



Palletizing



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Introduction

Overview

It is important that products and materials that pass through the warehouse are securely packaged for handling and transport. The most economical unit of packaging would be as large as possible but small enough to be moved with conventional warehouse equipment that can also be shipped by conventional ground transportation. To prepare product for warehousing and shipping, quantities of product are usually grouped together on pallets.

Pallets are horizontal platforms that are used as a base for assembling, storing, handling, and shipping in unit loads. Palletizers are machines that are used to load cases, bulk containers, bags, pails, and other containers onto pallets on which they may be shipped or stored. Depalletizers are machines that remove the cases, bulk containers, bags, pails, or other containers from the pallets and feed them onto a conveyor line. Pallets may be made in the size and shape that is needed to fit a particular unit of product or containers. Pallets may be as large as 60" x 60" or they may be small enough to hold a single stack of bags. They may be made of wood or plastic materials.

Bottom pads or slip sheets made of fiberboard, chipboard, or plywood are used in place of pallets in many operations. The size and type of pallet or slip sheet that is used is determined by the size and weight of the units being palletized and the manner in which they will be handled by conveyors, forklifts, or other techniques.

Robots may also be used to pick up the cases, pails, or drums and place them on the pallets.

Some cases are reshippers that hold empty containers that will be uncased, filled with product, and reloaded into the same cases. These cases will normally have either the top or bottom flaps left unsealed, so that they can be uncased and reused easily.

The case palletizer may also be used for trays filled with cans, bottles, or other objects. The trays may be open, or they may be closed with shrink-wrap or other wrapping techniques.

Objectives

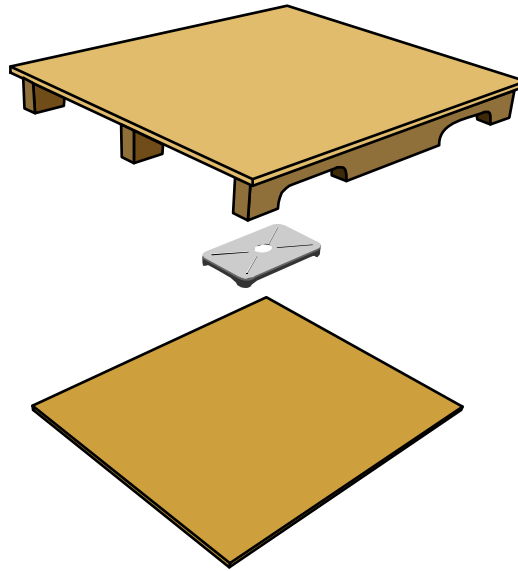
Upon completion of this unit of study you will be able to identify and describe the uses of:

1. High level case palletizers
2. Low level case palletizers
3. Bag palletizers
4. Pail and drum palletizers
5. High level bulk palletizers
6. Low level bulk palletizers
7. High level depalletizers
8. Low level depalletizers
9. High level bulk depalletizers
10. Low level bulk depalletizers
11. Different types of pallet dispensers, stackers and conveyors
12. Tier sheet dispensers and stackers
13. Maintenance and repair requirements that will keep your palletizers in good operating condition.



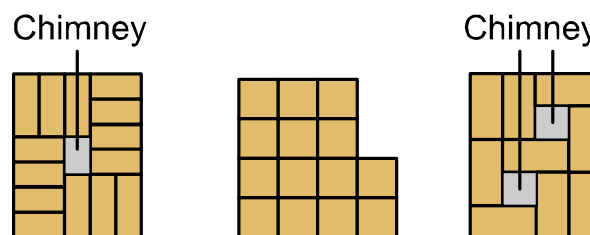
Palletizing Overview

While most pallets are designed for general use and can be used for nearly any type of product, some pallets are designed to provide specific environmental protection to a specific load. The illustration below shows some typical pallets designed for general use.



Pallet Designs

The containers that are loaded onto the pallet can usually be arranged in different patterns depending upon their size and shape. The illustration below shows different arrangements in which cases can be placed on a pallet. The pattern that is used in building a stack does not always work out so that all the voids are filled, so it may be necessary to form chimneys at various positions. Layers can be held together by using interlocking patterns and tier or slip sheets between the layers.



Pallet Configurations

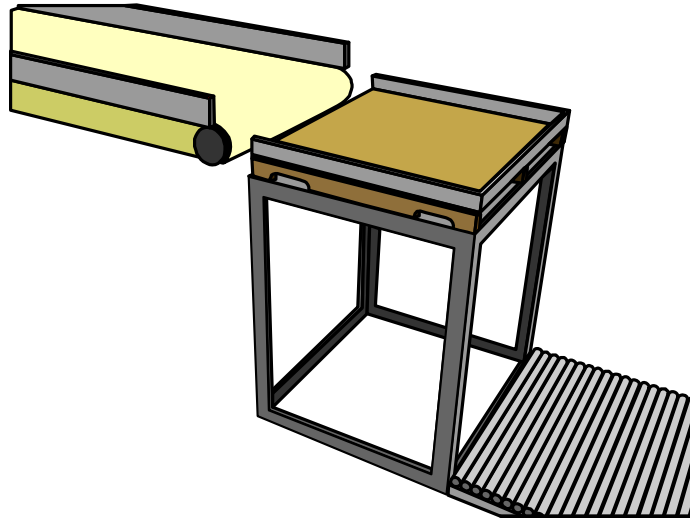
Palletizing Machinery

Different types of palletizers and depalletizers have been designed to handle particular types of products. Warehouses can select machinery that has been designed in such a way that it will fit well into warehouse operations and handle their products safely and efficiently. Two basic types of machines are the high level and low level systems.



High Level Case Palletizers

High level palletizers are used to collect cases or trays from a conveyor, arrange them, and stack them into layers on a pallet. The cases may contain filled containers or other finished products. The conveyors on high level palletizers deliver the containers and product that is to be loaded onto the pallets at the top of the machine. The pallet is indexed down as successive layers of product are loaded. High level depalletizers unload the pallets and discharge the product onto conveyors at the top of the machine as the pallet rises as each layer is removed. High level palletizers and depalletizers usually require a metal platform, catwalk, and stairs to provide operator access to the pattern-forming and loading stations.



High Level Palletizer

Cases of bottles, cans, and different types of products can be palletized on a high level palletizer. The pallets are loaded at floor level, and the cases are loaded at the hoist's top position that may be seven or more feet from the floor.

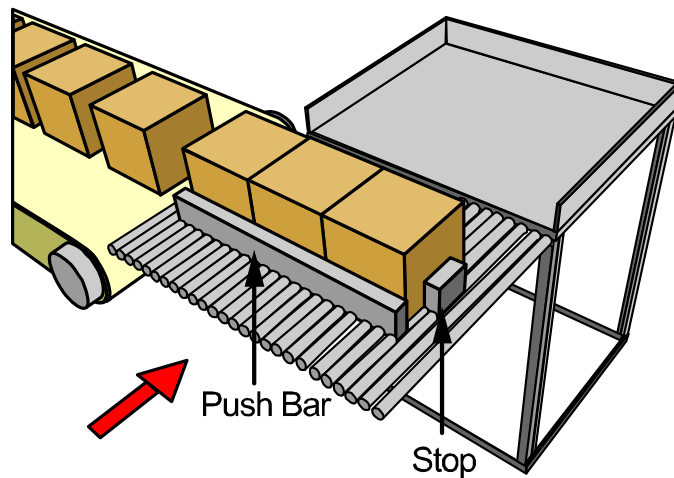
The basic palletizer and depalletizer can be modified for specific types and sizes of products or containers by the addition of guides, stops, and other components sized and shaped for the particular application. Some palletizers and depalletizers are simple manually operated systems that consist of little more than conveyors and pallet turntables. Some systems are semiautomatic and require the operator to push buttons and perform a number of operations. Other systems are automatic to a degree that requires the operator to do little more than monitor the operation.

High Level Palletizer Operation

1. The pallet is loaded onto the hoist manually or by an auto-dispenser while the hoist is at its lowest position.
2. The pallet hoist raises the empty pallet up to the level of the conveyor and row former that arranges the pattern of each layer of cases.
3. The cases are turned and arranged in rows to provide the palletizing design. When the row of cases is arranged, it is pushed onto the pallet. Each row is collected, arranged and pushed until the tier is completed.
4. The pallet hoist lowers the pallet one case height each time a layer is completed. When the pallet is completely loaded, the hoist can be lowered to its lowest position so that it can be discharged and another pallet can be loaded onto the hoist.
5. The hoists are raised and lowered by chains that are driven by electric motors and gearboxes. They are held by electric brakes. The positions of the platform and the extent of movement on each cycle are controlled by photoelectric sensors and limit switches.

Case Delivery and Orientation

The cases are delivered to the top of the high level palletizer by a conveyor which feeds them onto the row former which is a section of live roller conveyor. The leading case in a row is stopped and positioned when it makes contact with a metal stop that rises between the rollers.



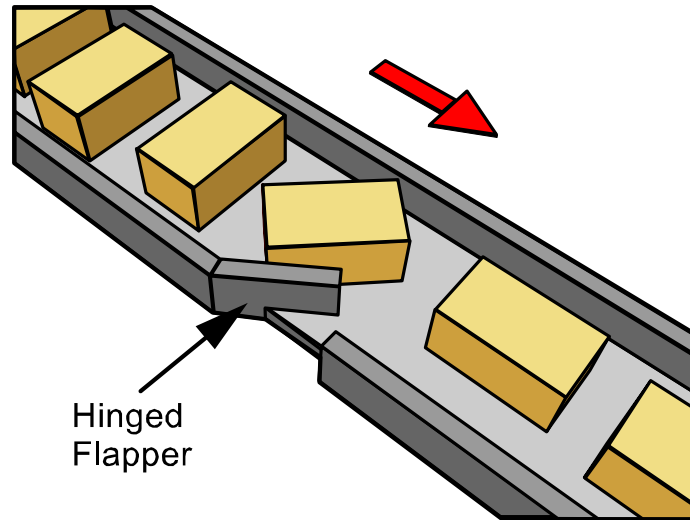
Case Stop and Push Bar

The pattern of the cases may change from layer to layer to provide more support and make the load more rigid.

On a fully automatic machine, the Programmable Logic Controller (PLC) will determine when a pattern change is to be made and regulate the machine operation.

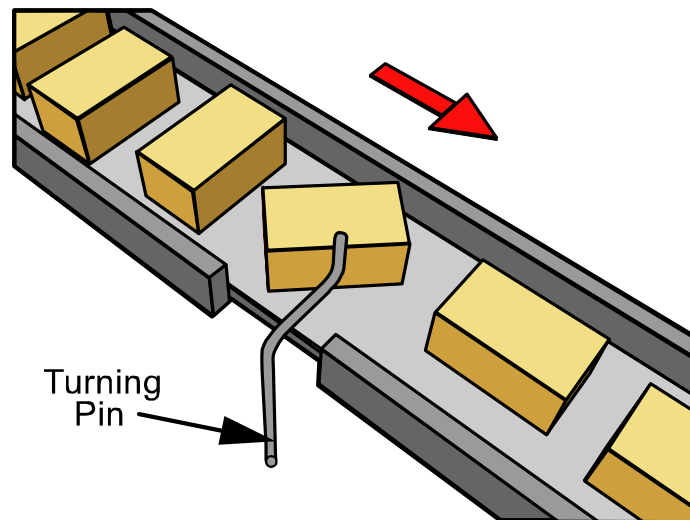
Space needed to turn a case can be obtained by moving the case from a slower moving conveyor onto a faster one. This increase of speed will cause a gap between the cases.

On some machines, the case is turned to the direction that is needed for the tier pattern by a flapper type arm that swings in from the guide rail to give the case a sharp slap that will turn it ninety degrees.



Turning Flapper

The case may also be turned by a turning arm or pin that moves into place in front of the case. When the case makes contact with this arm or pin, the momentum provided by the conveyor will cause the case to make a ninety-degree turn.

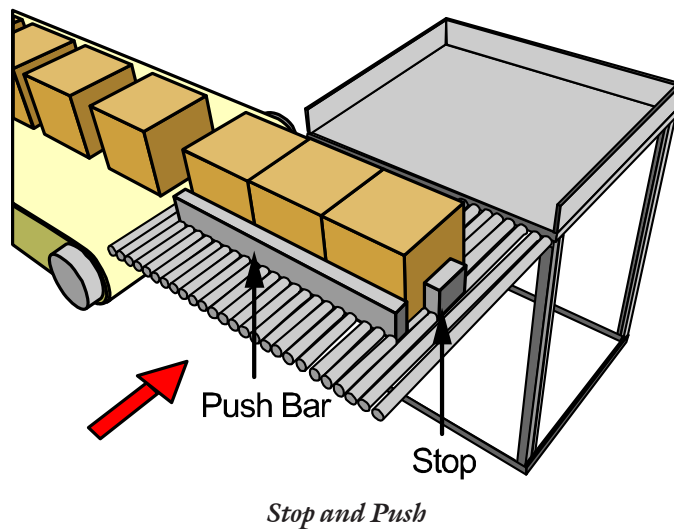


Turning Arm or Pin

Tier patterns can also be formed by moving the cases manually or with semiautomatic machinery.

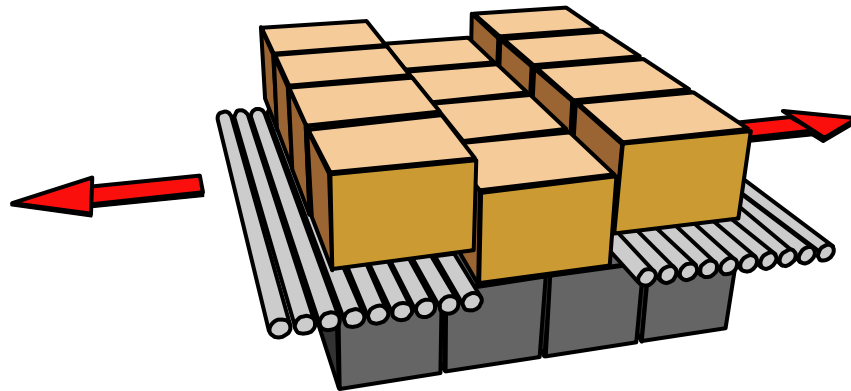
When the pallet is in position for adding a tier, a draw plate moves over the top layer of the pallet load to provide a smooth surface on which to push the next layer. The row of cases that is assembled on the row former is pushed onto the front of the draw plate by a pusher bar.

The pusher bar then retracts to receive the next row that it will also push onto the plate. Each row pushes the first row farther onto the draw plate until the tier is complete.



Retaining bars hold the sides of the tier in place as the draw plate is pulled out, and the cases are allowed to settle onto the top of the lower tier.

Some machines use a retractable apron or a divided accumulation table that moves in both directions to drop the center of the tier first as the side sections move out from under it.



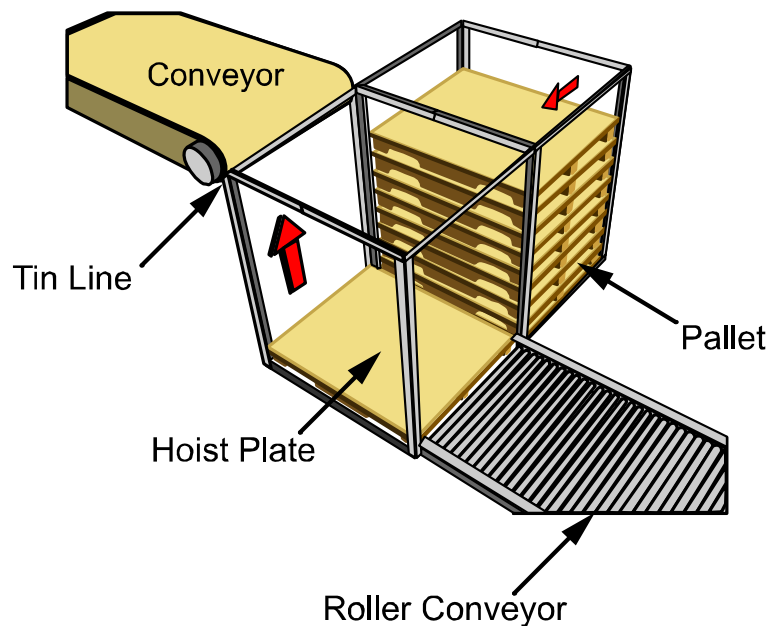
Divided Accumulation Table

A high-speed machine may also use an intermediate accumulation table that will make it possible to assemble the next tier while the preceding one is being moved onto the pallet.

Some machines have a flexible accumulation plate positioned directly over the top of the pallet load. The rows of cases are pushed into place by continuously moving pusher bars. When the load is complete, the accumulation plate made of narrow strips moves out from under the load and up over it in a movement like the operation of a roll top desk.

Pallet Dispensers

Semiautomatic and automatic palletizer systems have pallet dispensers that automatically feed the empty pallets into the palletizer. Depalletizers may have pallet stackers that stack the unloaded pallets for removal from the depalletizer and shipment back to the container or product producer for another load.



Pallet Dispenser and Hoist

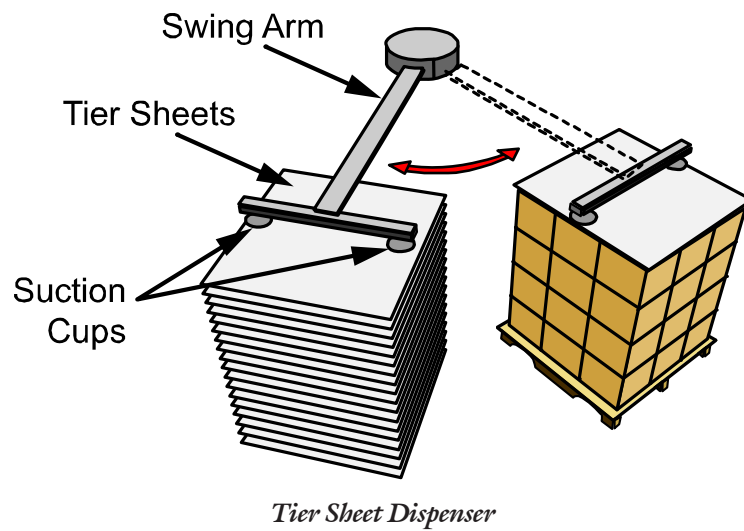
Tier Sheets

Tier sheets made of paperboard or chipboard are sometimes used to separate the tier on the pallet and provide additional stability. Tier sheets may also be called slip sheets or separator sheets.

