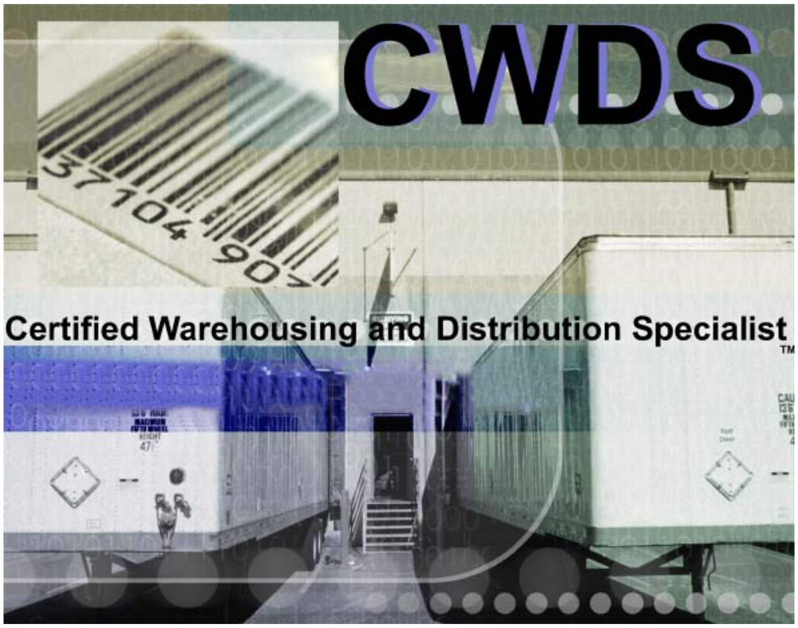

Protecting Materials and Merchandise

QUICKSTART®
TECHNICAL COLLEGE SYSTEM OF GEORGIA

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Table of Contents

Introduction

Overview

An important consideration for any warehouse or distribution center is protection of the product that is being handled. Just as manufacturers design and build special equipment to support and protect the product throughout the manufacturing process, warehouses have devised ways to continue this special handling for most products.

One of the most important aspects of product protection is protection from damage caused by handling. With the average package handled by up to nine different people and with more than 445,000 packages a day per distribution facility, the risks of the distribution environment can be great. A manufactured product is useless if it cannot arrive at its destination undamaged. Physical protection must be provided to all products during storage and shipping as well as any time that value is being added to the products.

Much of the subjective value of manufactured goods depends on the appearance of the product. Cosmetic damage rarely reduces the functionality of the finished product but many items are returned or rejected for sale because of it. Any department that handles a finished product can cause damage to the company's image if it doesn't protect the product from cosmetic damage.

These days it seems that the electronics industry is exploding with new products. Another protection challenge that warehouses must add to their list is Electrostatic Discharge (ESD) protection for the product they are charged to handle.

Objectives

Upon completion of this unit of study you will be able to:

1. Explain the advantages of cardboard packaging.
2. Describe the use of blister packs.
3. Describe the operation of the forming machine and identify the machine components and operations used in thermoforming.
4. Describe the operation of the supported web blister-forming machine and identify the machine components and operations used in thermoforming.
5. Explain the advantages of Expanded polystyrene packaging.

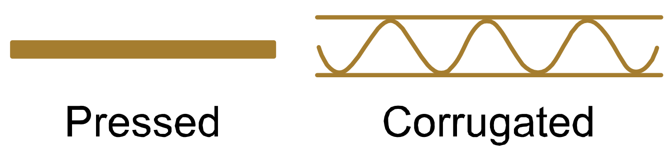
Physical Protection

Cardboard

However it is packaged, we seem to take it for granted that all of the products that we buy in a store are packaged safely and efficiently so that we can get the most use out of it. However, there are people behind the scenes who don't take it for granted. They realize the importance of appropriate packaging when it comes to the products you use everyday. They also understand the importance of "product marketing". While some of the products they box are a necessity, such as medical supplies, others are sold because of the "look" of the package. The right kind of cartons and packages heightens the "shelf appeal" and protects the taste, appearance and overall effect of the products. The most appropriate containment depends on the product and can range from a simple plain cardboard box to a fluted or folding box with words and designs.

The numerous options that are possible in the packaging industry are as varied as the products that are packaged. In order for the appropriate package to be manufactured, every characteristic of the product must be studied and evaluated. It takes years of experience in the industry to understand what it takes to package the diversity of products in such an efficient way. Not only is the correct packaging important but understanding and giving the customers what they want is just as important.

The case or container that is used to package a product plays a major role in reducing the physical damage that the product may encounter. An industry standard of pressed or corrugated cardboard seems to offer the advantages of sufficient strength to protect the product. Frequently the product is cased in pressed cardboard that can more easily display labels and printed material. The cases are then packaged in corrugated cardboard that absorbs damage better. When an object strikes the corrugated cardboard the corrugations must first collapse before damage can occur to items inside the case. Damaging the contents of a corrugated box usually requires the case to be penetrated. Since cardboard enjoys industry-wide acceptance for packaging, its price is kept very low. The supply of cardboard is plentiful and, as an added benefit, over half of the cardboard in use is made from some quantity of recycled material. Large demand, plentiful supply, recyclability, and ease of use makes cardboard an economical choice for most packaging tasks.



Edge View of Pressed and Corrugated Cardboard

Blister Packs

In blister packages the product items are held in cuplike plastic blisters that are sealed with a flexible or semirigid, or rigid cover. Blister packages can provide an airtight seal, and they can be used for vacuum pack, gas flushed, and sterilized packaging.

