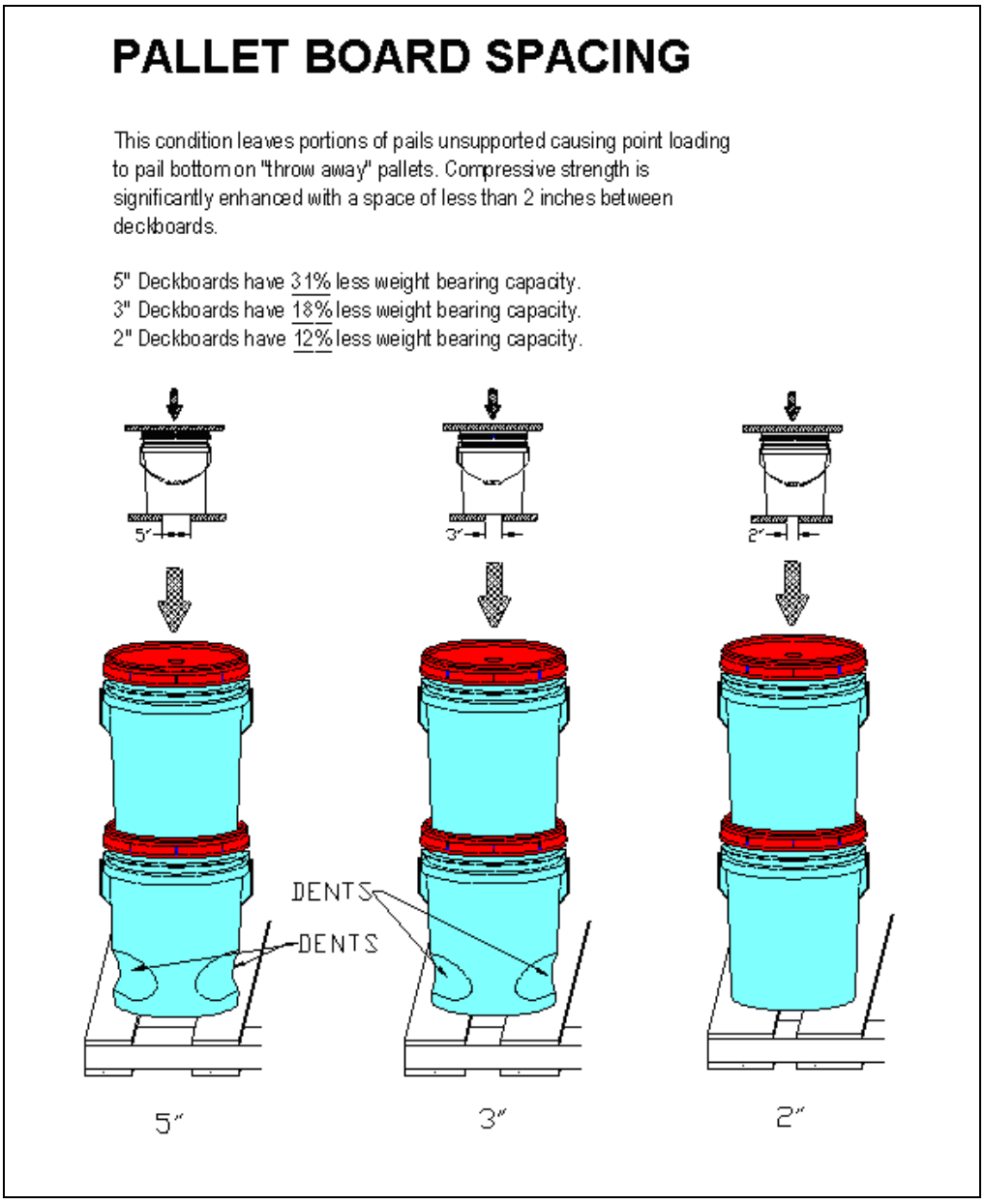
Proper pallet selection is critical to successful transport and long-term storage of plastic pails. Pallets should be of a type that spreads the stack load over the largest bearing surface. Double-faced pallets with a plywood or corrugated top are best. Double-faced pallets with tight board spacing on top and bottom are good. Single-faced pallets with wide deck board spacing and few bottom boards should be avoided.