On automatic machinery tier sheets are stacked alongside the pallet hoist. Vacuum cup mechanisms pick up the top sheet from the stack, and arms move it over the pallet and place it in position. The tier sheets may also be positioned manually by the operator.

Tier Sheet Dispensers

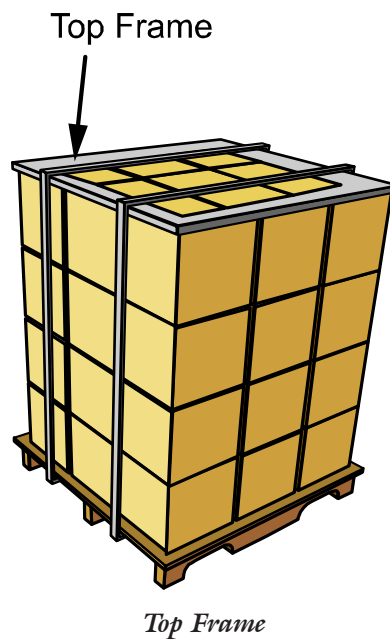
Tier sheet dispensers can automatically remove a tier sheet from a stack and position it on top of a layer that has been positioned on the load by the palletizer. Tier sheet stackers are used on depalletizers to lift the tier sheets off the pallet tiers and stack them for removal and reuse.





Top Frame

When the last tier is in place, the operator places a wooden top frame on top of the load to hold it square and protect the cases when the straps are pulled tight around the loaded pallet. The top frame is sometimes called the “picture frame” because of its shape.



Lowering the Pallet

When each tier is positioned on the load, squaring bars press against the sides of the tier to push all the cases compactly into place.

When the cycle has been completed, the hoist is lowered one case height and stopped in position to receive the next tier of cases. Photoelectric sensors and limit switches control the motions. The sequence is controlled by a PLC on a fully automatic machine or it may be controlled by an operator with push buttons on a semiautomatic unit.

When the last tier is loaded a red light comes on and the machine stops. The operator sets the top frame in place and pushes a button that causes the hoist to be lowered to its lowest position. At the bottom of the hoist the loaded pallet is removed from the hoist and carried by conveyor to the strapping unit.

Another pallet is placed automatically or manually on the hoist, and the sequence is repeated.



Loading Operating Sequence

The steps in the sequence of operation of a high level case palletizer may be summarized as:

1. An empty pallet is placed on the hoist.
2. The hoist and pallet are raised to the loading level.
3. The cases are turned on the conveyor to form the row pattern.
4. The conveyor delivers the cases to the row former.
5. The draw sheet moves over the top of the pallet.
6. A pusher bar pushes the assembled row onto the draw plate.
7. The pusher bar retracts and pushes other rows onto the plate until the tier is complete.
8. Bars hold the cases in place as the draw plate is pulled from under the tier and the cases settle onto the pallet or lower tier.
9. A tier sheet is placed over the tier as needed.
10. The draw plate is positioned over the top of the tier.
11. The top frame is placed on the top tier.
12. The operator pushes a button to lower the loaded pallet.
13. The loaded pallet is removed at the bottom of the hoist.
14. Another pallet is placed on the hoist and the sequence is repeated.

Strappers and Wrappers

The load on the pallet can be stabilized by wrapping it with straps and/or stretch wrap or shrink-wrap material. The strapping machine may be incorporated into the palletizer, but more frequently, the loaded pallet is moved by conveyor into separate strapping and/or wrapping machines.

Progress Check #1

Circle the letter in front of the correct answer.

1. Pallets are used for collecting and holding containers or product for
 - a. storage.
 - b. shipping.
 - c. storage or shipping.
2. Loaded pallets are moved by
 - a. conveyor.
 - b. fork trucks.
 - c. conveyors or fork trucks.
3. Containers are loaded onto a pallet by a
 - a. depalletizer.
 - b. palletizer.
 - c. stacker.
4. Depalletizers remove the
 - a. containers from the pallets.
 - b. pallets from the palletizer.
 - c. containers from the conveyor.
5. The pallet load is stabilized by using
 - a. uniform stacks.
 - b. an interlocking pattern.
 - c. a bottom pad.



6. The pallet is indexed down as it is loaded on
 - a. high level palletizers.
 - b. low level palletizers.
 - c. all palletizers.

7. Pallet stackers are used with
 - a. palletizers.
 - b. depalletizers.
 - c. palletizers and depalletizers.

8. The reshipper case will normally have
 - a. the top flaps unsealed.
 - b. the bottom flaps unsealed.
 - c. either the top flaps or bottom flaps unsealed.

9. The pallets are loaded onto a high level case palletizer when the hoist is at its
 - a. highest point.
 - b. intermediate point.
 - c. lowest point.

10. The cases are loaded onto a pallet on a high level palletizer when the pallet is
 - a. at its lowest point.
 - b. raised.
 - c. moving.

11. The extent of the hoist movement on each cycle is controlled by
 - a. photoelectric sensors.
 - b. limit switches.
 - c. photoelectric sensors and limit switches.
12. Cases on a conveyor are separated for turning by
 - a. transferring them to a faster conveyor.
 - b. transferring them to a slower conveyor.
 - c. changing the speed of the conveyor.
13. Cases on a conveyor are normally turned
 - a. with a turntable.
 - b. by striking a turning pin or arm.
 - c. transferring to a faster conveyor.
14. The raw former on an automated high level case palletizer is normally a
 - a. chain conveyor.
 - b. belt conveyor.
 - c. live roller conveyor.
15. The cases are usually pushed onto the pallet one
 - a. case at a time.
 - b. row at a time.
 - c. tier at a time.



16. The cases are pushed from the row former onto the
 - a. draw plate.
 - b. lower tier of cases.
 - c. tier sheet.

17. The draw plate is pulled back to
 - a. turn the cases.
 - b. push a row of cases onto the pallet.
 - c. lower a tier of cases onto the pallet.

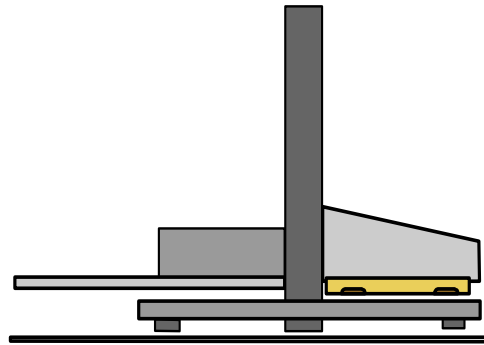
18. The cases are protected from the tightening straps by
 - a. tier sheets.
 - b. top frame.
 - c. restraining bars.

Notes:



Low Level Case Palletizers

Low level palletizers receive the product from conveyors at normal conveyor height and raise each layer of the load into position on top of the pallet after the layer is formed. The low level depalletizer removes each tier or layer from the top of the pallet and lowers it to conveyor level for discharge.



Low Level Palletizer

Low level case palletizers are used for loading all types of cased products onto a pallet. The cases and pallets are both loaded at the floor level or at operator height. The low level palletizer is used to collect cases or trays from a conveyor, arrange them into a pattern, and stack them into tiers or layers on a pallet. The cases may be sealed cases of filled containers or reshipper cases that hold empty containers that will be uncased, filled with product, and reloaded into the same cases. The reshippers will normally have either the top or bottom of the case unsealed and special handling techniques may be used to keep them from opening during handling. Case palletizers may also be used for trays filled with cans, bottles, or other products. The trays may be open, or they may be closed with shrink-wrap or some other wrapping technique.

Operation

Low level palletizers may be fully automatic, semiautomatic, or manually operated. The controls and amount of work done by the operator may be different, but the principles of operation are very similar.

Pallet Loading

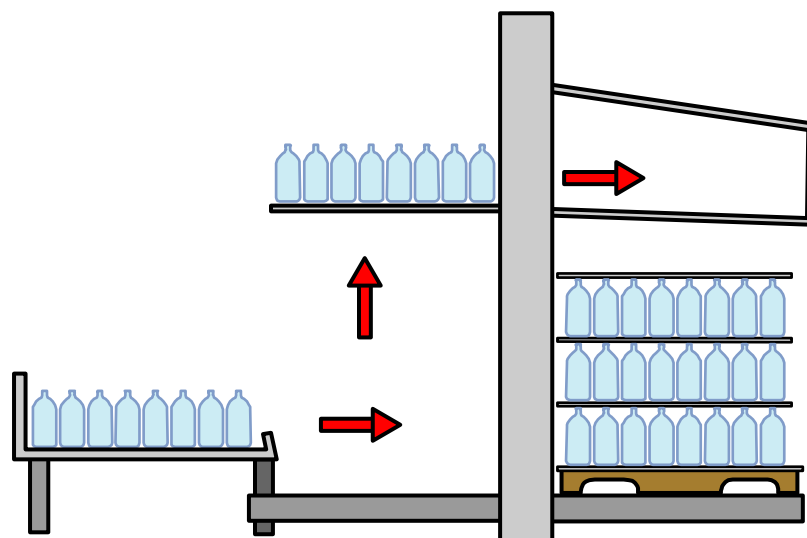
The pallet may be loaded into the palletizer manually or by an automatic pallet dispenser. The pallet is positioned next to the transfer plate that carries the cases from the in-feed conveyor to the pallet.

Case Delivery and Orientation

On an automatic machine, the cases are delivered to the palletizer on a conveyor that delivers them onto the transfer plate. The cases are turned to the proper orientation as they pass by a turning arm or pin which moves over the conveyor, as it is needed. The pattern that is being used can be stored in program control units, and these units can produce the signals that will operate the turning mechanism, as it is needed. On a semiautomatic machine the operators may push a button to operate the turning mechanism and they may turn them by hand on a manual machine.

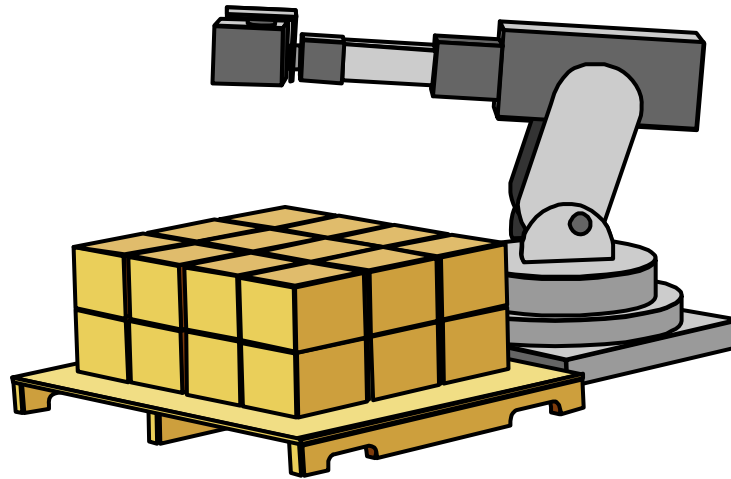
Loading

On an automatic machine the pusher plate pushes the cases off the conveyor and onto the transfer plate of the case palletizer. Each row of cases is turned in the direction that will produce an interlocking pattern on the pallet. Each row of cases pushes the preceding rows farther onto the transfer plate until the tier is complete. When the tier is completed, the table is lifted to the loading height for the pallet, and the transfer plate moves forward until the cases are positioned over the pallet and between the retaining rails. The sweep bar is then lowered in front of the cases to sweep them onto the top of the pallet load as the transfer plate is pulled out from under them. The sweep bar is raised, the transfer plate is lowered down to the conveyor level, another tier is loaded onto the plate, and the cycle is repeated.



Loading the Low Level Palletizer

Robots may also be used to pick up the cases and place them on the pallet . The robot arms may be equipped with fingers or plates that grasp the sides of the cases, large suction cups that grasp them around one corner, or either large or small suction cups that hold them by the top.



Loading Pallets With a Robot

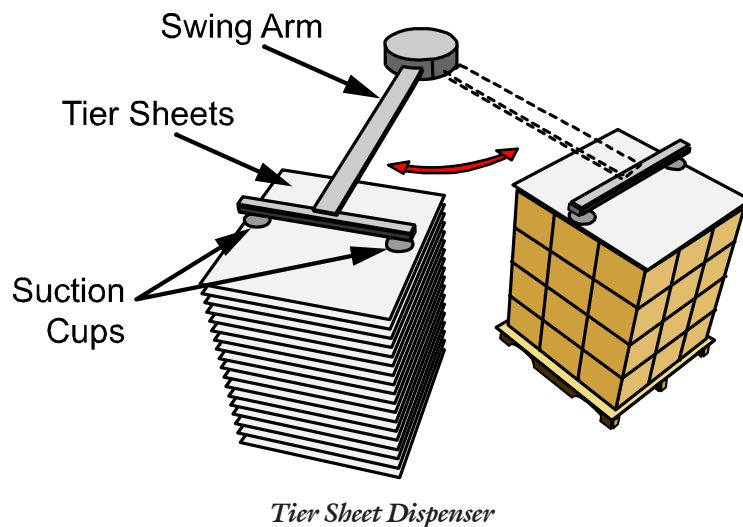
On automatic machines, the cycles are controlled by the PLC. On semiautomatic and manual machines, the cycles may be initiated by the operator pushing control buttons. Photoelectric sensors and limit switches determine the positions of the components in each operation, and control the motions.

Squaring

After each tier of cases has settled into place on top of the pallet stack, squaring plates move against the sides of the stack to position the cases and ensure that the load is tight and square.

Tier Sheets

Tier sheets made of paperboard or chipboard are sometimes used to separate the tiers, or layers, on the pallet. These tier sheets (also called slip sheets or separator sheets) help tie the cases together and increase the stability of the stack. On automatic machines the tier sheets are stacked alongside the pallet. Vacuum cup mechanisms pick up the top sheet from the stack and place it on the top tier of cases. The tier sheets may be placed manually by the operator. When the last tier is in place, a wooden top frame is placed to hold it square and protect the cases.



Pallet Discharge

When the pallet is loaded and the top frame has been positioned, the loaded pallet is moved out of the palletizer on a roller conveyor that will carry it to the strapping and/or stretch wrap machine. Another pallet is loaded into the palletizer, and the sequence is repeated.

Operating Sequence

The steps in the sequence of a low level case palletizer may be summarized as:

1. An empty pallet is placed in the palletizer.
2. The cases are turned on the conveyor to form the row pattern.
3. The conveyor delivers the cases to the transfer plate.
4. The pusher plate pushes the cases from the conveyor onto the transfer plate.
5. The transfer plate rises and moves in to carry the tier over top of the pallet.
6. The sweep bar is lowered.
7. The transfer plate moves out as the sweep bar holds cases on the pallet.
8. The sweep bar is raised.
9. The squaring plates move against the cases.
10. The transfer plate is lowered to conveyor level.
11. A tier sheet is placed on top of the tier layer when needed.
12. The cycle is repeated for other tiers.
13. The top frame is placed on top of the top tier.
14. The loaded pallet is moved by conveyor to the strapping or stretch wrap machine.
15. Another pallet is placed in the palletizer, and the sequence is repeated.



Progress Check #2

Circle the letter in front of the correct answer.

1. A low level case palletizer receives the cases at
 - a. the top level.
 - b. conveyor level.
 - c. floor level.

2. On a low level case palletizer the cases are moved to the top of the load by the
 - a. transfer plate.
 - b. conveyor.
 - c. pallet hoist.

3. The transfer plate on a low level case palletizer moves
 - a. back and forth.
 - b. up and down.
 - c. both back and forth and up and down.

4. The cases are turned for the row patterns on the
 - a. conveyor.
 - b. transfer plate.
 - c. pallet.

5. The cases are positioned on top of the pallet load by
 - a. pushing them off the conveyor.
 - b. pulling the plate from under them.
 - c. pushing them off the transfer plate.
6. The sweep bar is used to
 - a. hold the cases on the pallet.
 - b. push the cases onto the transfer plate.
 - c. push the cases off of the transfer plate.
7. On a case palletizer tier sheets are
 - a. not used.
 - b. used between some tiers.
 - c. used between all tiers.
8. The cases are protected from damage from the strapping by
 - a. corner reinforcements.
 - b. tier sheets.
 - c. top frames.
9. On an automatic case palletizer, the top frame is positioned by the
 - a. operator.
 - b. vacuum transfer mechanism.
 - c. transfer plate.



10. On an automatic case palletizer the tier sheets are positioned by the
 - a. vacuum cup transfer mechanism.
 - b. transfer plate.
 - c. operator.

11. The loaded pallet on a low level case palletizer is removed from the palletizer by
 - a. rolling it to one side.
 - b. lowering it and rolling it to one side.
 - c. raising it and rolling it to one side.

[illegible]



Bag Palletizers

Bags, which come in a variety of sizes, shapes, and materials, can be palletized and depalletized by machines that are very similar to the palletizers used for cases when special attachments are used to handle the bags. In the bag palletizing operation, the bags may be vibrated to loosen the material inside the bag and to expel the air so that the bags are reshaped. The bags are turned and positioned for tier patterns and loaded onto the top of a pallet load. Bags can be palletized on either low level or high level palletizers. The bag palletizers may be either automatic or semiautomatic. Bags may be palletized in large stacks on full sized pallets, on mini-pallets that hold a single stack of bags, on slip sheets, or on other variations that are particularly appropriate for the size and type of bag and the desired load.