Blister packages are used for a large variety of different types and sizes of products. Food items such as luncheon meats, cheeses, hot dogs, and sausages are frequently vacuum packed in blister packs. Blister packs are also widely used for health care products and hospital supplies that need to be kept sterile until they are used. Some blister packs are used for cookies and other snack foods, and they are widely used for nuts, bolts, screws and other hardware items.

The pressed cardboard printed cards that are used as the cover and seal on some blister packs can be designed to provide space for labels and product information, and they may be punched or shaped to facilitate hanging and display of the product in the retail store.

Types of Blister Packages

Materials

Blister packages are normally made from two webs of material, a "formed" web and a "flat" web. The blister is produced from the "formed" web by thermoforming, which is a process of forming the blister material in a heated die, allowing the material to cool and take shape in a die. A portion of the flat web may be heat sealed to the open side of the blister to seal in the product.

The "formed" web may be either semirigid or flexible material. It may be solid colored, printed, or transparent.

The flat web may be film, surgical paper, or other materials that can be treated with heat-sealing materials. Cards may also be used to seal the packages and provide space for advertising as well as a means for hanging the item on a store display.

Vacuum and Vacuum-Gas Packs

Oxygen in the air causes meats and other food products to discolor or deteriorate in the package. Evacuating all the air from the blister package can protect food products such as hot dogs and sausages by keeping the product sealed in a vacuum. Evacuating the air from the package and replacing it with nitrogen can better protect some other products. Nitrogen is an inert gas that will not damage the product.

Sterilization

Bandages, syringes, gloves, and many other hospital supplies and health care products are packaged in sterile blister packs. On these packages, the flat web is made of surgical paper that will allow the product to be sterilized in the package while keeping contaminating materials out.

Types of Machines

Blister packages can be produced on an assortment of machines with varying complexity. The simplest uses blisters that are formed on a separate machine or have been purchased from a supplier. The product may be inserted into the blisters by hand, and the seal may be made on a simple machine.

Thermoform-fill-sealing machines can form the blisters, load product into them, seal them, and cut the packages apart automatically. Some machines also can produce a vacuum pack or vacuum-gas pack. Still others can automatically pack the finished packages into cartons or cases.

Thermoform-fill-seal machines will use either a supported or unsupported web. The supported web machine has a moving die train that indexes forward with each step of the operation to support the web and the resulting packages; consequently, the supported web machine is also known as a “die train” machine.

Unsupported web is held tight as it moves through the machine by pins or clamps along each side. The pins or clamps are attached to the chain that pulls the web through the machine.

Most thermoform-fill-sealing machines operate with an intermittent motion that stops the web during each machine operation. However, some thermoform-fill- sealing machines operate with a continuous motion in which the forming elements, sealing units and other moving parts travel with the web as it moves through the machine.

Product Loading

For packaging fragile items, irregularly shaped items, or items that are difficult to handle, the product may be loaded into the blisters by hand on many machines that are used. Manual loading is also used on machines that are operated for relatively short runs and with a number of different items. This reduces the amount of time that is required for a changeover and makes it unnecessary to have different automatic feeding units for the machine.

Machine operating speed can be increased and the staffing requirements can be decreased by using automatic feeding units on machines with relatively long runs or machines that are dedicated to packaging similar items that can use the same feeders.

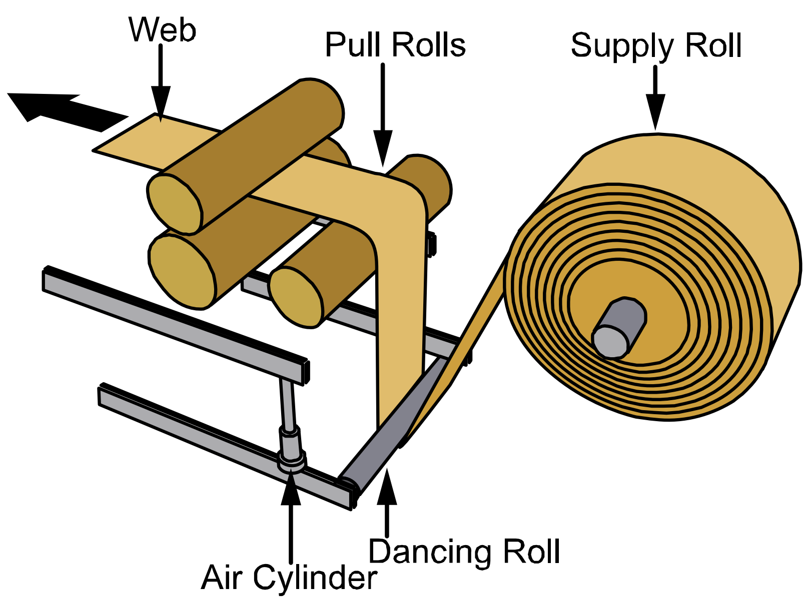
Unsupported Web Blister Forming Machine

The forming machine draws the web of thermoform material from the supply roll and forms it into the blisters or cups that will hold the product. In the unsupported web forming machine the web is held by pins or clips on the chain that moves it through the machine.

The forming machine may be used as the first stage of a thermoform-fill-sealing operation or it may be operated independently to form blisters that can be filled and sealed on other machines.

