

IDEAS AND INNOVATION

• SECOND EDITION •

A handbook for designers, converters
and buyers of paperboard packaging

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PAPERBOARD PACKAGING COUNCIL



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PAPERBOARD PACKAGING COUNCIL



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PAPERBOARD PACKAGING COUNCIL
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The Paperboard Packaging Council (PPC) is a leading industry association that serves converters and suppliers of all forms of paperboard packaging, including folding cartons, rigid boxes, paper cylinders, and small-flute paperboard containers.

PPC's Roots

The modern association traces its roots to the Institute of Better Packaging (IBP) formed in 1929, and to the Folding Paper Box Association of America (FPBAA) formed in 1933. IBP represented those companies producing packaging for wet and oily foods, while FPBAA supported converters producing folding cartons for all other product categories. As membership in the two organizations began to heavily overlap, IBP and FPBAA decided to merge. In 1964, the two associations came together to form the modern day Paperboard Packaging Council.

Continuing a Legacy

PPC has always provided a wide selection of comprehensive programs, seminars and services for package manufacturers, structural and graphic designers, financial experts, marketing professionals, human resource managers, top-level executives and others within the paperboard packaging industry. Programming is planned in response to member needs and changes in the marketplace.

The association gathers information from members and other sources to compile an array of publications on shipments, market trends, safety statistics, financial information, and numerous other topics. *Ideas and Innovation: A Handbook for Designers, Converters and Buyers of Paperboard Packaging*, is a best-selling guide explaining in-depth approximately 700 creative variations of carton styles. *Ideas* is an accepted reference tool for university package design students.

The association maintains a marketing program to increase awareness, understanding and appreciation of the many benefits of paperboard packaging. The comprehensive "It's Hip to be Square" campaign targets packaging decision-makers through advertising and direct mailings, touting the convenience, graphic impact and design opportunities found only in paperboard packaging. PPC's revamped website, www.ppcnet.org, contains features for members, packaging decision-makers, media, students and the public.

PPC remains committed to fulfilling its mission - to grow, promote and protect the paperboard packaging industry, and provide tools for members to compete effectively in the marketplace. PPC has also taken an active role in developing the next generation of packaging leaders, ensuring that the paperboard packaging industry continues to create new technology and innovative products, and adapt to the ever-changing needs of customers.





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PAPERBOARD PACKAGING:
OVERVIEW

0.000

OVERVIEW

- 0.100 *Introduction*
- 0.200 *The Package Development Process*
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- 0.400 *The Converting Operation*
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- 0.600 *Folding Carton Protocol*

IDEAS AND
INNOVATION
- SECOND EDITION -



Ideas and Innovation (A Handbook for Designers, Converters and Buyers of Paperboard Packaging) - Second Edition updates the first edition of the manual which was published in 2000. It elaborates on and consolidates two earlier PPC publications: "The Folding Carton," an overall perspective of the folding carton industry, last printed in 1996; and "Handbook of Folding Carton Style Nomenclature," which focused on basic carton styles and industry nomenclature and was last reprinted in 1992. *Ideas and Innovation - Second Edition* expands the earlier edition to include additional folding carton styles, combination paperboard, promotional packaging, alternative paperboard packaging and carton design features.

THE OBJECTIVES OF THIS PUBLICATION

- To create a common language to facilitate communications among converters, customers, die makers and other vendors; and among packaging school faculty and students.
- To describe the basic materials and processes used in the manufacture and conversion of carton grade substrates.
- To identify the categories of paperboard packaging and to illustrate the fundamental characteristics and styles associated with each, highlighting the advantages and benefits associated with paperboard packaging.
- To create an information base which will serve as a foundation for future design, converting and marketing creativity.

POTENTIAL USES FOR THIS PUBLICATION

- New employee orientation for the converting industry (manufacturing, design, marketing and sales personnel).
- A reference manual for customer packaging, purchasing, engineering, marketing and design personnel.

- A reference manual for companies that supply materials and equipment to converters or consumer packaging groups.
- A reference manual for third party entities such as independent design firms, advertising agencies, public relations and marketing firms.
- A convenient text and guide on paperboard packaging in general, and the folding carton industry in particular, for college and university faculties and students.

A BRIEF HISTORY: PAPER AND PAPERBOARD

Although the word *paper* is derived from the Egyptian term, *papyrus* was not a true paper in the modern sense. The invention of paper by blending cellulose fibers didn't occur until the beginning of the second century A.D.

Ts'ai Lun, a member of the court of the later Han Dynasty, is generally credited with developing the first real papermaking process in 105 A.D.

Using the inner bark of a mulberry tree, he formed sheets of paper by pouring a mixture of tree fibers and water into a sieve-like box made of bamboo. The water was allowed to drain through a porous cloth, leaving a mat of fibers. This mat was lifted from the mold on the felt-like cloth, then pressed and dried to form the finished sheet.

Reduced to its simplest form, this is still the same basic method used for making paper and paperboard today.

It wasn't until the beginning of the 18th century that workable machines were developed to mass produce paper and certain forms of paperboard. The *Fourdrinier machine* was the first on the market and produced a homogenous (*single-ply*) sheet of boxboard in various thicknesses. It was soon joined by the *Cylinder Mould machine* which formed a multi-layered (*multi-ply*) type of paperboard. These machines were first installed in the United States around 1830. Highly refined versions of the two are still the primary machines used to produce paper and paperboard throughout the world.



THE GENESIS OF PAPERBOARD PACKAGING

Merchandising, as we know it today, was virtually non-existent until the mid-to-late 1800's. Until supply caught up with, and began to exceed demand, product was distributed in whatever convenient receptacle available.

However, once competition became part of the equation, packaging began to develop as a means of expanding beyond local markets and informing potential customers about the identity of the manufacturer and the virtues of the product. Gradually, the package moved the concerns for cleanliness and untainted products away from the retailer and placed it with the manufacturer. The package assured consumers that they were receiving a quality product while enhancing the reputation of the manufacturer. This opened vast new markets for the manufacturer.

Paperboard packages were being commercially produced at a local level as early as 1839 when Aaron L. Dennison, a Boston jeweler, began making set-up boxes for himself and other local jewelers. By 1850, this business had been expanded to include boxes for a wide assortment of small products. Within ten years, others established their own box-making plants and began developing specialized equipment to speed production and reduce costs. The set-up box business was now established and flourishing.

The *folding carton* developed over the next two decades. A direct descendant of the *set-up box*, the folding carton could be shipped flat and set up by the customer. Laminating machines were developed allowing the bonding of high quality paper to less expensive grades of paperboard.

***What is a folding carton?** In general terms, the folding carton is a container of varying size and shape made from bending grades of paperboard or small flute paperboard; which is typically printed, cut and creased, folded and glued, and delivered flat to the customer where it is filled with product for distribution to retail outlets.*

In 1879, a fortuitous "mistake" by a careless pressman in the Robert Gair box plant paved the way to manufacturing truly inexpensive, mass produced folding cartons. The pressman failed to notice that, due to a poor press make-ready, the printing plates were neatly cutting through the paper. This ruined press run gave Gair an idea. He turned a mistake into an invention by developing steel rules, locking them into a form, putting them on a platen press, and in a single operation, cutting and creasing carton blanks.

In 1896 the newly formed National Biscuit Company gave the industry an enormous push forward with the introduction of UNEEDA, an improved type of soda cracker, protected by an inner waxed paper wrap, a folding carton shell, and a colorfully printed overwrap. The result was a nationally distributed barrier package with strong brand identification. The *folding carton* was now established as one of the premier means of packaging, marketing and distributing product on a national scale. The fundamental advantages of the folding carton and the basic manufacturing practices were now in place.



Early 20th century merchandising



Since the turn of the last century, the folding carton industry has experienced tremendous growth. With the advent of the 21st century, the United States folding carton market represents roughly a \$8.6 billion industry, consuming 5.4 million tons of paperboard annually (50% made from recycled fiber) and employing approximately 47,000 people.



THE FOLDING CARTON TODAY

Paperboard packaging and its role in the marketing of consumer, business and industrial products is constantly changing and improving. New technologies, designs and equipment appear on almost a daily basis. Seen in virtually every retail environment, the folding carton is an integral part of the product; providing protection, and communicating brand identity and product benefits to the consumer.

In the retail environment, the folding carton must capture the attention of the consumer and effectively communicate the sales message of the product manufacturer. It must also contribute to repeat sales by delivering the product in excellent condition and by providing extra packaging “benefits” such as easy dispensing, which can become an integral part of the perceived value of the product.

WHAT CAN BE DONE WITH PAPERBOARD?

There is the obvious: Print, cut, fold and glue it. But such a simple statement begs the issue of what paperboard can really do? Considering the basic paperboard sheet which is comprised of compressed pulp, the sheet itself can be enhanced by:

- Clay coating one or both sides to create a smooth, bright white surface to accept inks and other surface treatments.
- Modifying sheet density to meet specific packaging needs.
- Adding mold resistance, wet strength, stiffening agents, or anti-static characteristics.
- Extrusion coating or laminating paper, foil, films or composites of these materials.
- Staining or coloring the base sheet.

In addition to merely “printing” with fundamental solvent or water based inks, the paperboard package can be enhanced by:

- Applying fluorescent inks and/or pearlescent, ultraviolet, infrared or heat set coatings with high gloss or matte finishes.
- Applying heat seal, non-skid or barrier coatings.
- Applying scented inks.

Marketing and functional characteristics can be further improved through:

- Embossing, hot foil stamping, or the application of holograms.
- Clear film windowing
- Combining with other materials; i.e., flexible or semi-rigid films, paper, metal, rigid plastics or other grades of paperboard.
- Labeling, coding or imprinting.
- Skiving, taping, edge coating, or adding tip-ons or coupons.
- Applying tear tapes or handles.



WHAT CAN PAPERBOARD PACKAGING DO?

A paperboard package will do the obvious: contain the product, moving it from the manufacturing source to the retailer and ultimately to the consumer. But this is only the “tip of the iceberg.” Paperboard packaging offers advantages to the product, the consumer products company, and the customer.

For the product, paperboard packaging can:

- Unitize product by count, weight or volume.
- Deliver physical protection against breakage, pilfering, sifting and tampering.
- Offer barrier protection against odor, gas, moisture or grease transfer.
- Create a liquid-tight, sterile or aseptic product environment.



For the consumer products company, paperboard packaging can:

- Provide unparalleled brand identification.
- Offer an exceptional platform for communications and product information.
- Deliver product visibility, billboard impact, and product differentiation.
- Allow for creative merchandising opportunities and exciting visual impact through unmatched graphics and almost limitless shape, size and design potential.
- Provide ease of storage, filling, shipping and shelving.
- Deliver superior environmental benefits.
- Include consumer convenience features (pour spouts, tear strips, dispensing devices, etc.).

For the customer, paperboard packaging can:

- Deliver the product in perfect condition.
- Provide convenient features for home use and storage.
- Provide information on health, safety and general use of the product.
- Provide coupons or special offer inserts.
- Offer promotions and instant-win contests.



Paperboard packaging remains an exceptional solo performer, excelling in markets as diverse as whimsical novelties and straight-forward functional partitions to highly sophisticated sterile, aseptic, ovenable and microwaveable packaging, to elegant cosmetic and gift packaging.

It is also an outstanding partner, in combination with other packaging media, (i.e., flexible films, metal, corrugated, and a host of thermoformed or injection molded plastics) to yield composite packaging that maximizes the unique qualities of each component. These composite packages compete very effectively with other forms of packaging; such as metal cans, glass bottles and jars, plastic cans, tubs and buckets.

The paperboard package is versatile, environmentally friendly, and ever changing. The following pages will introduce you to the fundamentals of paperboard, the converting process, and to the exciting design potential of this extraordinary packaging medium.



THE RAW MATERIALS

The appearance and capabilities inherent in the finished board are largely determined by the materials that compose the pulp and the process by which it is refined. *Virgin fiber* is primarily acquired by harvesting a number of species of soft and hardwood trees grown especially for pulpwood. Some fiber is gleaned from waste wood produced by lumber mills, plywood manufacturers and logging operations.

Wood arrives at the pulp plant in the form of chips, end pieces or unusable logs. This mass is reduced and separated into wood fibers by either a *mechanical* or *chemical process*, or by a combination of the two.

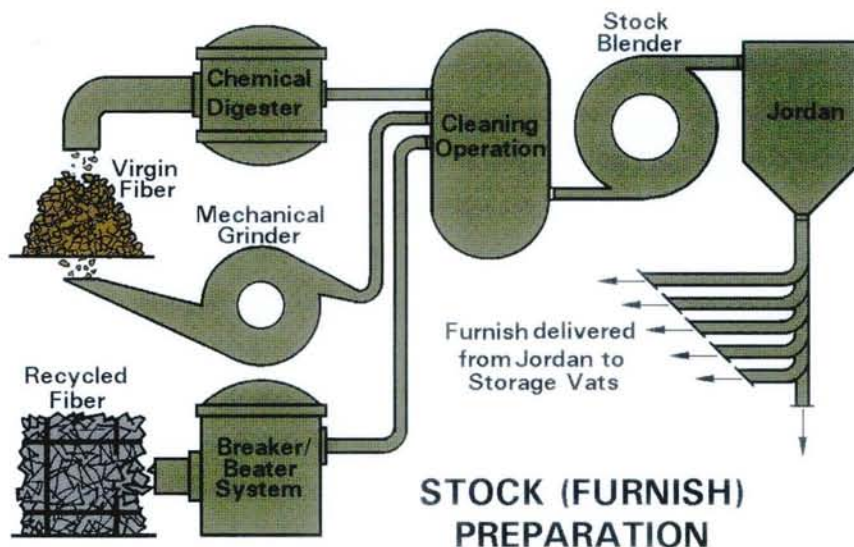
The *mechanical process* is used primarily to grind long-fiber, non-resinous woods into relatively short fiber pulp. This produces a rather inferior, weak quality pulp that discolors easily. As a result, it is normally used in combination with chemically produced pulp.

There are *three types of chemical processes*: sulfite, sulfate (or kraft), and soda process. Each is named for the chemical used to dissolve the lignins, sugars and other substances which bind the cellulose fibers together in the wood.

Virgin fibers account for approximately half of the pulp used in the manufacture of paperboard. The other half is recycled fiber which comes from a wide variety of sources, including old newspapers, cartons, corrugated, as well as waste paper from offices, factories and schools.

Recycled fiber is separated from waste paper primarily through the use of hot water, strong agitation, and heavy beater rolls, with chemicals sometimes used to process or disperse non-fibrous materials.

Although reclaiming the fiber is simple, the cleaning is formidable, since waste paper usually contains an array of contaminants. There are several methods and steps to the cleaning process for removing metals, rags, rubber bands, dirt and sand. Once completed, the cleaned and reclaimed fibers are blended into stock solution along with other recycled and virgin fibers.



Stock Preparation

Once the quantity and type of fiber for the grade of paperboard are determined, chemicals and coloring agents are chosen and the ingredients blended. These stocks, or *furnishes*, are prepared in three basic steps:

First, the fiber is blended in beaters, where water is added, the fibers thoroughly mixed and impurities removed. In the second step, chemicals, minerals and colorants are added. Step three further refines the blend by passing it through a machine called a *Jordan* which smooths the fibers while adding a large amount of water. During this process, the stock is brought to a fiber/water ratio of one part fiber to 99 parts water. The various stocks, or furnishes, are then pumped into storage vats to await processing into paperboard.

THE PAPERMAKING PROCESS

The manufacture of paperboard is a continuous process starting with a slurry of water and fiber entering the paper machine at approximately a 99% water level. Through a series of pressing and drying actions, water is removed to a point where the “web” or “sheet” of paperboard exits the machine with a moisture content of about 5%.

Regardless of the type of machine used, the manufacturing sequence is:

- Forming
- Pressing
- Drying and size pressing
- Precoat calendering
- Coating
- Dry calendering
- Winding and slitting

Forming

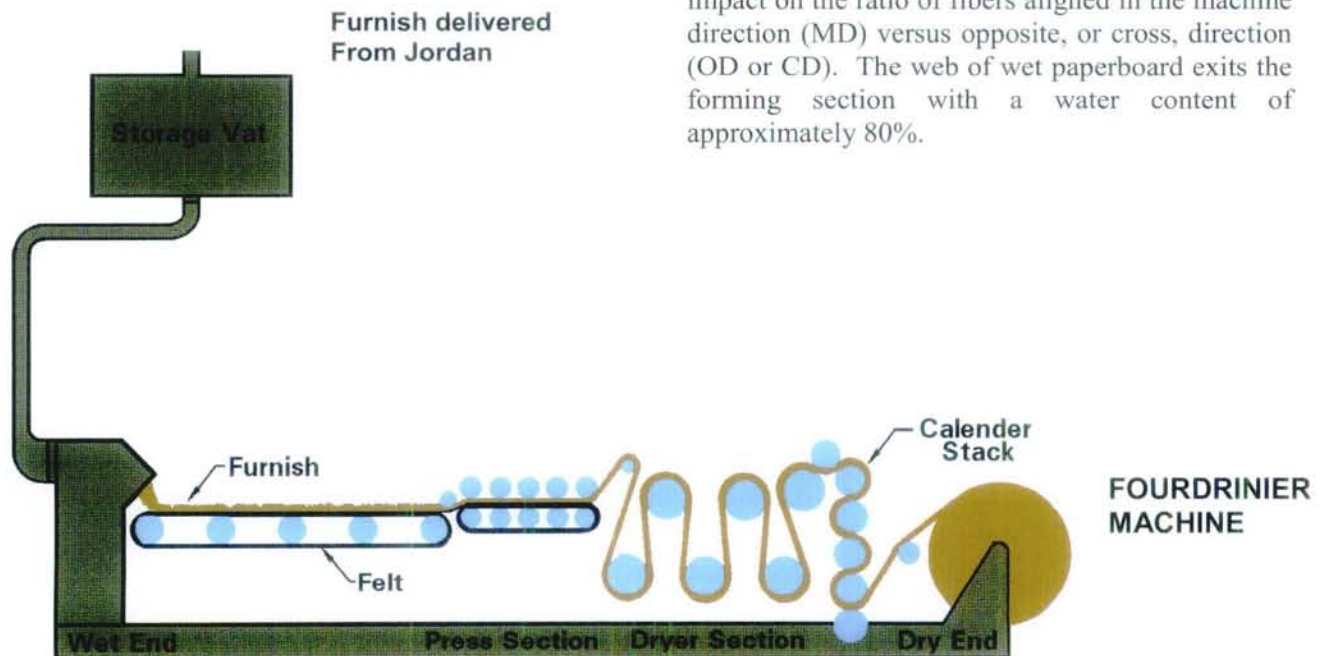
The forming process has the most significant impact on the properties of the finished product. There is a natural tendency for the fibers in the slurry to align in the direction in which the slurry travels through the papermaking machine (the

machine direction). By manipulating or interrupting the slurry flow, the ratio of fibers in the machine direction (MD) versus opposite, or cross, direction (OD or CD) and vertical direction (ZD) can be altered. This, in turn, impacts on the relationship of MD versus OD/CD resistance to bending. This relationship is referred to as the “squareness” of the sheet. This characteristic will be described in greater detail in the “Substrates” section beginning on page 0.109.

There are two basic ways of commercially converting pulp into paperboard. Both are identified by the type of paperboard machine used to transform the slurry of water and fiber into a sheet (web) of paperboard. These are (1) the Fourdrinier Machine Process and (2) the Cylinder Machine Process. The fundamental forming processes are described and illustrated as follows:

Fourdrinier Machine Process

In the fourdrinier process the water/fiber slurry (or furnish) is deposited on an endless, continuously moving, finely woven belt (wire). The wire is shaken as it moves in the machine direction. This shaking motion has a significant impact on the ratio of fibers aligned in the machine direction (MD) versus opposite, or cross, direction (OD or CD). The web of wet paperboard exits the forming section with a water content of approximately 80%.



Fourdrinier machines are used to manufacture solid bleached sulfate, coated unbleached kraft and some clay coated newsback paperboard. Two, three or four fourdrinier sections may be combined to produce a sheet of a like number of plies. The make up of the grades noted above is illustrated and described in the “Substrates” section beginning on page 0.109.

Most fourdrinier mills are located close to their primary material source - virgin wood fiber. In North America, this would be the hardwood forests of Canada and the northern United States; or near the pine and soft wood forests of the southern United States.

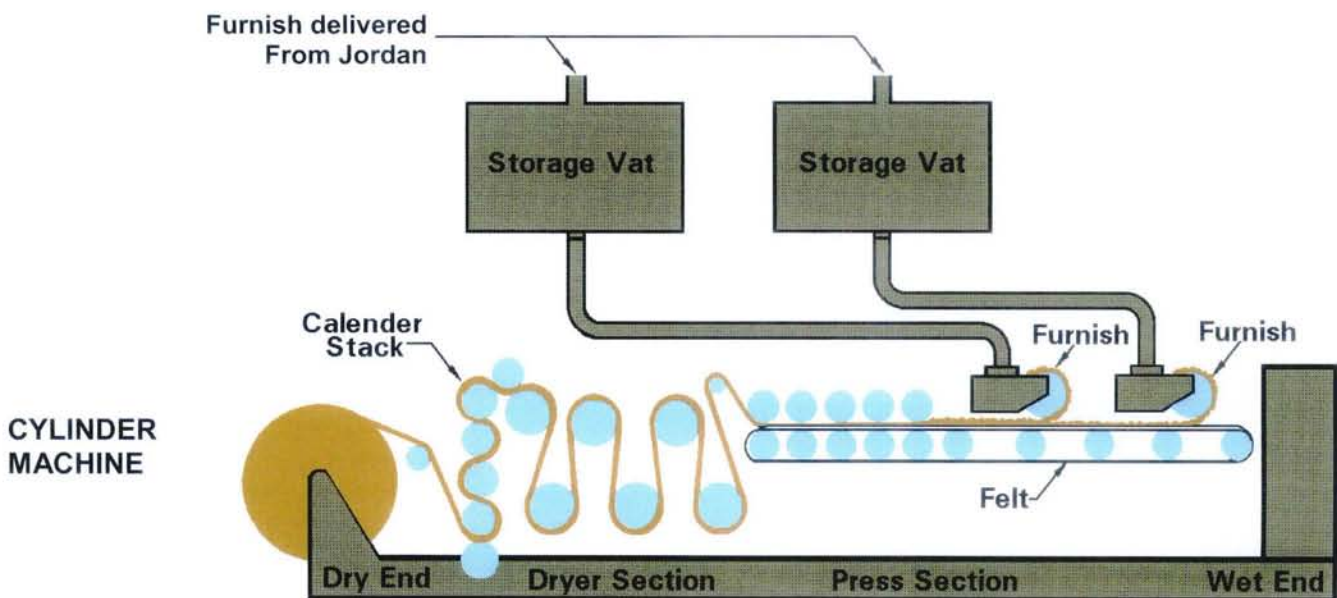
Cylinder Machine Process

The basic cylinder vat machine process differs from the fourdrinier process in that the water and fiber slurry is deposited onto a series of fine wire mesh cylinders rather than a single wire belt. Each cylinder rotates half-submerged in a vat of the desired furnish. As the cylinder turns, it picks up fiber allowing the water to drain off, then deposits the resulting fiber mat onto a moving felt. The felt carries the mat through the machine, picking up new layers of fiber as it passes each successive cylinder.