Pallets should be in good condition. Pallets with warped deck boards or deck boards of varying thicknesses should be avoided, as should damaged or broken pallets. Make certain that no nails or nail heads are protruding from the pallet surfaces.

Filled pails can generally be stacked onto pallets up to three pails high. The pails should be arranged in a pattern such that their weight is evenly distributed over the entire area of the pallet with none of the pail bottoms overhanging the edges of the pallet. Some common pallet configurations, depending upon pallet dimensions, are 4x4, 3x4, and 3-2-3.

Filled pallets can generally be stacked (2) high. Some users successfully stack (3) pallets high for short periods of time while staging loads for transport. However, this is not recommended and filled pallets should never be stacked (3) high for long term storage.



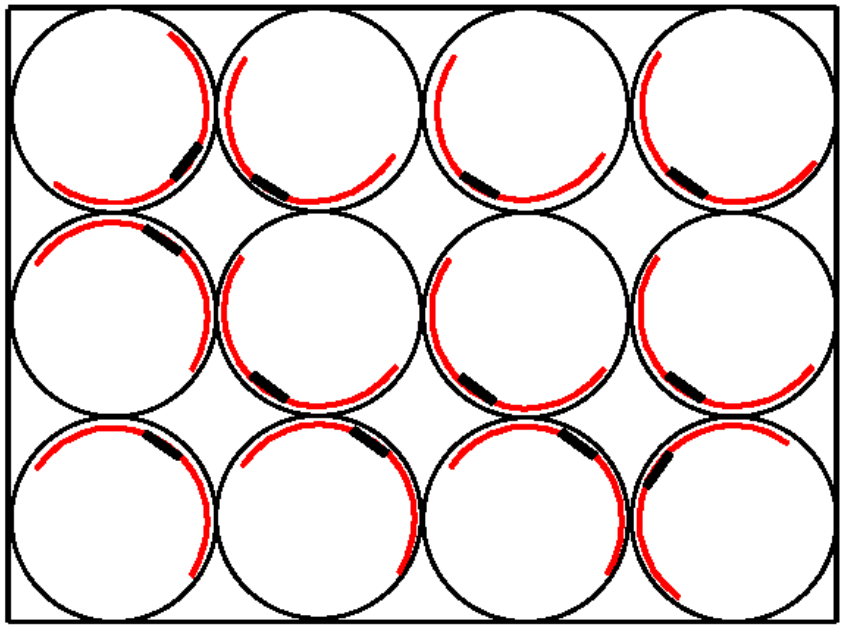


STRETCH FILM TENSION

If wrapped too tightly, the stretch film used to secure stacked pails onto pallets for shipment and storage can impart side loads onto the pails that decrease their effective load carrying ability. This can result in pail buckling and failure. High stretch wrap tension can also distort the pail and cover in a manner that adversely affects the container's seal integrity, potentially leading to product contamination or degradation. Pails located at the outermost corners of the pallet where the tension of the wrap is at its highest are most affected. Apply stretch film with the minimum amount of tension necessary to unitize the load for shipment and storage. When securing for over-the-road transport, always wrap the pails to the pallet, not just to one another.

HANDLE ORIENTATION:

Improper orientation of the pail handle can have detrimental effects on adjacent pails in a pallet. Handles that get sandwiched between two pails can dent into the pails' sidewalls under load, creating buckling points that may eventually fail. This is also true of handles sandwiched between the pails and the stretch wrap. Handles oriented toward the outside of the pallet also create catch points that lead to handling damage. Handles should always be oriented inward towards the center of the pallet and the grips should be aligned with the gaps between the pails as shown in the figure below.



Handle Orientation on Pallet

PALLETIZATION DO's and DON'Ts:

- Do use pallets with tightly spaced top and bottom deck boards.
- Do place pail bottoms fully onto the pallet surface.
- Do place pail bottoms of upper pails fully into the cover pockets of the pails below.
- Do stack filled pails only (3) high per pallet.
- Do center stacked pallets atop one another to uniformly spread the load.
- Do use minimum stretch wrap tension.
- Do stack filled pallets only (2) pallets high.