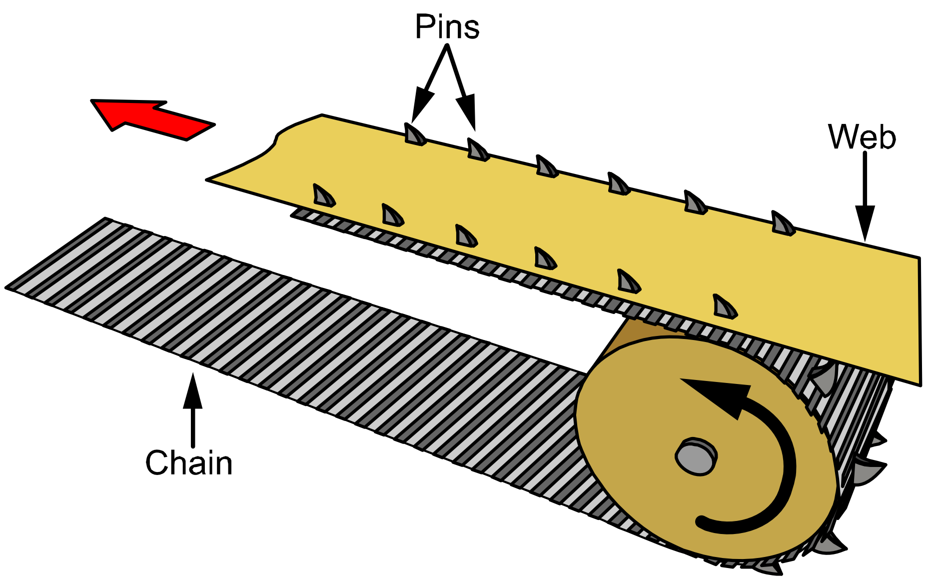
Machine Operation

The filling machine operations include web feeding, web heating, forming, and slitting. The flexible web is fed into the machine, preheated, formed into blisters and the lines of blisters are slit apart or perforated. Blisters are made from a web that is pulled from the large supply roll by a set of pull rolls. One of the pull rolls is a power-driven roll and the other one is a spring- or air cylinder-loaded floating rubber roll that maintains an even pressure on the web. A spring- or air cylinder-loaded dancer roll takes up the slack, stores the extra web, and controls the tension.



Unsupported Web Forming Machine

Slack in the web will allow the dancing roll to move to its extreme position and activate a switch that operates the electric clutch-brake to stop the web feed rollers. Stored web is drawn from the dancer roll as the machine indexes. This moves the dancer roll and releases the switch that restarts the web drive and pulls web from the supply roll. The web is fed onto chains that catch each edge with pins or clamps to hold the web tight and move it through the machine.

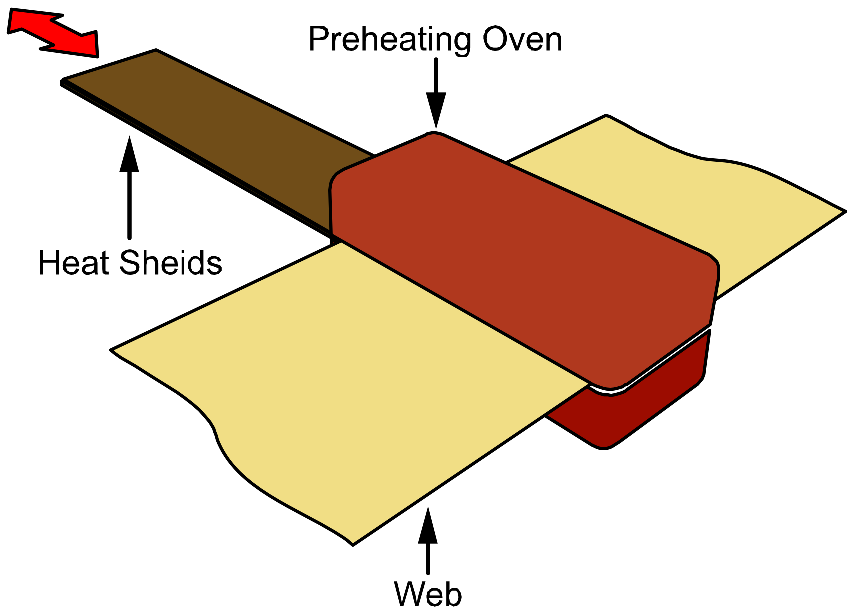


Web Moving Through the Machine

The forming web should be threaded so that the sealing side is exposed. Edge guides control the position of the film in the machine. They may be adjusted to move the web from side to side and keep it centered.

The web passes through a preheating oven that raises its temperature to the forming level.

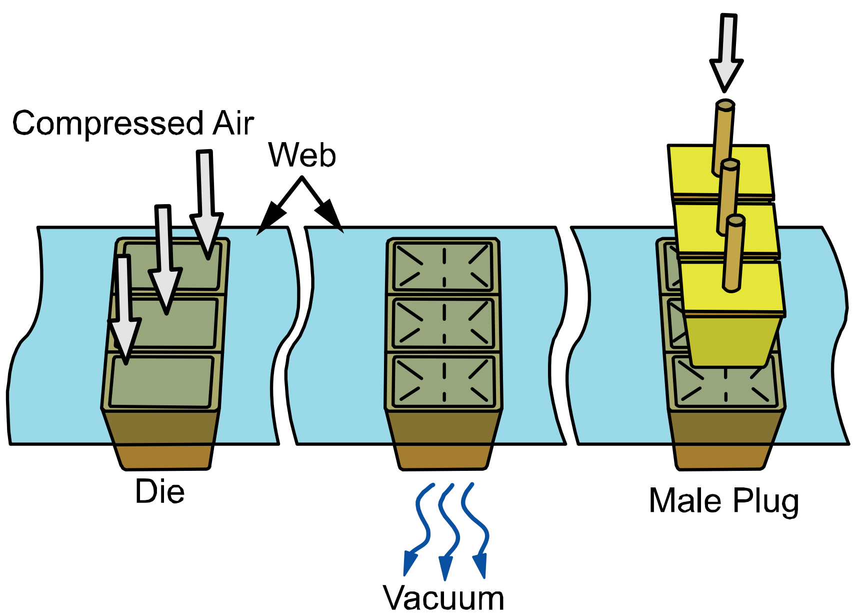
Whenever the machine is stopped, a heating shield automatically moves between the heating element and the web to protect the web from overheating, melting, or burning.