Because there is no shaking action with this process, there is less ability to modify the natural tendency for the fibers to align in the machine direction. Typically 75% to 80% of the fibers will lie in the machine direction (MD). As with the fourdrinier process, the slurry enters with a water content of approximately 99% and exits the forming section with a water content around 80%.

Cylinder machines are used to produce several grades of uncoated paperboard and most of the clay coated newsback (CCNB) made. The typical cylinder sheet is comprised of seven to nine plies which may be customized to deliver specific qualities to the finished sheet. The number of plies also determines the thickness (caliper) of the finished paperboard. While virgin fiber may be included, most of the raw material used for cylinder paperboard will consist of recycled material. For this reason most cylinder machine mills are located close to large metropolitan areas or distribution centers - the source of the raw recycled material.

Note: A hybrid called a compact ultra former includes a short fourdrinier wire used to deliver furnish onto the top of the cylinder. The result is a sheet with a ratio of about 65% : 35% MD to OD/CD. This is substantially more “square” than the standard cylinder sheet.



With the exception of the forming function, the remaining operations in the papermaking process are essentially the same for all methods of manufacture.

Pressing

In the press section of the paperboard machine a combination of pressure and vacuum suction is utilized to further reduce the percentage of water from 80% to between 40% and 60%, as the paperboard web proceeds to the dry end of the machine.

Drying and Size Pressing

The dryer section is the largest part of the paperboard machine. Here, the web is wound through a series of rotating steam-filled drums which remove additional water through evaporation from the 40% to 60% level down to approximately 5%.

Size presses which apply a coating of starch or sizing resins to the top, bottom or both surfaces of the paper are located between dryer sections and are incorporated into many processes. These treatments assist in bonding the cellulose fibers to the sheet surface and aid in water holdout for subsequent coating and printing processes.

Precoat Calendering

As a post-drying stage, a starch solution can be applied on a wet stack calender in addition to, or instead of, a size press application on fourdrinier machines.

Coating

After wet stack calendering, pigmented coatings are applied as part of the pre-coating process. These coatings are comprised of blends of pigments, binders, and additives which are used to enhance the appearance and surface characteristics of the paperboard.

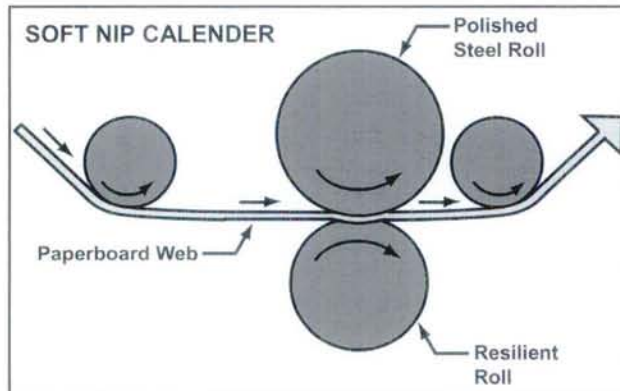
Pigments such as clay or titanium dioxide, and synthetic (styrene butadiene rubber, polyvinyl acetate) or natural (protein) binders are used to bond coating pigments to each other and to the

fibers. Additives (biocides and slimicides) are utilized to enhance the process by maintaining quality and stability. Other additives enhance functionality; i.e., insolublizers to improve offset printability, lubricants to aid in diecutting, or dyes to control coating shade.

There may be two or more coating units, each typically applies and dries a coating before the paperboard proceeds to the next unit.

Dry Calendering

Dry calendering is a finishing step in the papermaking process whereby the paperboard web is passed through a stack of calendering rolls (hard nip calendering) or between a highly polished heated cylinder engaged against a resilient rubber backing roll (soft nip calendering). The purpose of the process is to polish the sheet and control thickness (caliper). This process improves the smoothness and increases the gloss of the finished sheet of paperboard.



Winding and Slitting

The final step in the papermaking process is the winding of the paperboard into a giant roll, referred to as a "reel." This "reel" is the width of the machine (from under 100 inches to upwards of 300 inches) and up to 10 feet in diameter. The reel is carried to a slitter which cuts the paperboard into rolls in the desired width, diameter and core size to meet a particular converter's specifications.



THE SUBSTRATES

The primary materials, or substrates, used in the converting process are various types of paperboard grades (single wall) or hollow core paperboard (referred to in the trade as small flute paperboard).

PAPERBOARD

“Box board,” “folding box board,” or “board” are other terms used for what most in the converting end of the industry call “paperboard.” In this publication, we will use the term “paperboard” primarily, but occasionally the term “board” may find its way into the text.

As noted in the prior section on the paperboard manufacturing process, paperboard is made primarily from cellulose fiber derived either directly from trees (virgin fiber) or from waste products such as newspaper, old corrugated boxes discarded office papers, or converting plant scrap (recycled fiber).

Paperboard is distinguished from “paper” primarily by thickness (caliper). Anything under .010 inch thick is referred to as “paper;” anything .010 inch thick and over is referred to as “paperboard.” Most mills and converting plants in the industry are geared to produce and convert paperboard in calipers between .010 inch and .040 inch (also referred to as 10 point to 40 point, 10 mil to 40 mil, or 10 thousandths to 40 thousandths).

There are two basic types of paperboard. As mentioned in the section “The Papermaking Process,” both are directly related to the process by which the paperboard was produced. These are cylinder paperboard (generally seven to nine plies, or layers, of multiple grades of fiber – mostly recycled grades), or Fourdrinier paperboard (one to four plies, or layers, of mostly bleached or unbleached virgin fibers).

CYLINDER PAPERBOARD CATEGORIES

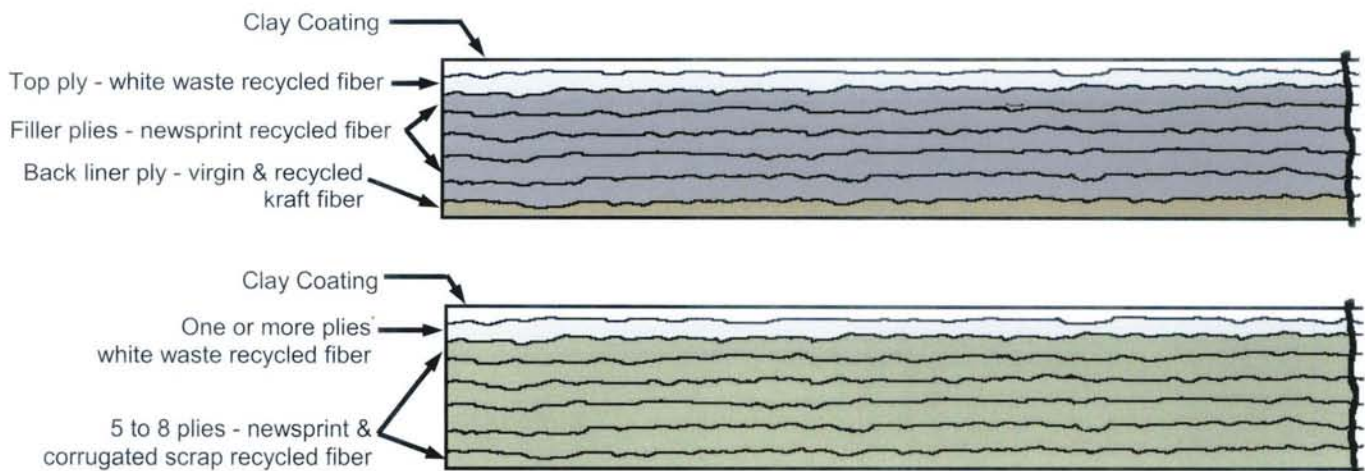
Uncoated Cylinder Paperboard

This is the least complex and least costly grade of paperboard. It can be further divided into non-bending and bending grades.

Coated Cylinder Paperboard

This is the largest category of cylinder paperboard and includes a multitude of substrate combinations. Clay is the most common surface coating (for printing) and virtually all grades are bending grades (capable of being folded 180° without cracking or flaking of the outer coated surface). Clay coated newsback (CCNB) is one of the most popular grades of coated cylinder board because it combines a good printing surface (clay) with an inexpensive, but bending grade, substrate (corrugated and newspaper waste).

EXAMPLES OF POSSIBLE CYLINDER SHEET PLY COMPOSITION



Coated recycled paperboard accounts for approximately 40% of the total folding carton market and is dominant in several major product categories including:

- Laundry soaps and detergents
- Dry bakery products (crackers and cookies)
- Paper products
- Dry foods (pastas)
- Hardware
- Cake mixes
- Cereal

The examples on the previous page indicate some of the possible furnish combinations available in recycled paperboard.

Note: While recycled fiber is the predominant furnish for the multiple plies of a sheet of cylinder paperboard, some grades may include one or more plies of virgin pulp to meet specific packaging needs.

FOURDRINIER PAPERBOARD CATEGORIES

Solid Bleached Sulfate (SBS)

This is typically the most expensive grade of paperboard on a cost per ton basis. It is comprised of a clay coated surface for excellent printing

qualities, a top ply of bleached virgin hardwood fibers for smoothness, with the remaining plies made up of bleached virgin softwood or a blend of softwood and hardwood fiber. Solid bleached sulfate accounts for approximately 35% of the folding carton market. Because it is a solid white sheet, it is the grade of choice for food packaging and many high end retail products including:

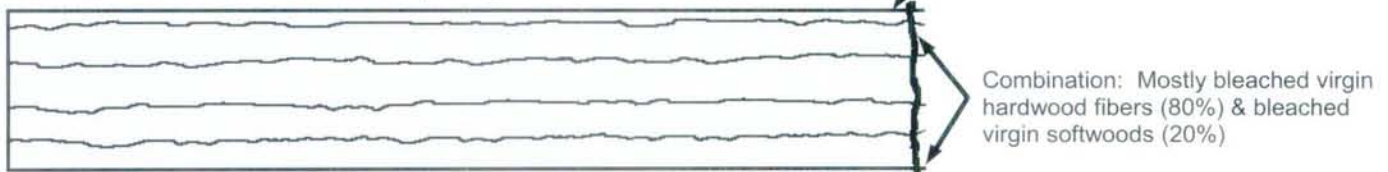
- Cosmetics
- Wet foods
- Frozen foods
- Tobacco
- Dairy products (butter, ice cream, milk)
- Meats
- Perishable bakery products
- Medical products

Coated Unbleached Kraft (CUK)

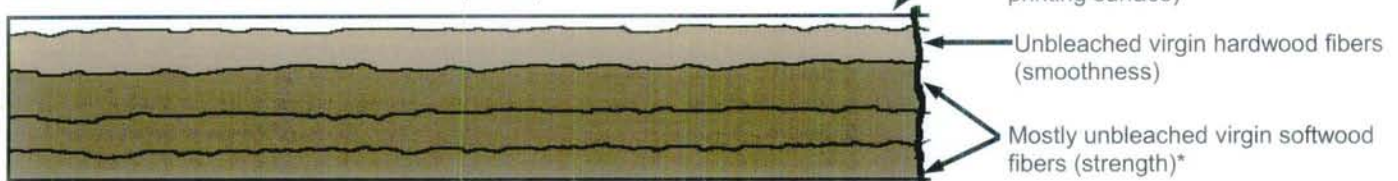
This board grade is made up primarily of various southern pine species (softwoods) with some hardwood fiber, particularly in the top ply. The long, large pine fibers impart excellent strength and tear resistance qualities to the finished sheet.

This grade of fourdrinier paperboard dominates the beer and soft drink beverage container market.

SOLID BLEACHED SULFATE (SBS)



COATED UNBLEACHED KRAFT (CUK)



**Up to 20% recycled material may be used in the furnish in some grades of unbleached kraft*



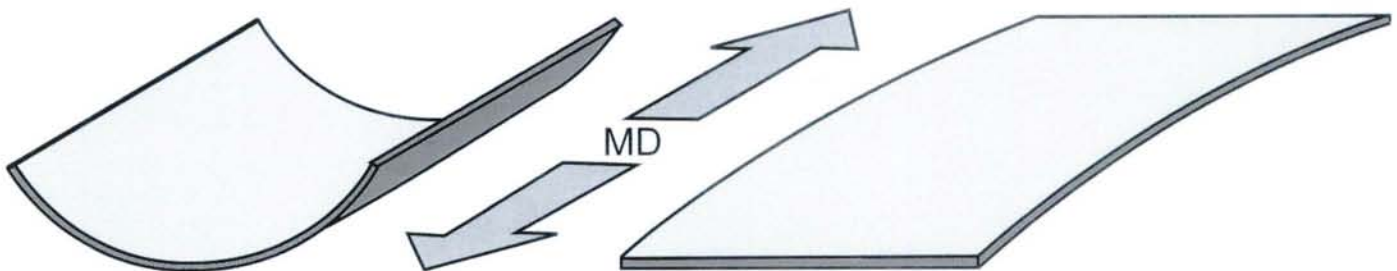
In addition to typical differences in the type of furnish used and the method of applying the furnish to the wet end wire, there is another significant difference between cylinder and fourdrinier paperboard: the “grain” of the sheet.

The preponderance of fibers aligned in the machine direction (MD) in cylinder paperboard results in a sheet that is very stiff in the machine direction and easy to roll or curl in the cross, or opposite, direction (CD or OD). The stiffness versus roll characteristics of the MD versus CD in a fourdrinier sheet is not nearly as pronounced. This relationship is referred to as the “squareness” of the sheet.

Fourdrinier machines make the squarest sheet with a MD to CD ratio in the range of 1.5 - 2.0 : 1

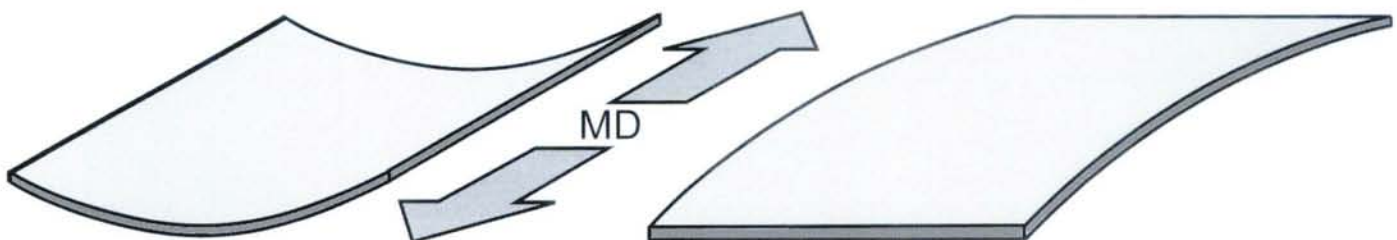
range while cylinder paperboard is much less square, having MD to CD ratios ranging from 3.5 – 4.5 : 1 for conventional cylinder vat machines to 2.2 - 3.8 : 1 for paperboard made by the ultraformer process.

The illustrations below dramatize this fundamental difference between the two basic types of paperboard. Product or package requirements are the driving force behind selecting the right substrate for the job. The clever designer uses these inherent characteristics to advantage in designing cartons that run efficiently through the converting and packaging processes, and function effectively for the consumer (protect the product, open properly).



Cylinder Paperboard

Fibers aligned predominantly in MD (75% to 80%) vs. CD (20% to 25%). Little resistance to curl in CD. Stiff and curl resistant in MD.



Fourdrinier Paperboard

More balanced in fiber alignment in MD (55%) vs. CD (45%). Slightly more resistant to curl in MD than in CD.



CYLINDER MACHINE PAPERBOARD TYPES

	<u>Board Type</u>	<u>Composition</u>	<u>Characteristics</u>	<u>Typical Uses / Comments</u>
UNCOATED GRADES	Plain Chip (Non-Bending)	100% Recycled scrap. (newsprint, old corrugated).	<ul style="list-style-type: none"> Poor printing & bending/ (folding) properties. Color range tan to gray. 	<ul style="list-style-type: none"> Body stock for paper overwrapped set-up boxes, partitions, shirt boards. Lowest cost grade of paperboard.
	Bending Chip	100% Recycled scrap. (newsprint, old corrugated, office waste).	<ul style="list-style-type: none"> Good bending qualities. Poor to fair printing quality. Color range tan to gray. 	<ul style="list-style-type: none"> Partitions, distribution, institutional or commodity packaging. Lowest cost carton grade paperboard.
	Bleached Manila	Bending chip base with white manila top liner.	<ul style="list-style-type: none"> Good bending qualities. Poor to fair printing quality. 	<ul style="list-style-type: none"> Distribution, institutional or commodity packaging; low end retail. Best of the uncoated boards for visual impact.
	Plain Kraft Board	Mostly recycled corrugated scrap with some virgin kraft fiber.	<ul style="list-style-type: none"> Good bending qualities. Fair printing quality. 	<ul style="list-style-type: none"> Commodity or distribution packaging needing good strength & durability. Some hardware and automotive.
COATED GRADES	Clay Coated News Board (CCNB)	Typically clay coated one side with a clean (white scrap) liner and remaining plies of recycled news or kraft scrap. Generally 100% recycled.	<ul style="list-style-type: none"> Good bending and printing qualities. Smooth, bright white outer surface. Gray back liner (typically). 	<ul style="list-style-type: none"> Wide range of consumer products; not typically used as food contact medium. Clay coated news board (newsback) has become generic term for many custom furnish combinations. May include virgin fiber furnish.
	Clay Coated Kraft	Clay coating over combination of virgin, unbleached softwood and hardwood fibers.	<ul style="list-style-type: none"> Good bending and printing qualities. Smooth, bright white outer surface. Tan colored back liner. 	<ul style="list-style-type: none"> Hardware, automotive and heavy product needing good strength and durability characteristics. One or more ply may contain some virgin kraft fiber.



FOURDRINIER MACHINE PAPERBOARD TYPES

	Board Type	Composition	Characteristics	Typical Uses / Comments
UNCOATED GRADES	Uncoated Solid Bleached Sulfate	Uncoated base sheet, subsequently waxed or extrusion coated on one or both sides (usually polyethylene).	<ul style="list-style-type: none"> • Good bending qualities. • Good moisture/water holdout. • White sheet throughout. 	<ul style="list-style-type: none"> • Plain or waxed grades for frozen food shells which are covered with a printed overwrap. • PE extrusion coated grades are readily printable.
	Solid Unbleached Kraft	Low density, uncoated natural kraft fiber.	<ul style="list-style-type: none"> • Good moisture resistance. • Good stiffness and tear resistance characteristics. • Good printing surface. 	<ul style="list-style-type: none"> • Industrial and institutional products, retail boxes, carriers and mailers. • May be extrusion coated or laminated with various films or paper grades.
COATED GRADES	Solid Bleached Sulfate (SBS)	Clay coated printing surface. Short, bleached hardwood fiber top liner. Softwood fillers and back liner.	<ul style="list-style-type: none"> • Good bending qualities. • Good moisture/water holdout. • White sheet throughout. 	<ul style="list-style-type: none"> • Used to package wide variety of food grade and high end retail products. • Can be coated both sides if need dictates.
	Coated Unbleached Kraft (CUK)	Clay coating over unbleached virgin kraft fiber. Mixture of softwood and hardwood furnish.	<ul style="list-style-type: none"> • Good bending and printing qualities. • Good wet or dry tear resistance. 	<ul style="list-style-type: none"> • Heavy duty retail packaging such as hardware and concentrated laundry detergents. • Dominant grade for multiple packaging of beer and beverage products.



ENHANCEMENTS TO PAPERBOARD

The section covering the papermaking process touched on ways to modify or enhance the characteristics of paperboard. These and some additional examples of enhancements (prior to printing, cutting and finishing in the converting plant) are noted below:

Paper Machine Additives

Slimicides: Control mold and fungus growth.

Starch: Improves dry strength characteristics (stiffness, burst, tensile strength).

Sizing: Resists liquid penetration into the paperboard.

Resins: Improve wet strength (tear) characteristics.

Fillers: Improve surface and optical properties.

Fluorocarbons: Provide grease barrier characteristics.

Dyes: Modify the color of fibers (typically a cylinder machine additive).

Binders: Improve adhesion of coating pigments to each other and to the basic fiber.

Paper Mill Process and/or Converting Plant Enhancements

Extrusion Coatings: Coatings on one or both sides of the paperboard (i.e., polyethylene).

Laminations: Paper, foil, film, or a combination thereof to one or both sides of the substrate.

Embossing: Non-registered, overall embossed patterns.

Waxing: Surface or impregnation.

PROPERTIES OF PAPERBOARD

The following is a grouping of paperboard properties which can be measured and monitored to impart predictable performance characteristics of the paperboard.

Basic Properties

Caliper: Thickness of the board measured in the United States as thousandths of an inch or points, and in Europe as millimeters (mm) or micrometers. Paperboard ranges in thickness from 10 to 40 points (thousandths).

Basis Weight: Measurement of weight per unit area. In the United States, it is measured as pounds per thousand square feet, and in Europe as grams per square meter (gsm).

Moisture Content: Amount of water in the board expressed as a percentage. Excessively dry or wet board will gain or lose moisture, resulting in property changes.

Density: The relationship between basis weight and caliper; i.e., Where two sheets of paperboard have the same basis weight but different calipers – the sheet with the higher caliper will have a lower density.

Performance Properties

Stiffness: Resistance of board to deflection from an external source, often measured in Taber units. This property varies significantly between grain and cross-grain directions and will vary with moisture content of the board.

Scoreability: Ability of paperboard to bend (fold) cleanly through 180° without surface fracture or flaking.

Compression: Resistance to deflection or collapse under pressure.

Tear: The ability to resist tearing, or tear, in a predictable or controlled manner.

Flatness: Resistance to curl.

Surface Strength: Ability of the front and back surfaces to maintain integrity (no flaking, shredding or linting) through the converting process.