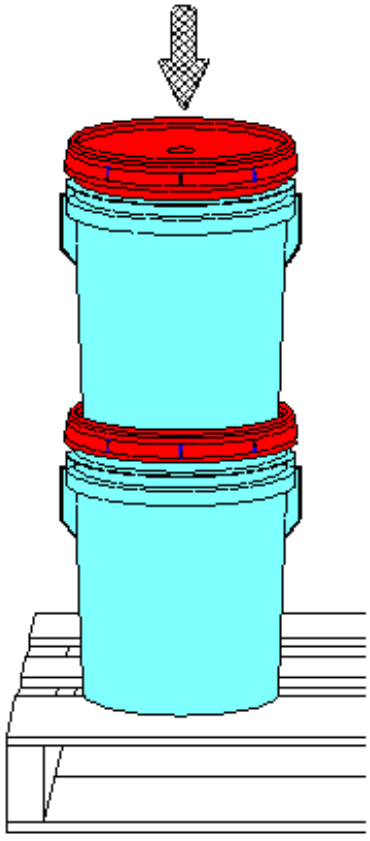
- Don't use damaged or broken pallets.
- Don't use pallets with wide deck board spacing.
- Don't allow pail bottoms to overhang pallet edges.
- Don't stack filled pails more than (3) high per pallet.
- Don't stack filled pallets more than (2) high.
- Don't use excessive stretch wrap tension.

EFFECTS OF LOADING CONDITIONS:

The following diagrams outline the effects of various storage conditions on the performance of the pail and underscore the importance of proper pallet arrangement.

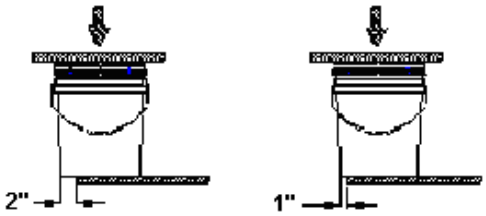
TOP CENTER LOAD

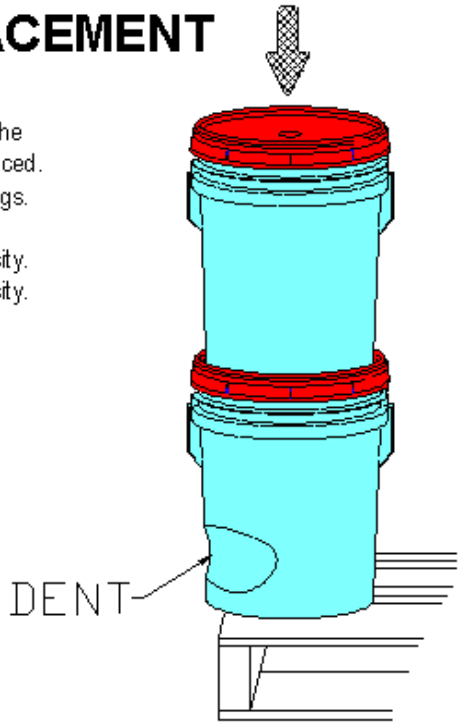
Equally centered downward force evenly distributed around the top pail is ideal. Proper spacing of bottom deck boards of the upper pallets is critical. This focuses force on the tops of the pails underlying these pallets. Pails stacked in this manner will withstand the highest average peak load.



OVERHANGING PAIL PLACEMENT

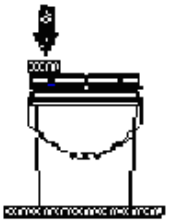
When a portion of the bottoms circumference projects out from the pallet, the weight bearing capacity of the pail is significantly reduced. Note that the test was conducted with 2 inch and 1 inch overhangs. Pails stacked in this manner will have a reduced peak load. The 2" (inch) overhang will have 43% less weight bearing capacity. The 1" (inch) overhang will have 30% less weight bearing capacity.