Preheating Oven

The blister is formed when the preheated web is drawn or forced into the cavity of the forming die. Clamps hold the edges of the web. A clamping plate may be used to keep the areas in which the seal will be made from developing wrinkles as the blister is formed and the web cools. The temperature of the web as it leaves the oven is affected by the temperature of the heater and the length of time it is in the oven, so both the temperature and exposure time must be closely regulated.

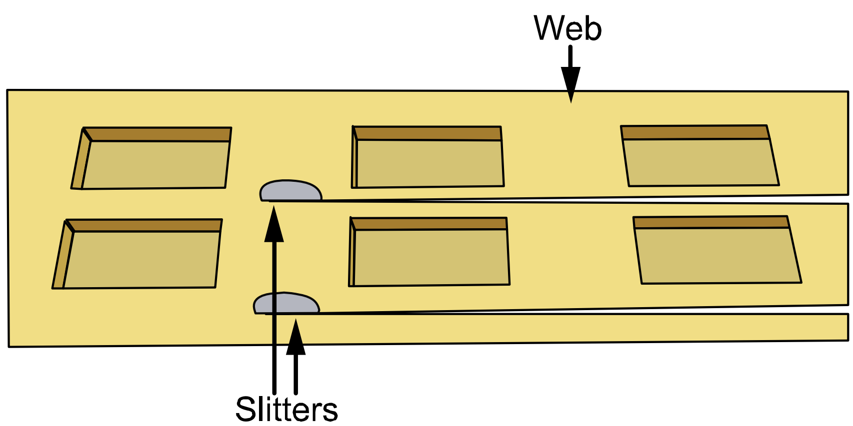
Compressed air may be used to push the web into the cavity of the die, vacuum may be used to pull it in, and they may both be used in the same operation. A male plug also may be used to push the web into the die. The size and shape of the blister is determined by the configuration of the die or die filler. A product change will usually require a change of dies or die fillers. Die fillers are inserts that shape the die to fit a particular size and shape of blister. When the formation of the blister is completed, the clamping plate will release the web and the die will move downward to allow the formed blister to be released and move forward. Some machines are equipped with corner thickening attachments to prevent the reduction in thickness of the material in the areas in which the corners of the blisters are formed. This strengthens the area of the package that is most vulnerable to damage.



Forming The Blister

A typical corner thickener momentarily applies heat sink pads to the areas that are to be protected. These pads partially cool the preheated web by absorbing some of the heat. This reduces the amount that the web will stretch at these points. The amount of heat that is absorbed and the thickness of the web in the corners is controlled by the length of time the pads are in contact with the web. For round packages the pads are shaped as rings, and part of the thickened area will be on the bottom of the container, and part of it will be on the side.

Two, four, or more blisters may be made across the width of the web in indexing of the machine. These blisters are cut apart into strips by slitter knives. Blisters are slit apart before they are filled on some machines and after they are on others.



Slitters

Progress Check #1

Circle the letter that is in front of the correct answer.

1. On a thermoform-fill-sealing machine the blister is made from

   a. the flat web.

   b. the formed web.

   c. either web.

2. The die train is under the entire web on the

   a. unsupported web thermoform-fill-sealing machine.

   b. supported web thermoform-fill-sealing machine.

3. On an unsupported web thermoform-fill-sealing machine the web is held by

   a. pins.

   b. clamps.

   c. either pins or clamps.

4. The flat web is used

   a. to make the blister.

   b. to seal the blister.

   c. either to make or seal the blister.

5. Most thermoform-fill-sealing machines operate with

   a. intermittent motion.

   b. continuous motion.

6. Blister packages of hospital supplies are sealed with

    a. cards.

    b. film.

    c. surgical paper.

7. Surgical paper is sealed to the blister because it is

    a. treated with heat-sealing materials.

    b. applied with glue.

    c. a heat-sensitive material.

8. Product is loaded into the packages on thermoform-fill-sealing machines

    a. manually.

    b. automatically.

    c. either manually or automatically.

9. Blister packaging machines used on short runs will normally

    a. fill the packages by hand.

    b. fill the packages with an automatic filler.

10. The formed web material is

    a. flexible.

    b. semirigid.

    c. either flexible or semirigid.

11. Hot dogs and similar products are normally packaged in
    a. air.
    b. nitrogen.
    c. oxygen.
    d. vacuum.

12. The forming web is pulled from the supply by
    a. the feed chain.
    b. two driven feed rolls.
    c. one driven feed roll and one floating roll.

13. The dancing roll is used to
    a. draw the web from the supply roll.
    b. hold the web against the feed roll.
    c. control the slack in the web.

14. Excess slack causes the electric clutch-brake to
    a. start the web drive.
    b. slow the speed of the web drive.
    c. stop the web drive.

15. The forming web is threaded through the thermoform-fill-sealing machine with the sealing side
    a. exposed.
    b. turned toward the feed chains.
    c. turned either way.

16. On a thermoform-fill-sealing machine, the web is heated for forming in the
    a. preheating oven.
    b. forming die.
    c. both the preheating oven and forming die.

17. Wrinkles in the sealing area of a blister are prevented during forming primarily by
    a. side tension on the web.
    b. the clamping plate.
    c. varying the heat.

18. The forming web is forced into the cavity of the forming die by
    a. vacuum.
    b. compressed air.
    c. vacuum and compressed air.
    d. any of the above.

19. The blister is removed from the cavity of the forming die by
    a. blowing it out.
    b. raising the web.
    c. lowering the die.