Surface Properties

Smoothness: The opposite, or the lack, of roughness. Smoothness may be measured through several different methods and often relates to printability.



Slip: Measure of how paperboard will move (slide) during the converting, packaging, and distribution process.

Absorption: Measure of how each surface absorbs or resists seepage of water into the substrate.

Water (Moisture) Vapor Transfer Rate: A measurement of resistance to transmission of water in its gaseous state through the paperboard.

Glueability: The ability to make a secure (fiber tearing) bond between surfaces of paperboard.

Appearance: Largely subjective evaluation of the evenness and opacity of the paperboard surface(s).

Color/Shade: Measure of the appearance of the outer surface under different light sources.

Gloss: Measure of light reflectance of the surface of paperboard (typically the outer surface).

Brightness: The quality of white intensity defined as the percent of reflectance of the boxboard surface, as measured using a standardized testing method such as TAPPI Standard T 452m.

While there is a degree of subjectivity associated with some of the paperboard qualities noted above, most are quite measurable. Standards for equipment and testing protocols have been developed and are in place throughout the paper mill, converting, and consumer packaging operations.

As in the case of the fundamental grain characteristics of cylinder versus fourdrinier paperboard, the carton converter will use these paperboard properties to advantage in blending together a structure, graphics, and converting process that best meet the customer's and consumer's needs.

SMALL FLUTE PAPERBOARD

Most folding cartons and other paperboard products are made from "solid" paperboard; i.e., a single sheet of either cylinder or fourdrinier paperboard. However, some are fabricated from a hollow core composite sheet of paperboard known as small flute corrugated, or the term preferred in the carton industry, small flute paperboard.

Small flute paperboard is made by combining multiple sheets of paperboard, specifically containerboard grades, into a corrugated structure. The structure consists of a wavy, fluted corrugating medium (fluting) and one (single-face) or two (double-face) sheets of linerboard glued to the corrugating medium. The size or height of the flute profile determines the overall thickness of the corrugated board. Traditional corrugated containers (brown shipping containers) have larger flute profiles and are quite thick and stiff (e.g., A, B and C flutes).

A smaller flute profile (E) has been available for some time, but in the late 1980's advances in fabricating corrugated board lead to the development of quick changeover single facers. The ability to change the single facer from one flute to another in a matter of minutes lead to a proliferation of new, small flute profiles and opened the opportunity for corrugated to expand from its traditional shipping container base into the realm of the folding carton.

COMMON SMALL FLUTE PROFILES				
	Height (Inches)	Flutes Per Foot	Height (mm)	Flutes Per Meter
E Flute	.045	85	1.14	278
F Flute	.030	128	0.76	420
N Flute	.020	170	0.50	558

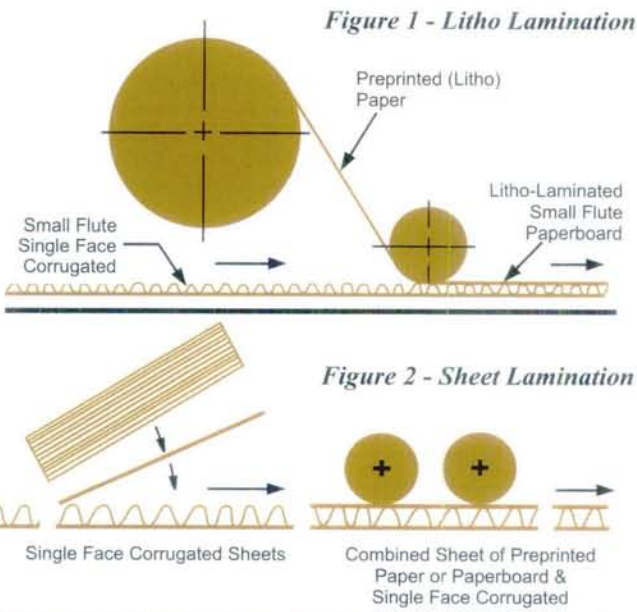
Since the base sheet is thinner and less bulky than the larger fluted stocks, small flute paperboard can be converted on most folding carton equipment (printers, cutters, folder/glueers) to achieve high quality structures, outstanding graphic impact with excellent protective qualities.

To create the basic printed lithographic sheet from which the paperboard product is produced, one of two basic processes are employed. The first, litho-lamination, involves either 1) laminating pre-printed paper or paperboard roll stock to a base web of single face corrugated, then sheeting it to create a printed double faced sheet, or 2) combining pre-



printed paper or paperboard sheet stock with sheets of single face corrugated to create a printed double faced sheet of small flute paperboard. Figures 1 and 2 below illustrate these basic techniques.

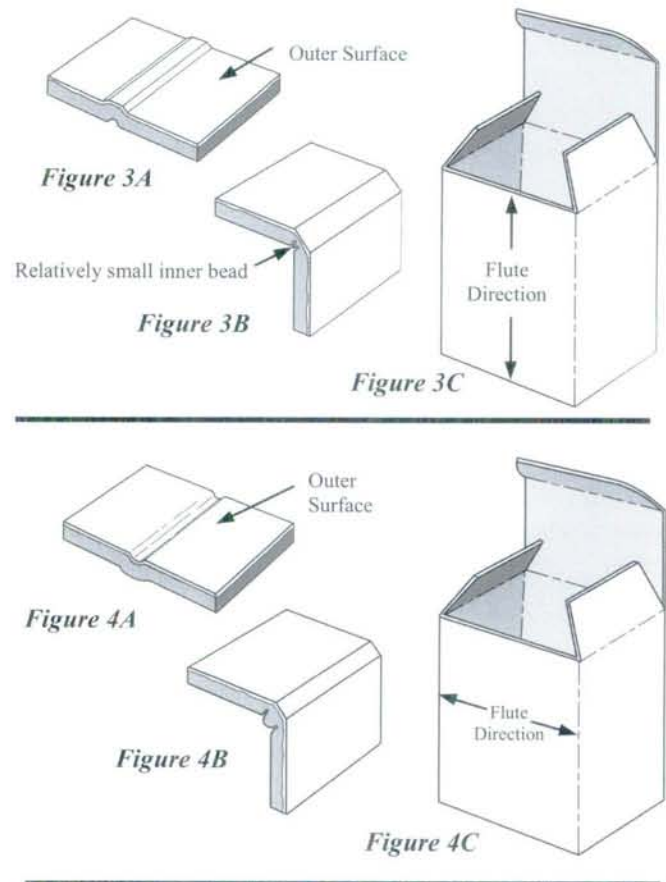
In the second process, generally referred to as direct offset printing, the printing is done directly onto plain, double face small flute paperboard sheet stock.



There are two schools of thought on the “proper” way to score small flute paperboard, and in which direction the “grain” (flute direction) should run.

Conventional practice in the corrugated container industry is to configure the fold lines as shown in Figures 3A and 3B, which minimizes the size of the bead inside the case. The flutes typically run in the vertical direction to maximize stacking strength (Figure 3C). The folding carton industry will typically score small flute paperboard the same as they would conventional paperboard (Figures 4A and 4B). Using a tube style carton as a reference, the grain (or flute direction) is in the horizontal direction (Figure 4C).

There really is no right or wrong. Both practices are valid, as is still another option: scoring the sheet as illustrated in Figures 4A and 4B, but running the flute direction vertically. This combination will be found on many larger cartons



made of small flute paperboard, for products such as small appliances or electronic components where the cartons may be palletized and stretch wrapped directly rather than being case packed.

By the 1990’s, small flute paperboard had become one of the folding carton industry’s standard substrates, taking its place alongside traditional solid sheet grades of paperboard. Most folding carton converters are now routinely converting E, F and N flute grades of paperboard.

NON-FLUTED LAMINATES

A fourth substrate option is to laminate two or more plies of conventional paperboard to create a composite sheet heavier than the typical upper caliper limit of 40 thousandths (.040). The resulting heavy gauge composite sheet possesses many of the attributes of small flute paperboard and competes in the same product categories.



Good packaging cannot guarantee success for an ill-conceived or poorly executed product, but a poorly conceived package can certainly jeopardize the success of a perfectly good product.

Ideally, product development and package development are concurrent activities. As the product evolves, so should the package. The most innovative and effective packaging results when the package design process is an integral part of the total product/marketing development program. The more inclusive the development team, the greater the potential for a successful new product/package introduction. Input from the consumer products company staff, converter staff and other outside resources is extremely valuable. Factoring in the knowledge and creativity of those involved with the manufacturing, handling and use of not only the product but also the package in which it is contained is key to a successful outcome.

Principal players may include the consumer products company's marketing and market research, R&D, manufacturing and engineering, planning and logistics, purchasing, packaging and legal counsel personnel; the converter's structural and graphic design, market research, and manufacturing personnel; material suppliers, equipment manufacturers, or other resources which enhance or complement in-house services.

PACKAGING AS A MARKETING TOOL

Marketing is the driving force behind new consumer product development. While the key focus is, naturally, on the product the wise brand manager takes steps to insure that the packaging fully complements and supports the marketing effort. Suppliers, in this case packaging converters, that are fully in tune with marketing objectives are an important ingredient to a successful product introduction. Following are some suggested guidelines for developing a mutually beneficial customer/converter relationship.

1. Qualify sound packaging suppliers.
Consumer products company purchasing and packaging personnel will typically take the lead. However, quantifying the depth and quality of a converter's design and development team and their proven ability to deliver sound, yet innovative, packaging solutions should factor into the decision, along with cost, converting locations, etc. This aspect of the qualification process may require input from other internal resources.
2. Establish a continuing relationship with key converters.
Sharing goals, strategies and technology creates an environment where both parties can respond to current challenges and plan for future change in an orderly fashion.
3. Involve packaging converters early in the product development process.
Primary converter contact may be through purchasing and product development resources, but brand management is well served if they insure that marketing goals are understood and addressed early in the package development process. Early converter involvement allows the potential for innovative packaging solutions by avoiding tight delivery timelines, which may occur if packaging is handled as an afterthought.
4. Look for converters that successfully integrate structural design, graphic design, and packaging system development.
These are separate disciplines, but an integrated effort on the part of the consumer products company packaging and engineering staffs, and the converter's structural, graphics, and equipment design (mechanical packaging) personnel sets the stage for package development that takes full advantage of converting material technology,



market trends, competitive trends, and the combined skills of the creative services group.

5. Document packaging line requirements.

To contribute effectively, the converter's design team needs to be totally aware of packaging line conditions and requirements. Line speeds, number and type of packaging sites, packaging environment (wet, humid, cold, etc.), order quantities and similar factors impact on the type of package that best fits the customer's needs.

6. Insure that the converter understands and effectively addresses distribution and retail needs.

The converter that understands the full range of actions and conditions the package will face through distribution and in the retail handling and display environment, is in a strong position to deliver solutions that address these, as well as fundamental product containment and display issues.

7. Identify consumer needs and wants.

Product protection is a given, but what are the expectations for other tangibles such as display, dispensing, use instructions, reusability, disposal; or intangibles such as pleasing aesthetics, excitement, or just plain fun? Product and product/package focus group testing results should be shared between the customer and converter to insure that pertinent consumer feedback is factored into the ultimate packaging solution.

8. Identify direct and indirect competition.

The design team should be made aware of similar products vying for the same consumer dollar, in order to promote a package solution that helps distinguish the product/package from existing or anticipated competition.

9. Supply sufficient product and product specifications.

Multiple manufacturing or packaging sources, multiple primary package component vendors, product tolerance and potential variances between prototype and production product will impact on package detailing. Supplying product that accurately represents anticipated tolerance or detail variations in quantities sufficient to conduct both physical testing and packaging line trials before product ramp-up is critical.

10. Document applicable laws and regulations as well as corporate, industry or association policy and guidelines.

Most major converters have a good working knowledge of federal, state and even international laws and regulations that may apply to new packaging. However, understanding policies or guidelines set forth by the consumer products company or association that could impact on the structural or graphic design of the package is just as important.

11. Maintain a flexible position regarding intellectual property.

Innovation can come in many forms and from a multitude of sources. Joint ventures, licensing or the outright purchase of rights to a new technology are viable options to internally developed innovation. Good documentation and the open mindedness of all parties are key to successfully marketing innovative solutions without causing friction or disharmony.

12. Understand the converting process.

Just as it is important for the converter to understand their customer's product, packaging and distribution requirements, the brand manager and his or her team are well served by having a good working knowledge



of the various materials and converting processes they will encounter. Almost anything can be done – at a cost – but creating innovative packaging with a sound technical base comes through shared knowledge of past and present practices, coupled with a mutual vision of where the future can take you.

THE DESIGN PROCESS

The perfect “packaging solution” does not happen by sudden inspiration or luck. Rather, good package design is the result of personal creativity combined with a sound working knowledge of:

- Packaging material characteristics
- Packaging components converting process
- Customer packaging line requirements
- Marketing objectives
- Handling process, including transportation and storage demands
- Retail outlet requirements
- Consumer needs and desires
- Applicable government regulations and laws
- Competitive packaging offerings
- Environmental impact

A great package design delivers positive results to the converter, the customer, vendors and services contributing to the package development and, most importantly, to the ultimate consumer. To the extent the design team recognizes and effectively addresses the needs of each, the final design should be an outstanding package perfectly suited to the environment in which it must perform.

The Paperboard Packaging Council National Carton Competition recognizes three basic areas of design achievement: 1) Converting Excellence, 2) Customer Needs and Expectations, and 3) End-User (Consumer) Needs and Perceived Value.

These areas dovetail perfectly with the design considerations outlined above.

Sometimes, an “off the shelf” solution which uses a basic package design, standard converting practices, and existing materials and packaging line equipment may be acceptable. In this case, the package development process may be simple, quick and relatively inexpensive. However, even under these circumstances, early package design involvement is key to making informed, intelligent package design decisions. When the situation is more complex, exploring packaging options early in the process becomes much more critical.

DESIGN CONSIDERATIONS:

Converting Factors

- The substrate, film, foil, and other package components that best suit the demands of the product and package environment.
- The converting processes, in order to develop a structural and graphic design that will function flawlessly through the converting process: an efficient layout which minimizes waste and spoilage and contributes to fast turnaround from design to manufacture.
- Detailing to ensure that finished cartons hold up well through internal handling, warehousing and distribution, and will arrive at the customer’s operation in perfect condition.

A well developed design can favorably impact the converter’s bottom line by minimizing waste, spoilage and make-ready time and maximizing run speeds. Accomplishing this without compromising the customer’s position or the ultimate end user, a sound design contributes profit potential to the converter and advantages to the customer and consumer.

Customer Factors

- Number and make-up of manufacturing sites.
- Receiving, storage and handling prior to use.



- Packaging line performance: feed, form, fill and close requirements; line speed demands and other factors such as packaging line environment (wet, cold, etc.) and off-line packing requirements.
- Handling, storage and distribution demands.
- Retail outlet needs: receiving and storage, shelf facings and display environments (dry, wet, cold, etc.).
- Proper sizing: for the product, for efficient handling on 48/40 pallets.
- Meeting all marketing objectives.

Designed effectively, the package will allow the consumer products company to maximize line speeds, and minimize machine down time, quality rejections, and damage in handling and distribution.

Consumer Factors

- Product protection: physical barrier, pilfer protection, etc.
- Convenience features: product visibility, opening and reclosing features, ease of home storage.
- Meeting both practical and psychological consumer expectations.
- Mandatory and informational copy required for making an informed purchase.
- Enhancing and promoting the quality and key features of the product.
- Post-consumer use and ease of disposal.
- Environmental considerations.

A well designed package can provide greater perceived value for a product, and be an integral part of developing repeat sales.

A comprehensive package design is more than an attractive structure that protects and dispenses product effectively. The structural, graphic and equipment designs incorporate environmental, ergonomic, consumer safety, safe manufacturing practices, fair packaging and labeling, and other similar governmental or industry laws, regulations and guidelines.

OTHER DESIGN CONSIDERATIONS

In addition to converter, customer and consumer requirements, other design considerations may include Federal, State, and Local Governmental Regulations and Guidelines:

- Food and Drug Administration (FDA): health and nutritional claims. Nutrition Labeling Education Act (NLEA) Tamper Evident Packaging
- Federal Trade Commission (FTC): environmental and advertising claims. Fair Packaging and Labeling Act (FPLA)
- National Conference on Weights and Measures (NCWM) Fair Packaging and Labeling Act (FPLA)
- Environmental Protection Agency (EPA)
- Department of Commerce – National Institute of Standards and Technology (NIST)
- International Government and Industry Agencies and Organizations
- National Trade and Industry Associations

DESIGN DEVELOPMENT RESOURCES

Consumer Products Companies

Most large consumer products companies maintain in-house packaging departments. Their responsibilities may include writing packaging specifications, conducting package testing, insuring optimum packaging line performance, acting as the liaison with material and packaging vendors, as well as package design. While package design may be accomplished completely internally, it is more often done in conjunction with major package or packaging component converters.

The fundamental purpose of the in-house packaging department is to insure that incoming packaging meets all internal demands. The strength of the consumer products company's package design group is their knowledge of the product, the manufacturing process, and their marketing and distribution needs.



Converters

Many paperboard packaging converting companies offer a variety of in-house design and development services which may include structural design, graphic design, mechanical packaging development, and market research services. They may operate separately or as an integrated "Creative Services/Resources" organization whose function is to meld the knowledge and capabilities of their respective groups with those of outside vendors such as commercial packaging equipment suppliers label or adhesive suppliers, and their customers' packaging departments to develop the best possible solutions in a timely fashion.

Creative services groups can deliver an invaluable service to smaller consumer companies with no in-house packaging departments, and can nicely complement their larger customers' packaging personnel, whose strength is an in-depth knowledge of their product packaging lines and distribution process.

Independent Design Firms

Independent package designers, industrial design or graphic design firms, or advertising agencies are also sources for structural or graphic package design. Their traditional strength is design objectivity, since they are not locked into a particular packaging medium or converter.

THE DESIGN FUNCTIONS

In the carton converting industry the design functions include the creation of the carton structure and graphics. It also encompasses the development of the packaging system which may involve grouping existing packaging components into a coordinated system or the design of entirely new equipment. This trio of design functions is frequently referred to as the creative services group.

Whether these functions are performed entirely by the carton converter or in concert with consumer products company packaging and engineering or with independent design and/or engineering resources, the process is essentially the same.

STRUCTURAL DESIGN

This is where the design process begins. While the tools have changed the process is the same. Drawing on a knowledge of the factors outlined on the previous pages, the designer develops a structure which becomes the foundation for creating a variety of products or services which may be provided by the converter, the consumer products company or a vendor.

A knowledgeable structural designer maintains constant communication with key material, converting, and consumer products group personnel to insure that the talent, capabilities and contributions of the entire package development team is incorporated into the final concept.

Through most of the 20th century the structural designer's tools of the trade were the drawing



Plotter / Samplemaker

Photo courtesy of ESKO Graphics

Once developed at the CAD work station, the design is electronically transferred to a computer-driven Plotter/ Samplemaker for preparation of cut and scored samples which will exactly match the CAD design and all subsequent design, pre-press or production programs or products developed from the original CAD design. Examples of these additional "products" include:

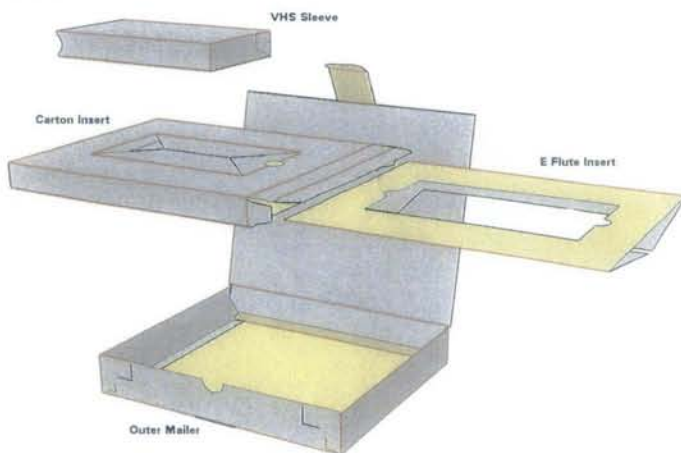
- *Art boards and vinyls*
- *Dimensional drawings*
- *One-up and production die programs*
- *Pre-production printed samples from press sheets matching the customer approval sheet*



board, drawing instruments, an X-acto[®] knife, and die knives. The graphic artist employed brushes, paints and illustration board; and a drafting table, slide rule, drawing tools and vellum were used by the mechanical packaging engineer.

Beginning in the late 1970's, the computer, industry-specific software, and specialized equipment such as the plotter-samplemaker (shown on page 0.205) had made their way into the design process. By 1990 the industry had essentially completed the transition to a CAD/CAM (computer aided design / computer aided manufacturing) system. Structural design, graphic design, mechanical packaging, engineering, graphic arts/pre-press, estimating/planning and purchasing were integrated as were the manufacture of a host of production tools such as die boards, counter plates, stripper boards and blanking tools.

Example of a CAD exploded view showing the component parts of a multiple-piece paperboard package.



Courtesy of International Paper

The CAD terminal is capable of turning out perspective views, exploded component views, glue sequencing, and a host of technical support documents so important to effective communications among converter, customer and suppliers in an increasingly demanding market.

It should be recognized that the computer is a contemporary design tool and this publication is a design resource. But, the "right" answer to a packaging requirement may not automatically be available from structural or graphic design software, CAD library, or a publication of this nature. The long term success of a designer and the company he or she is part of depends on a thorough understanding of the entire packaging process and the application of proper design, be it from a "CAD catalog" or a unique new structure as yet undiscovered.

GRAPHIC DESIGN

As in the case of structural design, the creative "process" is essentially the same as it has always been, but computer tools permit exploration of graphic design options faster and more comprehensively than could be imagined two decades ago.

Working from a computer file supplied by the structural design department, the graphic designer uses his or her computer tools to create a piece of digitized art, complete with text, graphics, color specifications, color bleeds, etc. The finished art is transferred electronically to a clear contact film, adhered to paperboard, and cut and scored on the plotter samplemaker to yield a customer presentation sample that will exactly match future production samples in structural and graphic detailing.

Communication to the graphic arts department, and to the customer, is electronic – swift and error-free.

The objective of the graphic designer is to meld the designer's creativity, converter's capabilities, customer's mandatory copy requirements and marketing objectives, retail outlet conditions and consumer expectations into an exciting, high impact design that will set the product and package apart from the competition.