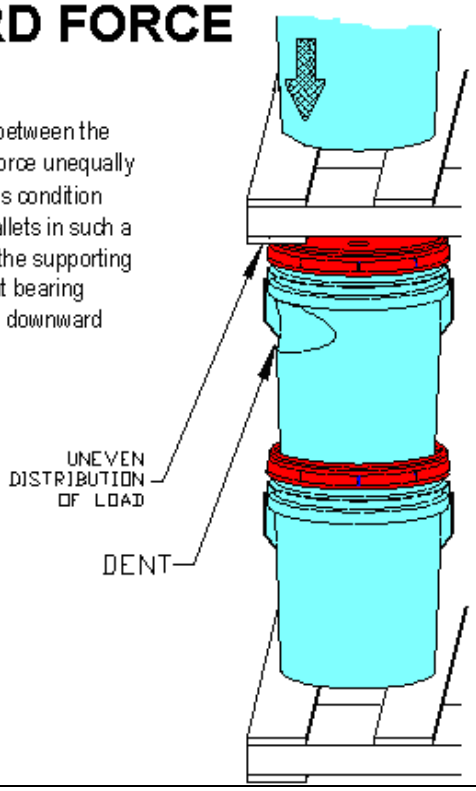


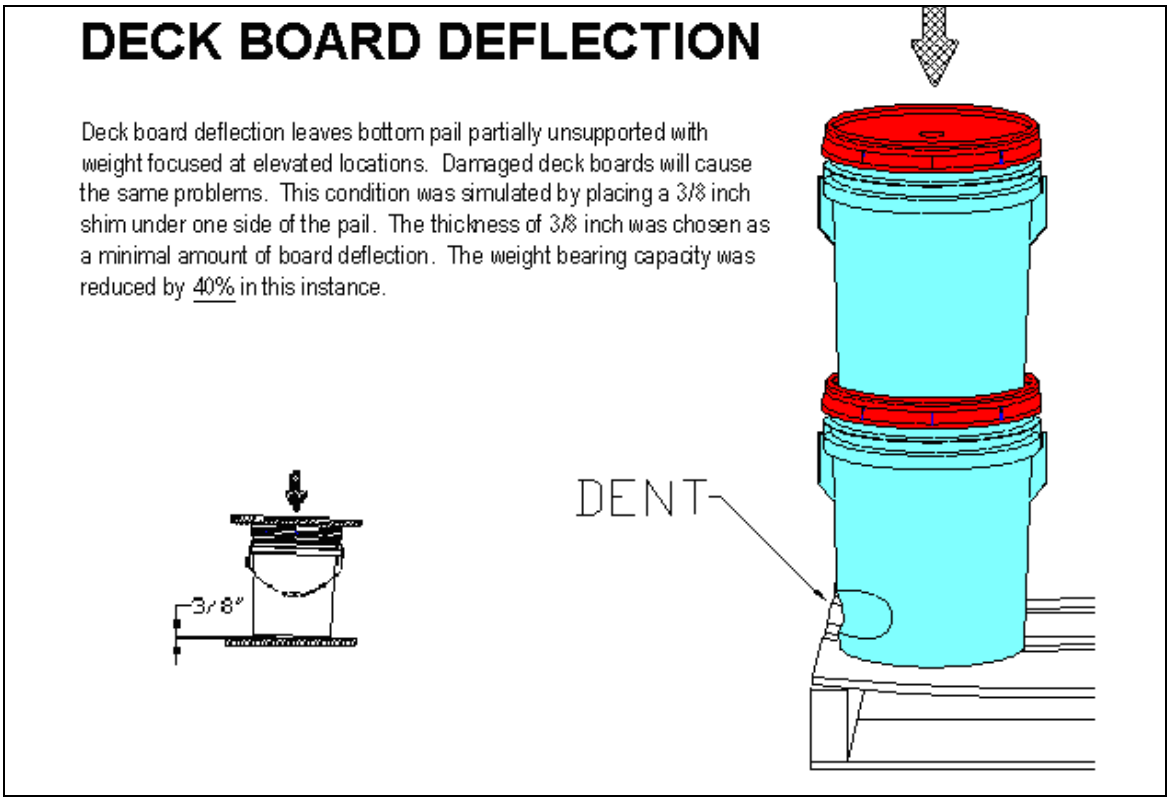


UNEVEN DOWNWARD FORCE

Uneven downward force is caused by wide spaces between the bottom deck boards of upper pallets. This focuses force unequally on the tops of the pails underlying these pallets. This condition will be exacerbated