Operation

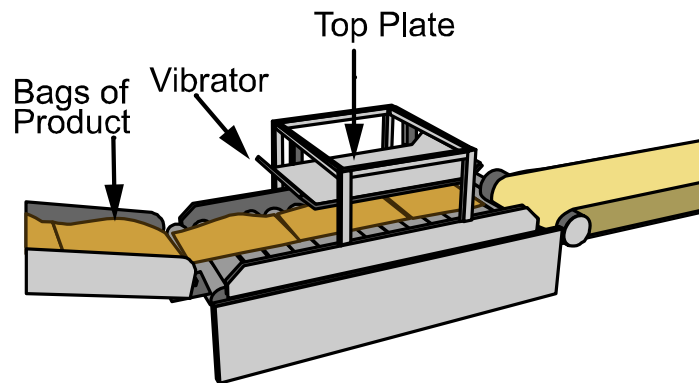
Pallet Loading

Pallets are loaded into the palletizer manually or by an automatic pallet dispenser. The pallet on the low level palletizer is automatically in position for loading when it is placed into the palletizer.

The hoist raises the pallet on the high level palletizer to the level of the bag conveyor and the stacking plate. Bags can be palletized on either low level or high level palletizers. The bag palletizers may be either automatic or semiautomatic.

Bag Shaping

One section of the accumulating conveyor is equipped with an oscillating vibrator unit that shakes each bag as it passes over the unit on the belt conveyor. The vibration loosens any product that has hardened and allows the air to escape from the bag. The loosened product settles in the bag and can be shaped more easily as the bag passes through the shaper.

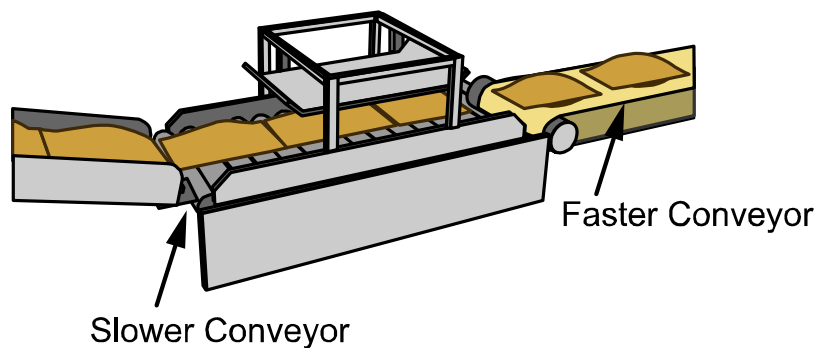


Bag Vibrator

The top of the bag is flattened as it passes under the top plate and the sides are squared as it passes between two side rails. This produces a flat top and regular shape which makes it possible to stack the bags more evenly in the tiers on the pallet.

Positioning

Bags are spaced and turned into position for the tier pattern while they are on the accumulation conveyor. The bags can be separated and spaced as they move from the slower flattening and indexing conveyor onto the faster conveyor on which the bags are turned and arranged into the tier pattern. The difference in the speeds of the two conveyors pulls the bags farther apart as they move onto the faster conveyor. Different types of turning mechanisms are used for different sizes and types of bags. The illustration below shows diverter gates which direct the bags down the center of the conveyor without turning them or moves them against the side rail where they will engage the turning post.



Bag Diverters

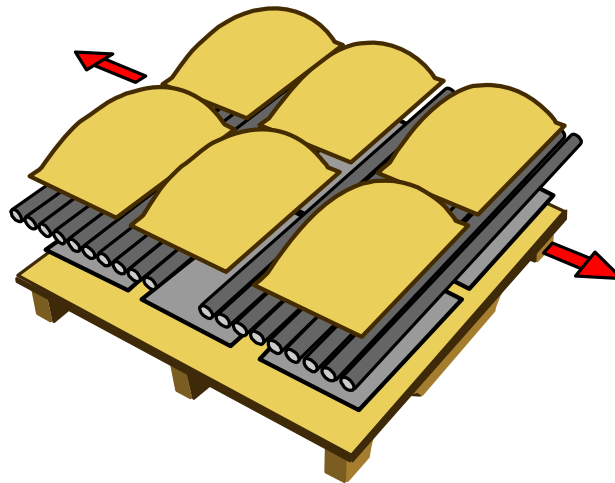
When the bag contacts the turning post, the momentum of the conveyor carries it forward, and it turns ninety degrees as it moves around the post. Some machines move all the bags along the guide rail that has a hinged flipper section. When a bag should be turned, the controller unit operates the flipper section that swings out and turns the bag ninety degrees.

Larger bags may be turned on a turntable mounted in the center of a section of a driven roller conveyor. When the bag is over the turntable, the controller operates the motor that turns it ninety degrees. In some cases, the turntable raises the bag above the conveyor, turns it, and lowers it back onto the conveyor.

On a semiautomatic system, the operator may turn the bags and arrange them in the tier pattern by hand.

Pallet Loading

The bags are moved onto the transfer plate or accumulation table and onto the top of the pallet load by the same types of operations that are used on similar machines for palletizing cases. The guides, stops, and pusher plates that are used are shaped to fit bags that are being loaded. Special precautions or procedures may be needed to keep the load square and keep the sides of the load from shifting. The illustration below shows the bags being positioned on the pallet with a split delivery table on a high level palletizer. In this operation, the table is lowered on top of the previous tier to flatten the top surface. Then the table rises slightly and separates to lower the bags onto the flattened surface.



Split Delivery Table

The squaring bars press against the sides of the tier to help shape the bags and square the tier after it is in position and the split delivery table has been removed.

Tier Sheets

Tier sheets may be placed between the tiers of a pallet to help stabilize the load and keep the bags from slipping. The tier sheets are inserted in the same manner that is used for palletizing cases.

Top Frame

The operator places a top frame on the top tier when the load is completed.



Progress Check #3

Circle the letter in front of the correct answer.

1. In a palletizing operation, bags are vibrated to
 - a. loosen the product.
 - b. allow air to escape.
 - c. loosen the product and allow air to escape.

2. Bag palletizers are most similar to palletizers used for
 - a. cases.
 - b. bulk bottles.
 - c. filled cans.

3. The tops of the bags are flattened by
 - a. passing under the top plate.
 - b. tamping with the transfer table.
 - c. both of the above.
 - d. neither of the above.

4. The sides of the bags are squared by
 - a. passing between side rails.
 - b. the diverter gate.
 - c. being struck by the hinged rail section.

5. The bags may be separated by moving them from
 - a. a slower conveyor to a faster one.
 - b. a faster conveyor to a slower one.
 - c. increasing the speed of the conveyor.
6. Diverter gates are operated to direct the bags
 - a. against the turning post.
 - b. away from the turning post.
 - c. against or away from the turning post.
7. The bags are moved around the turning posts by
 - a. the movement of the turning post.
 - b. operation of the hinged rail section.
 - c. momentum provided by the conveyor.
8. Turning posts are used to turn bags
 - a. 90 degrees.
 - b. 180 degrees.
 - c. 360 degrees.
9. The transfer table may be pressed against the top tier on a pallet to
 - a. unload the bags.
 - b. flatten the top of the tier.
 - c. square the tier.



10. Tier sheets may be used to
 - a. keep the load from shifting.
 - b. separate the bags in the tier.
 - c. protect the bags in the center of the tier.

11. The top frame is used to
 - a. keep the pallet load square.
 - b. protect the bags from the straps.
 - c. keep the load square and protect the bags.

12. The squaring bars press against the tier
 - a. while the bags are on the delivery table.
 - b. as the bags are taken off the delivery table.
 - c. after the bags are on the pallet.

13. The squaring bars are used to
 - a. shape the bags.
 - b. square the tier.
 - c. shape the bags and square the tier.

[illegible]

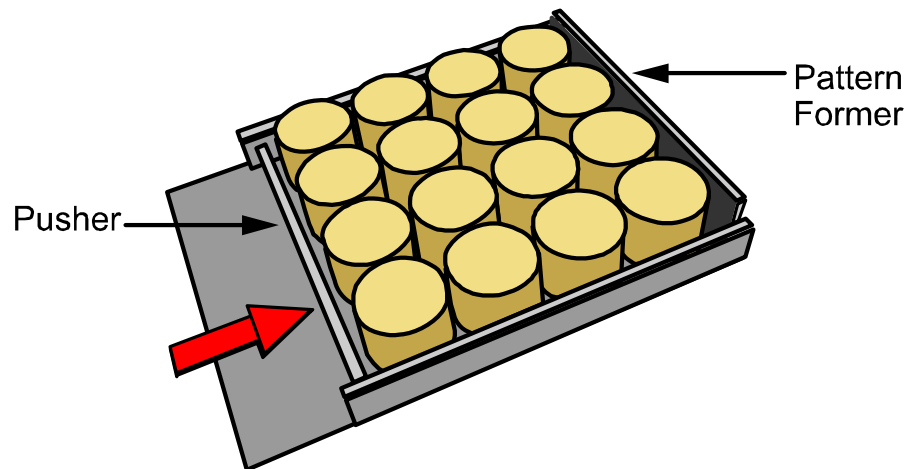


Pail and Drum Palletizers

Filled or empty drums or pails with lids can be palletized for shipping and storage. Pails and drums are normally loaded onto wood or plastic pallets. They may be loaded by individual tier palletizers, stack palletizers, or robot palletizers.

Individual Tier Palletizers

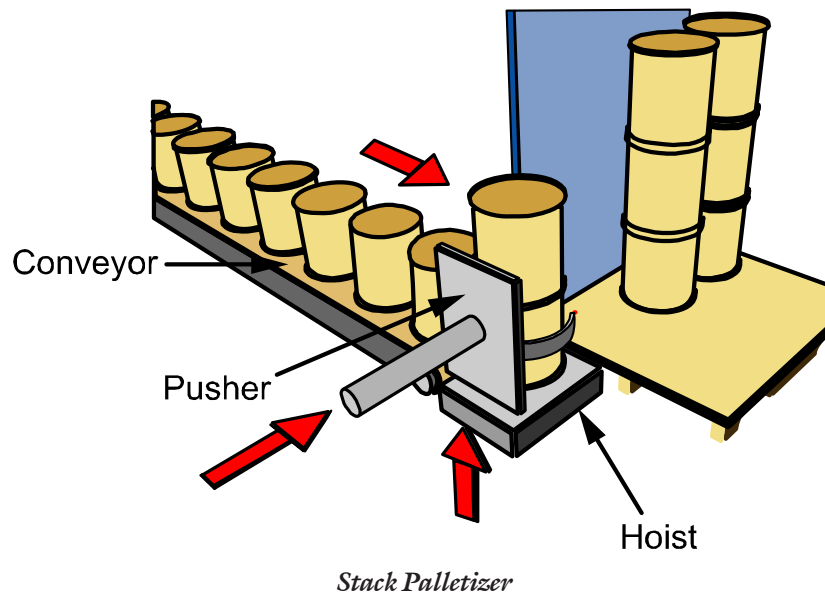
The low level and high level palletizers used to load pails and drums one tier at a time are basically the same machines as the ones used for palletizing cases or bags. Special pattern formers, guides, stops, and pusher plates are needed to fit the particular type of container that is being palletized (see below). Automatic bail orienters may be used to turn the pails so that the bails do not interfere with the tight nesting pattern that is formed on the pallet.



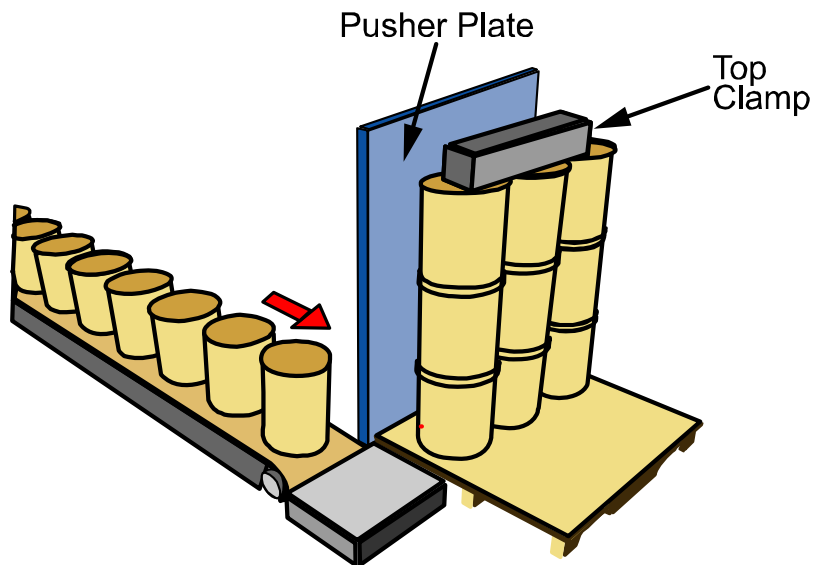
Individual Tier Palletizers

Stack Palletizers

Drums and pails may be stacked before they are moved onto delivery plate. The stack is then pushed onto the delivery plate. The figure below shows a type of stacker in which the pail or drum is moved to the hoist from the conveyor. The hoist raises the container into position to be grasped and held by a set of clamps. The hoist is lowered and the container is held suspended. Another container is moved onto the hoist and raised to lift the two containers. The lower container is held by the clamps and the hoist is lowered again. This procedure is repeated until the stack is complete.



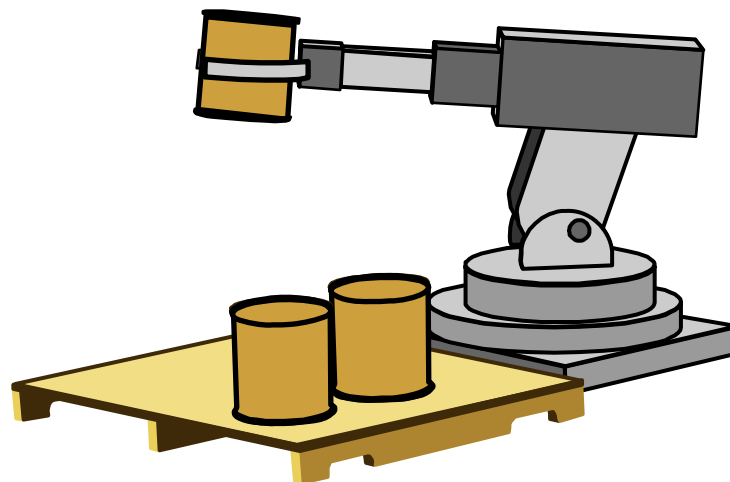
The stack of containers is pushed onto the dead plate that is above the pallet, and another stack is formed. Each stack pushes the preceding ones forward until the row is complete. When the row is complete the top clamp is lowered onto the top of the containers to hold them steady and the pusher plate pushes the row onto the front of the pallet. The top clamp is raised. The top clamp and pusher plate are moved back into position to receive the next stack. The pallet is moved forward to receive the next row of containers and the cycle is repeated. A top frame may be added and the loaded pallet may be strapped and/or wrapped with stretch or shrink-wrap.



A Complete Row on the Stack Palletizer

Robot Palletizers

Robots may be used to pick up pails, drums, and other containers and position them on the pallet. Robots are particularly effective for loading heavy drums and other more difficult-to-handle containers. The containers are normally moved one at a time. The robots may be programmed to operate automatically in a structured situation or the arm may be guided manually or positioned by operator-manipulated controls. Containers are grasped and held by clamps, vacuum cups, or other holding mechanisms mounted on its arm. The holding devices may be designed for the size, shape, and weight of a particular container or they may be designed for general use.



Robot Palletizer



Progress Check #4

Circle the letter in front of the correct answer.

1. The main difference in a low level pail palletizer and the same type palletizer used for cases is the
 - a. hoist.
 - b. pattern former and pusher bar.
 - c. conveyor.

2. Bail orienters are used to
 - a. tighten the nesting pattern.
 - b. pick up the pails.
 - c. keep the pails upright.

3. On a stack palletizer the pails are stacked
 - a. as they are set on the dead plate.
 - b. before they are pushed onto the dead plate.
 - c. as they are pushed onto the pallet.

4. The pails are stacked by positioning each pail
 - a. under the pail on the stacker.
 - b. over the pail on the stacker.
 - c. over and under the pail on the stacker.

5. Drums are normally palletized on
 - a. only wood pallets.
 - b. wood or plastic pallets.
 - c. slip sheets.
6. Stacked pails are placed on the pallet
 - a. one stack at a time.
 - b. one row at a time.
 - c. one pallet load at a time.
7. Stacked pails are kept from tipping forward by the
 - a. pusher plate.
 - b. top clamp.
 - c. guide rail.
8. A robot palletizer usually picks up one
 - a. drum at a time.
 - b. stack of drums at a time.
 - c. row of drums at a time.