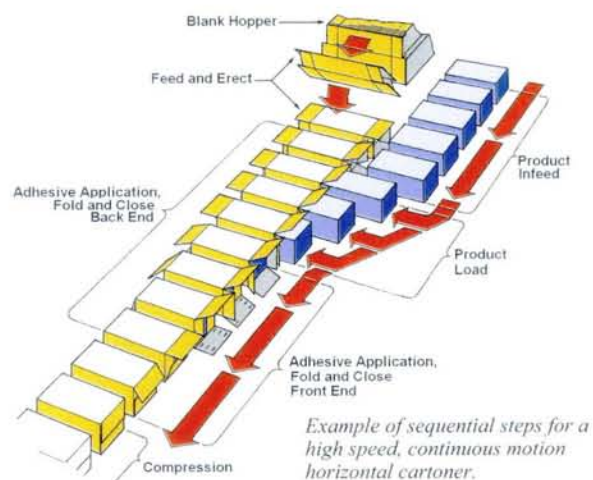


MECHANICAL PACKAGING

Mechanical packaging is usually a cooperative effort of converter, equipment manufacturer and customer packaging and engineering staffs. Packaging lines will run the spectrum from “off the shelf” commercially available equipment components to customized proprietary systems, or customer designed and built components.

Depending upon customer requirements, these packaging lines will range from intermittent motion and assembly concepts (30 cartons per minute) to high speed lines performing a variety of functions (cartridge fed, auto erect, load/fill, close, case pack, palletize and warehouse lines) operating in excess of 400 cartons per minute.

The most successful installations take full advantage of the knowledge and creativity of the converter, equipment manufacturer and customer. This ensures that the substrate, basic structure, and package and equipment design, optimize packaging line and distribution performance; taking into consideration the environment in which the equipment must perform, or food safety standards.



SPECIFICATIONS

Once the prototype carton, graphics, materials, costs, etc., have been approved by the customer, a document detailing the structure, graphics and all other information required to process the package

through conversion, packaging and distribution cycles, must be prepared and disbursed to all parties involved. This document is the **Package Specification**. The document is usually developed by the customer’s packaging department, but it will include input from the carton converter and other converting material or component suppliers, as well as other disciplines from within the customer organization; i.e., manufacturing, purchasing, engineering, planning, distribution, marketing, etc.

The **specification** becomes the communication vehicle which documents:

- Product Information: Name, weight, size, special properties, etc.
- Carton Data: Style, size, special features.
- Material (Substrate) Data: Paperboard type and caliper; film type, gauge, etc.
- Graphic Design Data: Finished art including graphics, type, mandatory or legal copy.
- Colors and Coating Data: Number of colors, type(s) of ink/coating, color match information.
- Printing Process: Type of process – litho, gravure, flexo, combinations.
- Special Features: Detailing related to windowing, embossing, hot stamping.
- Quantity: Desired volume with under/over run parameters.
- Packaging Line Data: Type of equipment, line speeds, etc.
- Shipping and Receiving: Specifications on converter packing, data on packing and palletizing, and customer receiving, warehousing and distribution data.
- Other: Any additional data specific to the job.

INTELLECTUAL PROPERTY

The focus of this publication is the creativity which can be applied to paperboard packaging. It documents past and present industry innovation, but this is an industry in constant flux. With changing materials, processes and technologies, new market



opportunities, and new personnel entering the industry with fresh ideas, it is virtually guaranteed that innovation will continue.

Individuals and corporations grow and prosper by capitalizing on their creative efforts. Knowledge of the types of protection available, their implications, and how to implement each is an important aspect of the design process. Under the broad title of *Intellectual Property*, Patents (utility and design), Trade Secrets, Trademarks, and Copyrights are available to the creative team as vehicles for documenting, protecting and exploiting innovation. The fundamental process is as follows:

- Documentation:
An important element in the creative process is to document novel concepts. A detailed description of invention, key date information, potentially unique features, benefits, etc., should be forwarded to counsel for possible action to protect and exploit the concept.
- Search and Evaluation:
Patent counsel searches and reports on novelty and infringement.
- Protective Action:
Circumstances will dictate what action is to be taken (assuming there is no infringement and identified utility, novelty and non-obviousness).

Protective action may be in the form of:

- Utility Patents:
Protection for the structure or function of new and useful processes, machines, articles of manufacture and compositions of matter. Utility patents applied for after June 8, 1995 have a duration of 20 years from the date of application.
- Design Patents / Design Registrations:
Protection for new and ornamental designs for articles of manufacture. Design Patents are valid for 14 years.
- Trade Secrets:
Information including a formula, pattern, compilation, program, device, method,

technique or process that provides a benefit and is now known or can be readily ascertained by others - and is kept secret. A patent is a teaching tool. For novel ideas where it would not readily be discernable that another party was infringing, it is best to treat this material as a trade secret.

- Trademarks:
Used to identify a company's goods or products and distinguish them from others in the marketplace.
- Service Marks:
Used to identify a company's services and distinguish them from others in the marketplace.
- Trade Dress:
Protects product and article configurations and/or packaging appearances that are used to identify the source of goods or services.
- Copyright:
Protection under law for original works of authorship (literacy, musical, drama and visual arts) which have been fixed in a tangible medium. It protects against copying. Generally, the duration of a copyright is the lifetime of the author plus 70 years.

A well managed Intellectual Property program can have both tangible and intangible benefits to the corporate bottom line. A customer's positive view of a converter's position as an innovator can contribute to continued or expanded business. Solid patent protection can create new customer opportunities. Additionally, it affords the potential for royalty income through a national or global licensing program.

The designer is an important member of the team creating, protecting and exploiting a corporation's intellectual property. The information contained here is only a "sketch" of the process. Designers and engineers should avail themselves of the knowledge and expertise of patent counsel to insure they are effectively contributing to the protection of this valuable corporate asset.



Once design and costing are complete, the pre-production phase begins. *Pre-production* includes all products and activities required after an order is received, but prior to the actual manufacture of cartons.

PURCHASING

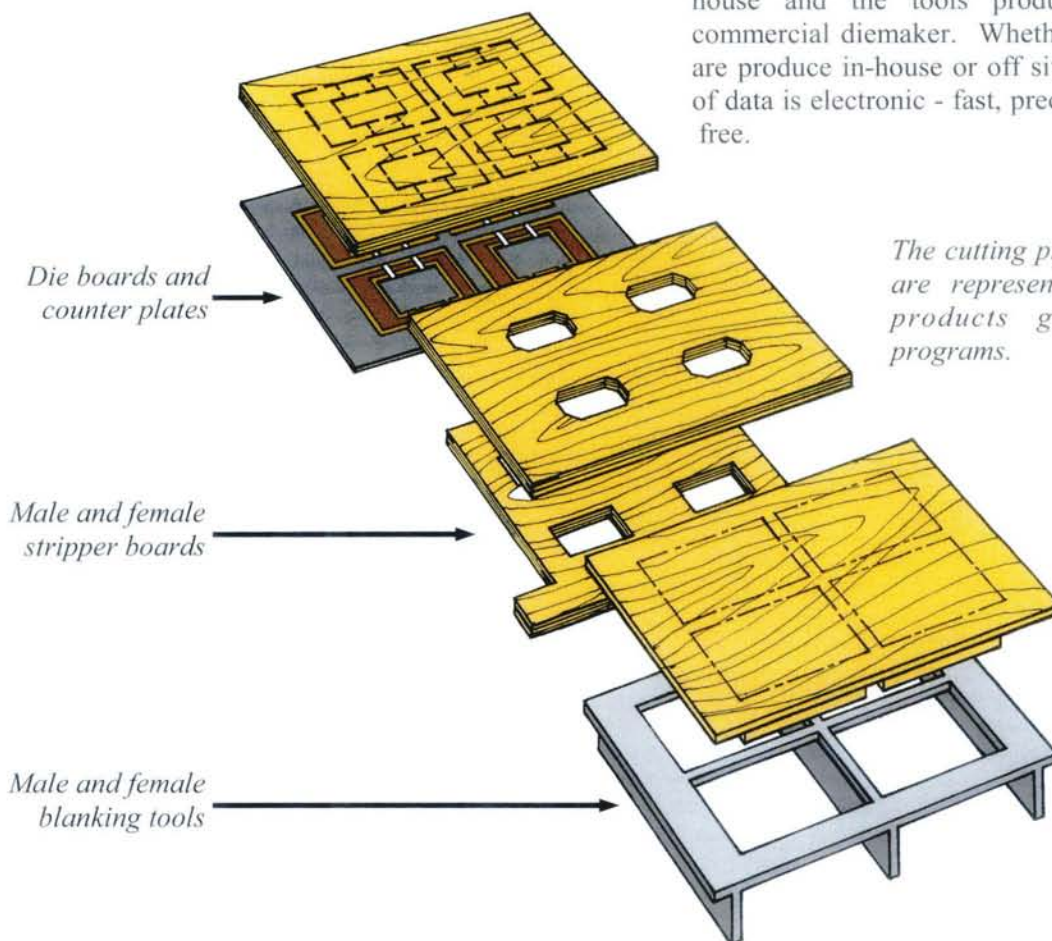
Outside materials required for the production of the cartons must be acquired, including board, inks, film and other raw materials associated with the job.

COMPUTER ASSISTED MANUFACTURING (CAM)

The CAD program becomes the foundation for a series of *CAM* (Computer Assisted Manufacturing) products and services associated with the manufacture of dies and related products including:

- Production die layouts (paper copies and programs) used to create laser burned die boards and to calculate the materials required to manufacture the die.
- Manufacture of support products (counter plates, stripper boards and blanking tools) which use the computer production die program as the point of reference.

Typically the CAM programs are produced in-house and the tools produced off site by a commercial diemaker. Whether goods and services are produce in-house or off site, the communication of data is electronic - fast, precise and virtually error free.



The cutting press tools illustrated here are representative of manufacturing products generated from CAM programs.



ELECTRONIC PRE-PRESS

“Pre-Press” is the term used to describe the actions and processes that take place between the creation of original art and the actual printing. Pre-press traditionally included the steps of making color separations and films from an original piece of hand-rendered art mounted on illustration board, analog proofs, production films, plates and press proofs. This process has changed and further changes are on the way.

As the graphic designer’s product has evolved from hand-rendered to digitized art, so has the pre-press operation.

The first change was to eliminate the color separation process; taking the digitized art directly to computer generated proofs, then on to full production films. This system **Computer-to-Film (CtF)** transitioned to an even more direct process - **Computer-to-Plate (CtP)**, which eliminates the film process completely.

A technology pioneered by the commercial printing industry, CtP is now a standard procedure

in much of the paperboard packaging industry. In this process, input from the CAD/CAM and graphics work station is combined to create digitized production art that is transmitted to a Raster Imaging Processor (RIP) which performs the color separation function, creates a digitized production proof, and transmits digitized data to the plate-making unit.

A newer technology, **Direct-to-Press (DTP)** further streamlines the system by eliminating off-press generation of printing plates; blurring the line between traditional “pre-press” and “press” functions. **Direct Imaging (DI)**, one iteration of DTP does exactly what the name implies - creates a laser generated image directly to the plate, on press (Figure 1).

“Plateless” printing is a second DTP concept in which a laser generated image is transferred to a specially coated cylinder on press (Figure 2).

Both DTP technologies are new, small format, relatively slow processes, but they offer high quality, quick change, low cost printing suitable for many small volume niche packaging markets.

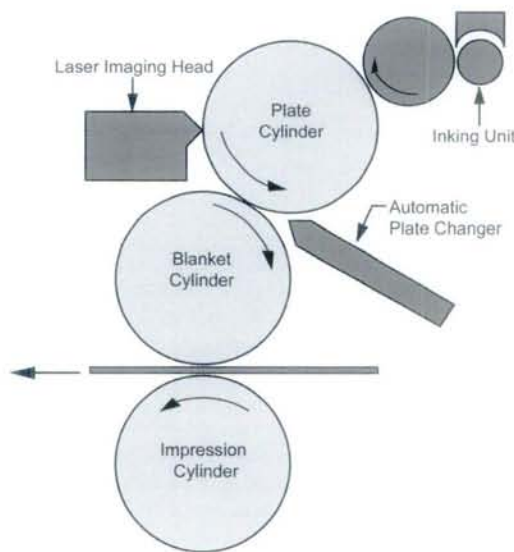


Figure 1: Direct Imaging

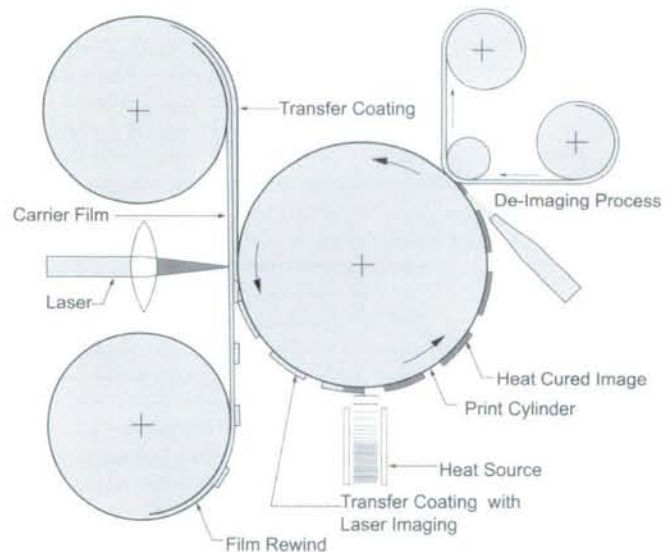


Figure 2: Plateless Printing

Note: This diagram illustrates the basic imaging and “de-imaging” processes of one plateless printing concept, but is not intended to illustrate an actual press configuration.



THE CONVERTING OPERATION

The major emphasis of this publication is paperboard packaging, but it should be noted that the equipment in the typical carton converting plant is not limited to the production of paperboard cartons. A broader view would be to treat the converting operation as a means of processing conventional or small flute paperboard to create a “product.” This “product” may be a carton, or something else entirely.

The most typical flow of material (paperboard) through the converting operation would be:

- Receiving paperboard: In roll or sheet form from a paper mill or jobber. Sheeting a roll of stock in-house may take place as a separate operation.
- Printing: “Printing” should be viewed as both a decorative and functional operation. In addition to carton graphics, this is the stage where barrier or protective coatings may be applied, or a waxing or laminating function performed.
- Diecutting: Here, too, “diecutting” is too limiting a term. This function should be regarded as the stage where the paperboard sheet is further converted by cutting, scoring (creasing), debossing, embossing, stripping, etc., to change the printed sheet into a carton blank or other type of paperboard product. Some converters may include other operations such as hot stamping or application of holograms as part of the “diecutting” or “cutting” function.
- Finishing: Fundamentally, this function covers windowing and gluing, but again this represents only a portion of the possibilities. The finishing operation may be viewed as anything that is done to the paperboard blank after diecutting and before shipping to the customer. This would include combining with other substrates, couponing, imprinting or coding, skiving, edge treating, perforating or diecutting film or paper (windowing), metal edging, as well as the more traditional operations of windowing and gluing to complete the transformation of paperboard blanks into folding cartons.

- Warehousing and Distribution: The finishing department typically delivers glued, folded and collapsed cartons which are case-packed and/or palletized before proceeding to warehousing prior to distribution to the customer’s packaging operation. A relatively recent variation on this theme is to pack cartons or blanks into cartridges or forms that are compatible with the high speed packaging line in the customer’s plant. This facilitates high speed automated handling of blanks or cartons; a necessary element for many of today’s packaging lines.

If the preceding is the “typical” flow, it should be mentioned that there are notable exceptions to the rule. Some worthy of mention are:

- Unprinted blanks (shells) which ship directly from the diecutting operation, bypassing the printing and finishing operations. This is typical for the frozen food industry.
- Shipping printed, non-glued blanks directly from the diecutting operation to the customer. This is the usual procedure where the customer has fully automated packaging lines for forming, loading, and sealing cartons. Examples of this are printed flip-top tobacco cartons and printed, locked corner trays with glued covers for the frozen food industry.

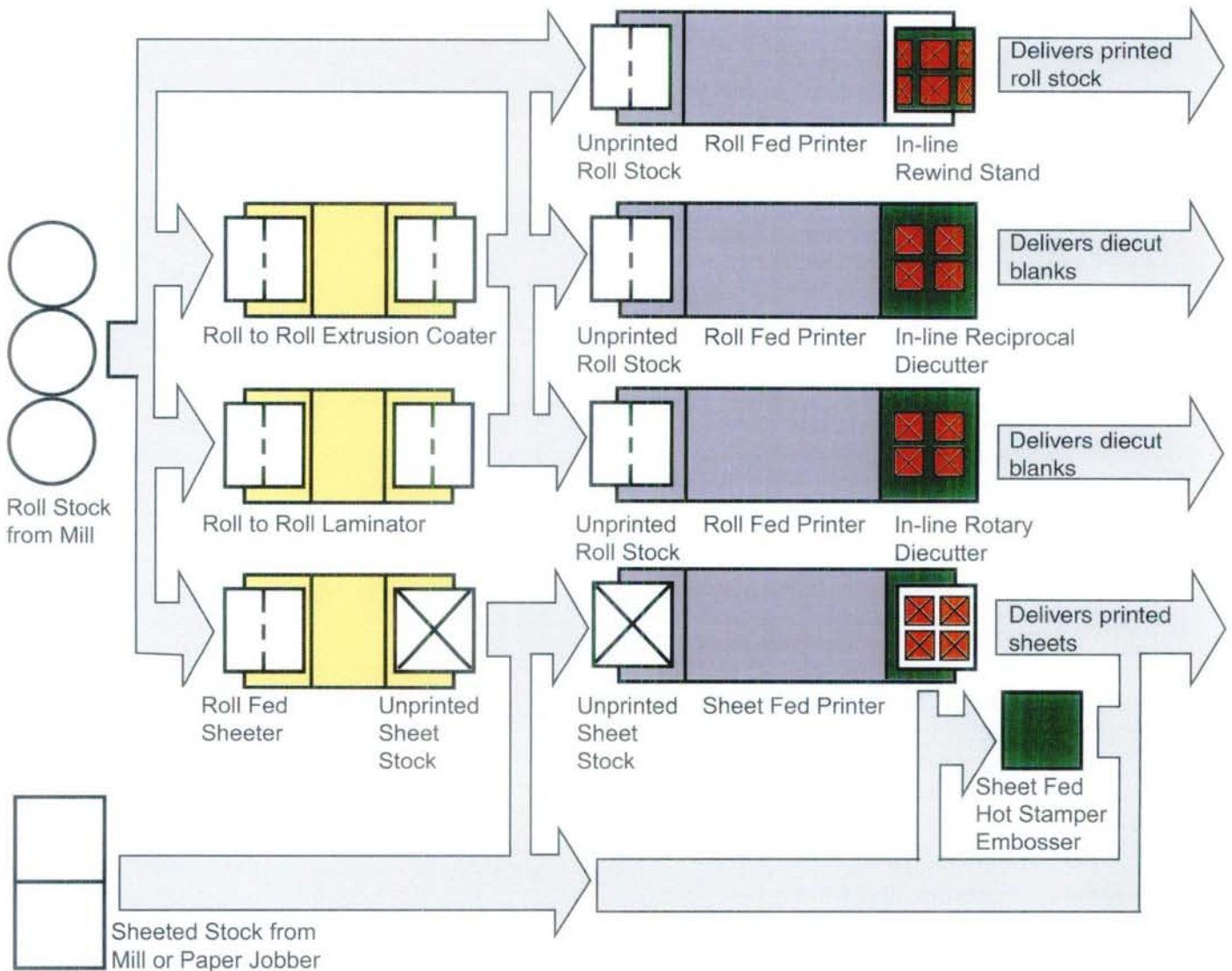
Another example exists in the fast food industry where in some instances the blank is not glued and folded flat for delivery to the customer, but rather where tapered trays or scoops are glued in rigid erected form, nested and wrapped for distribution (e.g. tapered trays).



THE PAPERBOARD PACKAGING CONVERSION PROCESS

The flow chart illustrated here is not intended to represent the typical folding carton converting facility. It is unlikely that any given plant would be configured as shown. Rather, the chart is intended

to demonstrate the basic flow from raw material (roll or sheet stock) in one end and a finished product (a folding carton or other paperboard product) out the other end.



RECEIVING / PRE-PRODUCTION PREPARATION

Sheeting roll stock.
 Laminating or extrusion coating to one or both sides of the paperboard (if not received in this form from mill).

PRINTING

Printing and/or coating on one or both sides of the paperboard via: web or sheet fed offset lithography, letterpress, gravure or flexographic processes.

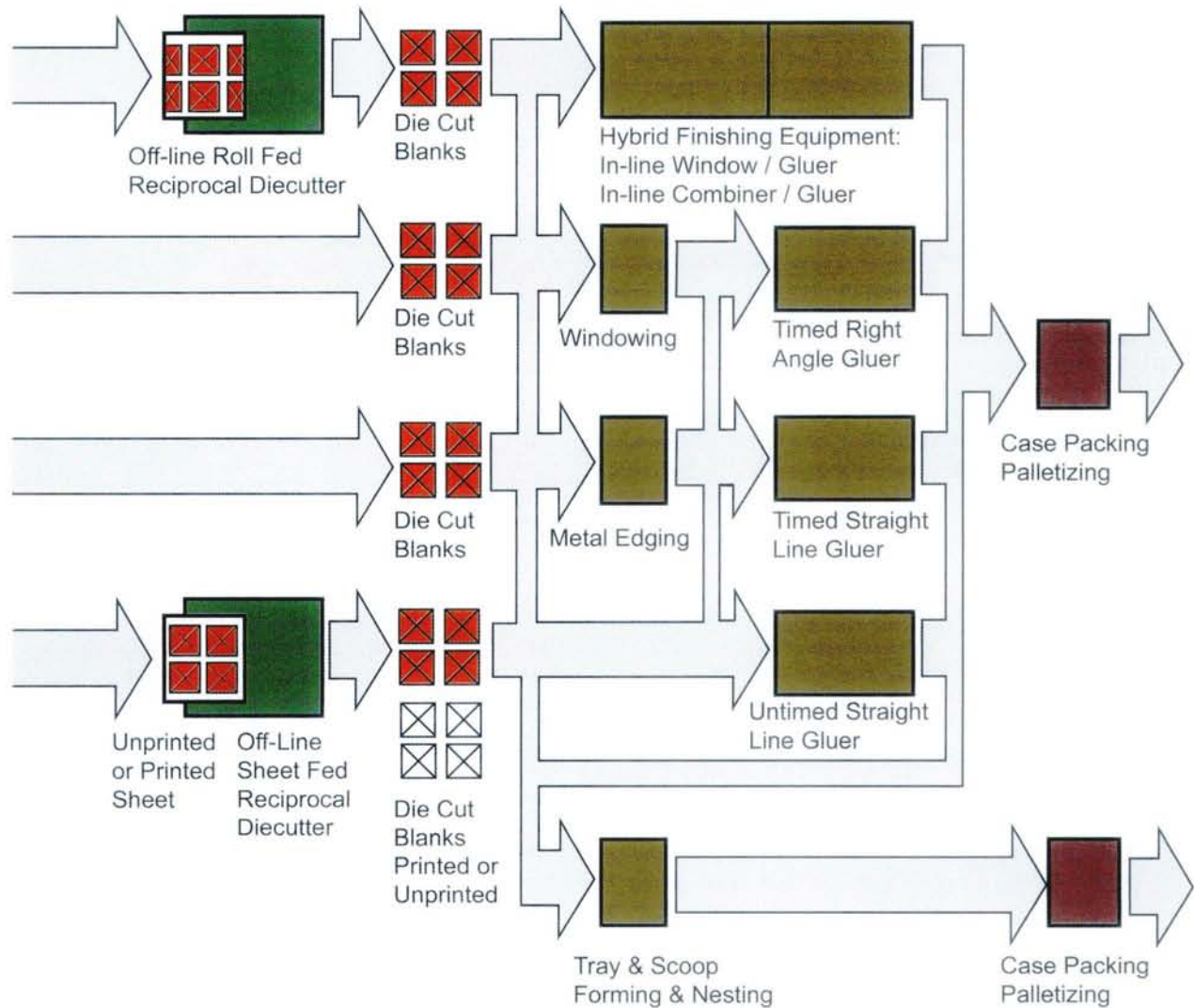
CUTTING

Cutting and scoring.
 Internal and external scrap removal.
 Hot stamping, embossing.