by erratic placement of upper pallets in such a way as to concentrate weight on the outer edges of the supporting pails. Pails stacked in this manner will have a weight bearing capacity of less than 50% of pails stacked with even downward force.







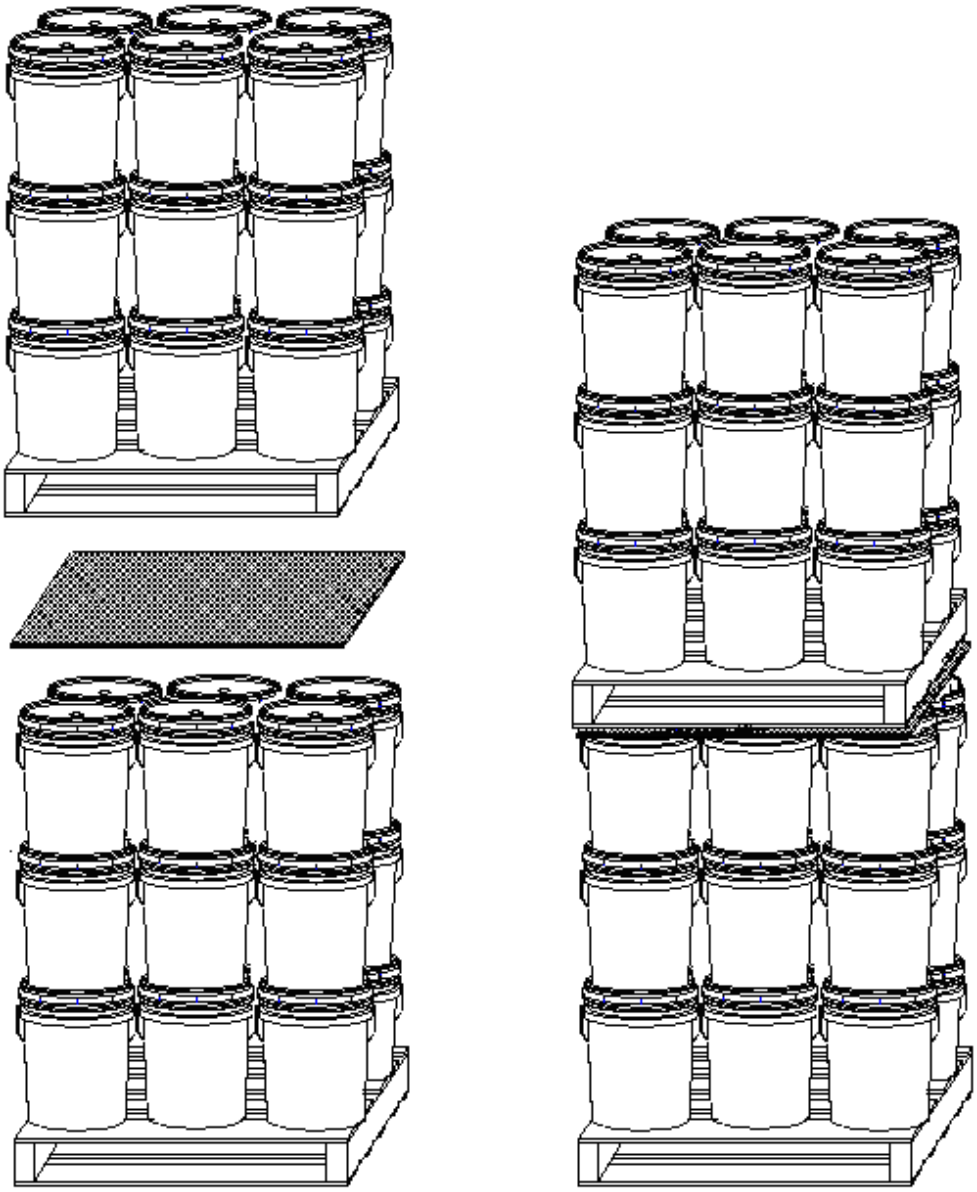
WAREHOUSE RACKING SYSTEMS:

When it is necessary to stack filled pallets more than (2) high in order to utilize existing warehouse space, pallet racking systems must be employed. Such systems should allow for not more than (2) pallets high per shelf and each shelving unit must provide adequate support for the pallet. There are various pallet racking systems available on the market today, each with its own set of benefits and limitations. Some of these systems are described below.

- Simple shelving:
  - Generally provides the best pallet support
  - Only allows storage one pallet deep
- Push back rack:
  - Trolleys for rear positions provide reasonable pallet support
  - Front pallet position tilts forward and does not support pallet center
  - Allows storage (3) pallets deep
- Drive-thru rack:
  - Provides 2-sided access
  - Allows for depths of (2) or more pallets
  - Supports ends of pallets only – no center support (very poor)
  - Limited racking height

RECOMMENDED STACKING TIP

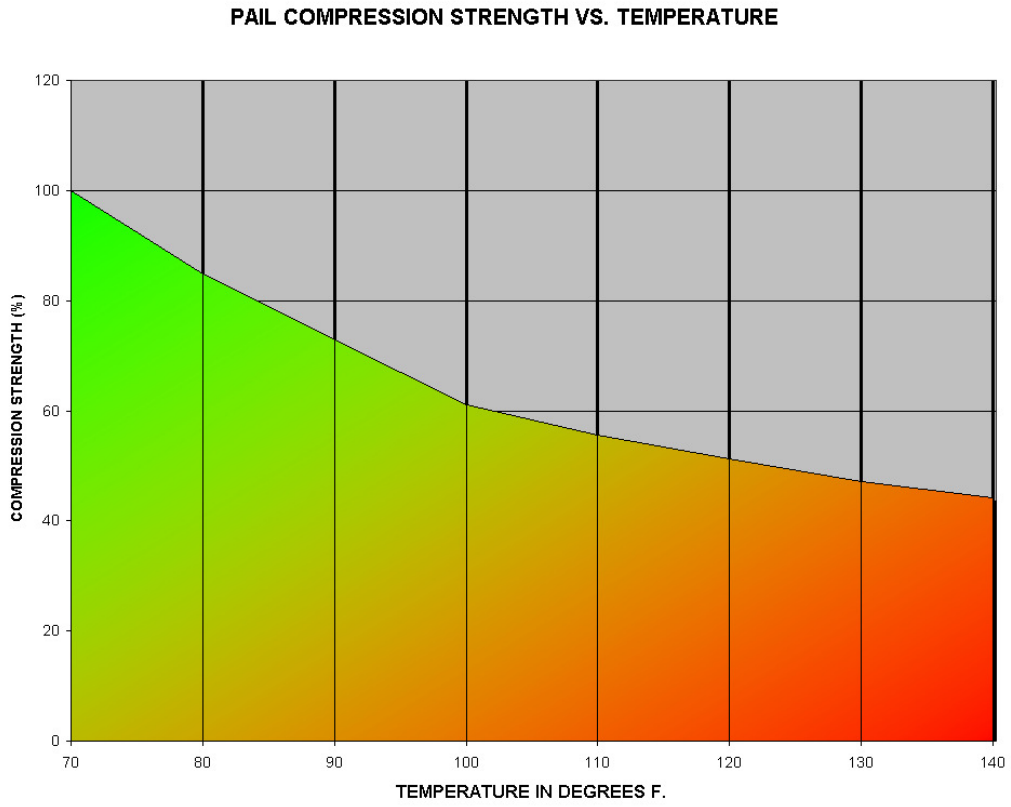
PLACE SLIP SHEET ON TOP OF PAILS TO SPREAD THE TOP LOAD EVENLY.