20. Corner thickeners absorb heat from the corner areas to cause the material to

    a. cool slower.

    b. stretch more.

    c. stretch less

21. The formed web is cut into strips of blisters by

    a. cutoff knives.

    b. slitters.

    c. strippers.

22. The area between the blisters is perforated

    a. to produce cleaner slitting.

    b. when two or more blisters are packaged as a unit.

    c. to allow the air to escape.

23. The heat shield is in position inside the preheater

    a. when the machine is not running.

    b. when the machine is running.

    c. at all times.

Supported Web Blister Forming Machine

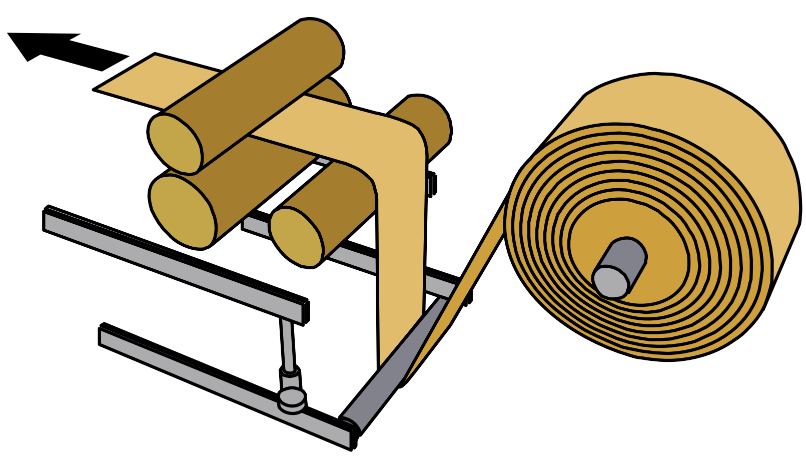
The supported web blister forming machine supports the web with a moving die train as it passes through the machine. The supported web blister forming machine is particularly useful for forming blisters from the more difficult to handle, rigid and semirigid materials. It may be used as the first stage of a thermoform-fill-seal operation or it may be operated independently to form blisters that can be filled and seated on other machines.

Machine Operations

The supported web forming machine performs the same operations as the unsupported web machines covered in the last section, but it performs them in a different manner. The web is fed into the machine, preheated, formed into blisters, and the lines of blisters are slit apart or perforated.

Web Feeding

The web feed is very similar on the supported and unsupported web blister machines. The web is pulled from the supply roll by a set of pull rolls. One of the rolls is power driven, and the other one a spring- or air-cylinder loaded rubber roller that maintains an even pressure on the web.



Supported Web Forming Machine

The dancing roll moves up and down to take up the slack as the web is pulled into the machine. As the slack accumulates, the dancing roll operates a switch that stops the electric clutch-brake mechanism. When the web tightens, the dancing roll moves and the electric clutch and brake are restarted. The roll is held in alignment by edge guides. Clips hold the web on each end of the dies in the die train. The web is moved through the machine with an intermittent motion as the die indexes forward.

The web is pulled through the preheating oven as the die train indexes forward.

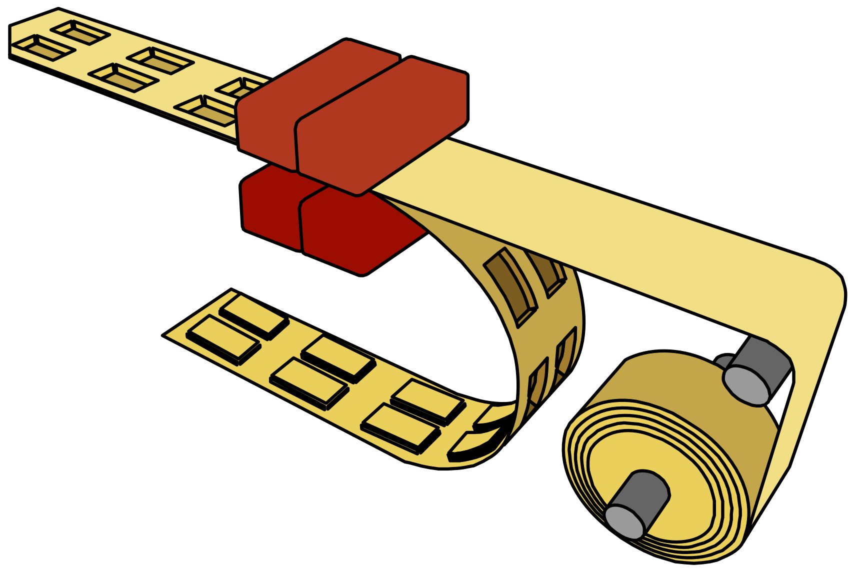
The temperature and time in the oven is controlled to heat the web until it is softened and at the forming temperature when it reaches the forming station.

If the web remains in the preheating oven too long, it will melt, scorch, or burn, so a heat shield automatically moves between the heating element and the web whenever the machine stops or the web will be held in the oven too long.

The preheated web advances to the forming station as the die train inches forward. The web material is clamped against the top of the dies by aluminum clamping bars. Vacuum is applied to draw the material into the die. A male plug or compressed air may be used to help push the material into the die. After the blister if formed, the web cools. The size and shape of the blister is determined by the configuration of the die or die filler that is inserted into the die. Some machines are equipped with a corner thickener attachment and sometimes heat sinks are applied to areas of the web that need to be protected.

When the blister is formed the forming vacuum is turned off and the lower level holding vacuum is applied to hold the blister in the die as it indexes forward. Slitters are then applied as in the last section.

The blisters are then indexed into a product loading station of the thermoform-fill-seal machine or onto the delivery conveyor if they are to be loaded and sealed on another machine.