High Level Bulk Palletizers

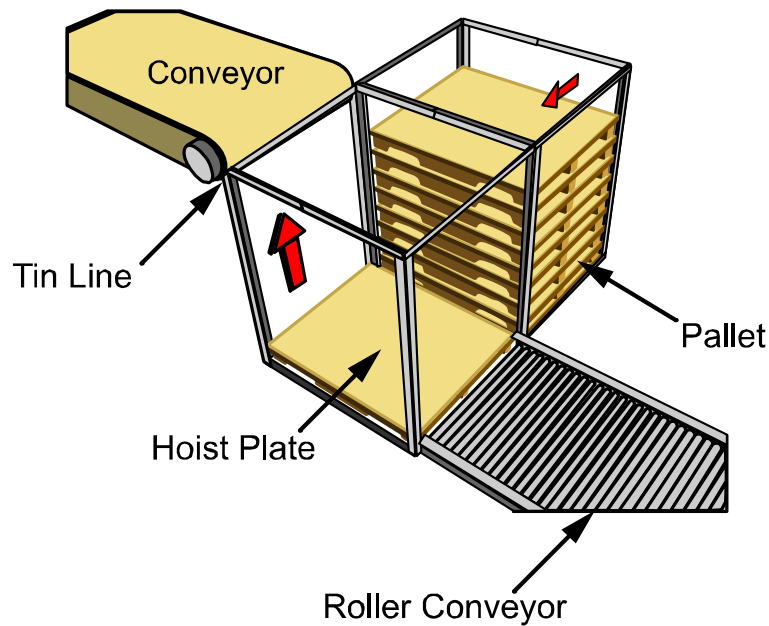
High level bulk palletizers are used for palletizing empty cans, round glass or plastic bottles, filled cans, and non-round containers. The type of palletizer or the attachments that are used may be modified for the size, shape, and stability of the containers or the use of labels on the containers. The bulk palletizer collects cans or bottles from a manufacturing line, arranges them into a layer pattern, and loads them onto a pallet for shipment to the user plant. Bulk palletizing makes it possible to ship or store the containers without using cases or trays. The high level palletizer is used in operations in which the containers are delivered to the palletizer by conveyors at the top of the palletizer which may be seven to nine feet above the floor. These conveyors carry the containers to other operations or move them down from a higher floor.

Palletizing Round Objects

Bulk palletizers may be automatic or semiautomatically operated. On the automatic machines, the operations are started by the actions of sensors and controller units, on the semiautomatic machines the operators initiate some of the actions by operating the buttons or other controls.

Pallet Hoist

The pallet dispenser loads a pallet onto the hoist at its low position that is near floor level. The hoist raises the empty pallet up to “tin line”; the level where the bottom of the cans are even with the top of the conveyor.

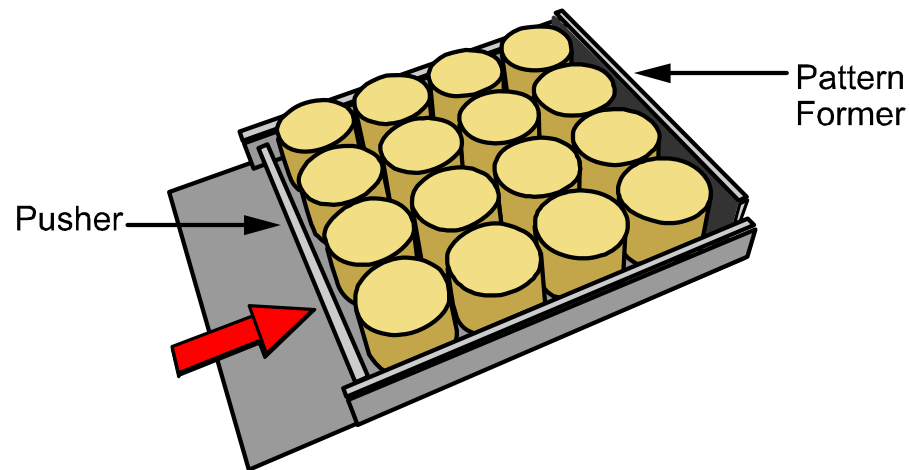


Pallet Dispenser and Hoist

The pallet hoist lowers the pallet one container height each time a layer is added. When the pallet is filled, the hoist lowers it to the lowest position so that it can be discharged and another pallet can be loaded onto the hoist. The hoist platforms may be raised and lowered by chains that are driven by electric motors and gear boxes and they are held in place by electric brakes. The positions of the platform and the extent of movement is controlled by photoelectric sensors and limit switches.

Pattern Forming and Loading

The conveyor delivers the containers onto the accumulation bed of the palletizer where they are formed into the pattern of the pallet layer. The accumulation bed is a conveyor belt, and the pattern-forming carriage moves along with the belt to transfer the containers onto the pallet.



Pattern Former

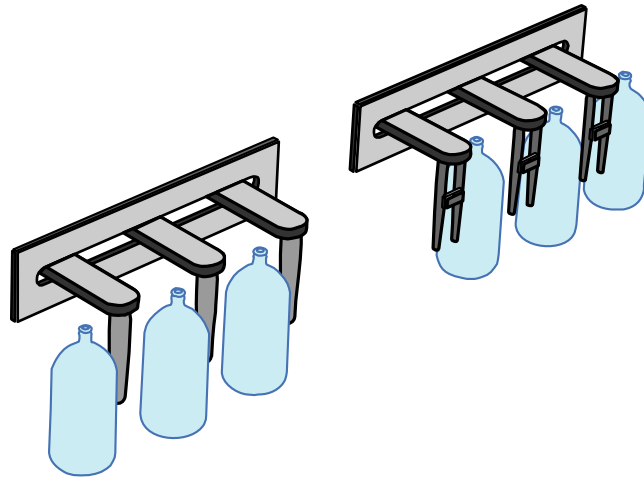
Empty containers are unstable and topple easily when they are pushed, so pins, fingers, or blades are used to support and hold the back row of containers as they are moved in a layer pattern.

Empty Cans

Empty cans are controlled by lowering pins attached to the pattern former into the open tops of the cans in the front and back rows. The carriage and conveyor move forward and carry the layer of cans into position on the slip sheet (or tier sheet) to form a layer on the pallet. When the cans are in position, the carriage moves up to raise the pins out of the cans, moves back to the accumulation bed, and lowers the pins into the next set of cans. The tier of cans on the hoist is lowered, and the process is repeated with another tier.

Bottles

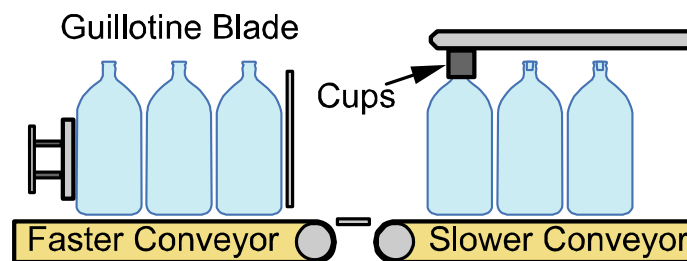
When it is difficult to insert the pins into the mouths of small-necked bottles, blades may be positioned in front of the leading row and behind the trailing row. This controls the bottles as they are moved with the same type of accumulation bed and pattern former carriage that is used for open top cans. The blades can damage the labels that are placed on some two-liter plastic bottles before they are palletized. The large labeled bottles can be controlled with pins that fit in the triangular void between the bottles.



Palletizing Bottles

Plastishield Bottles

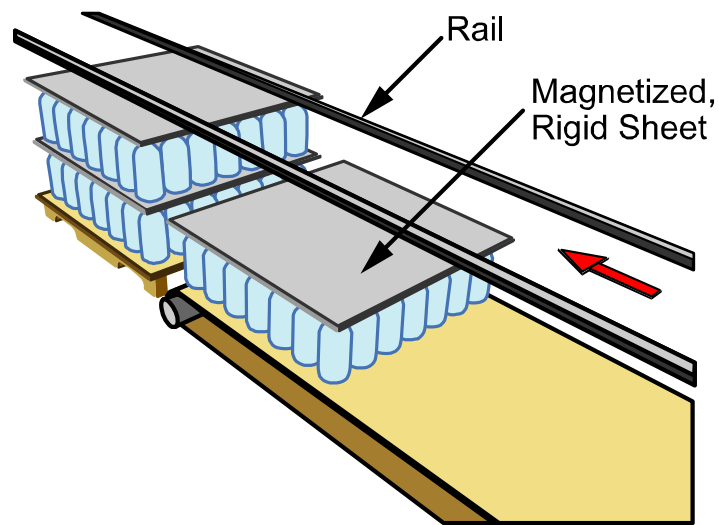
The space between plastishield bottles is very small and the plastic is easily damaged so holding cups and a guillotine blade pusher may be used to control the bottles. When the bottles are on the pallet the carriage and guillotine blade are raised and moved back over the accumulation bed. The holding cups are raised, the bottles on the entry conveyor move forward, and the process is repeated.



Plastishield Bottles

Filled Cans

Filled cans can be loaded onto the pallet with a magnet. A large magnetic plate mounted on the carriage is lowered onto the top of the patterned cans. It raises the entire tier of cans off the conveyor, carries it into position over the pallet, and lowers it into position. The cans are released, the carriage moves the magnet plate back into position over the next load, and the operation is repeated.

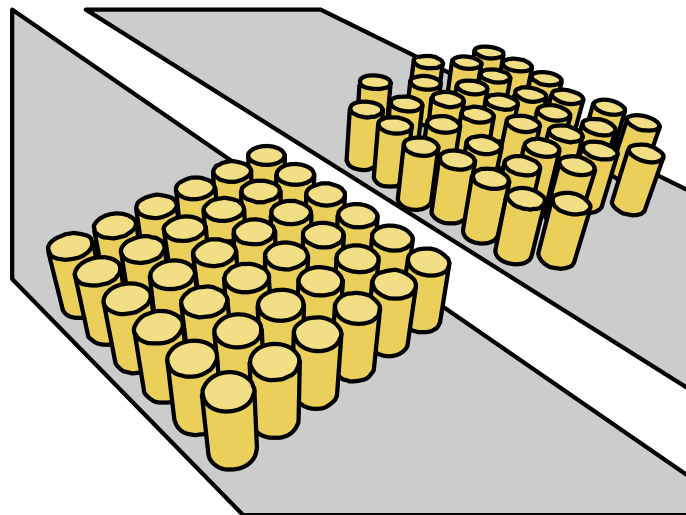


Magnetic Palletizing

Odd Row Reject

The pattern of cans on each tier of a pallet is determined by the size of the cans and the size and shape of the pallet. When each row has the same number of containers, the front of the pattern is a straight line and easy to control. When the containers are nested and the rows do not all have the same number of containers, there may be an extra can at the beginning of every other row. These extra containers need to be removed and returned to the input flow. There are several different methods by which these extra containers may be removed and replaced in the flow. One technique has a belt that crosses the machine in front of the front row of containers that are being held by the pins, blades, or other type of holder.

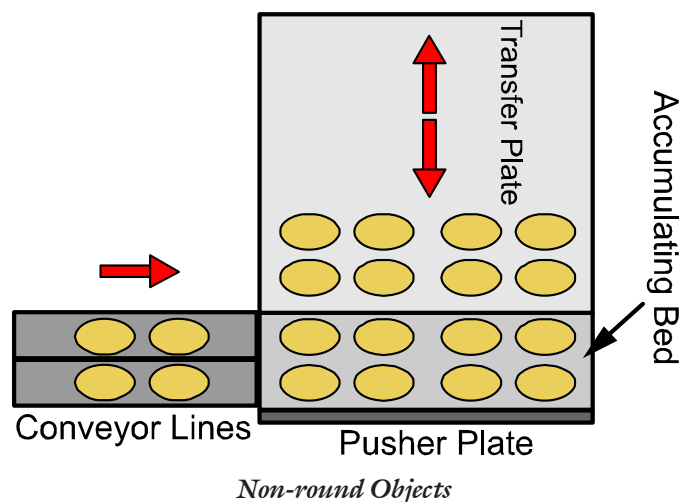
When the belt moves, it carries the extra containers that are not being held by the pins off the accumulation bed. A conveyor alongside the machine will carry these containers to the back of the line and feed them onto the delivery conveyor that returns them to the accumulation bed. The extra containers may also be removed just before they are to be pushed onto the pallet, and some machines use suction cups or magnets to remove the containers from the far side of the pallet.



Even and Uneven Rows

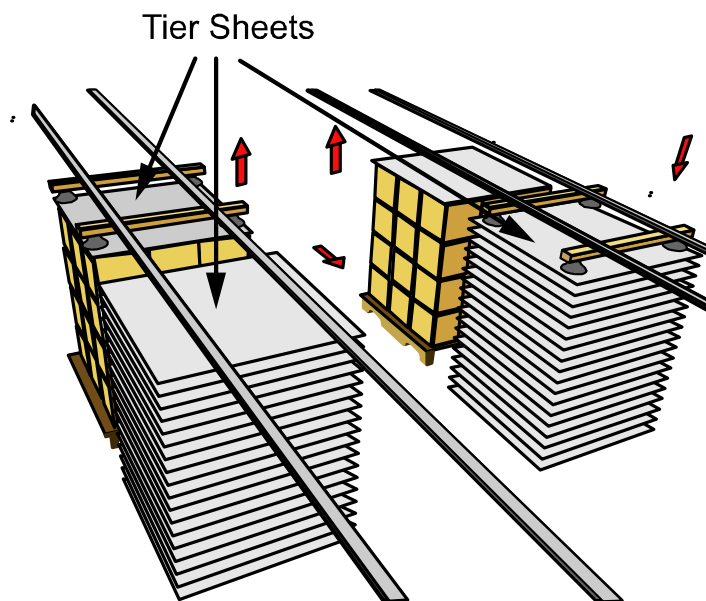
Palletizing Non-Round Objects

Non-round objects such as oval salad dressing bottles and rectangular cocoa boxes must be properly positioned and turned in the same direction in order to form a compact pattern with the maximum number of containers in a tier on a pallet. Non-round containers can be palletized by conveying them to the accumulating bed on individual parallel conveyor lanes where they are properly positioned. When the lanes on the accumulating bed are full, a pusher plate pushes the accumulated containers onto the pallet and retracts to allow the lanes to refill, and the process is repeated until the tier is filled. The tendency of oval shaped containers to nest helps produce a stable grouping, so that the containers are delivered in a staggered position on the adjacent conveyors. Guides or pattern-forming blocks at the end of the lines hold the containers in position and deliver them onto the accumulator bed in a nested pattern.



Tier Sheet Placement

Tier sheets made of paperboard or chipboard may be placed under the bottom tier or layer and on top of all or some of the tiers to help stabilize the load and provide a smooth even surface on which to set the containers. Tier sheets are also called slip sheets or separator sheets. A stack of tier sheets is located alongside the pallet hoist level with the top of the exposed tier. After the tier of containers is in place on the pallet, one slip sheet is picked up by a suction cup assembly, moved over the load, positioned, and released on top of the containers. Clips may be used to hold the slip sheet in place while the load is pushed onto it. The following tier of containers is pushed or set on the tier sheet, and the vacuum cup assembly is returned to the stack to pick up the next sheet. The tier sheet placement mechanism may be a reciprocating unit that operates with the pattern-forming carriage, or it may be a hinged arm mechanism that moves the head into the desired positions.



Tier Sheet Placement/Removal

Top Frame Placement

When the pallet load is completed, the top frame is placed on the top of the load to provide support and hold the load square when the straps are tightened around it. The top frame or “picture frame” is usually placed manually by the operator.

Lowering the Pallet

When the layer is positioned on the load, bars called layer squares move in from the four sides to push the containers close together and square the load. The hoist is lowered one container height and stopped in position for the next layer by the operation of a photoelectric unit. When the last layer is in place and the load is full, a red light comes on and the machine stops. The operator places a top frame (or picture frame) on top of the slip sheet and pushes a button to start the hoist and lower the pallet. When the hoist reaches the bottom, the filled pallet is moved to the strapping station on a conveyor. An empty pallet is then placed on the hoist, and the hoist is raised to position the top of the pallet at the can line ready for a load.



Progress Check #5

Circle the letter in front of the correct answer.

1. A bulk palletizer is used to palletize
 - a. empty cans.
 - b. empty bottles.
 - c. filled cans.
 - d. empty cans, empty bottles, and filled cans.

2. A high level palletizer is loaded by moving
 - a. the pallet up to the containers.
 - b. the containers to the top of the pallet.
 - c. the containers down to the pallet.

3. The distance a hoist is moved on a high level palletizer is controlled by
 - a. photoelectric sensors.
 - b. limit switches.
 - c. photoelectric sensors and limit switches.

4. The empty containers are moved from the accumulation bed to the pallet by the
 - a. pattern-forming carriage.
 - b. conveyor.
 - c. pattern-forming carriage and conveyor.

5. Blades are attached to the carriage to support and guide
 - a. empty cans.
 - b. glass bottles.
 - c. plastishield bottles.
6. Empty cans are held in the layer pattern by
 - a. blades outside the can.
 - b. pins inside the can.
 - c. fingers inside the can.
7. The pattern-forming carriage rises above the containers when
 - a. the containers are on the pallet.
 - b. the containers are on the conveyor.
 - c. the containers leave the accumulation bed.
8. Non-round containers are delivered to the palletizer on
 - a. bulk conveyors.
 - b. single line conveyors.
 - c. either bulk or single line conveyors.
9. Non-round containers are positioned for the nesting pattern by
 - a. pattern-forming blocks on end of conveyors.
 - b. cups attached to the carriage.



10. While the pallet is strapped, the top of the load is held-square by the
 - a. slip sheet.
 - b. layer squarers.
 - c. top frame.
11. On a high level palletizer the empty pallet is loaded onto the hoist
 - a. at the top of its stroke.
 - b. at floor level.
12. When the last slip sheet is in place on a high level palletizer
 - a. the machine stops.
 - b. the hoist automatically lowers.
 - c. the hoist automatically rises.
13. The top frame is usually placed on the pallet
 - a. by an automatic mechanism.
 - b. by a semiautomatic mechanism.
 - c. manually.
14. The odd row reject system is used on loads with patterns in which
 - a. all rows have same number of containers.
 - b. alternate rows have different numbers of containers.
 - c. the containers are not in rows.

[illegible]



Low Level Bulk Palletizers

Low level palletizers can be used for palletizing filled cans and some types of empty containers. Bulk palletizing makes it possible to ship or store empty or filled containers without using cases or trays. This eliminates the expense of obtaining the cases or trays and the need for handling them. Bulk palletizers collect the containers from a manufacturing line, arrange them into a layer or tier pattern, and load them onto a pallet for shipment to the plant in which they will be filled. It is also used for storage of filled cans that are being held for labeling.