This will greatly reduce the incidence of buckling pails if you are not using recommended pallets.

TEMPERATURE EFFECTS ON HDPE PAILS:

In the summer months, it is not uncommon for the upper levels of a typical distribution center or warehouse to reach temperatures of 120ºF or more depending upon the local climate. As temperatures increase, most plastics, including polyethylene, soften and experience a reduction in their tensile and compressive strengths. At 120ºF, HDPE pails have been shown to lose more than 45% of their load bearing ability (see chart below). This can exaggerate the effects of less-than-ideal pallet stacking and result in pail buckling or pail failure, particularly with heavy contents.

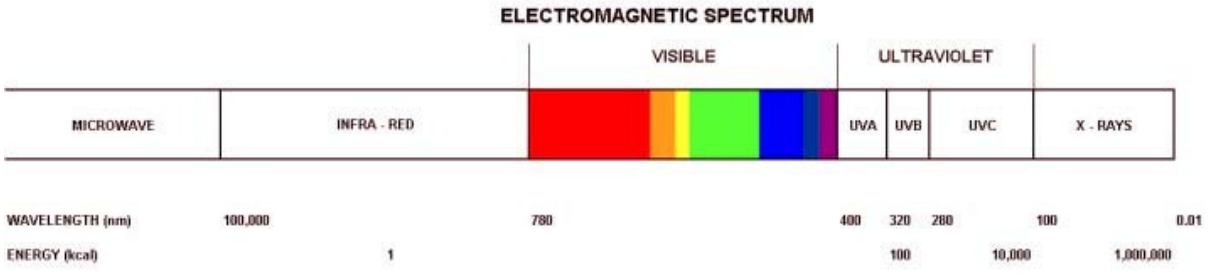


Furthermore, many products packaged in plastic containers have a definite shelf life. Some may react with or permeate the polyethylene over time. While such a reaction or permeation may be very slow at room temperature and therefore considered acceptable, prolonged storage at elevated temperatures may drastically increase the reaction rate and reduce the product's life. This is especially true when the containers are under stress and the contents are non-ionic surfactants or wetting agents, such as some detergents and higher alcohol's.

Filled and stacked containers should be stored in temperatures of less than 120° degrees F. Keep stacked containers away from steam pipes or other heat sources. If the storage area is not climate controlled, then adequate ventilation and air circulation is recommended to keep temperatures down. Users may want to consider stacking pallets only one high in warehouse areas subject to higher temperatures.

EFFECTS OF U.V. EXPOSURE ON HDPE PAILS:

Many distributors, retailers, and end users, particularly those in the construction and agricultural arenas, often store products in outdoor locations. If these products are in plastic containers and the storage area exposes them to direct sunlight, this practice can have disasterous results.



Prolonged exposure of high density polyethylene (HDPE) to ultraviolet (UV) radiation causes photo-oxidation and a disruption of the underlying molecular structure of the polymer. This photo-degradation process increases the plastic's crystaline structure and decreases its tensile strength, making the material generally more brittle. Symptoms of overexposure to UV can include a chalky appearance and a color shift on the surface of the material in the exposed area. Fine cracks may form on the exposed surfaces. These effects can penetrate to depths of nearly 25% of the wall thickness of a typical openhead pail, greatly reducing the pail's stack strength. Affected pails may crack, split, or buckle under seemingly normal loading conditions; spilling their contents and toppling the containers above them.

- Always store plastic containers under cover and away from direct sunlight.
- Storage buildings should be constructed with curtains or dividers that block out direct light and plastic containers should be stored well inside away from doors and openings.
- Never store plastic containers in open outdoor areas such as lawns, parking lots, or pastures.

ACKNOWLEDGEMENTS:

BWAY would like to credit the following sources for providing some of the information contained in this document.

Plastic Shipping Container Institute (PSCI): http://www.pscionline.org/
Ten-E Packaging Services: http://www.ten-e.com/

Additional Plastics Resources:

Society of Plastics Industries (SPI): http://www.plasticsindustry.org/
American Chemistry Council: http://www.americanchemistry.com/