Blister Forming From A Supported Web Machine

Progress Check #2

Circle the letter that is in front of the correct answer.

1. The web in a supported web thermoform-fill-sealing in

    a. pins.

    b. clips.

    c. dies.

2. The die train on an intermittent motion supported web thermoform-fill-sealing machine moves

    a. continuously.

    b. forward on each indexing.

    c. backward on each indexing.

3. The web is pulled from the supply roll by

    a. two driven pull rolls.

    b. one driven and one floating roll.

    c. three driven rolls.

4. Stack in the web is controlled by

    a. edge guides.

    b. dancing rolls.

    c. draw rolls.

5. The temperature of the preheated web is controlled by adjusting

   a. time in the oven.

   b. temperature of the oven.

   c. both time and temperature.

6. The web on a supported web thermoform-fill-sealing machine is attached to the die train by

   a. pins in the chain.

   b. clips on the chain.

   c. clips on the dies.

7. The purpose of the heat shield is to

   a. protect the web when the machine is stopped.

   b. protect the web when the machine is running.

   c. prevent anyone from being burned.

8. The softened web is forced into the die by

   a. vacuum.

   b. compressed air.

   c. male plug.

   d. any or all of the above.

9. The formed blister is held in the die by

   a. compressed air.

   b. gravity.

   c. vacuum.

10. A blister is supported as it moves through a supported web thermoform-fill sealing machine by

    a. pins or clips on the chains.

    b. a series of dies.

    c. a single die.

11. A blister is formed as the heated web

    a. is drawn into the die.

    b. cools in the die.

    c. is pushed out of the die.

12. Blisters move from the forming station into the

    a. preheaters.

    b. loading station.

    c. seating station.

Expanded Polystyrene (EPS)

In today's busy world, safe product delivery requires a strong and efficient packaging material that can hold up under tough conditions. Expanded Polystyrene (EPS) meets the challenge.

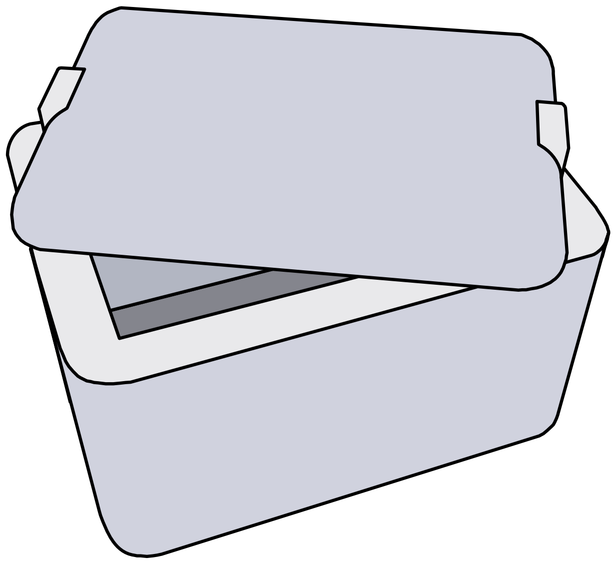
Used in thousands of different ways by individuals and businesses around the world, expanded polystyrene (EPS) is relied upon to provide superior performance in various foam product applications. As a closed-cell, rigid plastic, EPS relies on the use of a blowing agent, typically pentane, to allow individual beads to be expanded from 2 to 50 times their original size. Whether used as protective packaging for fragile items during shipment, as custom insulation in building applications, or even as a bicycle helmet, EPS is serving an important role in our everyday lives.

EPS protective packaging offers a broad range of physical properties to the designer and user. These properties, in combination with satisfactory engineering considerations provide the design flexibility required to create truly cost-effective protective packaging. Millions of manufacturers over the past 40 years have relied on EPS transport packaging because of its exceptional cushioning properties and high tensile strength.

When choosing EPS, original equipment manufacturers realize cost savings across the board. Beyond its competitive material pricing, EPS, because of its versatility and lightweight characteristics can offer savings in design and development, product assembly and distribution costs.

Mechanical Properties

The mechanical properties of molded EPS depend largely on density.



Molded Expanded Polystyrene (EPS)

Generally, strength characteristics increase with density. However, variables such as the grade of raw material used, geometry of the molded part and processing conditions will affect package properties and performance. As seen below, most properties of foams are strong functions of density, which allows a processor to fine-tune the exact performance needed by a simple processing change, without redesign of tooling.

Typical properties of EPS foams			
Property	Values		
Density, lb./cu. ft	1.0	2.0	3.0
Compressive strength, p.s.i.	12-17	31-37	52-56
Tensile strength, p.s.i.	22-27	58-61	92-95
Thermal resistance, R/in	3.8	4.2	4.3

EPS Physical Properties

Superior Insulation Value

Many temperature sensitive pharmaceutical and medical products use EPS because comparable packaging materials can rarely offer the same level of thermal insulation. Strongly relied upon in the food distribution industry, EPS is ideal for long distance shipment of perishable foods.

EPS is highly resistant to heat flow. Its uniform, closed cellular structure limits radiant, convective and conductive heat transfer. The thermal conductivity (k-factor) of molded polystyrene varies with density and exposure to temperature, as shown below.

Typical Thermal Conductivity (k Factor)		
Density (pcf)	Mean Test Temperature (°F)	k Factor (BTU-In./Ft.2Hr°F)
1.0	0	0.22
	40	0.24
	75	0.26
	100	0.28
2.0	0	0.20
	40	0.21
	75	0.23
	100	0.25

EPS k-Factor

Substantial Cost Savings

Equipment manufacturers realize cost savings across the board when they use EPS. The material pricing for EPS is competitive. EPS, because of its versatility and lightweight characteristics, can offer savings in design and development, product assembly and distribution costs.