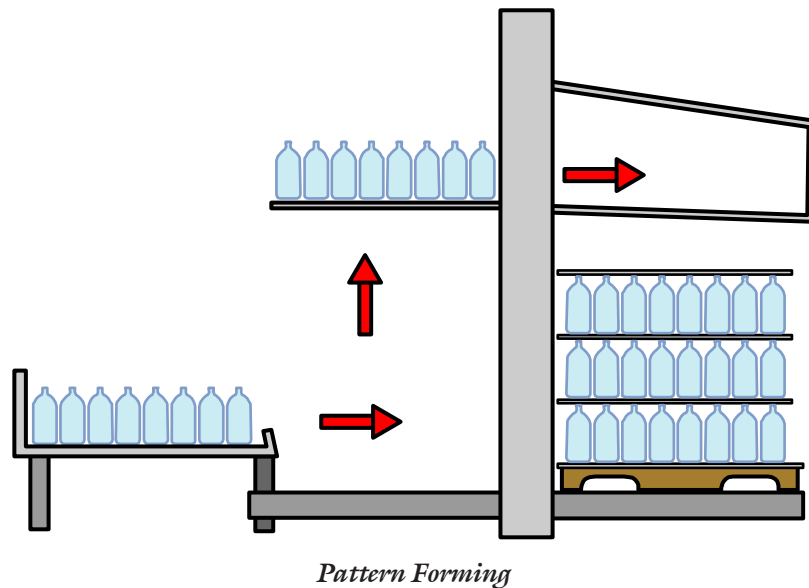
Sweep-Off Bulk Palletizers

Low level bulk palletizers are normally operated by either the “sweep-off” or “lift-off” techniques. The sweep-off type of low level bulk palletizer is very similar to the low level case palletizer. The pallet is loaded into the machine near floor level, and it is held in one position while it is loaded by a transfer plate mechanism that carries the containers to the top of the stack.

Pattern Forming and Loading

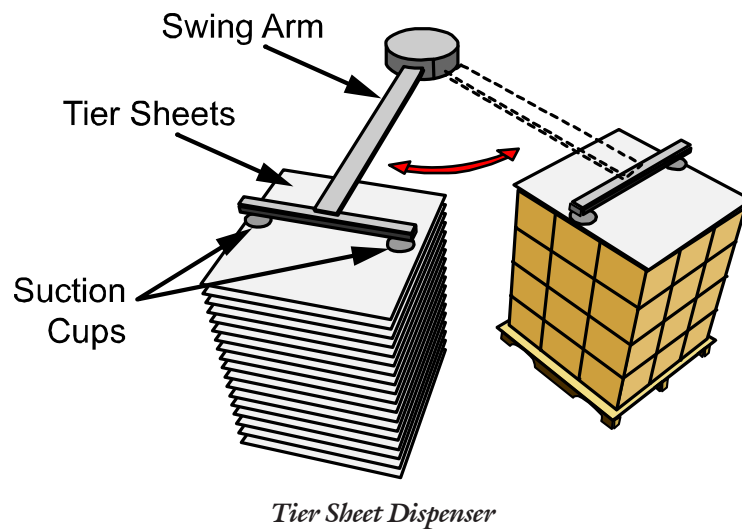
Containers are delivered to the palletizer by a conveyor that is equipped with mechanisms to orient them and arrange them in rows ready to be pushed onto the transfer plate. The containers are pushed onto the transfer plate one or more rows at a time, and pattern formers attached to the guide rails and retaining bars hold them in the desired pattern. The transfer plate moves to the top level of the pallet stack, and moves in over the top layer. The sweep bar is lowered in front of the pattern to hold the containers in place as the transfer plate pulls out from under the tier.

As the containers settle onto the stack, the squaring bars move in from the sides to compact square the tier. The sweep bar rises and the transfer plate returns to the conveyor level to receive the next load from the conveyor.



Tier Sheets

A tier sheet, or slip sheet, normally made of paperboard or chipboard, is placed over the tier of containers to provide stability to the pallet stack and provide an even surface on which the next tier can be placed. The tier sheets can be placed automatically by a vacuum cup and swinging arm mechanism which picks one up from the top of the stack alongside the palletizer, swings it over the containers, and lowers it into position. Gripper clips may be used to hold it in place until the next tier is in place.



Top Frame

The operator places a top frame over the tier sheet on the top tier to help hold the pallet stack square and protect the containers when the straps are tightened. The top frame is made of wood and resembles a picture frame.

Pallet Discharge

The loaded pallet is moved out of the palletizer on a live roller or chain conveyor that carries it to the strapper or stretch wrapping machine. A turntable may be used to turn the pallet when the rails of the pallet are not turned to ride across the conveyor rollers. Another pallet is loaded into the palletizer and the operation is repeated.

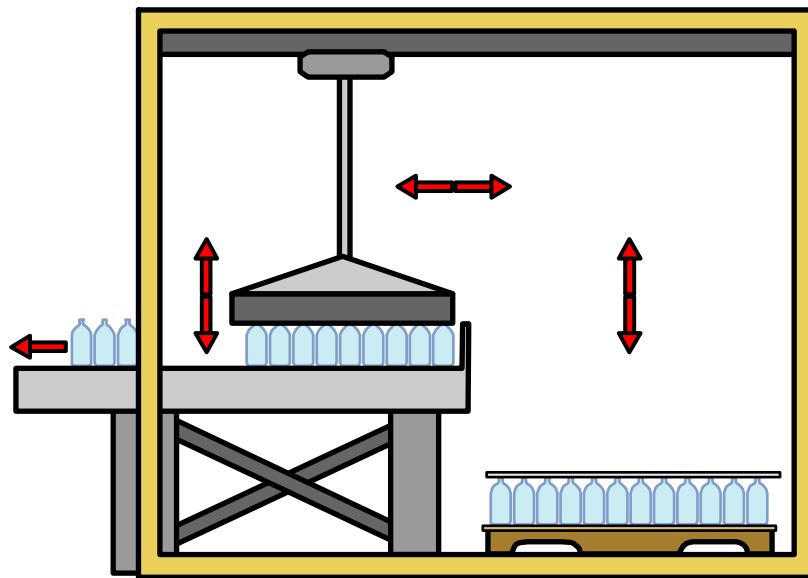
Operating Sequence

The steps of operation of a sweep-off, low level bulk palletizer may be summarized as:

1. An empty pallet is placed on the palletizer.
2. The containers are oriented and delivered by conveyor.
3. The rows of containers are pushed onto the transfer plate.
4. The containers are held in the pattern by pattern formers on the guide rails and retaining bars.
5. The transfer plate rises and moves in to carry the tier over the pallet.
6. The sweep bar is lowered.
7. The sweep bar holds the containers on the pallet load as the transfer plate moves out from under it.
8. The sweep bar is raised.
9. The squaring bars square the tier.
10. The transfer plate is lowered to conveyor level.
11. A tier sheet is placed over the tier of containers.
12. The cycle is repeated for other tiers.
13. A top frame is placed over the top tier.
14. The loaded pallet is moved by conveyor to the strapping or stretch wrapping machine.
15. Another pallet is loaded, and the operation is repeated.

Lift-off Low Level Palletizers

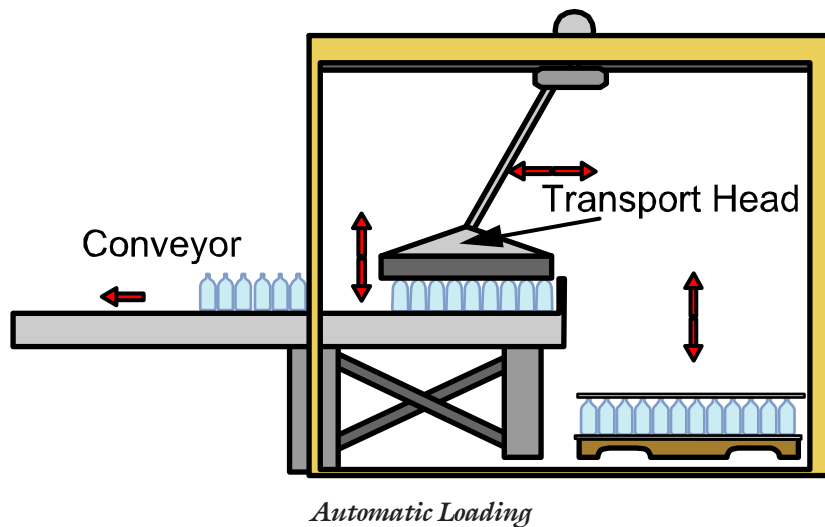
The lift-off low level bulk palletizer grasps the tops of the containers, lifts them, carries them to the top of the pallet loader and sets them onto the slip sheet. This technique uses a minimum amount of bottle contact, and it can be used with unstable bottles. The machine consists of a transport head, motorized lift, overhead track, and pallet conveyor.



Lift-off Low Level Palletizer/Depalletizer

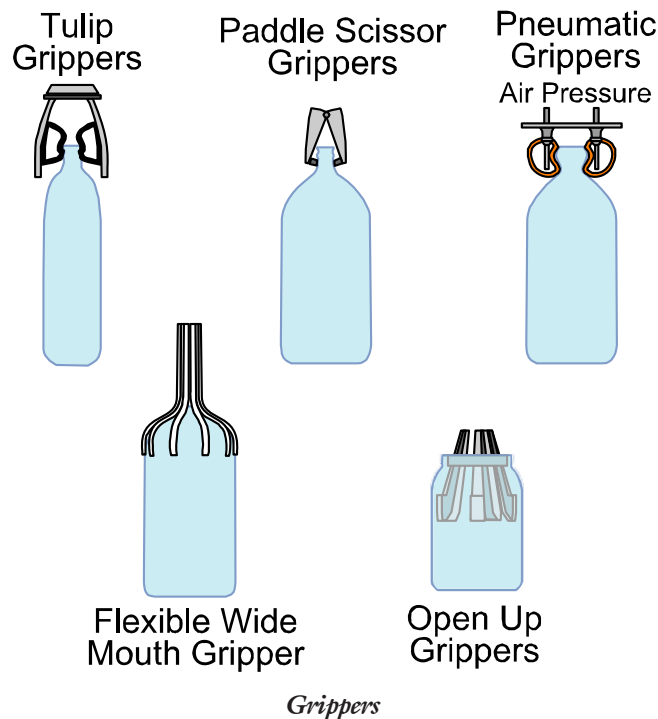
Automatic Loading

The pallet is placed on the pallet conveyor near floor level where it remains stable until it is loaded. The containers are fed in on a conveyor and formed into a pack pattern that will become one layer of the pallet load. The transport head is lowered over the open tops of the bottles and individual grippers grasp each bottle top. The transport head rises to lift the bottles off the conveyor and above the top of the pallet load. It then moves horizontally and gently lowers the bottles onto the top of the slip sheet that covers the top of the pallet or the previous layer.



Grippers

Different types of grippers are used to grasp the different sizes and shapes of the bottle tops. The tulip gripper has a rubber bladder that fits around the neck of a long necked bottle and the padded scissor gripper has padded clips that grasp the outside of small necked screw type bottles. A larger bladder on a pair of pneumatic grippers can grasp the outside of most all styles of bottles. The flexible wide-mouth grippers fit inside the lip of wide mouth bottles and the open-up grippers press against the inside surface of short and small jars.



Tier Sheet

The tier sheet or slip sheet, is placed over the tops of the tier of bottles in the same type of operation that is used for the sweep-off, low level bulk palletizer.

Top Frame

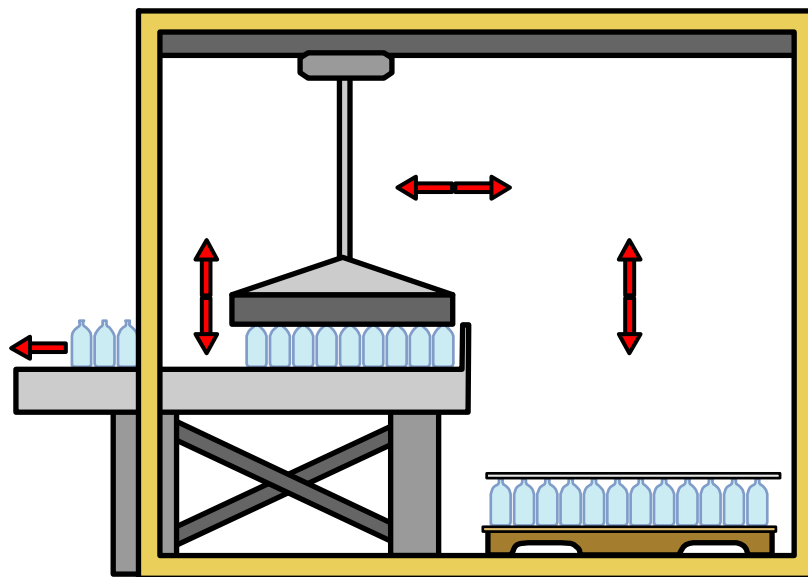
The top frame is placed on top of the pallet load to help keep it square and protect the top tier of bottles.

Pallet Removal

The loaded pallet is moved by conveyor to the strapping or stretch wrapping machines. Another pallet is loaded and the process is repeated.

Semi-Automatic Operation

The lift-off low level bulk palletizer may be a semiautomatic machine that requires an operator to perform some of the functions. The bottles are fed in on a conveyor and formed into the pack pattern. The operator uses a switch to start and stop the lifting transport motor and guides the bottle transport head as it is lowered over the tops of the bottles. The operator activates the lifting transport motor, and the bottles are lifted from the conveyor. The operator guides the bottle transport head as it moves horizontally and operates the lift motor and continues to guide the head as the bottles are lowered onto the pallet. The operator returns the head to the conveyor for the next tier and positions the tier sheet over the tier of the pallet.



Lift-off Low Level Palletizer



Operating Sequence

The steps of operation of a lift-off low level bulk palletizer may be summarized as:

1. An empty pallet is placed on the pallet conveyor.
2. The bottles are delivered by conveyor and formed into layer size packs.
3. The transport head is lowered over the open tops of the bottles.
4. The grippers grasp each bottle top.
5. The transport head raises the bottles off the conveyor and higher than the top of the pallet load.
6. The transport head moves horizontally to position the bottles over the pallet.
7. The transport head lowers the bottles onto the slip sheet and releases the grippers.
8. The transport head rises and returns to the conveyor for another load.
9. The slip sheet is placed on top of the layer on the pallet.
10. The top frame is placed on the top slip sheet when the pallet load is completed.
11. The loaded pallet is moved from the palletizer to the strapper or stretch wrapper.
12. Another pallet is loaded into the palletizer, and the sequence is repeated.

Progress Check #6

Circle the letter in front of the correct answer.

1. On a sweep-off, low level palletizer, the pallet is loaded by moving the
 - a. pallet hoist up and down.
 - b. transfer plate up and down.
 - c. pallet and transfer plate up and down.
2. The sweep bar
 - a. pushes the containers onto the transfer plate.
 - b. pushes the containers off the transfer plate.
 - c. holds the containers as the transfer plate moves.
3. The transfer plate on a sweep-off, low level bulk palletizer moves
 - a. horizontally.
 - b. up and down.
 - c. horizontally and up and down.
4. On a sweep-off bulk palletizer the containers are
 - a. pushed onto the pallet.
 - b. dropped onto the pallet.
 - c. dropped and pushed onto the pallet.



5. The containers on a pallet are squared
 - a. one layer at a time.
 - b. several layers at a time.
 - c. entire pallet load at a time.
6. Each layer of a pallet of empty containers sets on the
 - a. lower layer.
 - b. slip sheet.
 - c. pallet.
7. The top frame
 - a. protects the edge containers.
 - b. stabilizes the pallet load.
 - c. stabilizes and protects the load.
8. A lift-off bulk palletizer lifts the bottles by the
 - a. top.
 - b. bottom.
 - c. slip sheet.
9. On a lift-off bulk palletizer the transport head moves
 - a. horizontally.
 - b. up and down.
 - c. horizontally and up and down.

10. Tulip grippers and pneumatic grippers hold the bottles with
 - a. clips.
 - b. vacuum.
 - c. bladders.

11. The padded scissor grippers press against the
 - a. inside of the bottle.
 - b. outside of the bottle.
 - c. inside and outside of the bottle.

12. The lift-off bulk palletizer
 - a. pushes the containers onto the slip sheet.
 - b. sets the containers onto the slip sheet.
 - c. drops the containers onto the slip sheet.



Depalletizing Overview

When the warehouse receives product to distribute, bulk containers, or packaging materials, the materials are frequently supplied on pallets. In order to assist the warehouse in performing efficiently the incoming pallets must be depalletized or broken-down as efficiently as possible.

[illegible]



Case and Bag Depalletizers

Depalletizers remove the cases or bags or other goods from the pallets and position them on the conveyors for delivery to areas in which they will be used. The construction of depalletizers is very similar to that of the related palletizers, but they operate in the reverse direction.

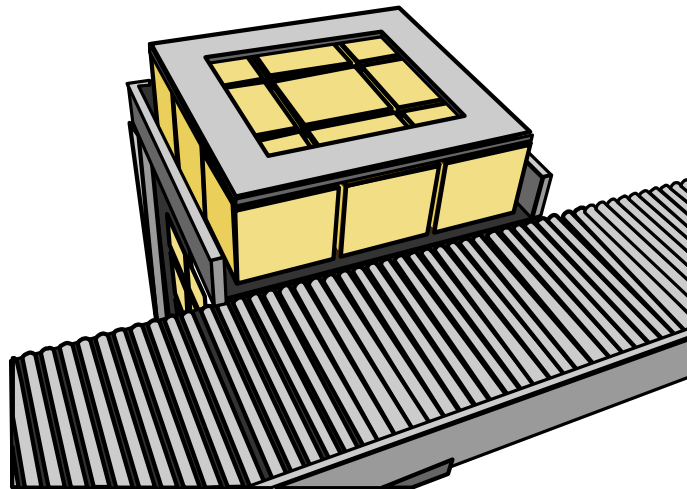
Operation of High Level Depalletizers

Pallet Hoist

The filled pallet is moved to the depalletizer and positioned on the hoist by conveyors or a forklift. The filled pallet is raised by the hoist until the bottom of the top tier is in line with the accumulation bed and discharge conveyor.