Further, it illustrates the various types of converting equipment that might be seen in each of the major facets of the converting process (printing/cutting/finishing). It also hints at the many options available in the converting process; each one

contributing in its own way to the creation of paperboard packaging solutions that meet the demands of customers with a broad range of product protection requirements, distribution and marketing expectations.



CUTTING
 Cutting and scoring.
 Internal and external
 scrap removal.
 Hot stamping, embossing.

STAGING

FINISHING
 Folding & Gluing
 Windowing
 Metal Edging
 Tip-on & Couponing
 Coding & Imprinting
 Tape/String Insertion
 Combining
 Skiving
 Labeling
 RFID Tags
 EAS Tags
 Plastic Edging

DISTRIBUTION

Case packing and
 palletizing
 Stretch/shrink wrap
 Warehousing and
 distribution



In elementary form, the major functions of the converting plant have been described as printing, diecutting and finishing; but it should be noted that for each of these functions there are several fundamental process options. The following pages will examine these operations in greater detail.

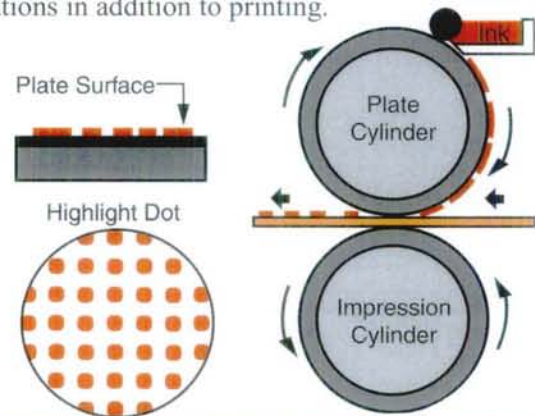
PRINTING

There are a number of different printing processes used for folding carton production. Each process has unique performance and production characteristics which may influence the selection that is best for reproducing the graphics of a particular design. Factors used in the selection of a specific process include:

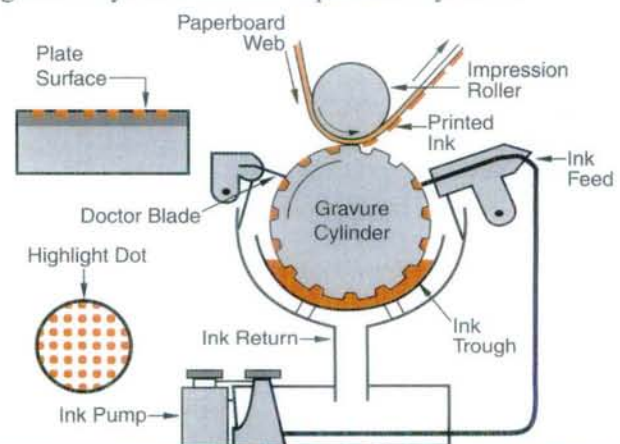
- Length of the run (order quantity)
- Complexity of the graphics
- Quality requirements
- Color requirements
- Register tolerance
- Desired ink coverage
- Make-ready time
- Cost of plate and die preparation

There are four primary printing processes used in the folding carton industry: **Letterpress**, **Gravure**, **Flexography** and **Offset Lithography**. All of these printing processes involve the application of ink to a printing plate and the transfer of the ink (the image) to the substrate. These methods may process substrate in sheet-fed format, which uses individual sheets fed into the press; or in web-fed format, which uses entire rolls of substrate.

Letterpress is the oldest printing process in the industry and consists of platen, flat-bed cylinder and rotary type presses. The printing plate uses a raised surface to carry the ink which is transferred directly to the substrate. Letterpress process has good ink quality and results in a clean, sharp image. Once a dominant process, it is currently the least used, but is good for short-run orders and can be modified for embossing, cutting and scoring operations in addition to printing.



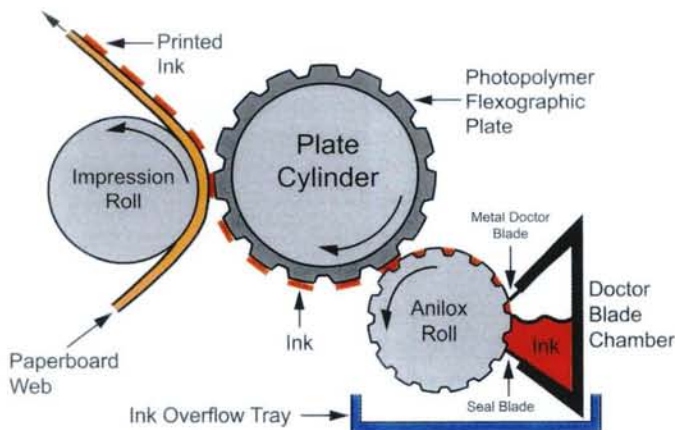
Gravure, or rotogravure, printing results in very high quality printing, producing solid color, good coverage and clean multi-color process work. It is also excellent for applying fluorescent and metallic inks. Gravure does not utilize printing plates but instead uses an engraved cylinder (gravure cylinder). The gravure cylinder has thousands of tiny, etched cells on its surface. This cylinder rotates in an ink bath. A doctor blade removes the excess ink, leaving ink in the cells. The ink is transferred as the substrate passes between the gravure cylinder and an impression cylinder.



While there are some sheet fed gravure presses in use, most gravure operations in the carton industry are web fed presses with six or more printing stations (stacks); one or two of which are capable of printing on either the front or back of the sheet and/or applying special inks (metallic, pearlescent, fluorescent) or coatings (ultraviolet). In the gravure process, one cannot separate printing from cutting since many, if not most, of the presses in this industry have reciprocal or rotary diecutters integrated into the delivery end of the press. Another option is to print roll-to-roll, then sheet and diecut as separate operations. The fundamental process is generally as follows:

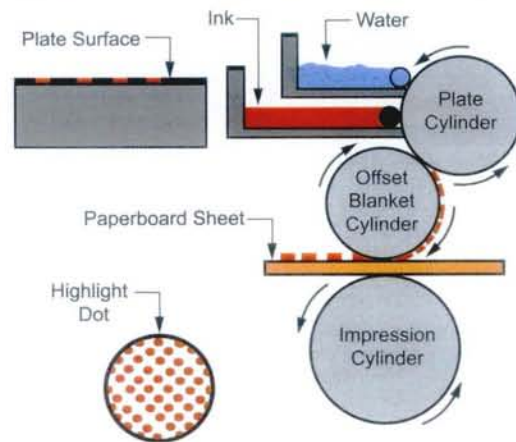
1. Unwind
2. Print
3. Dry or cure ink or coating
4. Repeat Step 3 for as many colors or coatings as required
5. Diecut or rewind

Flexography, or flexo, is an adaptation of letterpress printing, featuring a rubber or photopolymer printing plate with raised surfaces that carry the ink. In flexo, the ink is transferred first onto an anilox roll, which is essentially a fully engraved gravure cylinder. The anilox roll transfers the ink to the raised portions of the printing plate cylinder that transfers the ink to the substrate. Flexo is exclusively a web-fed process.



Traditionally considered a lower quality process for longer-run commodity cartons, flexo's quality and make-ready times have improved dramatically in recent years. Flexography provides solid color and good ink coverage. As the quality has improved, the use of flexography for printing cartons has grown and is challenging gravure for some applications.

Offset Lithography is currently the most widely used printing process for folding cartons. Lithography is used for high quality process printing and achieves very high screen quality.



Graphic quality is excellent and the process is economical for short or long runs. The lithographic printing plate is planographic, or level, consisting of imaging surfaces that repel water, and non-imaging surfaces that accept water. The printing plate is attached to a cylinder that is covered in water before the ink is applied. When the ink is applied to the plate, the surfaces that accept water *repel* the ink, but ink *remains* on the imaging surfaces that repel the water. As the plate cylinder turns, the image is transferred to the offset blanket cylinder, which then transfers the image onto the substrate running in between the blanket cylinder and an impression cylinder. The process is called "offset" because the plate does not directly contact the substrate.

Traditionally, litho presses are sheet fed, but in the past two decades narrow web offset presses have become more prevalent.



Most of the time, a single press will utilize a single method of printing. There are some combination presses in existence that combine different methods to achieve results that could not be accomplished by a single printing process alone. Examples of these presses include flexo/gravure and offset presses with gravure stations for coating and spot colors.

Below: A contemporary sheet fed offset (litho) press capable of continuous printing up to 15,000 sheets per hour

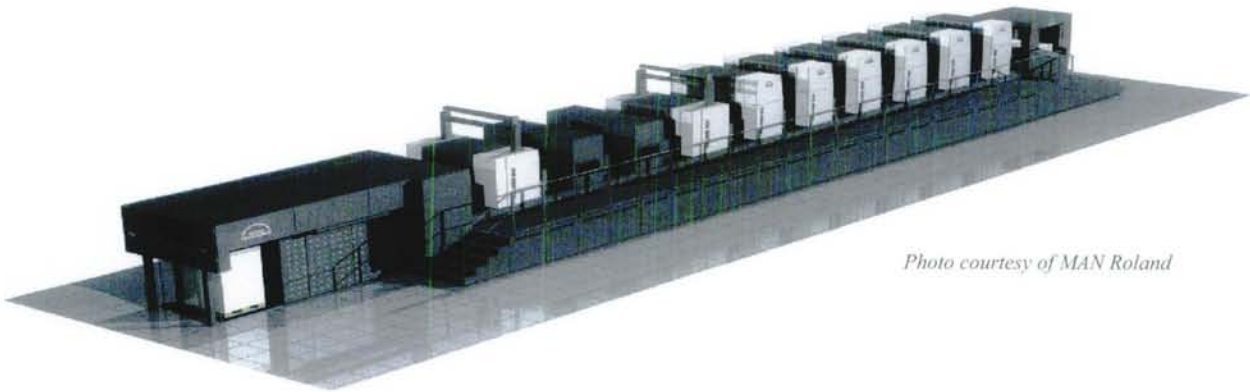
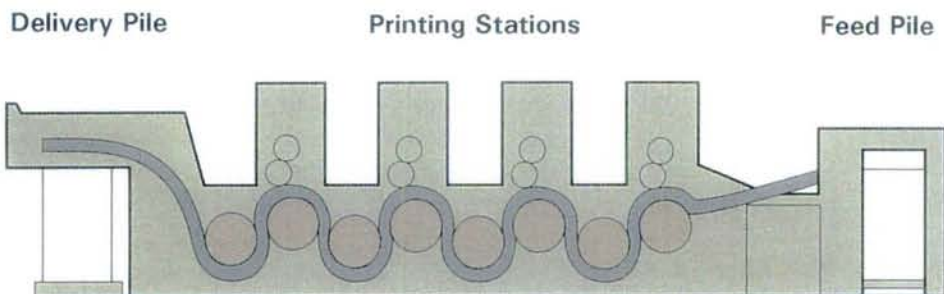


Photo courtesy of MAN Roland

Following the laying down of inks, a coating is often applied to provide gloss, protect the inks from rubbing and smudging, or to impart water, grease or chemical resistance to the printing and substrate. These coatings may be applied by a station on the printing press, a special coating unit on the press, or on an off-press coating unit. Coatings may consist of a varnish, water-based, or UV (ultraviolet) coating. UV coatings are cured by exposing the wet coating to an intense ultraviolet light.



*Typical flow through a contemporary sheet fed offset press.
Note: Some presses are equipped with double pile delivery to facilitate continuous high speed printing.*

DIECUTTING

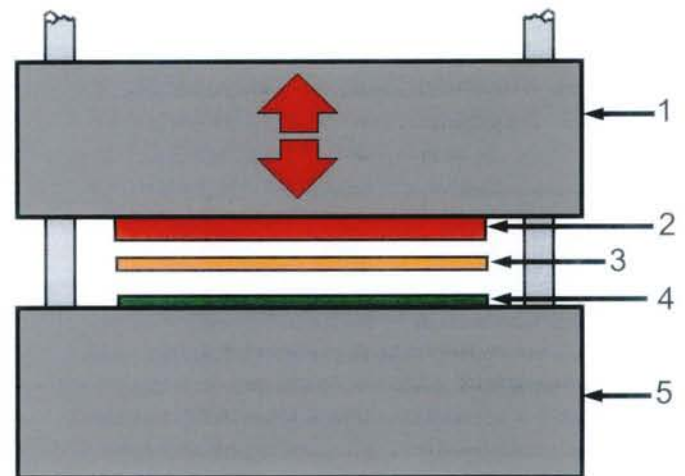
There are two fundamental types of cutters used in the paperboard packaging industry. The first category, *flat bed cutters*, utilize flat dies made of wood, metal or composite material bases, and steel cutting or creasing rule.

The second category, *rotary diecutters*, use cylindrical etched or machined steel dies and machined cylindrical counter plate units.

Flat Bed Diecutting

Flat Bed (Reciprocal) Diecutting ranges from a simple hand-fed “clam shell” flat bed cutter to a large width, fully automated reciprocating intermittent motion cutting and stripping press, which operates as an integral part of a web fed press or as a free standing sheet fed unit. The latest generation of reciprocal cutting presses have integrated stripping and blanking capabilities which transform printed sheets into stacks of carton blanks with all scrap removed. Embossing and debossing (imprinting) are also functions performed on the cutting press; the limitation being the press’s tonnage pressure capability versus the pressures required to render good cut, crease and emboss definition across the entire surface of the press sheet.

Below: Elevation View of a Reciprocal Diecutter



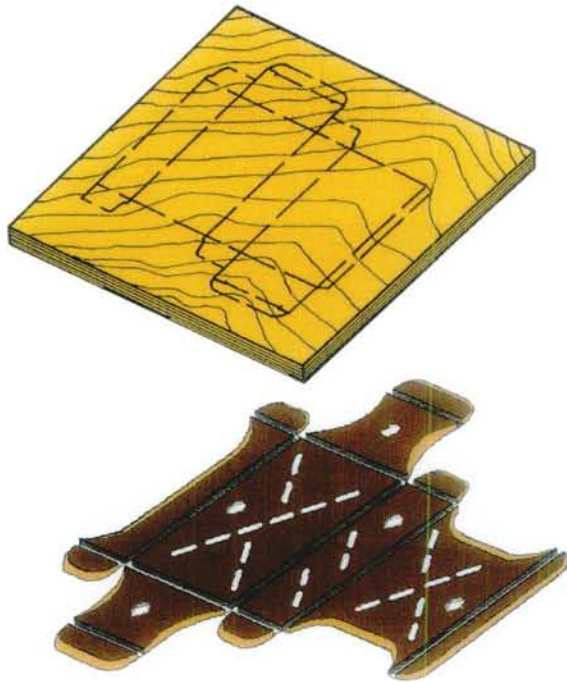
1. Platen
2. Die Chase
3. Paperboard Sheet
4. Counter Plate(s)
5. Impression Plate



Photograph courtesy of Bobst Group, Inc.

Left: A contemporary sheet fed, intermittent motion, reciprocal cutter with integral blanking unit capable of speeds up to 15,000 sheets per hour.





Today's cutting press utilizes die boards, counter plates and stripper boards generated from the same CAD program used to develop the original design. These production tools exactly match the original carton design as well as the printing plate layout.

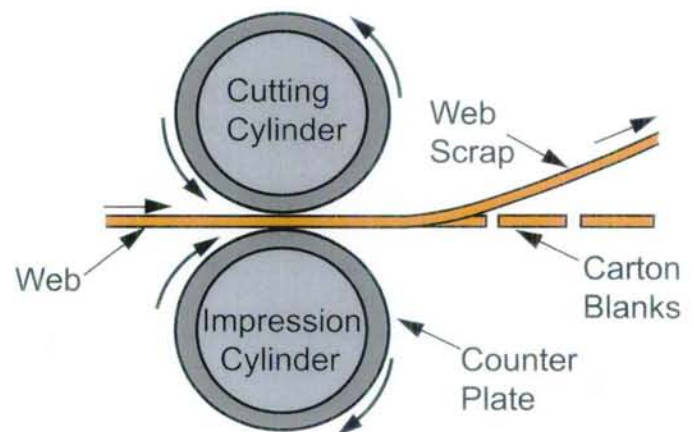
Left: Examples of a computer generated, laser burned, one-up die board and a computer driven, routed, one-up counter plate.

Rotary Diecutting

Rotary diecutting was explained briefly under gravure printing, and indeed rotary diecutting is almost exclusively employed as an integral part of a web fed printing press.

In rotary diecutting, there is a single point (or line) of contact between the die and back-up cylinder. Cut and score definition is excellent. Another advantage is that the rotary diecutters are capable of matching the potential speed of a web fed printing press. Cutting is not the speed limiting factor here that it is for inline reciprocal cutting. The disadvantage of rotary diecutting is higher cost and greater lead time required for manufacturing dies as compared to the simpler and less costly flat dies used on flat bed or reciprocal diecutters.

Rotary dies are best suited for business where design changes are minimal and typical production runs are quite large. Here, higher run speeds and the opportunity to reuse the die many times can offset the higher costs and greater lead time requirement. The classic gabled top milk carton is an excellent example of the type of business perfectly suited to rotary diecutting.



The diecutting process, reciprocal or rotary, can be viewed simply as a means of converting paperboard from sheet form to individually cut and scored carton blanks.



CUTTING DEPARTMENT FUNCTIONS

The following illustrates and describes cutting department techniques for scoring or otherwise manipulating the surface(s) of paperboard to create functional means for folding, tearing or enhancing glue adhesion or decorative means to enhance package graphics.

FUNDAMENTAL SURFACE SCORING, DEFLECTING and/or ENHANCING TECHNIQUES

CUT

The paperboard is cut through 100% from outer (clay) surface. Typical uses:

1. To separate blank from base sheet.
2. To separate blank into individual component parts.
3. To be incorporated into other means of scoring paperboard; i.e., cut and crease or perforation type lines of weakness.

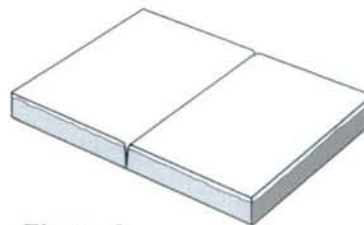


Figure 1

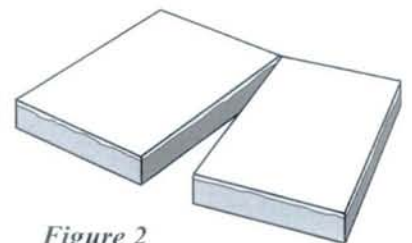


Figure 2

CREASE SCORE a.k.a. BAR SCORE

A controlled line of weakness created by depressing a round head steel rule into the paperboard, typically from the exterior (clay) side to form a fold line with an unbroken outer surface. This is the most widely used method of creating fold lines between panels, flaps and tabs of the typical folding carton.

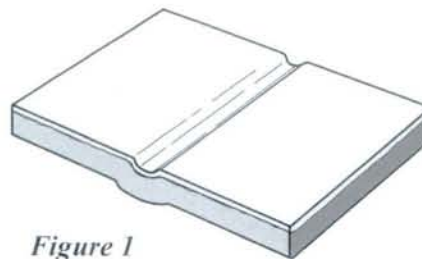


Figure 1

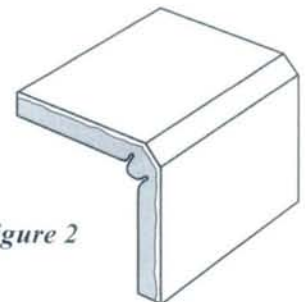


Figure 2

CUT SCORE a.k.a. HALF SCORE

An alternative type fold line to the crease score, cut approximately 50% through from the outer (clay) surface. Cut scores fold easily and cleanly, but interior fibers are exposed in the folded state. Cut scores are frequently incorporated into opening features; i.e., double cut score, or in combination with a perforation type line of weakness, to control accidental top surface delamination.

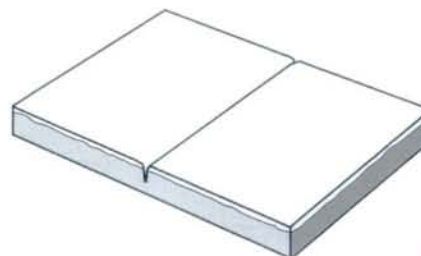


Figure 1

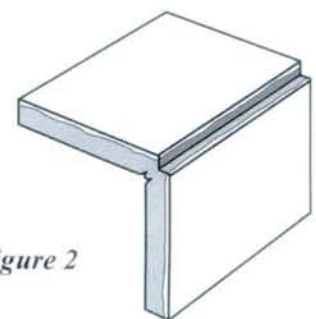


Figure 2

PERFORATION

A line of weakness comprised of intermittent cuts and spaces. Used as the primary type of scoring for reverse folding paperboard. Perforation may also be incorporated into various types of tear strips or opening features.