Water Absorption and Transmission

The closed cellular structure of molded polystyrene is essentially impermeable to water and provides no capillary action to absorb water, however, EPS may absorb moisture when it is completely immersed due to its fine channels within the bead-like structure. While molded polystyrene is nearly impermeable to liquid water, it is moderately permeable to vapors under pressure differentials. Vapor permeability is a function of both density and thickness. Generally, neither water nor vapor affects the mechanical properties of EPS.

Electrical Properties

While EPS will not readily conduct electrical current flow, the surface can hold static charges for quite some time. Molded EPS can be treated with antistatic agents to comply with electronic industry and military packaging specifications.

Chemical Resistance

Water and aqueous solutions of salts, acids and alkalis do not affect molded polystyrene. Most organic solvents are not compatible with EPS. This should be taken into consideration when selecting adhesives, labels and coatings for direct application to the product. All substances of unknown composition should be tested for compatibility. Accelerated tests may be carried out by exposing molded polystyrene to the substance in question at 120-140 °F.

UV radiation has a slight effect on molded polystyrene. It causes the surface to yellow but does not otherwise affect physical properties.

Environmental Considerations

With more than 200 collection sites in the U.S. and Canada, EPS generates several million pounds of post-consumer EPS annually. Working with nationally recognized OEMs, EPS manufacturers have developed an effective recycling infrastructure for post-consumer EPS packaging. It can be easily recycled into new foam packaging or durable consumer goods such as cameras or videocassette casings, and due to its resiliency, can be recycled over and over again.

Source Reduction

By working with resin producers and equipment manufacturers to minimize the use of natural resources and air and water emissions, EPS processors are able to make packaging parts with less virgin material, white maintaining the same high level of performance. By improving the design of a single product line, one polystyrene manufacturer, for example, diverted more than 28,000 tons of waste from disposal in 1994. This is the equivalent of the amount of municipal solid waste a typical town of 35,000, like Annapolis, MD, generates in an entire year.

Reuse

Expanded polystyrene loose fill is one of the most commonly reused packaging materials. Consumers and manufacturers reuse nearly 30 percent of all loose fill for mailing services, the reuse rate is as high as 50 percent in some facilities. And, in special market applications, EPS molded parts can often be reused multiple times. Polystyrene represents a tiny fraction, less than one percent by weight, of the solid waste stream.

Recycling

Prior to 1988, there was essentially no recovery of post-consumer polystyrene for recycling. Although the availability of polystyrene recycling programs varies by community, in 1996, just eight years later, almost 54 million pounds of polystyrene were recycled.

Post-consumer EPS foam is reprocessed and used again in new foam packaging. Foam can also be manufactured into consumer products like coat hangers, CD jewel cases and agricultural trays. The percentage of post-consumer polystyrene diverted from landfills, as a result of source reduction, reuse and recycling, has risen from 0.8% in 1974 to 10.4% in 1994.

Between 1974 and 1994, the amount of polystyrene packaging and disposables diverted from the waste stream through source reduction increased more than 20 fold, eliminating more than 800,000 tons of polystyrene. The amount of polystyrene source reduced in 1994 had an energy savings equivalent of having recycled 24% of polystyrene packaging and disposables produced in that year.

Progress Check #3

Circle the letter in front of the correct answer.

1. Expanded Polystyrene (EPS) is a ridged plastic that has been blown up to as much as __________ times its original size.

   a. 10

   b. 25

   c. 50

2. One use for EPS other than packaging material is

   a. motorcycle helmets.

   b. anchors.

   c. flagpoles.

3. As a packaging material EPS provides the advantage of

   a. absorbency.

   b. flammability.

   c. light weight.

4. Tensile strength, compressive strength, and thermal resistance all increase as the EPS density

   a. increases.

   b. decreases.

5. As the density of EPS increases the thermal conductivity

   a. increases.

   b. decreases.

6. Which product listed below is one of the most commonly reused packaging materials?

    a. Shredded paper.

    b. Wood shavings.

    c. EPS loose fill.

Notes:

Electrostatic Damage

As electronic components become increasingly complex and operate at higher and higher speeds, they become more and more sensitive to Electrostatic Discharge (ESD). Electrostatic fields can produce and transmit energy without contacting the device that can be energized. When an electrostatic field comes close to a sensitive electronic device, the electrostatic field can induce an electrical charge into the device. Electrostatic fields in close proximity to an unprotected circuit card serve as a source for charging a component or assembly. Charging occurs when a conductor makes momentary contact with the device in the presence of a charged field leaving the component in a charged condition. If the charged component then comes in contact with a conductive surface a damaging Charged Device Model (CDM) event may occur. A CDM occurs when the charge present in the electronic device finds a path that will allow it to equalize. The charge rushes through the electronic circuit so quickly that the sensitive circuits can become overheated and damaged.

Electrostatic field charging is not always bad. This phenomenon is used to charge Radio Frequency Identification (RFID) tags. The tag scanner projects an electrostatic field to the inventory ID tag and the tag is energized. The charged tag can then transmit its identification information to the scanner.