Top Frame

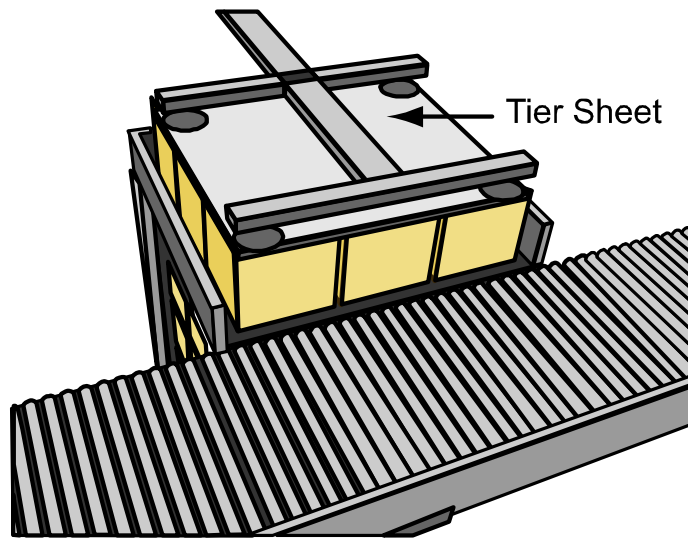
The straps are cut and the top frame is taken off the load by the operator.



Top Frame Removal

Tier Sheet

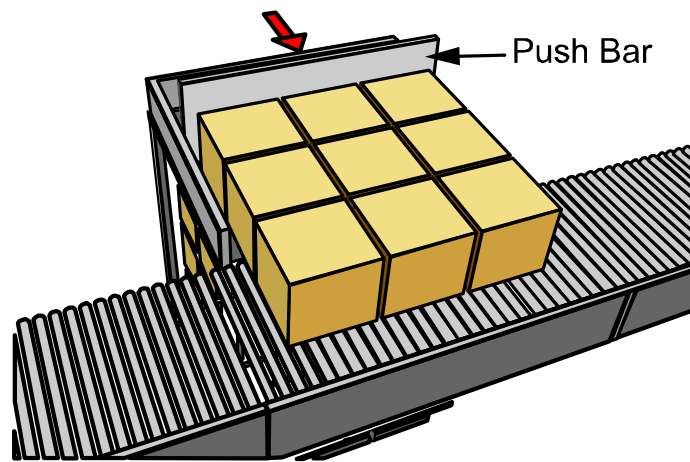
The tier sheet is removed from the top of the pack by the tier sheet stacker or the operator. On machines that have the tier sheet stacker attached to the reciprocating carriage head, a set of vacuum cups will settle onto the top of the tier sheet and pick it up. The tier sheet is then carried to the stack and released as the carriage moves over the pallet to remove the next tier. Some machines may have tier sheet stackers that are operated with a swinging arm rather than an attachment to the reciprocal moving carriage.



Tier Sheet Removal

Unloading

The carriage head moves over the top of the load and lowers a sweep blade behind the cases or bags. On some machines a set of clips will catch the edge of the tier sheet to hold it in place as the tier is swept off. As the carriage head moves forward, the sweep bar pushes the cases or bags onto the accumulation bed.



Unloading a Tier of Cases

The accumulation bed provides a means for separating the containers and feeding them onto the conveyors. Cross belts, single fillers, and conveyor lanes with different speeds may be used to arrange the containers into the desired patterns on the discharge conveyors. High speed machines may use a continuous-motion sweep in which two or more sweep bars are attached to a chain that carries them up and over the tier that is being removed. Then a sweep bar can be in position to start pushing off the next tier just as soon as the preceding tier is on the accumulation bed and the next tier is in position. This eliminates the delay that may be produced by the returning motion of a reciprocating carriage. When the tier is off the tier sheet the clips are released and the tier sheet removed by the tier sheet stacker. After each tier is removed the hoist raises the pallet to the position of the next tier for removal.

Pallet Removal

When all the containers and tier sheets have been unloaded from the pallet the empty pallet is lowered by the hoist and removed from the machine by the pallet stacker or the operator.

Controls

The control actions on an automatic machine may be initiated by the P.L.C. (Programmable Logic Controller) or other control unit. Semiautomatic machines may be controlled by operator-activated buttons and controls. Photoelectric units and limit switches sense the positions of the machine components and produce the signals needed for control operations.

Operating Sequence

The steps in the operation of the high level case and bag depalletizer may be summarized as:

1. The loaded pallet is placed on the hoist.
2. The loaded pallet is raised to the discharge level.
3. The straps are cut and the top frame is removed.
4. The top tier sheet is removed.
5. The sweep blade is lowered behind the top tier.
6. The tier sheet below the top tier is held by clips.
7. The sweep blade pushes the top tier onto the accumulation bed.
8. The containers are fed onto conveyors from the accumulation bed.
9. The tier sheet is removed.
10. The operation is repeated for following tiers.
11. The empty pallet is lowered by the hoist.
12. The empty pallet is removed by the pallet stacker or operator.

Operation of Low Level Box and Bag Depalletizers

Pallet Loading

The filled pallet is moved to and installed in the low level depalletizer by conveyor or forklift. The position of the pallet does not change during the depalletizing operation.

Top Frame

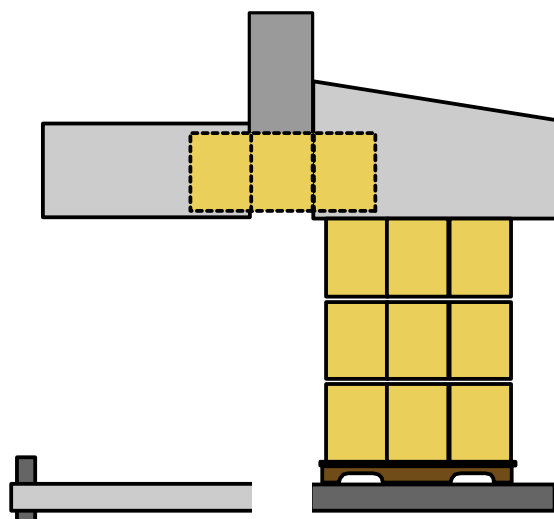
The straps are cut and the top frame is taken off the load by the operator.

Tier Sheet

The tier sheet is removed from the top of the pack by the operator or tier sheet stacker.

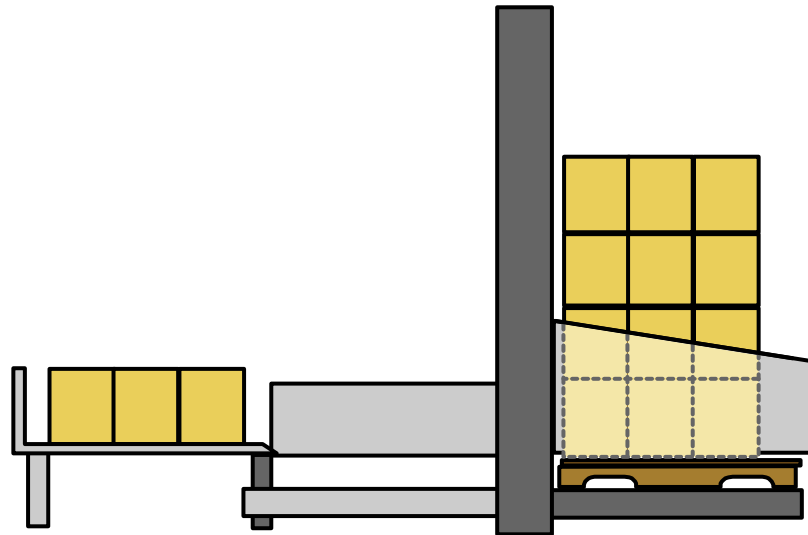
Unloading

When the machine is started the transfer plate moves up to the level of the bottom of the top tier of the pallet load. The sweep bar is lowered behind the tier of cases or bags and it is moved forward to sweep the layer off the stack and onto the transfer plate.



Unloading

The transfer plate is moved to the discharge conveyor level. A sweep bar pushes the cases or bags onto the discharge table from which they are directed into single lanes and fed onto conveyors that transport them to where they are needed. The transfer plate then moves into position to accept the next tier of the stack and the operation is repeated until the pallet is completely unloaded.



Moved From Transfer Plate to Conveyor

Tier Sheets

When tier sheets are used they may be removed from the top of the pallet before the tier is swept off the pallet. The tier sheet stacker may be a rotating vacuum cup mechanism or a reciprocating clip type tier sheet stacker. In some cases, the operator will remove them manually. The tier sheet may also be pushed off the stack with the containers and removed while the tier is on the transferable.

Pallet Removal

When all the containers and tier sheets have been unloaded from the pallet the empty pallet is removed from the machine by the pallet stacker or the operator.



Controls

The control actions on an automatic machine may be initiated by the P.L.C. (Programmed Logic Controller) or other control unit. Semiautomatic machines may be controlled by operator-activated buttons and controls. Photoelectric units and limit switches sense the positions of the machine components and produce the signals needed for control operations.

Operating Sequence

The steps in the operation of the low level case and bag depalletizer may be summarized as:

1. The wrap, bands, and top frame are removed from the loaded pallet.
2. The full pallet is positioned in the depalletizer by conveyor or forklift.
3. Tier sheet is removed when there is one.
4. The transfer plate is raised into position to receive the tier.
5. The sweep bar pushes the tier onto the transfer plate.
6. The transfer plate is moved to the discharge table.
7. The containers are pushed onto the discharge table.
8. On some machines the tier sheet is removed while on the discharge table.
9. The containers are directed onto the discharge conveyor.
10. The transfer plate is moved into position for each tier in order.

Progress Check #7

Circle the letter in front of the correct answer.

1. On a high level depalletizer the top tier is positioned at the discharge point by the movement of the
 - a. pallet hoist.
 - b. transfer plate.
 - c. discharge table.

2. On an automatic depalletizer the top frame is removed by a
 - a. fully automatic operation.
 - b. semiautomatic operation.
 - c. manual operation.

3. On a high level depalletizer the sweep bar is attached to the
 - a. carriage head.
 - b. transfer plate.
 - c. discharge table.

4. While the cases are being swept from the pallet the tier sheet may be held by
 - a. vacuum cups.
 - b. clips.
 - c. guides.



5. On a high level depalletizer each level is positioned by
 - a. raising the pallet.
 - b. lowering the pallet.
 - c. raising or lowering the pallet.
6. The control actions of a semiautomatic depalletizer are initiated by the
 - a. PLC.
 - b. limit switches.
 - c. operator.
7. Continuous-motion sweep bars are used on.
 - a. all high level depalletizers.
 - b. higher speed high level depalletizers.
 - c. lower speed high level depalletizers.
8. On a low level depalletizer the cases are moved to the discharge area by
 - a. the pallet hoist.
 - b. the transfer plate.
 - c. the discharge table.
9. On a low level palletizer the cases are pushed from the pallet onto the
 - a. transfer plate.
 - b. discharge table.
 - c. conveyor.

10. The transfer plate on a low level palletizer moves the cases to the
 - a. discharge table.
 - b. conveyor.
 - c. pallet.

11. The pallet is removed from an automatic depalletizer by the
 - a. pallet stacker.
 - b. pallet dispenser.
 - c. conveyor.

12. On a low level depalletizer the transfer plate moves over the top of the pallet on
 - a. all machines.
 - b. some machines.
 - c. no machines.



Bulk Depalletizers

Bulk depalletizing operations are the reverse of the operations used for bulk palletizing. The filled pallets are placed in the depalletizer and the machine systematically unloads the pallet, tier by tier, and delivers the containers onto the conveyor that will carry them to where they are needed.

Bulk depalletizers may be high level or low level machines and the containers may be swept off or lifted off the pallet.

Operation of High Level Depalletizers

Pallet Hoist

The loaded pallet is moved to the depalletizer and positioned on the hoist by a conveyor or forklift. The loaded pallet is raised by the hoist until the bottom of the top tier is in line with the accumulation bed and discharge conveyor.

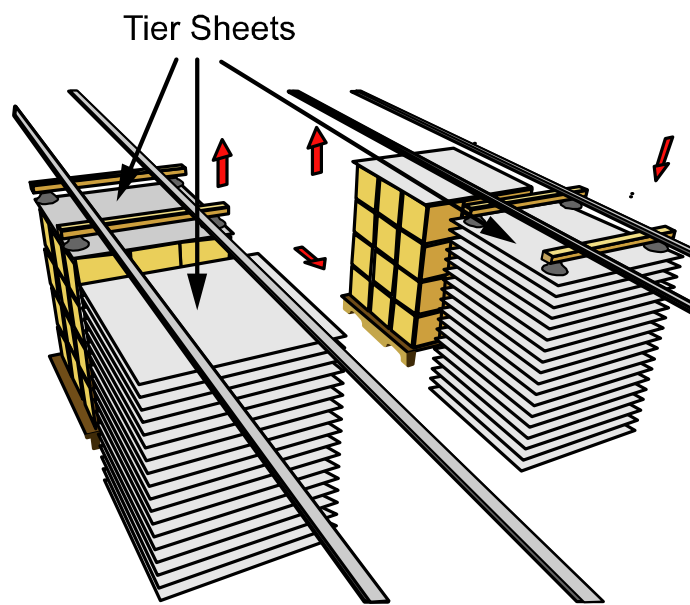
Top Frame

The straps are cut and the top frame is taken off the load by the operator.

Tier Sheet

Different types of tier sheet removal and stacker techniques are used on different machines.

On some machines the top tier sheet will be removed by the operator when the top frame is removed and on others it may be removed with the top tier of containers. On machines that have the tier sheet stacker attached to a reciprocating carriage head a set of vacuum cups will settle onto the top of the tier sheet and pick it up. The tier sheet is then carried to the stack and released as the carriage moves over the loaded pallet. Some machines have tier sheet stackers that are operated with a swinging arm rather than an attachment to the reciprocating carriage.



Tier Sheet Placement/Removal



Sweep-Off Unloading

The carriage head is moved over the top of the load and lowered so that the pins, fingers, or blades being used to stabilize the containers are lowered in place. The head will have the same type of configuration as the one used on the palletizer for the particular containers. For example, pins will fit inside open cans, blades will fit alongside long-necked bottles, and fingers will fit in the triangular space between two liter plastic bottles. The carriage head will sweep the containers off the tier sheet and onto the accumulation bed. This operation also places the vacuum cups on the tier sheet pickup assembly over the tier sheet on top of the next tier. On some machines clips may be used to hold the tier sheet under the tier and keep it from sliding with the containers that are on it.

The containers will be fed off the accumulation bed by a single filer or other mechanisms that will arrange them in the pattern needed for transport on the discharge conveyor. High-speed machines may use a continuous-motion head.

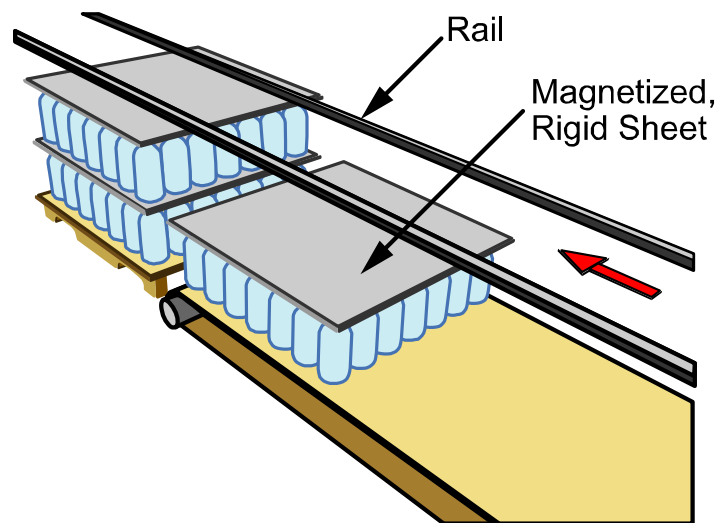
Operating Sequence

The steps in the operating sequence of the high level sweep-off depalletizer can be summarized as:

1. The straps are cut and the top frame is removed from the pallet.
2. The filled pallet is positioned on the hoist.
3. The hoist raises the filled pallet to expose the top tier.
4. The top tier sheet is removed and carried to the stack as the carriage head moves over the top of the pallet.
5. The carriage head is lowered and pins, fingers, or blades are positioned to hold the containers.
6. Finger clips may grasp the edge of the tier sheet.
7. The carriage head carries the tier forward and positions the tier sheet vacuum cup assembly over the tier sheet on the top of the pallet.
8. The tier moves off the tier sheet and onto the accumulating bed.
9. The carriage head is raised to release the containers.
10. The containers move off the accumulating bed and onto the conveyor.

Lift-Off Unloading

Filled cans may be lifted off the pallet by a high level bulk depalletizer with a magnetic head which operates in the reverse of the magnetic palletizer. The bottom surface of the carriage head is a magnetic plate that covers the top of the pallet tier. The carriage head carries the magnet over the top of the load and lowers the magnet down on top of the cans. The rising magnet lifts the cans off the top of the pallet, and the carriage moves forward and lowers to deposit the cans on the accumulating bed. The cans are single filed and fed from the accumulating bed onto the conveyor that will carry them into the labeler or other areas in which they may be needed.