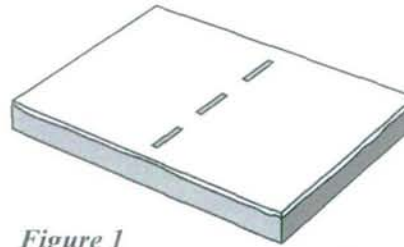


Figure 1

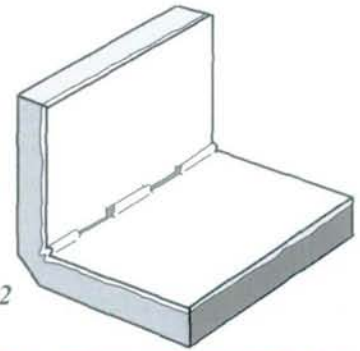


Figure 2

REVERSE CUT SCORE

An alternative to the perforation as a means of reverse folding paperboard. Cut approximately 50% through from the inside of the paperboard sheet.

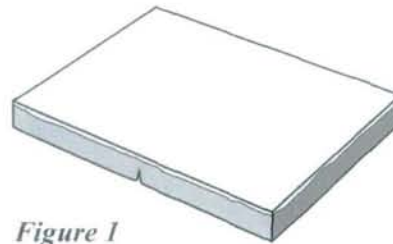


Figure 1

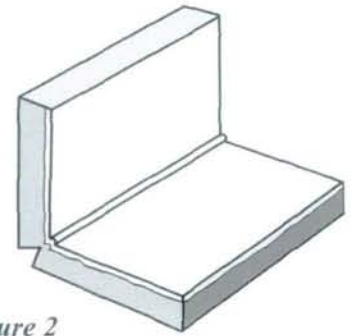


Figure 2

DOUBLE CUT SCORE

Pairs of offset and parallel cuts approximately 50% through from opposite sides of the paperboard sheet. Commonly used as an element of a tear strip as shown here, or incorporated into an opening feature as shown on page 7.201.

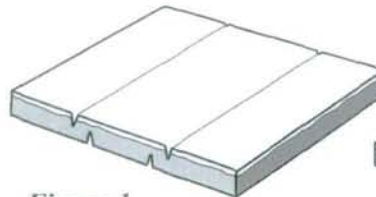


Figure 1

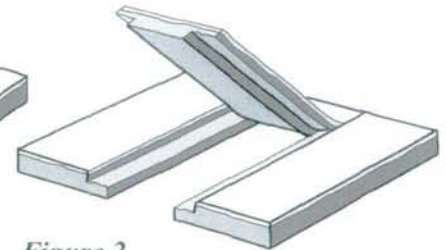


Figure 2

CUT and CREASE SCORE

An alternative to the crease score or cut score for forming a folding type line of weakness. Presents less resistance to folding than the conventional crease score, and is less prone to accidental top surface delamination than the cut score. Because the top surface is interrupted by cuts, this technique is generally limited to internal scores not visible when viewing the erected carton.

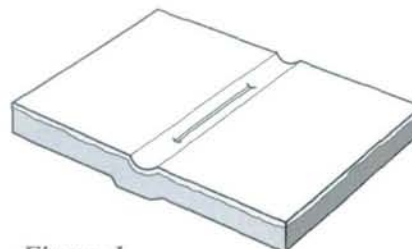


Figure 1

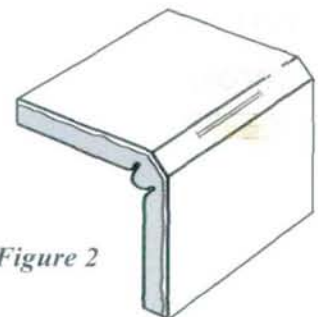


Figure 2



EMBOSSING

Conventional embossing raises a selected area of paperboard above the outer (clay) side of the sheet. Conversely, a negative embossing (a.k.a. debossing) depresses a selected area in the surface of the sheet. Each may be used as a decorative element or as a functional element to enhance gluing or heat sealing of end closure flaps or the like.

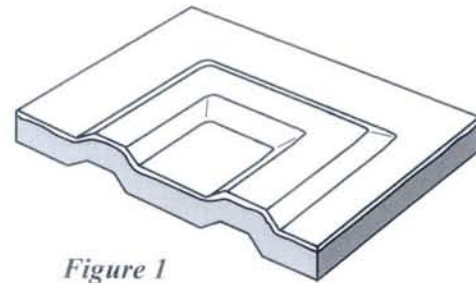


Figure 1

HOT STAMPING

A pattern of foil is transferred from a carrier roll of film onto the paperboard surface by means of a hot die (Fig. 1). Hot stamping can be combined with embossing to yield a pattern of foil embossings on a printed or unprinted paperboard surface (Figure 2).

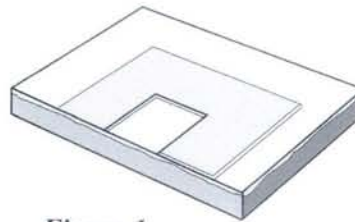


Figure 1

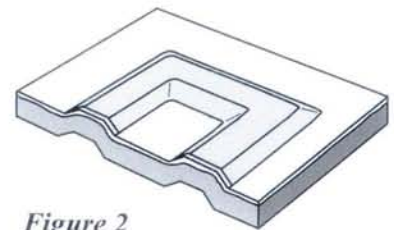
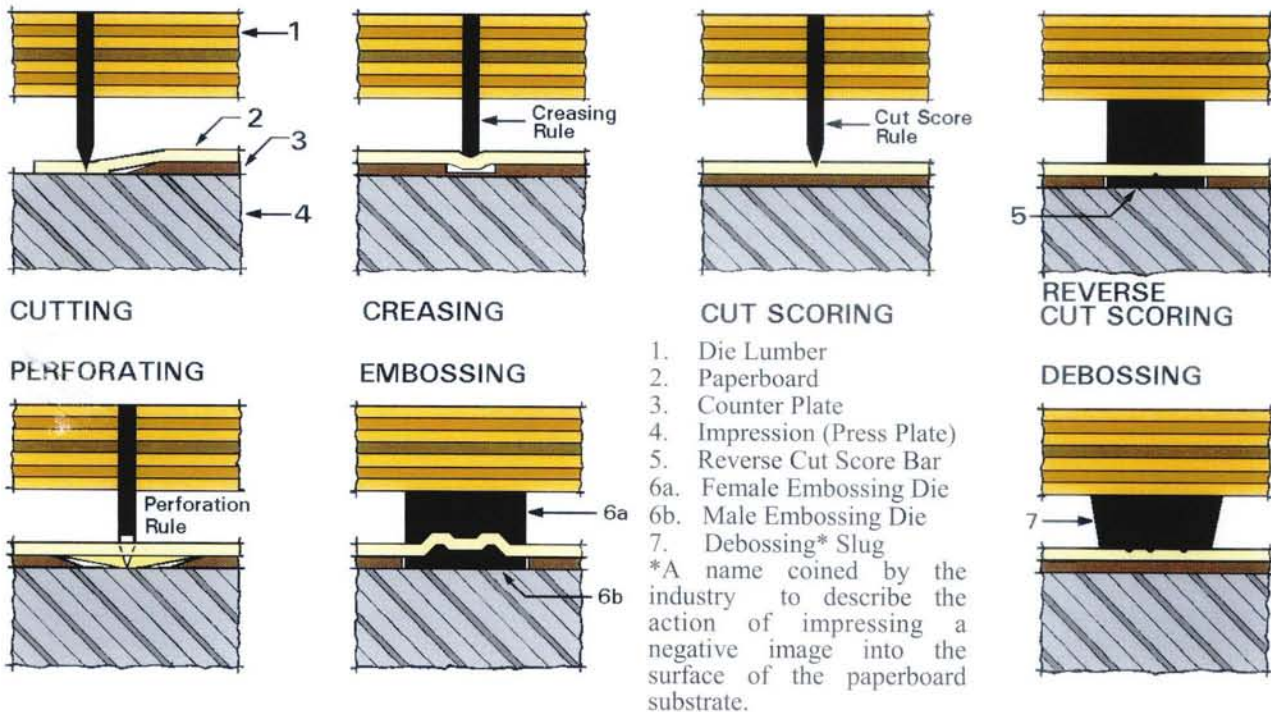


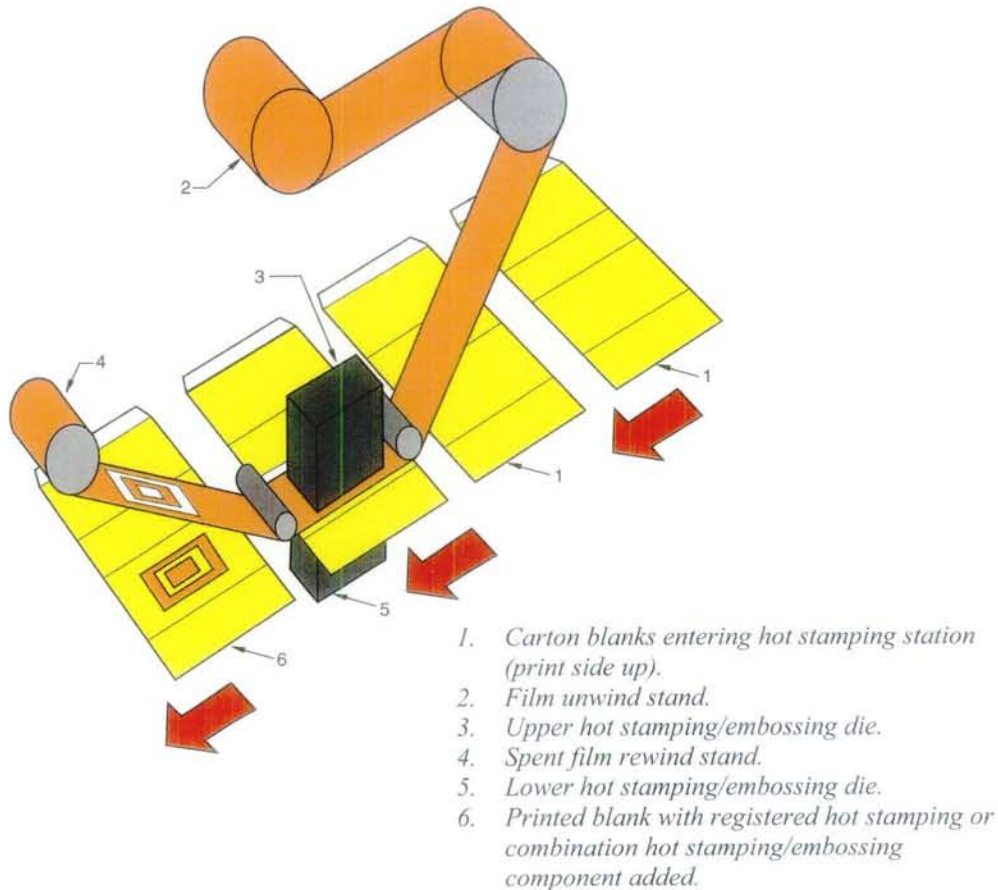
Figure 2

The drawings below illustrate how each of the afore mentioned techniques, with the exception of hot stamping, is achieved on press. Refer to page 0.412 for information on the hot stamping process.



Hot Stamping

Hot stamping may be a separate function or integrated with embossing. Like embossing, it is generally considered to be a function of the cutting process even though both are “decorative” in nature.



Note: For this illustration the hot stamping is shown being applied to an individual carton blank. In practice, this is a sheet fed, multiple row, multiple die operation.



THE FINISHING PROCESS

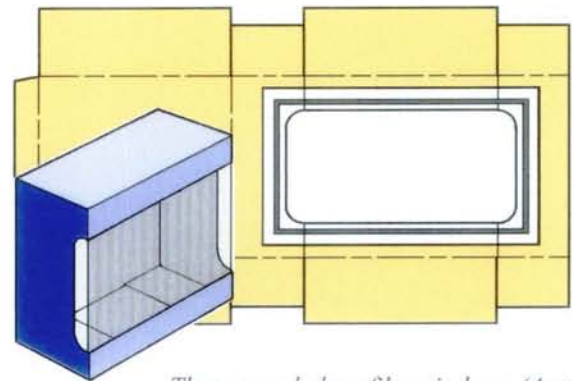
The two primary operations of the finishing department are windowing and gluing. However, these simple terms do not adequately describe the scope of this operation. The many finishing department functions are performed using four basic pieces of equipment:

- Windowing machine
- Untimed straight line gluer
- Timed straight line gluer
- Right angle gluer

WINDOWING

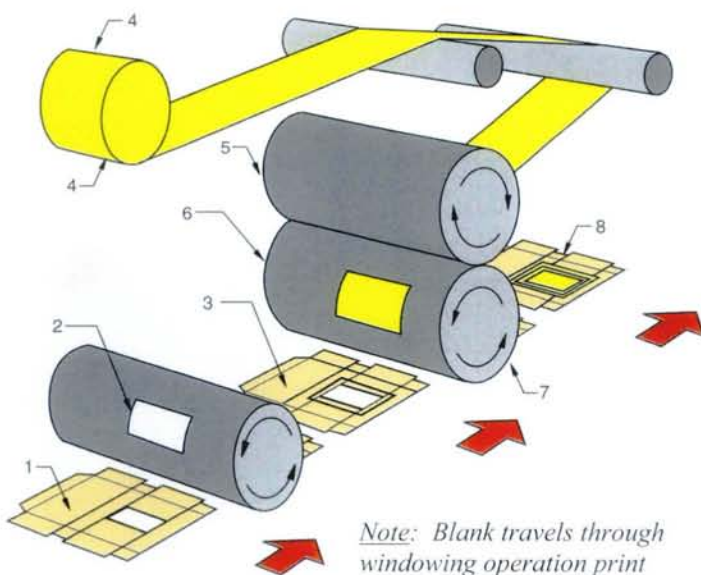
Following is the fundamental window machine operation:

1. Transfer carton blanks from a hopper, place them onto a timed or flighted conveying means.
2. Apply a registered pattern of adhesive to the blank.
3. Simultaneously unwind a web of flexible material (film, paper, or the like) from a roll stand.
4. Chop off a patch of the flexible material, transfer and place the patch onto the blank in register with the adhesive pattern.



Three-panel clear film window. (Acetate, polyester, polyethylene, polypropylene, etc. depending on design requirements.)

As with most of the converting operations, the general term used to describe the function only hints at the total potential. The most elementary operation in the windowing function is the simple application of a clear film patch covering a diecut aperture in one or more panels of a carton blank. The window provides product visibility and, in some instances, a degree of product protection and/or pilfer resistance.



Note: Blank travels through windowing operation print side down.

Elements of the Basic Window Machine

1. Carton Feed Station: Blank picked from hopper (not shown) and placed onto flighted conveyor.
2. Adhesive Application: Pattern of adhesive laid down on inside of carton blank.
3. Transfer Station: Carton blank advances toward window application station.
4. Film Unwind Stand.
5. Film Chop Station.
6. Vacuum Transfer Cylinder: Moves film patch in register toward carton blank.
7. Windowing Station.
8. Compression Station.

This basic piece of equipment can be customized to achieve a variety of special effects. In some instances, windowing machines will function in tandem with a gluer, integrating windowing and gluing into a single pass operation.



A great deal of creativity can be applied to the windowing operation, particularly between the film unwind stand and the film chop station.

The film web can be perforated, diecut, slit, folded or imprinted. Tear strips can be applied. Tube stock can be substituted for plain film to create a lined carton, and multiple rolls can be unwound creating overlapped film patches or multiple windows on a single blank. Several of these options are illustrated below.

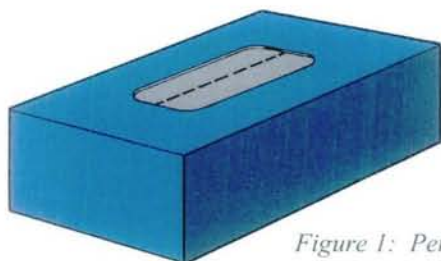


Figure 1: Perforated Film

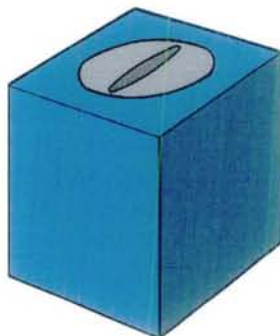


Figure 2: Diecut Film

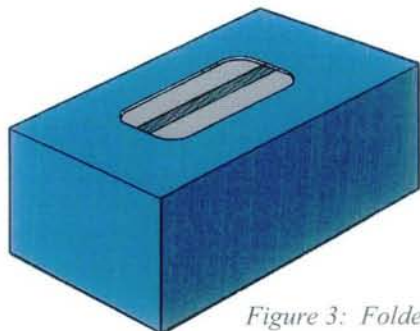


Figure 3: Folded or Overlapped Film

The applications shown above are common to the facial tissue trade. Those to the right represent sift resistant, barrier and decorative features, respectively.

Full or partial inner tubes or end patches are also viable window machine options.

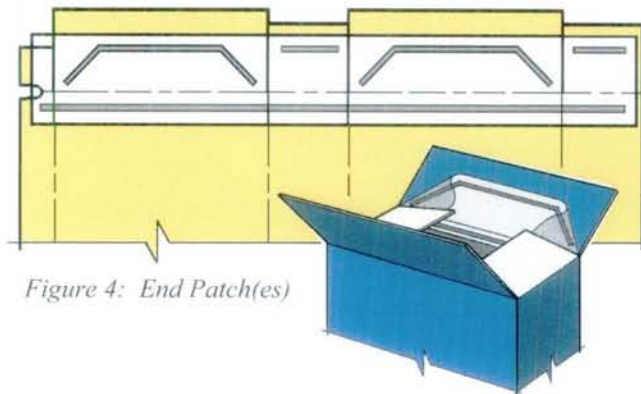


Figure 4: End Patch(es)

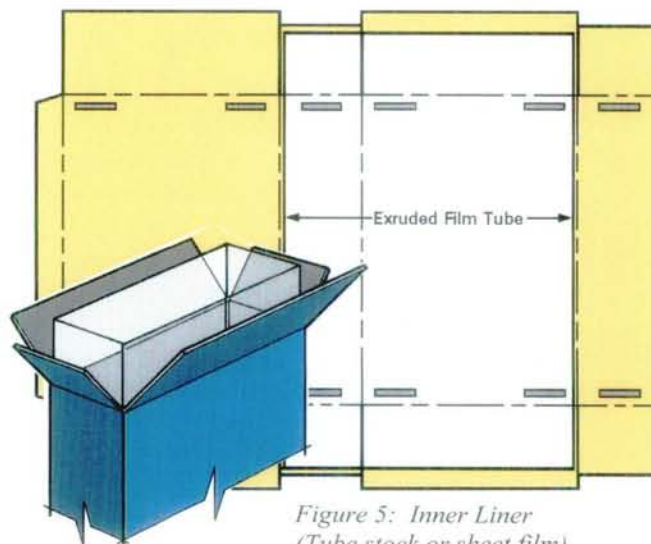


Figure 5: Inner Liner
(Tube stock or sheet film)

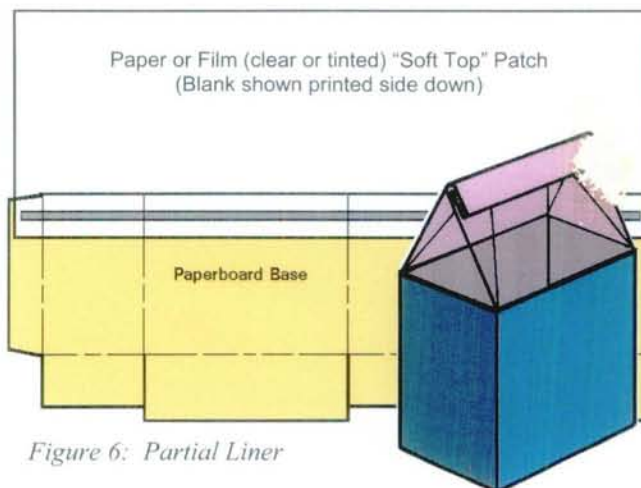


Figure 6: Partial Liner

While convention calls for a clear film window patch to be applied to the inside of a carton blank, a unique design can take the simple windowing concept beyond the norm.

Running the carton blank print side up and applying film bands, paper bands or printed wraps, rather than a simple clear film patch, opens the door to a whole new family of design solutions. Three of these concepts are illustrated here.

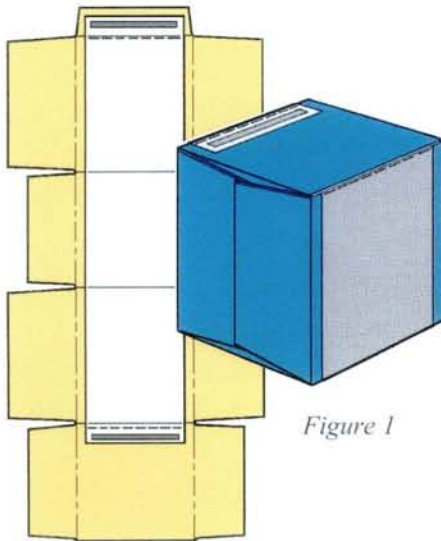


Figure 1

NOTE: Blanks illustrated on this page are shown printed side up.

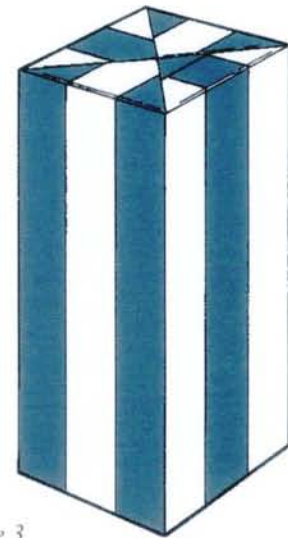


Figure 3

Figures 1 and 2 illustrate a preprinted and perforated removable film band. The band could carry mandatory, seasonal or promotional copy.

The illustration below (Figure 3) carries the concept shown in Figure 2 a step farther. Paper replaces film, and it extends beyond the top and bottom of the carton. The inner carton is closed, and the printed paper folded in to create what looks like a hand-wrapped gift carton.