Over the years this problem has been addresses by these two solutions:

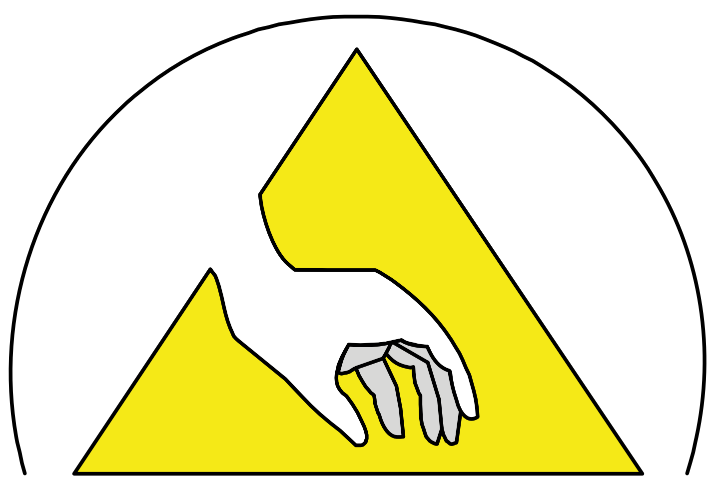
> The devices can be protected so that they are never exposed to electrostatic fields. This concept is called Electrostatic Shielding.
>
> All of the electronic contacts on the device can be connected together through a conducting material so that the charge will be drained from the device before it can enter the chip.

Electrostatic Shielding

Electrostatic shielding protects components and assemblies from failures caused by field induced energy. The level of shielding required is dictated by the amount of energy that will cause component failure. Most static shielding materials include a conductive metal or carbon element that suppresses the field, attenuates, or reflects field energy. Field induced energy may also be reduced by increasing the air gap between the inside side surface of the container and the susceptible component or assembly.

ESD shielding provides protection from ESD damage by enclosing electronic devices in static repelling bags and containers without conductive elements. This technique provides adequate protection from static field induced failures because the enclosed components cannot be affected by the presence of an electronic field. Static Shielding Bags are usually gray or silver in color and will usually have the static shield symbol printed on the bag.

Static Shield Bag

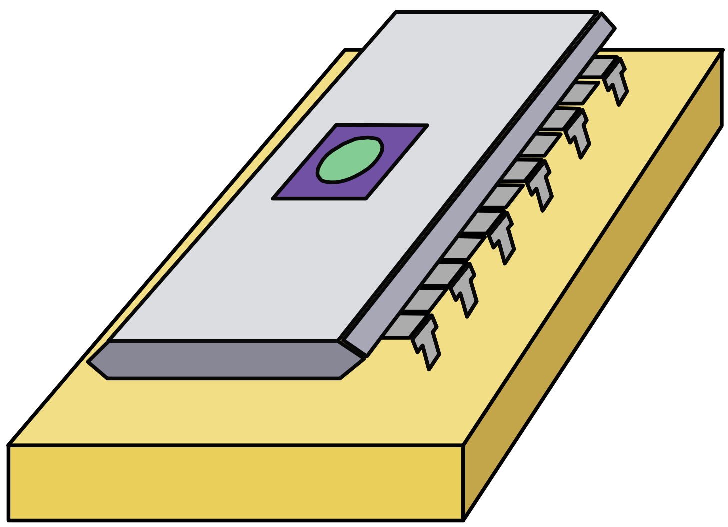


Static Shield Symbol

Once the product is enclosed in electrostatic shielding it should only be removed in an electrostatically safe environment. The device has been packaged without exposure to electronic fields and it must also be removed into the same way.

Conductive Materials

Conductive materials, like Styrofoam with conductive additives, are placed into contact with electronic conductors so that energy differences between all conducting surfaces are neutralized. This method of ESD protection dissipates CDM energy without damaging the device being packaged. Conductive packaging materials (including conductive shunts) that make physical contact with components or assemblies should be limited to use in static controlled environments where everything is grounded or maintained at the same electrical potential. The use of conductive packaging in uncontrolled environments may allow the exposed conductive surfaces to become the path for ESD events. Conductive foam usually appears as thin black sheets of foam rubber or Styrofoam.



Conductive Foam

Electrostatic Dissipation

Static dissipative bags or static dissipative partitions and bottom pads can be used with conductive bins, totes, and shipping boxes to provide ESD protection. It is critical that packaging designers and users understand the possibility of component damage if a charged device is placed on a surface that is too conductive.

Containers designed with static dissipative surfaces are a better choice for general ESD protection applications. Combinations of static dissipative surfaces with buried conductive elements or conductive outer packaging with static dissipative internal packaging components make very effective ESD control packaging. As the static charges are dissipated from the electronic devices it can be routed into conductive packaging elements. Static dissipative bags are usually pink in color.

However, in applications where packaging and handling products could become electrified, only static dissipative packaging should be used. Be careful when using materials with buried conductive elements in electrified environments. Be alert for conductive elements that may become exposed by abrasion or component poke-through.

Progress Check #4

Circle the letter in front of the correct answer.

1. Electrostatic damage occurs to
   a. electric motors.
   b. light bulbs.
   c. switches and other electrical devices.
   d. none of the above.

2. Electrostatic damage can be prevented by
   a. preventing electronic components from entering a charged field.
   b. draining charges before they can enter the electronic devices.
   c. dissipating charged fields into conductive materials.
   d. all of the above.

3. When packaging material attracts static electricity, what type of electrostatic protection should be used?
   a. Static dissipative bags.
   b. Electrostatic shielding bags.
   c. Conductive foam.

4. When opening a container filled with electronic devices in gray plastic bags
    a. You don't need to worry about static electricity.
    b. Only open the bags at an electrostatic-safe work station.
    c. Touch some metal before opening the bags.

5. Electrostatic energy is used to charge
    a. forklift batteries.
    b. RFID tags.
    c. scanners.

Summary

Damage to product costs manufacturers large sums of money every year. Most of the protection needed by products is designed into the packaging that contains the product. Product protection must be provided when cases of product are broken down for reshipping. As warehouse technicians, you should be aware of the physical forces and electronic dangers that various products will endure in subsequent repackaging and shipping. Always use appropriate packaging materials to provide adequate protection of all kinds.