Lift-off Unloading

The tier sheets are removed and stacked in the same type of operations that are used for sweep-off, high level depalletizing. Each time a tier is removed the pallet load is raised one level until it is completely empty.

Pallet Removal

When all of the containers and tier sheets have been unloaded from the pallet a control is activated by the operator to lower the hoist and the empty pallet. The empty pallet is removed from the machine by the pallet stacker or the operator, and it is then replaced by another filled pallet and the process is repeated.

Operating Sequence

The steps of operation of a high level lift-off bulk palletizer for filled cans may be summarized as:

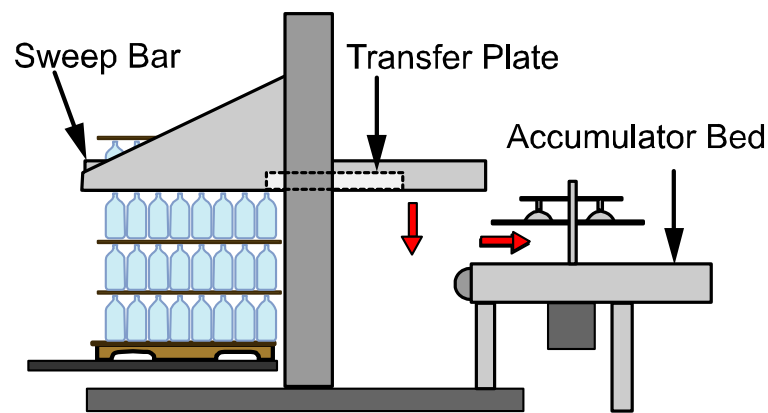
1. The straps are cut and the top frame is removed from the pallet.
2. The pallet of filled cans is positioned on the hoist.
3. The hoist raises the filled pallet to expose the tin level.
4. The top tier sheet is removed and carried to the stack as the carriage head moves over the top of the pallet.
5. A magnet equipped carriage head is lowered onto the tops of the cans.
6. The magnet attracts the cans and holds them as the carriage head rises.
7. The carriage head moves forward to carry the tier of cans to the accumulation bed and the vacuum cup assembly over the tier sheet.
8. The carriage head lowers the cans on the accumulation bed and the vacuum cup assembly onto the tier sheet.
9. The carriage head raises and returns to position for the next tier and carries the tier sheet to the stack.
10. When the last tier has been unloaded, the operator activates the switch to lower the pallet hoist.
11. The pallet is removed by the operator or pallet stacker, another loaded pallet is placed on the hoist, and the process is repeated.

Operation of Low Level Sweep-Off Bulk Depalletizers

The operation of low level sweep-off bulk depalletizers is very similar to that of the low level case depalletizers. The pattern of containers is held together by guides, rails, and clamps so that it can be handled as a single unit. The pallet is unwrapped, the straps are cut, the top frame is removed, and the filled pallet is loaded into the depalletizer.

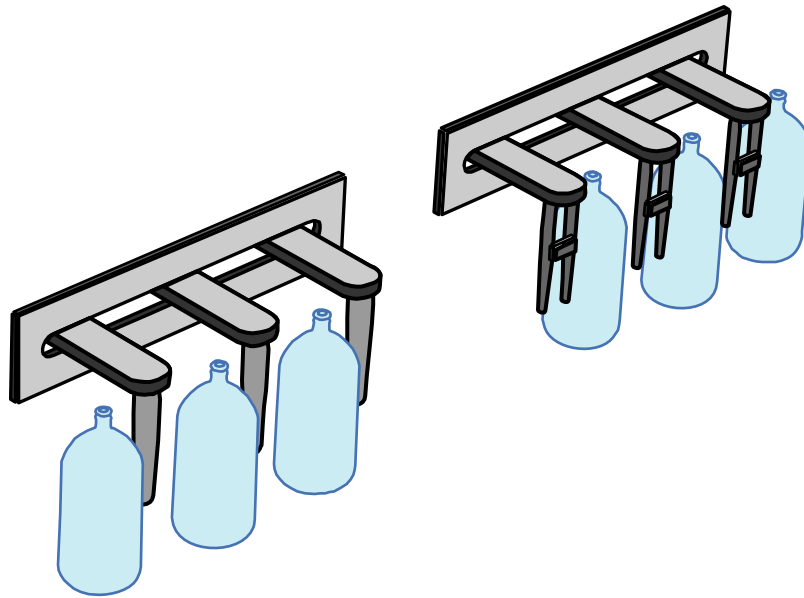
Unloading

When the machine is started, the transfer plate moves up to the bottom of the top level of the pallet load. The sweep bar is positioned behind the pack of containers and it moves forward to sweep the pack onto the transfer plate.



Sweep Bar behind a Tier of Containers

The transfer plate is moved to the discharge level. Then a sweep bar pushes the containers onto the discharge table from which they are directed into single lanes and fed onto conveyors that transport them to the areas in which they are needed.



Depalletizing Bottles

The transfer plate then moves into position to accept the next tier of the stack and the operation is repeated until the pallet is completely unloaded.

Tier sheets may be removed before the tier is moved off the pallet or it may be moved with the tier and removed while the tier is on the discharge table.

Pallet Removal

The empty pallet is removed from the machine by the pallet stacker or the operator.



Operating Sequence

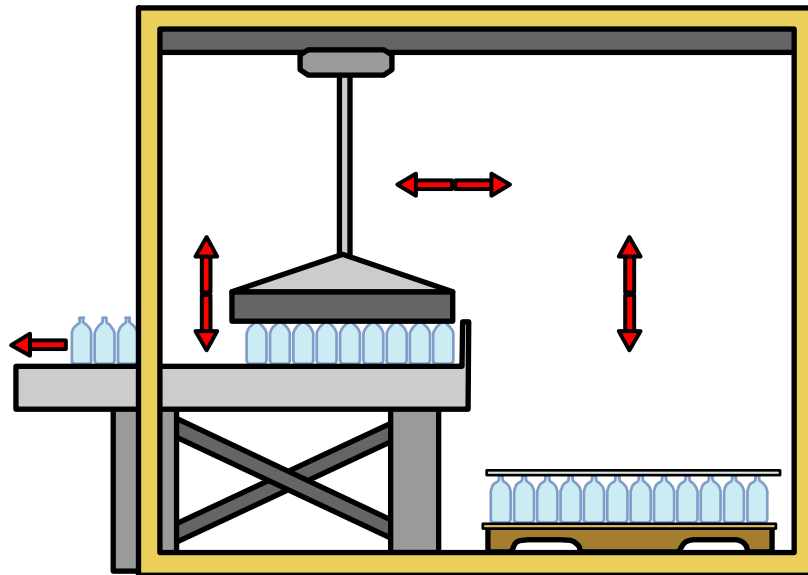
The steps in the operation of a low level sweep-off depalletizer may be summarized as:

1. The wrapping, straps, and top frame are removed from a loaded pallet.
2. The loaded pallet is placed in the depalletizer.
3. The transfer plate is moved to the discharge level.
4. Clamps or guide rails hold containers in their pattern.
5. The sweep bar is positioned behind the tier of containers.
6. The sweep bar pushes the patterned tier of containers onto the transfer plate.
7. The transfer plate moves to the level of the discharge table.
8. A sweep bar pushes the containers onto the discharge table.
9. The tier sheet is removed from the top of the containers and stacked.
10. The containers are directed from the discharge table onto the conveyor.
11. The transfer plate moves back to the position for the next tier.
12. When the pallet is empty it is removed from the machine.
13. The process is repeated.

Operation of Low Level Lift-Off Bulk Depalletizers

The operation of low level lift-off bulk depalletizers is the reverse of the operation of the low level lift-off palletizer.

The illustration below shows an automatic depalletizer. As the transport head is lowered over the top of the pallet, a set of grippers in the head grasps and firmly holds each container in the pack. The transport head carries the containers as it is raised, moved over the accumulation bed, and lowered. The grippers are released, and the containers settle onto the table.

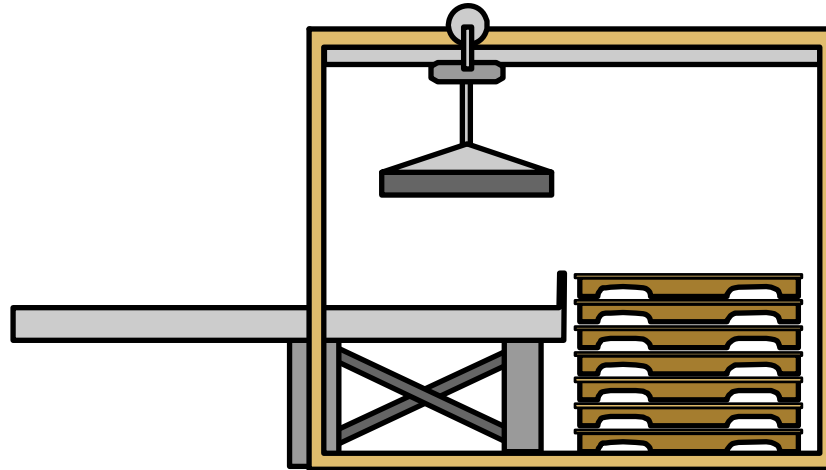


Lift-off Low-level Palletizer/Depalletizer

The containers are moved off the accumulation bed and onto the conveyor.

The tier sheet is removed from the top of the next tier, and the transport head is returned for another load.

The illustration below shows a semiautomatic lift-off depalletizer. The operator presses buttons to start and stop the motor and guides the head by hand as it is moved into position.



Semiautomatic Lift-off Depalletizer

Grippers

The same type of grippers used for palletizing are utilized in depalletizing processes.

Operating Sequence

The steps in the operation of a low level lift-off depalletizer may be summarized as:

1. The wrapping, straps, and top frame are removed from a loaded pallet.
2. The loaded pallet is placed on the depalletizer.
3. The tier sheet is removed from the top of the pallet.
4. The transport head is lowered over the open containers.
5. The grippers on the transport head grasp the containers.
6. The transport head and containers are raised.
7. The transport head carries the containers over the accumulation bed.
8. The transport head is lowered to place containers on accumulation bed.
9. The grippers are released.
10. The containers are directed onto the conveyor.
11. The next tier sheet is removed and placed on stack.
12. The transport head returns for the next tier.
13. When the pallet is empty, it is removed from the machine.
14. Another pallet is placed, and the process is repeated.



Progress Check #8

Circle the letter in front of the correct answer.

1. The pallet hoist is used on
 - a. low level depalletizers.
 - b. high level depalletizers.
 - c. both low and high level depalletizers.

2. The containers are swept off the pallet on a high level bulk depalletizer by the
 - a. sweep bar.
 - b. magnetic carriage head.
 - c. pins or fingers on the carriage head.

3. The tier sheet may be held during a sweep-off operation by
 - a. clips.
 - b. pins.
 - c. vacuum cups.

4. After each tier is removed from a high level depalletizer the pallet is
 - a. raised.
 - b. lowered.
 - c. not moved.

5. The high level lift-off depalletizer is used with
 - a. empty bottles.
 - b. empty cans.
 - c. filled cans.
6. The empty pallet is normally lowered in response to an action of the
 - a. limit switch.
 - b. operator.
 - c. control unit.
7. On a high level depalletizer the tier sheet removal mechanism is moved with the
 - a. reciprocating carriage head.
 - b. pallet hoist movement.
 - c. transfer plate movement.
8. On a low level bulk depalletizer clamps are used to hold
 - a. the containers in a pack.
 - b. tier sheet on the containers.
 - c. the containers on the transfer plate.
9. On a low level sweep-off bulk depalletizer the containers are moved to the discharge conveyor level by the
 - a. transfer plate.
 - b. pallet hoist.
 - c. transport head.



10. The moving part of a low level lift-off bulk depalletizer is the
 - a. transfer plate.
 - b. pallet hoist.
 - c. transport head.

11. The transport head on a low level lift-off depalletizer moves
 - a. vertically.
 - b. horizontally.
 - c. vertically and horizontally.

[illegible]



Pallet Dispensers, Stackers and Conveyors

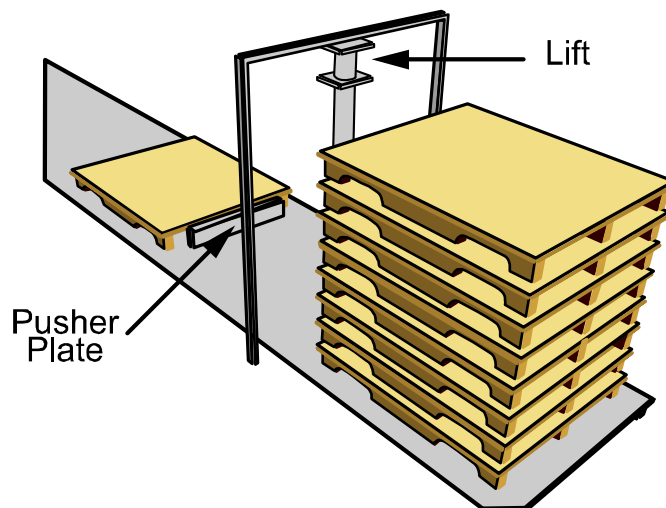
Pallet dispensers feed the empty pallets one at a time into the palletizer as they are needed and pallet stackers remove the empty pallets from the depalletizer and stack them for removal. Conveyors are used to move the loaded pallets away from the palletizers and to the depalletizers.

Pallet Dispensers

The pallet dispensers may be operated by lift tables, moving arms, or forklift tines.

Lift Table Operation

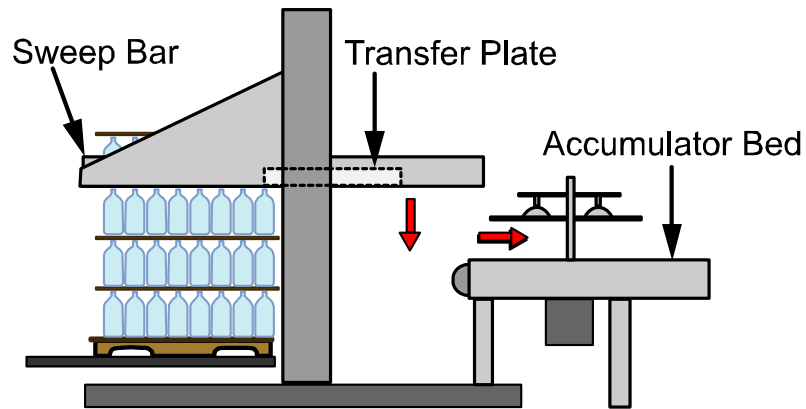
A stack of empty pallets is positioned on a lift table in the pallet dispenser section of the palletizer by a forklift or conveyor. The lift table raises the stack so that the second pallet from the bottom is in position to be held by swinging dogs or lugs. As the table is lowered, the bottom pallet is set onto the chain conveyor. When a pallet is needed the chain conveyor carries the bottom pallet into the palletizer. After the bottom pallet is removed from the dispenser the table rises to lift the next pallet above the dogs on which it is sitting. The dogs are retracted and the pallet is lowered onto the chain conveyor. As the pallets are lowered the dogs move back in to catch the second pallet and hold it so that the bottom one can be moved out from under the stack.



Lift Table Pallet Dispenser

Moving Arms

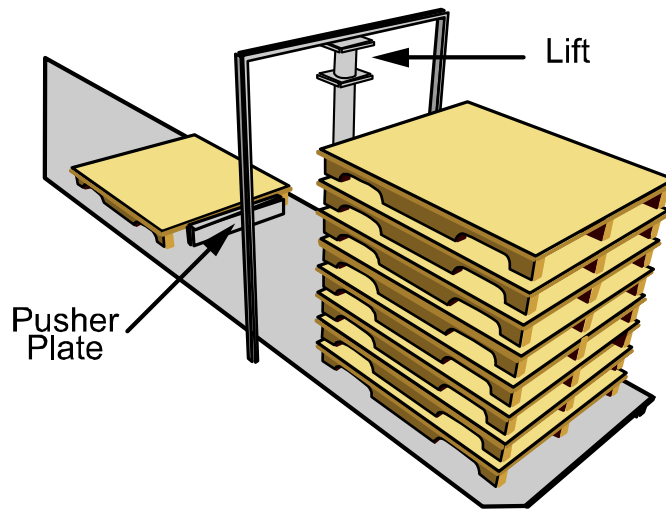
The stack of pallets is loaded into the dispenser with the bottom one sitting on the conveyor that will move it into the palletizer. Two sets of moving arms position lugs under the sides of the top surface of the second pallet from the bottom. The arms rise enough to lift the weight of the pallets in the stack off the bottom pallet. When a pallet is needed, the conveyor carries the bottom pallet into the palletizer. The arms lower the stack onto the conveyor and retract to release the one that is now on the bottom and setting it on the conveyor. The arms rise to the second pallet on the stack and insert the lugs under its top surface. The arms rise to clear the bottom pallet, and the cycle is repeated.



Moving Arms Pallet Dispenser

Forklift Tines

The forklift tines operation is very similar to that of the lift table mechanism. The forklift mechanism uses two tines attached to a hydraulic lift. The tines are inserted under one edge of the second pallet from the bottom. The machine is raised and lowered, and the tines are inserted and retracted to feed the bottom pallet onto the conveyor that will carry it into the palletizer.



Lift Table Pallet Dispenser

Pallet Stackers

The pallet stackers accept the empty pallets from the depalletizer and stack them for removal, storage, and shipping. The pallet stackers use basically the same machinery and operations as the pallet dispensers, except they operate in a reverse sequence. A conveyor carries the empty pallet out of the depalletizer and into the bottom of the pallet stacker. The stacking mechanism holds the stack suspended well above the conveyor. The stack is lowered onto the top of each pallet that is added, the lugs or dogs are positioned under the top of the pallet, and the stack is raised to make room for the next pallet.