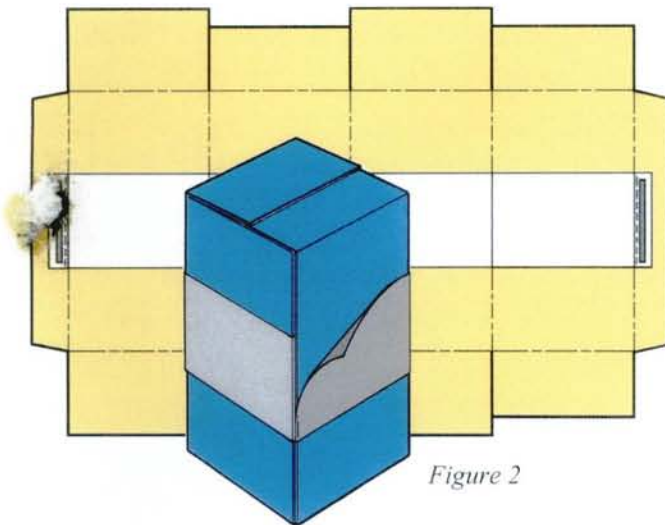


Figure 2

“Windowing” scarcely begins to describe the capabilities of this piece of converting equipment. The concepts illustrated here are all commercially successful packages and demonstrate the possibilities when the creative energies of design, engineering and production personnel are effectively harnessed.



UNTIMED STRAIGHT LINE GLUING

Untimed straight line gluing has the highest speed potential and the least make-ready time of the three basic gluing processes.

All folds are made by a series of fixed plows, and gluing is accomplished by either a continuous wheel application of resin adhesive or a simple timed application of hot melt. Depending on size and complexity, run speeds of well over 100,000 cartons per hour are achievable. All things being equal, this would be the gluing process of choice for simple economic and productivity reasons.

The basic gluing sequence of the Untimed Straight Line Gluer (Figure 1) is:

1. Pick up blanks from a hopper and place them onto a flighted conveyor.
2. Prebreak the non-working scores.
3. Return the blank to the flat state.
4. Apply adhesive.
- 5-6. Fold along the working scores.
7. Complete the folding sequence.
8. Move the folded carton into the compression section.

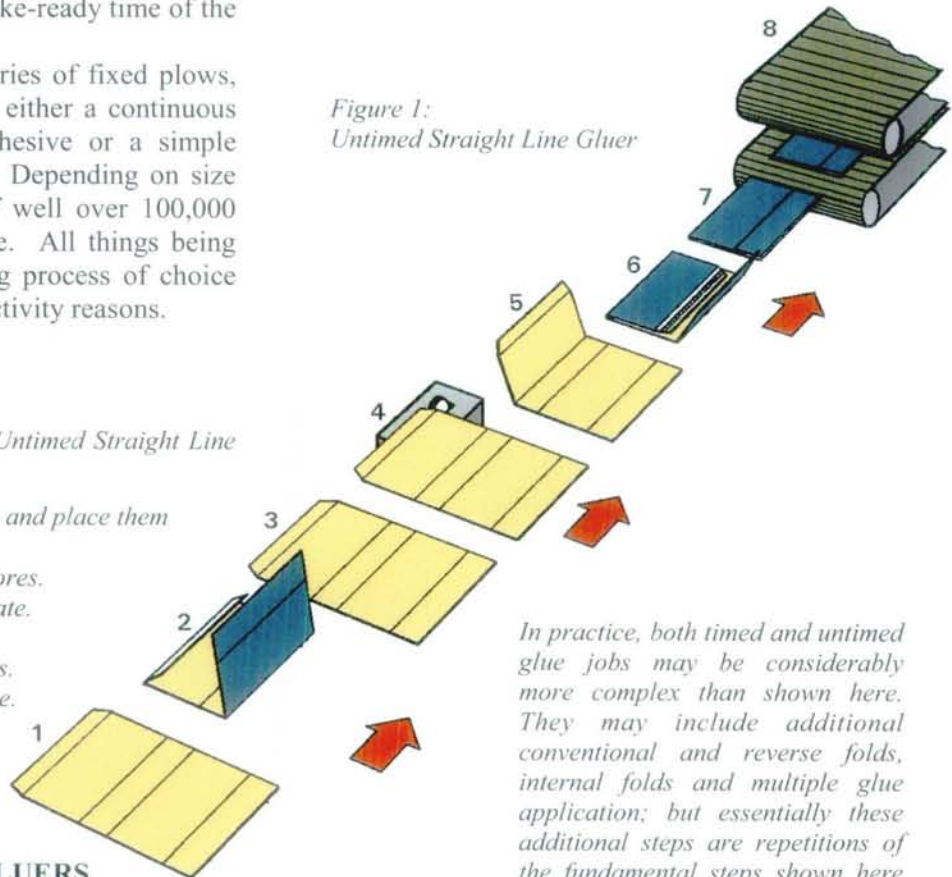


Figure 1:
Untimed Straight Line Gluer

In practice, both timed and untimed glue jobs may be considerably more complex than shown here. They may include additional conventional and reverse folds, internal folds and multiple glue application; but essentially these additional steps are repetitions of the fundamental steps shown here in Figures 1 and 2.

TIMED STRAIGHT LINE GLUERS

The essential difference between untimed and *timed straight line gluing* is the degree of sophistication in the folding and gluing applications. On a timed straight line gluer, there are means for leading and trailing panel folds as well as the conventional machine direction folds. These gluers are also capable of making complex internal flap or tab folds in any direction, in addition to laying down very intricate glue patterns. While line speeds are not as fast as the more simple untimed straight line gluer, they are typically faster than right angle gluers.

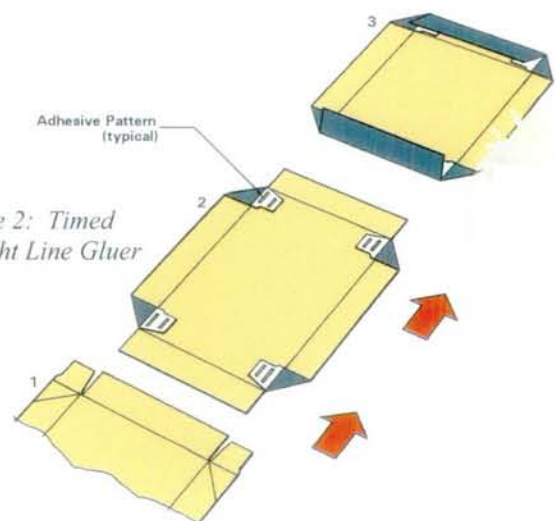


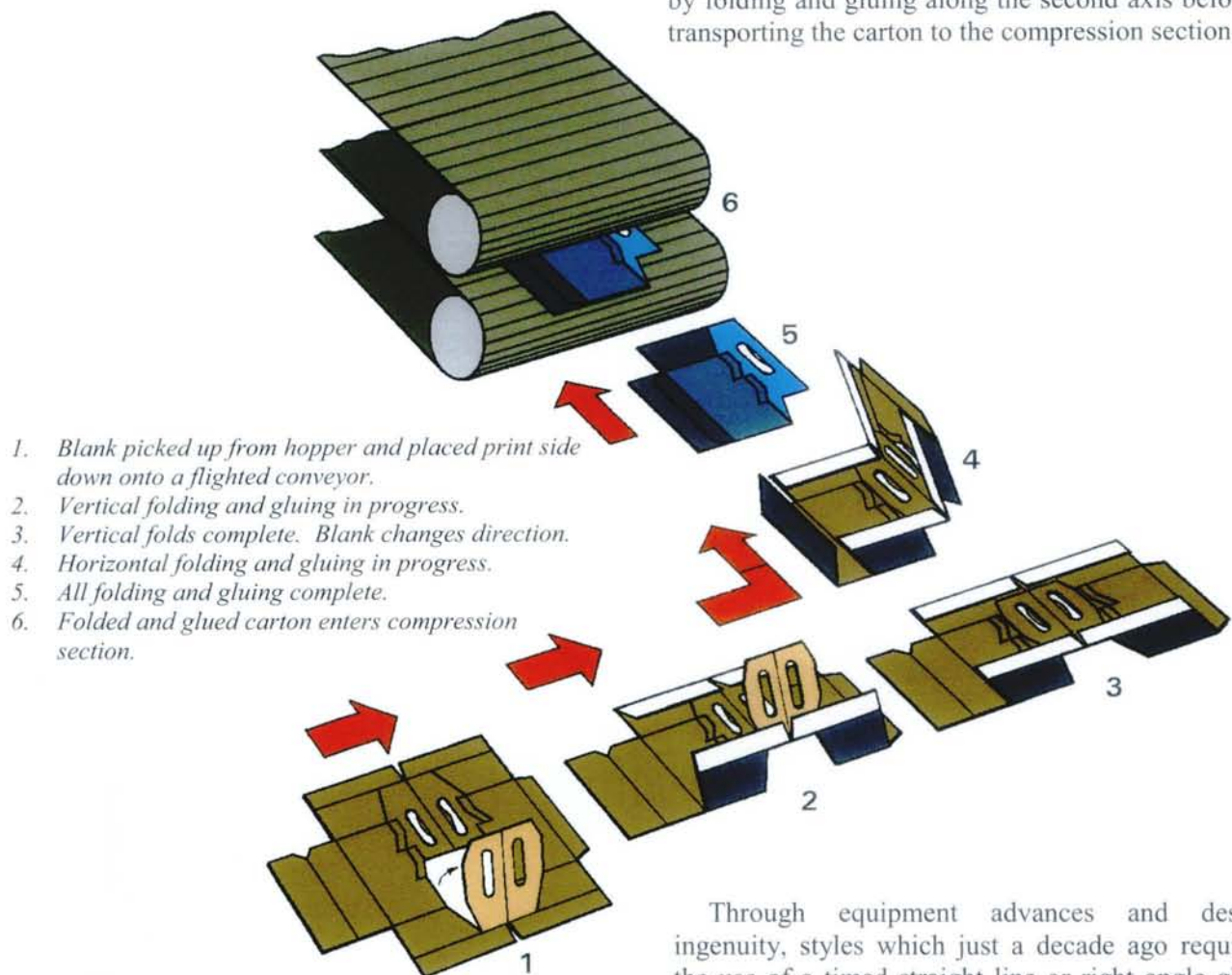
Figure 2: Timed
Straight Line Gluer

RIGHT ANGLE GLUERS

As the name implies, *right angle gluers* make a direction change in mid-stream. Blanks are placed onto a flighted conveyor where a series of registered folds and pattern adhesive applications are performed. The partially glued and folded blank hits a stop, then moves off to the left or right where additional folding and adhesive application functions are performed before the completed carton proceeds into the compression section.

This is a relatively slow operation, 10,000 cartons per hour remaining the industry average for the past several decades; but for the classic beverage basket carrier, this is the gluing means of choice. The basic operation is illustrated below.

A fairly recent variation on the right angle gluer is a timed straight line gluer which performs a number of folding and adhesive application operations along the first axis of the carton blank. It rotates the blank 90°, then completes the carton by folding and gluing along the second axis before transporting the carton to the compression section.



Through equipment advances and design ingenuity, styles which just a decade ago required the use of a timed straight line or right angle gluer can now be run on the untimed straight line gluer. However, for some jobs, like the basket carrier shown here, the right angle is the right tool.



BEYOND GLUING

“Gluing” is another word which no longer adequately describes the capabilities of today’s equipment. Current technology now permits intricate adhesive application at high speed and in tight register; and many additional functions are now performed on gluers, including:

- Skiving and heat sealing
- Combining: Paperboard to paperboard to semi-rigid plastic sheet or small flute corrugated
- Tip-ons and couponing
- Labeling, coding or imprinting
- Application of tear tapes or handles
- Transposed panels
- Edge treatments

**TIP-ONS
or COUPONING**

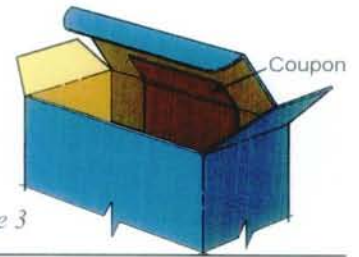


Figure 3

**LABELING, CODING or
IMPRINTING**

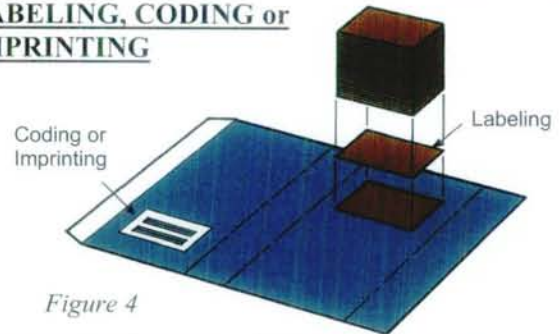


Figure 4

TEAR TAPES or APPLIED HANDLES

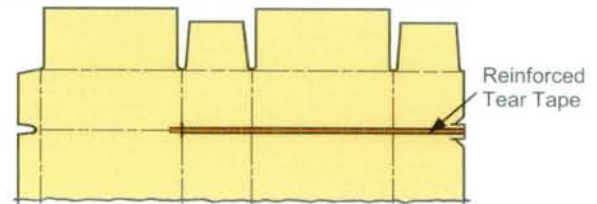


Figure 5

TRANSPosed PANELS

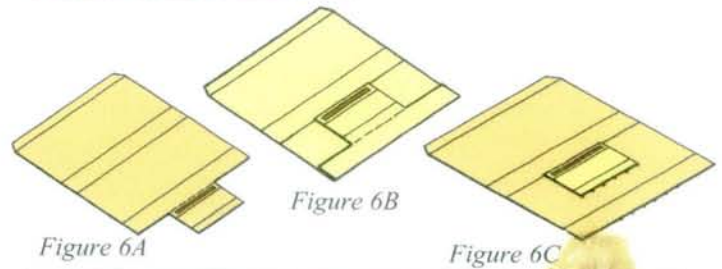


Figure 6A

Figure 6B

Figure 6C

SKIVING

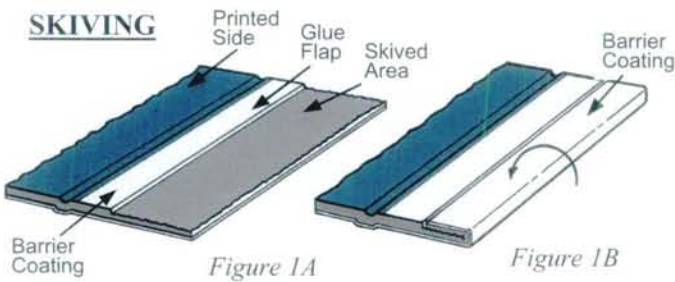


Figure 1A

Figure 1B

COMBINING

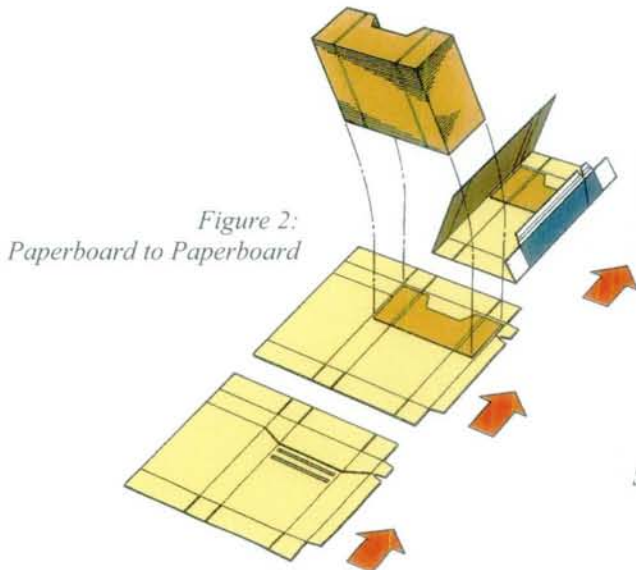
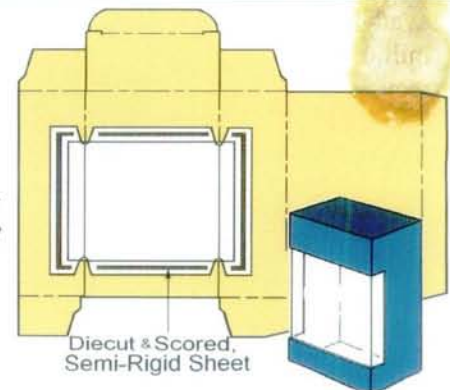


Figure 2:
Paperboard to Paperboard

Figure 7:
Semi-rigid plastic sheet



Diecut & Scored,
Semi-Rigid Sheet



ENVIRONMENTAL CONSIDERATIONS

The primary substrate of folding cartons is paperboard composed of virgin and recycled wood fibers that come from a renewable and recyclable natural resource: trees.

Virtually all virgin paperboard produced in the United States today comes from “tree farms” where trees are planted, harvested and replanted specifically for this end use. In the U.S., large old growth trees, redwoods and tropical hardwoods are not cut for paperboard production.

The U.S. forest and paper industry has made a bold commitment to long-term sustainable forestry practices, known as the **Sustainable Forestry Initiative™** (SFI™). The SFI requires participating forest products companies to reforest harvested land promptly, provide for wildlife habitat, improve water quality and ecosystem diversity, and protect forest land that has special ecological significance. The SFI is a comprehensive program designed to give future generations the same abundant forests we enjoy today. The SFI program is administered by the American Forest & Paper Association.

Recycling is an integral part of paperboard production. As early as 1907, waste paper was collected and recycled into paperboard packaging. Today, over 50% of all paperboard packaging is made from recycled paper. Paperboard production is one of the major consumers of recovered papers, such as newspapers, office paper, mixed paper and old corrugated containers.

Paperboard is also recyclable. According to EPA statistics, over 9,000 communities in the U.S. have recycling programs, and there are an additional 12,000 recycling drop-off centers available to the public. This represents over 107 million people, having access to paperboard recycling programs (according to the AF&PA).

In addition to the positive resource conservation and solid waste aspects of paperboard, many strides have been made to lower the environmental impact of producing folding cartons.

With the implementation of regulations requiring the control of volatile organic chemicals (VOC's) used in printing, and other hazardous substances, folding carton manufacturers have been

leaders in reducing their use and finding environmentally preferable alternatives. Folding carton manufacturers have reduced or eliminated emissions of VOC's by substituting water-based (aqueous) or low VOC content inks and solvents and by the use of emissions control equipment to capture or destroy VOC's. In-plant recycling of inks, solvents and other waste materials is also common.

REGULATORY CONSIDERATIONS

There are numerous regulatory considerations governing retail packaging. Regulations may address the packaging material itself, the labeling of the package, or environmental aspects of the product or package.

If the package is to be used in contact with food, the package and all of its components (inks, adhesives, etc.) should be in compliance with applicable U.S. Food and Drug Administration (FDA) regulations for food contact materials.

Consumer product package labeling should be in compliance with any applicable government standards for labeling. Product packaging labeling regulations can include product identity, declaration of contents, nutrition labeling, pharmaceutical labeling, health and safety information, environmental and other labeling requirements. Some regulating agencies include (but are not limited to):

- **Food and Drug Administration (FDA)** - health and nutrition claims, Nutrition Labeling Education Act (NLEA)
- **Federal Trade Commission (FTC)** - environmental claims, advertising claims, Fair Packaging and Labeling Act (FPLA)
- **National Conference on Weights and Measures (NCWM)** - Fair Packaging and Labeling Act (FPLA)

Other pertinent agencies are detailed in Section 3-Appendices.

Any claims made regarding the recycled content or any other environmental aspect of a folding carton should be in compliance with the Federal Trade Commission's (FTC's) *Guides for the Use of Environmental Marketing Claims* or the



applicable rules in countries where the package will be distributed.

Countries in Europe, and throughout the world, have developed laws regarding packaging and natural resource and waste disposal concerns. Under the resulting regulations, many of these countries require product manufacturers, importers, retailers, and even packaging manufacturers to pay fees on their packaging. The fees for paperboard are often minimal in comparison to other materials, but attention should be paid to laminates and composites that may result in the folding carton being charged a higher fee. Users of folding cartons should know, understand, and comply with, the applicable regulations and fees in the countries where the packaging is destined.



The possibilities for folding carton designs are almost unlimited. Section 2 of this publication will introduce the reader to some of the existing industry design standards. Additionally, it illustrates fundamental methodology and techniques which may be applied by the next generation of designers to create new variations on old themes; and perhaps to develop entirely new concepts that will become tomorrow's classics. Section 2 is divided into seven groups.

GENERAL DESIGN CATEGORIES

Tube Style Cartons

Tube Style Cartons are structures comprised of a series of hinge-connected panels joined at a corner (the *manufacturer's joint*) to form a basic tube or sleeve. Tube style cartons most frequently will include end closure panels and flaps which are fastened in a variety of ways to create tuck end, seal end, or lock end closure devices.

Tray Style Cartons

Tray Style Cartons are structures characterized as having a base with side and end panel hinge-connected to the base and secured to one another at the corners by an adhesive or locking means. Many trays will also include covers or lid components hinge-connected to one or more of the upper edges of the side or end panels.

Multiple Packaging

This is actually a type of packaging rather than a style grouping, in that it includes both tubes and trays as well as some hybrid styles. The common denominator is that all are secondary packaging for grouping and containing multiples of primary containers (bottles, jars, cans, cartons, etc.).

Specialty Packaging

This category consolidates cartons and related paperboard structures which do not fit into one of the aforementioned categories; or which are so closely associated with an industry, product or piece of packaging equipment that they cannot be considered broad based generic styles.

Alternative Paperboard Packaging

This category includes paperboard containers which fall outside basic tube, tray and multiple packaging; and features sub-categories where paperboard is combined with other media to produce carton and non-carton structures.

Promotions and Non-Carton Structures

Structures in this category may incorporate carton design elements, but are essentially specialized structures with very specific end uses.

Special Carton Features

This category includes items such as opening, carrying, cushioning and sift-resistant features which provide added convenience and/or product security, and goes beyond the basic carton categories.

Typical carton styles from each of these categories are illustrated in Section 2. Please note that many folding cartons currently in use are patented, have patent-protected features, or may be designed for use on proprietary packaging equipment. The folding carton designs shown in this publication are intended to depict generic styles only. Also keep in mind that the styles depicted are the most basic designs and represent a limited sample of the universe of available structures.