Conveyors

Conveyors are normally used to move the loaded pallets out of the palletizer and into the strapper or wrapping machine and from the wrapping machine to the loading area. Conveyors are also used to move the loaded pallets from the receiving area to the depalletizer. Powered roller conveyors or chain conveyors are frequently used to move the heavy loaded pallets. A pallet may have to be turned ninety degrees when it is moved from one conveyor to another so that the supporting rails of the pallet will slide across the tops of the rollers.

A turntable or raised chain conveyor can be used to turn the pallets. The turntable mounted in the center of the conveyor carries the pallet with it as it turns. The pallet may be moved across the conveyor rollers by a chain conveyor mounted between the rollers. The chain conveyor can be lowered out of the way when it is not needed and raised when there is a pallet to be moved crossways. The lugs of the link chain will catch the back edge of the pallet's supporting rail and push the pallet across the conveyor rollers and onto the ones that are turned in the other direction. The conveyor chain is lowered below the rollers until it is needed again.

Progress Check #9

Circle the letter in front of the correct answer.

1. The pallet dispenser feeds pallets into the
 - a. palletizer.
 - b. depalletizer.
 - c. palletizer and depalletizer.

2. The pallet dispenser feeds the pallets from the
 - a. top of the stack.
 - b. middle of the stack.
 - c. bottom of the stack.

3. The pallet stack is held up by the lugs or dogs under
 - a. each pallet.
 - b. the second pallet.
 - c. bottom pallet.

4. The pallet stacker operates in the
 - a. same sequence as the pallet dispenser.
 - b. opposite sequence as the pallet dispenser.
 - c. sequence not associated with the pallet dispenser.

5. A pallet stacker adds the pallets to the
 - a. bottom of the stack.
 - b. top of the stack.



6. A loaded pallet can be moved across the conveyor rollers by lugs on conveyor chains mounted
 - a. above the rollers.
 - b. between the rollers.
 - c. across the rollers.
7. The supporting rails of the pallets should be
 - a. parallel to the rollers.
 - b. diagonal to the rollers.
 - c. across the rollers.

[illegible]

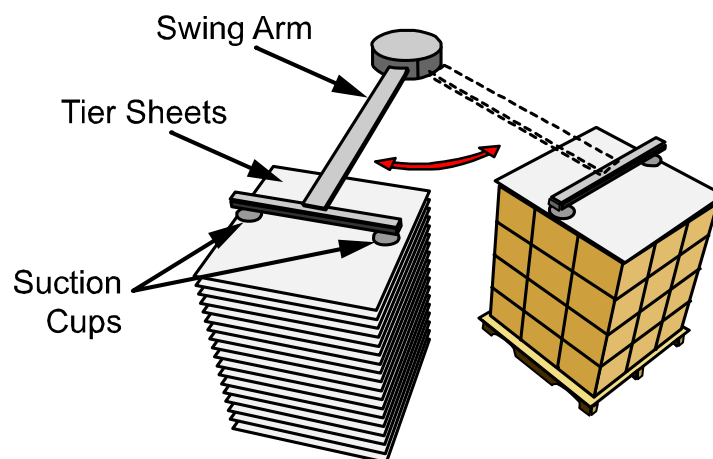


Tier Sheet Dispensers and Stackers

Tier sheet dispensers are used to position the tier sheets on top of some of the layers or tiers of the pallet in the palletizer, and the tier sheet stackers are used to remove the tier sheets from a loaded pallet on a depalletizer. Tier sheets are also called slip sheets and separator sheets because they fit between the layers or tiers of a pallet.

Tier Sheet Dispensers

The tier sheets that help stabilize the load may be taken from the stack automatically and placed on top of the tier on the pallet. The program of the controller unit will determine which tiers will be covered with a tier sheet and initiate the operation that will move it into place. A stack of tier sheets is normally located alongside the pallet, and the tier sheet is picked up by a suction cup mechanism and moved into position by a transport system. The illustration below shows a horizontal transport system that is attached to the tier loading mechanism on a high level palletizer. The tier sheet is moved into position over the tier as the head moves back to the accumulating table to pick up the next layer. When the tier sheet is in position, the suction cups release it, and allow it to settle into place. As the head returns over the pallet with the next tier load the tier sheet delivery mechanism is moved back into position for the next sheet. The controller will determine whether or not the vacuum pickup mechanism is operated to deliver a sheet on each layer.



Tier Sheet Dispenser

The top level of the stack of tier sheets can be maintained at the top level of the stack by a hoist under the stack. The tier sheet transport mechanism used on low level palletizers may be automatically raised and lowered to position the pickup on top of the stack and raise it to the height of the tier for release. Some tier sheet dispensers are operated by a swinging arm transport mechanism that picks up the tier sheet from the top of the stack, moves it into position over the pallet load, and releases it. Photoelectric sensors and limit switches operate in conjunction with a controller unit to control the machine's operations.

Tier Sheet Stackers

Tier sheet stackers remove the tier sheets from the top of the tier of a pallet that is being unloaded by a depalletizer. The tier sheet stackers use basically the same machinery and operations as the tier sheet dispensers except they operate in a reverse sequence. The transport mechanism places the pickup heads over the tier sheet on the pallet and the suction cups pick up the tier sheet. The transport mechanism carries the pickup head and sheet over the stack, and the vacuum cups release the sheet onto the stack. The transport mechanism returns to the top of the pallet, and the process is repeated. When the stacker is full of tier sheets, they are removed by powered industrial truck and wrapped for shipment back to the plant in which they will be reused.



Progress Check #10

Circle the letter in front of the correct answer.

1. Tier sheets are also known as
 - a. slip sheets.
 - b. separator sheets.
 - c. slip or separator sheets.

2. Tier sheet dispensers feed the sheets from
 - a. the bottom of the stack.
 - b. the top of the stack.
 - c. the top or the bottom of the stack.

3. The tier sheets are normally picked up off the stack by
 - a. vacuum cups.
 - b. clips.
 - c. friction rollers.

4. Tier sheet stackers are used on
 - a. palletizers.
 - b. depalletizers.
 - c. palletizers and depalletizers.

5. Tier sheet dispensers are used on
 - a. palletizers.
 - b. depalletizers.
 - c. palletizers and depalletizers.

6. Tier sheet dispensers operate with a sequence that is
 - a. not related to the tier sheet stacker sequence.
 - b. the same as the tier sheet stacker sequence.
 - c. the reverse of the tier sheet stacker sequence.
7. Tier sheets are removed from the stacker by a
 - a. conveyor.
 - b. vacuum cup mechanism.
 - c. powered industrial truck.



Maintenance and Repair Requirements

Regular maintenance is the key to good machine performance. Good maintenance programs keep machines running more smoothly, operating at higher speeds, breaking down less frequently, and having minimum downtime. Critical areas of machine maintenance include cleaning, lubrication, adjustments, and inspection and repair. Maintenance should be performed on a regular basis, and the maintenance schedule is one of the mechanics' most valuable tools.

Safety

Safety is always one of the most important considerations in any machine maintenance program. It is very important that the machine is kept in safe working condition so that the operators, mechanics, or anyone else in the area will not be hurt as a result of its operation.

All guards must be in place and all safety devices operating before you return a machine to production work. You should always follow your company's safety procedures when you are performing routine maintenance or repairing a machine. You should not remove any more guards than necessary, and you should replace them as soon as you can. Always keep your hands out of any moving parts and protect yourself. You should be sure that you understand how the "jog" system operates and use it appropriately. Protecting yourself and the other people around you is an important part of your job as a Warehousing and Distribution Technician. The machine should always be turned off during cleaning and parts replacement.

Scheduling Maintenance

The mechanics should have and follow a maintenance schedule for each machine for which they are responsible. This is particularly important in a two or three shift operation in which more than one mechanic is working on a machine and each mechanic can assume that someone else is performing the maintenance tasks.

The daily maintenance schedule includes tasks that should be performed during each shift or at least once a day. This includes cleaning, oiling, draining air filters, and machine inspection.

Weekly maintenance includes lubrication of cam tracks, bearings, and rollers, checking the oil level in gearboxes, checking alignment of major moving parts, and checking important clearances.

Periodic maintenance that is performed monthly, at six month periods or other intervals includes lubricating roller chains, greasing gears, replacing oil in gear boxes, tightening bolts and screws, and checking electrical connections.



Cleaning

Palletizers can produce dust, paper residue, spilled product, and oil or grease that can interfere with the operation of the conveyors and other machine components. The rollers must turn smoothly, and there should be no obstructions on the tracks or guides. Paper residue or spots of spilled product or lubricants can produce friction that will cause the materials or machine parts to grab or hesitate, and they may prevent rollers from turning in some situations. Electric eye sensing units can lose their sensitivity whenever dirt, dust, glue, or other materials coat the lenses and interfere with the light transmission. Chains and sprockets are normally coated with a thin layer of oil, so they have a tendency to collect any dust that is in the area. Daily cleaning of some parts of the machine and weekly cleaning of the rest should prevent any accumulation of foreign matter that can cause a problem. Most of the machine cleaning consists of wiping or blowing off the loose material and washing the machine with mild soap and warm water. There are a number of general procedures and precautions that will help you clean the machines safely and effectively.

The first step in cleaning a machine is to insure that it has been STOPPED and all SAFETY DEVICES ARE ACTIVATED (refer to your General Plant Safety manual). It is dangerous to clean a machine that is running. The moving parts can pull the cleaning rag and your hand into the machine and operating parts can pinch or cut you.

Any unused materials, containers, or other items that could be damaged by water or other cleaning products should be moved away from the machine.

All nonessential electrical devices should be turned off. The water should be removed from the air filters in the pneumatic systems. Lubricate the machine to replace any lubricant that has been removed. After the machine has been thoroughly cleaned, all the surfaces that will contact the conveyed items should be inspected and all wet areas should be dried before the machine is restarted. All guards that have been opened or removed during cleaning should be closed or replaced before the machine is started.

Lubrication

The machine lubrication schedule should be followed closely and only approved lubricants should be used. Lubrication is essential for machine operation but too much lubrication can be as bad or worse than too little. If the lubricant is too light or is applied too infrequently, the machine will not get the protection it needs and may wear excessively. Oil or grease that is too heavy or applied in too great a quantity can interfere with the machine's operation and cause the collection of dirt and dust. All excess lubrication should be removed promptly. Constant wear points should receive one or two drops of oil daily and the sprockets and chains should have a very light coat of oil at all times.

Oil baths should be checked regularly and oil should be added to keep the level at the recommended height. The oil should be drained and replaced according to the schedule and the number of hours that the machine has run. Some machines are equipped with automatic lubrication systems that can reduce this part of the mechanic's job to monitoring the system and adding the lubricants, as they are needed. Monitoring these systems is critical, because a stopped-up nozzle, damaged oil line, or some other malfunction can easily cause a bearing to stick or a machine part to malfunction due to the lack of lubrication.



Adjustments

Good adjustment is critical for any machine operation. The mechanic needs to set up the machines properly and make adjustments that are needed to keep them running smoothly and efficiently at high speeds. The machine speed should be set at the highest speed at which the containers can be handled efficiently and good quality pallets are efficiently produced. The speed should not be high enough to damage any product or containers or to interfere with the quality of the operation. All moving parts of the machine must be kept properly adjusted. These adjustments include regulating the position of the part when it is in the “rest” position, the length of the stroke or circular motion, the alignment of the part and timing of the machine movements.

The positions of guides, rails, pressure plates, and other machine parts are adjustable. These parts should be kept properly adjusted and tightly fastened. Improper adjustment can reduce the machine speed and cause it to produce inferior packages.

Fixed machine parts should be firmly attached and in the proper positions. Loose screws or bolts can allow vibrations that can cause a part to work loose or move into a position in which it is not effective or may cause damage. This is particularly true with machine guides and rails.

The operation of the photoelectric eye is affected by the amount of light it receives. Too much or too little light reaching the sensing unit can cause the machine to malfunction. The sensitivity of the unit can be adjusted, the path of the light can be realigned, the lamps can be replaced, and means can be taken to reduce the amount of accidental light that is hitting the unit.

The amount of air pressure or vacuum that is used can affect the machine’s performance significantly. Too little pressure may not move the parts far enough and too much pressure may move them too far. The mechanic should know how much pressure is needed and keep the valves on the best settings.

Inspection and Repair

The machine should be monitored during operation to identify signs of trouble and problems that need to be corrected. Close inspection during cleaning and lubrication can help you find signs of wear, poor adjustment, broken parts, and the need for additional lubrication or cleaning. Any unusual noises or knocking sounds should be investigated, because they could be indications of loose, misaligned, or broken parts. You should correct any whipping chains, loose screws, loose cams, or other parts and replace any broken parts.

Cam followers should be closely examined and any of them that are not turning should be replaced.

Worn pads, leaks in the hydraulic system, or the sound of escaping air can be indications that repairs are needed. Any worn or broken parts should be replaced or repaired before they can interfere with the machine's operation and cause down time. If you replace a part that is showing signs of wear, you may have to replace only that part. Waiting until the part breaks can result in damage to other parts and a considerable increase in the amount of work and down time that may be required. The parts around and related to a worn or broken part should be examined to determine if something else is out of line or otherwise causing unnecessary wear.



Progress Check #11

Circle the letter in front of the correct answer.

1. Chains and sprockets are normally
 - a. kept dry.
 - b. coated with a light oil.
 - c. coated with a heavy oil.
 - d. coated with grease.

2. The most popular cleaning materials for machines are
 - a. solvents.
 - b. soap and water.
 - c. light oil.

3. Spots of lubricants or scraps of paper residue
 - a. have no effect on machine operation.
 - b. may cause the machine to grab or hesitate.
 - c. may cause serious damage to the machine.

4. Excess lubricant may
 - a. decrease machine down time.
 - b. improve machine performance.
 - c. interfere with the machine's operation.

5. Constant wear points such as cam followers should be oiled
 - a. every day.
 - b. once a week.
 - c. once a month.
6. Improper adjustment can cause
 - a. poor quality packages.
 - b. reduced machine speed.
 - c. poor quality packages and reduced machine speed.
7. Dust on an electric eye sensor will
 - a. have no effect on the machine's performance.
 - b. interfere with the machine's performance.
 - c. improve the machine's performance.
8. Unusual noises can be an indication of
 - a. misaligned or loose parts.
 - b. worn or broken parts.
 - c. any of the above parts.
9. Waiting until a worn part breaks will probably
 - a. minimize costs.
 - b. reduce down time.
 - c. cause damage to other parts.



10. During cleaning and adjustment, the machine should be
 - a. turned off.
 - b. running slowly.
 - c. running at operating speed.

11. When a machine is running
 - a. all the guards should be in place.
 - b. most of the guards should be in place.
 - c. guards near the operator should be in place.

12. The machine speed should be set at the
 - a. highest level possible.
 - b. machinery manufacturer's recommended speed.
 - c. highest level that produces good quality packages.

[illegible]



Summary

Palletizing and depalletizing are important warehouse and packing functions that ensure that the product can be transported safely and securely to customers. Careful execution of palletizing helps the company save money and serve customers more efficiently. The complexity of palletizing operations requires a thorough knowledge of the types of equipment used and the care needed to keep it operating. Increased knowledge and awareness of palletizing and depalletizing make you a more valuable employee who has the knowledge to serve customers more efficiently.

[illegible]



Glossary

Automatic Bail Orienters	Equipment that moves pail bails so that the bail won't interfere with the palletizer.
Bag Diverter	Hinged flapper that is used to turn bags ninety degrees on a conveyor.
Bag Diverters	Direct bags down the center of a conveyor if the bags are not to be turned, if the bags are to be turned, the bag diverter sends the bag to the turning post.
Bag Vibrator	Flat steel vibrator that is pressed down onto bagged product to eliminate excess air and produce a square shape so the bags can be more easily palletized.
Case Pusher Bar	See Pusher Bar.
Case	Usually a corrugated cardboard container in the shape of a box.
Case-stop	Mechanical device installed within a roller conveyor that is used to block the conveyor path and stop cases from passing that point.
Depalletizers	Automatic or semiautomatic equipment designed to unload products or goods from pallets.
Depalletizing	Removing previously palletized goods from a pallet for further processing or distribution.
High Level	A conveyor, as much as 8 to 9 feet above floor level.

Low Level	A conveyor at floor level.
Pallet	Horizontal platform used as a base for assembling, storing, handling, or shipping of goods in unit loads.
Palletizer	Automatic or semiautomatic equipment designed to load products or goods onto pallets.
Palletizing	The act of placing goods or products on a pallet for ease of transport and handling.
Pusher Bar	Steel bar that swings out from the conveyor rail to turn a case 90 degrees on the conveyor.
Reshippers	Pallets that hold empty containers that are to be filled, reloaded on the pallet, and shipped from the processing facility.
Slip Sheet	See Tier Sheet.
Split Delivery Table	Table made of conveyor rollers that is split in the center so that it may be opened over a pallet and lower a complete tier of containers.
Squaring	Process which uses squaring plates to push the pallet load together on the sides to produce a square shape to the tier.
Strappers	Automated equipment used to strap the pallet load and top frame to the pallet.
Sweep Bar	See pusher bar.



Tier Pattern	Pattern of cases laid out in a tier that provides interlocking between layers or tiers.
Tier Sheet	Pallet-sized sheet of flake board, fiberboard, or plywood that is used to separate tiers of a pallet load to give the pallet load stability.
Top Frame	Pallet sized wooden frame that is placed on top of a full pallet to prevent straps from damaging the pallet contents.
Transfer Plate	Steel plate used to hold containers while the tier is being filled, also used to transport the full tier to the waiting pallet for loading.
Turning Flapper	Flat metal arm that swings out from the conveyor rail to strike a case and turn it ninety degrees.
Turning Post	A post at the side of the conveyor that is used to turn the bags that have been directed there ninety degrees.
Wrappers	Equipment used to encase the pallet and its load in stretch wrap or shrink wrap.