DIMENSIONING CONVENTION

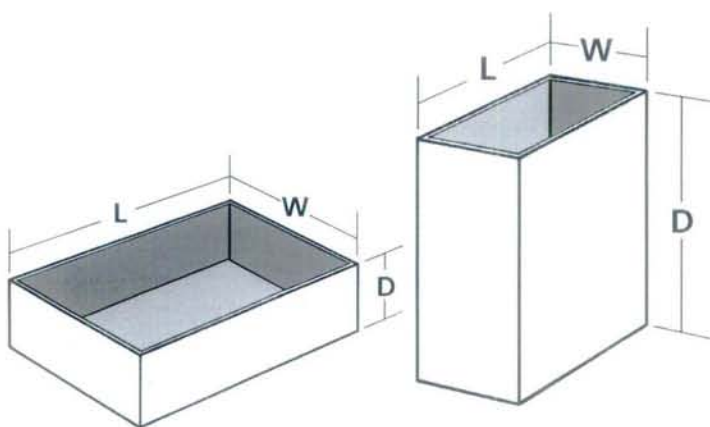
Dimensions, or measurements, for cartons in the tube and tray styles, and wherever possible in the multiple and specialty packaging styles, should always be expressed in the proper order of *length, width, and depth (LxWxD)*. Length, width, and depth should be measured as follows:

- Length and width are measured at the open or fill end of the carton.
- Length is usually the larger dimension at the open end of the carton, or the dimension that will be the front of the carton (in some instances it may be the smaller dimension, e.g., a counter display). Length should be expressed first.



- Width is usually the smaller dimension at the open end and should be expressed second.
- Depth, the remaining dimension, is the distance between the open ends of a tube, or from the open end to the bottom of a tray. Depth should be expressed third in order.

All dimensions, unless otherwise stated, are measured from center of score to center of score or edge of carton blank.



FUNDAMENTAL CARTON ELEMENTS

The fundamental elements of a folding carton are the *panels*, *flaps* and *tabs*. Wherever possible, these are the reference terms used in this publication. There are, however, certain other terms which have become part of the carton vernacular and are therefore also included.

Panels

The major component parts of a folding carton which define the major outer or partition elements. Example: A simple four-sided tube is comprised of a front, rear, left and right side, top and bottom PANEL.

Flaps

A secondary carton element hinge-connected along a free edge of a panel or another flap. Example: A simple four-sided tube with a tuck end closure top and bottom includes:

- A GLUE FLAP attached to the free edge of the rear PANEL.
- DUST FLAPS attached to upper and lower free edges of the left and right side PANELS.
- TUCK FLAPS attached to the outer free edges of the top and bottom closure PANELS.

Tabs

A tertiary carton element hinged to a portion of a free edge of a PANEL or FLAP, or struck from within the plane of a PANEL or FLAP. Example: A double wall Simplex tray has locking TABS hinged off a portion of the free side edges of the inner end PANELS (page 2.403). The side loaded tube style carrier shown on page 3.302 has partition TABS struck from within the bottom PANEL.

Foot

Term used to describe a special-use FLAP. Example: The Rigidwall Tray (page 2.405) has a locking FOOT off the free edge of the inner end PANEL and a second FOOT off the free edge of the inner side PANEL.

Flange

Term used to describe a special-use FLAP. Commonly used to describe the flaps extending outwardly off the top edges of a tapered tray, to be sealed to a separate lid element. Example: page 4.302 shows a gusset corner tray with FLANGES extending off the side and end PANELS.

Charlotte

Term used to describe side FLAPS off the cover PANEL member of the standard linerless ice cream carton (page 4.511) and certain hinge cover frozen food styles.

Disk

Term used to describe the separate end PANEL element of a paperboard can or paperboard insert injection molded lid. (See pages 5.103 and 5.104.)



DRAWING CONVENTION

The carton blank drawings in Section 2 are generally representative of fundamental folding carton styles. They do not necessarily show all the subtle detailing typically included on a dimensioned drawing (offset scores, typical panel setbacks, perforations, etc.). USE THESE DRAWINGS AS A GENERAL REFERENCE ONLY.

Unless otherwise indicated, the BLANK DRAWINGS ARE SHOWN PRINTED SIDE UP. References to length, width, depth and grain direction are included as are certain basic panel or size relationships. For example, on a tuck end carton, dust flap length is indicated as one-half of the combined width of the closure panel and tuck. Here, too, these are intended as general reference and are not to be construed as the only, or preferred, method for detailing a specific carton style.

PROPRIETARY SYSTEMS

The editor and contributors to this publication have attempted to include a broad base of generic styles and to specifically avoid illustrating or referencing current protected proprietary styles or terms. Any exception is purely inadvertent.





1.000

PAPERBOARD PACKAGING: TUBE STYLES

1.000
TUBE STYLES

1.000

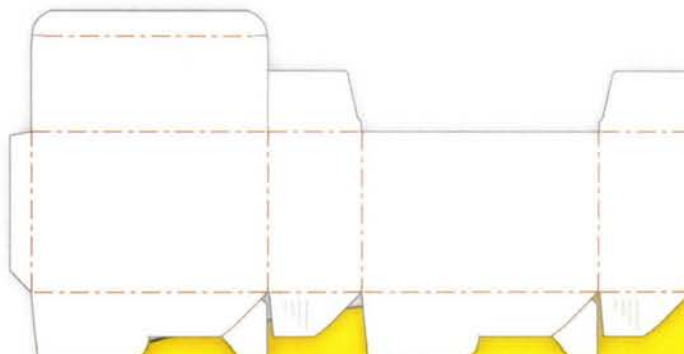
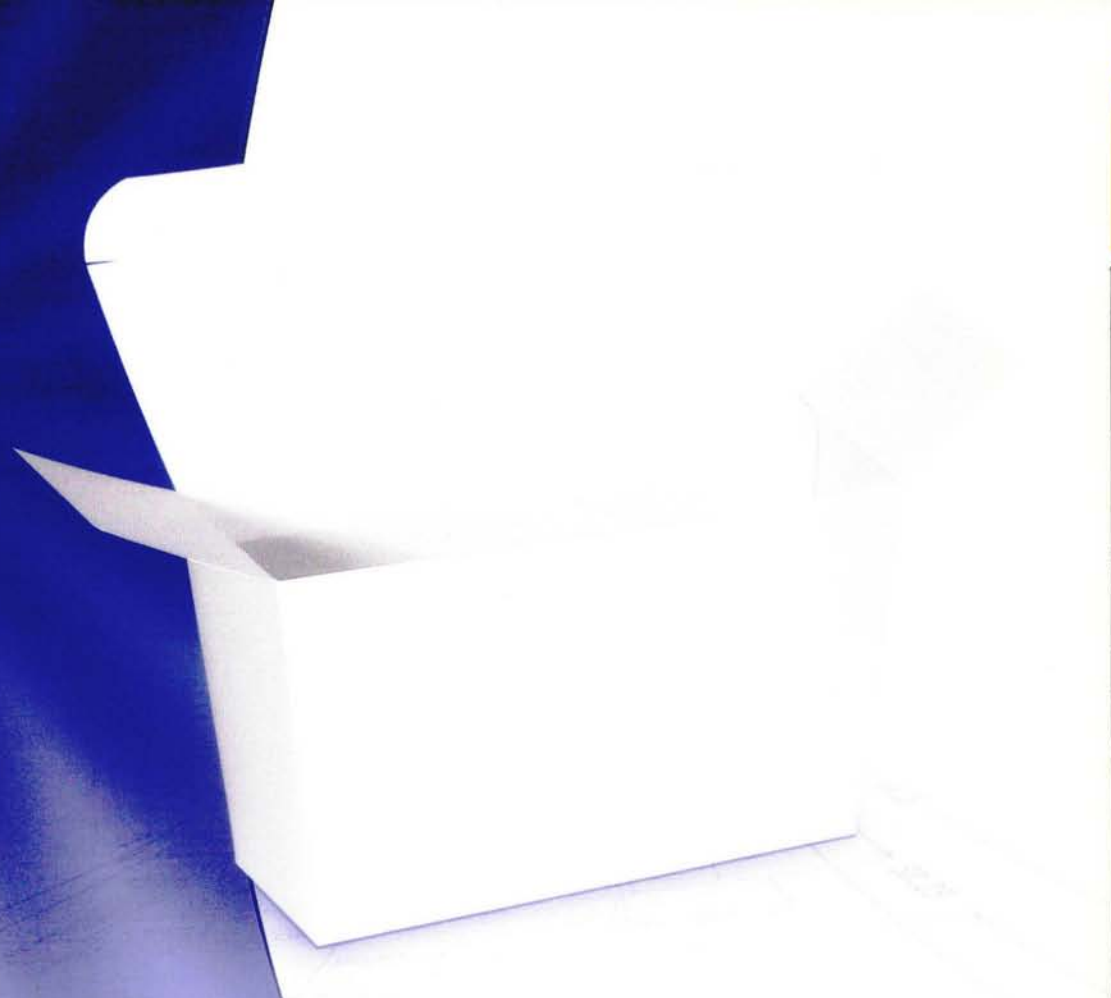
COMPONENT PARTS + DESIGN DETAILING

- 1.100 *Tubes without End Closures*
- 1.200 *Tubes with Tuck End Closures*
- 1.300 *Tubes with Seal End Closures*
- 1.400 *Tubes with Lock End Closures*
- 1.500 *Tubes with Combination End Closures*

1.600

DESIGN VARIATIONS

- Shape Options*
- End Closure Options*
- Partition and Platform Options*



IDEAS AND
INNOVATION
SECOND EDITION



Tubes make up a very large and diverse category of folding cartons ranging from uniquely shaped hand-erected, loaded and closed structures to simple rectangular cartons which are automatically erected, loaded and closed at speeds in excess of 400 cartons per minute.

The following pages will identify and detail the component parts of a tube style carton. Figure 1 on page 1.001 is a composite of several basic tube style cartons and is not intended to represent a commercial style. Its purpose is to introduce the terms used to describe the component parts and to assign the most commonly used design parameters to each of these parts.

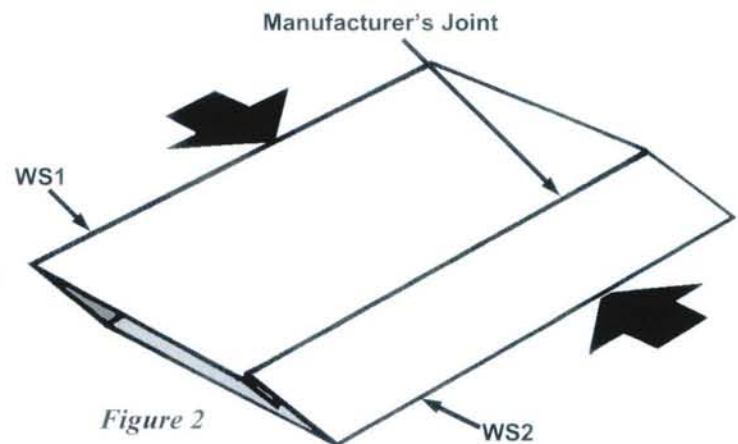
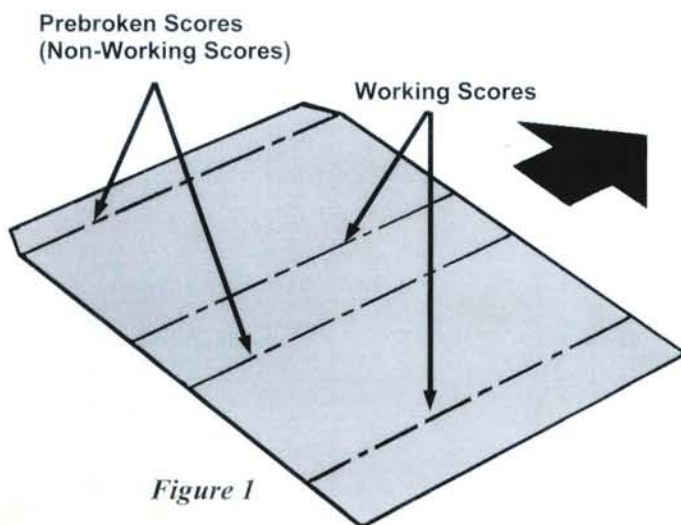
Sections 1.100 through 1.400 detail the fundamental end closure arrangements for the classic rectangular cross-section tube style carton, where both open ends of the tube are secured with essentially the same type of closure.

Section 1.500 illustrates some of the most common combinations of different types of end closures and provides the rationale as to why such combinations may be selected for a given packaging use.

Section 1.600 shows some of the design possibilities beyond a simple four-sided tube. It introduces cross-section alternatives, sculpted shapes and a number of partition, platform and end closure alternatives.

The blank in Figure 1 below is shown printed side down, glue flap to the left as it proceeds through the gluer. This is standard industry practice.

The folded and glued carton as it is delivered off the gluer and case packed. (Figure 2)



There are several references to working scores and false working scores, which are terms associated with the gluing process. The illustrations above and definitions noted below indicate how these terms are used in this publication.

Pertinent Terms and Definitions:

WORKING SCORE (WS) - Score(s) upon which the blank is folded to form the glued and collapsed flat carton as it is delivered off the end of the gluer.

FALSE WORKING SCORE (FWS) - Score(s) added to a blank to allow it to fold flat, and which become non-functional in the erected carton. False working scores are typically associated with odd (3, 5 or 7) sided cartons.

NON-WORKING SCORE - Score(s) that define elements of a finished carton, but not essential to the basic folding and gluing sequence transforming a blank into a folding carton.

PREBREAK (Prebroken Scores) - A function of the gluing process whereby non-working scores are folded (usually past 90°), then returned to a flat state. This technique helps to create a degree of "fluff" in the glued carton. This "fluff" is desirable because it creates a carton predisposed to erecting easily. This is particularly important when auto-erecting cartons at high speed.



**BODY PANELS
 and
 TUCK END CLOSURE**

The typical tube style carton blank when viewed **printed side up** will have the glue flap to the left, connected to the rear panel. In finished and erected form, the manufacturer's joint will be in the right rear corner and the top closure panel will hinge off the rear panel and tuck to the front. The classic design detailing of the body panels and a tuck closure is:

1. Glue Flap Taper: 10° to 15°.
2. Slit Lock Tuck/Closure Panel Width Reduction: Typically 1/32 inch or board thickness.
3. Slit Lock Tuck/Tuck Setback: Typically 1/32 inch or board thickness.
4. Slit Lock Tuck/Dust Flap Shoulder: Varies with carton size and/or board caliper.
5. Slit Lock Tuck/Primary Dust Flap Taper: Typically 45°.
6. Slit Lock Tuck/Secondary Dust Flap Taper: Typically 15°.
7. Dust Flap Setback: Typically 1/32 inch or board thickness.
8. Friction Lock Tuck/Tuck Flap Shoulder: Varies with carton size and/or board caliper.
9. Friction Lock Tuck/Primary Dust Flap Taper: Typically 15°.
10. Manufacturer's Joint Setback: Typically 1/32 inch or board thickness.

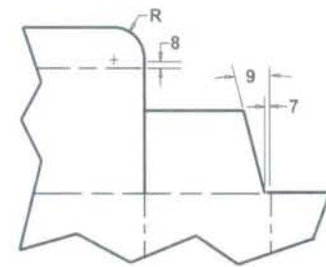
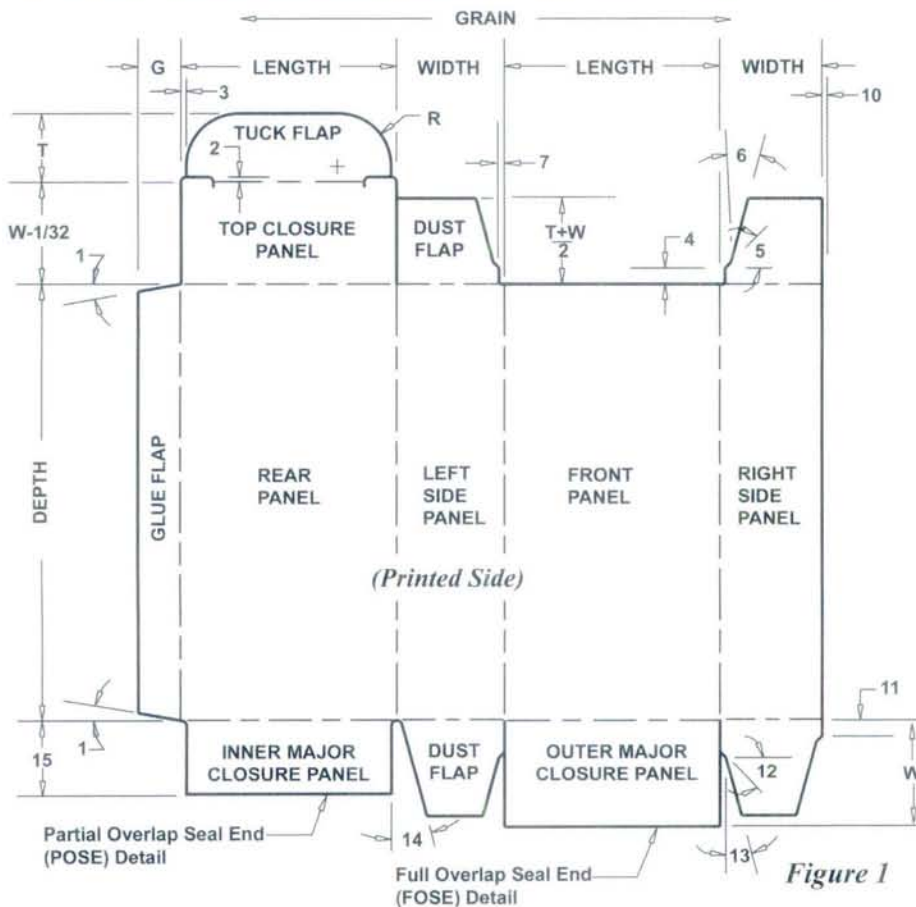


Figure 2: Friction Locking Detail

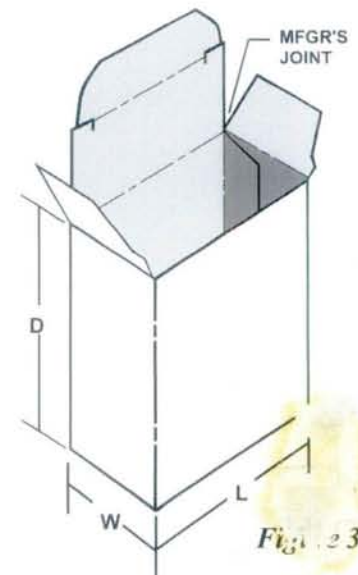


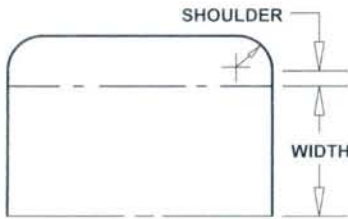
Figure 3

SEAL END CLOSURE

Two closure panel and two dust flap alternatives are shown in Figure 1. Typical design detailing for a full or partial overlap seal end is as follows:

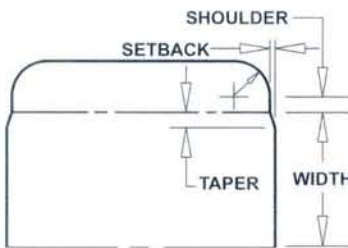
11. Full or Partial Overlap Seal End/Dust Flap Shoulder: Varies with size.
12. Full or Partial Overlap Seal End/Primary Dust Flap Taper: Typically 45°.
13. Full or Partial Overlap Seal End/Secondary Dust Flap Taper: Typically 15°.
14. Full or Partial Overlap Seal End/Alternative Dust Flap Detail: Typically 15°.
15. Partial Overlap Seal End Only: Typically 1/2 width plus 3/8 inch.





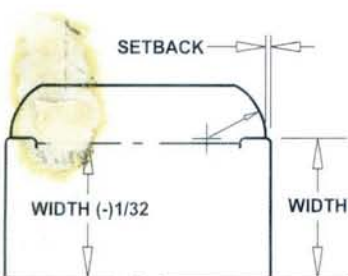
FRICITION LOCK TUCK
Variation No. 1

This is the most commonly used friction lock tuck detailing. There is no edge setback; but a shoulder, which will vary in size, is used to create the friction to keep the tuck properly engaged.



FRICITION LOCK TUCK
Variation No. 2

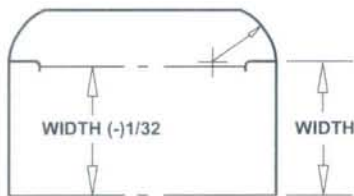
This style is not commonly used. However, for cartons made of very heavy caliper paperboard, the use of the setback may reduce the tendency to distort or fracture the corner scores.



SLIT LOCK TUCK
Variation No. 1

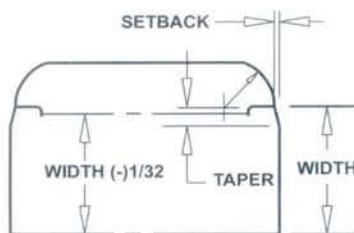
This is the most commonly used slit lock tuck detailing. There is a setback to the edges of the tuck, but there is no shoulder. The tuck radius starts at the outer edge of the slit.





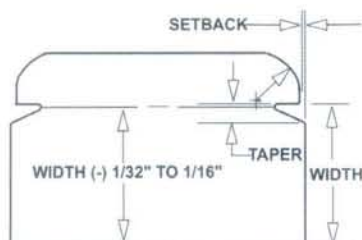
SLIT LOCK TUCK
Variation No. 2

While similar to Variation No. 1, there is no setback to the outer edges of the tuck flap. This variation is an option worth considering for cartons made of very light weight paperboard where the setback may create more side-to-side play than desired.



SLIT LOCK TUCK
Variation No. 3

This is the UNITUCK™ detailing which is no longer in common use; however, it may still be specified by some customers.

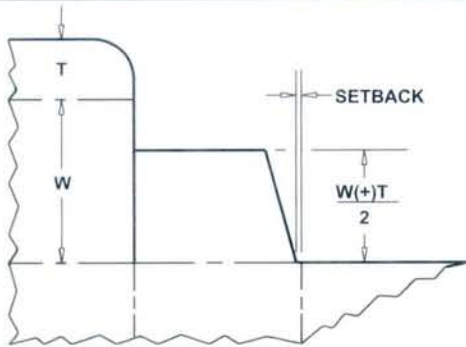


SLOT LOCK TUCK
Variation No. 1

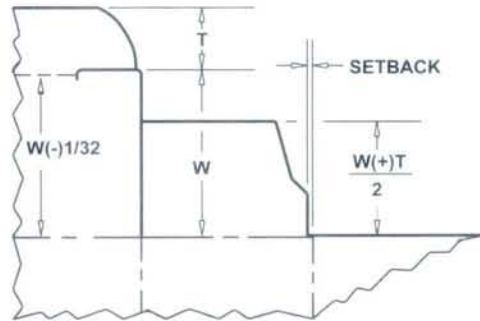
This detailing may be preferred to a slit lock tuck for heavy caliper paperboard or small flute paperboard. NOTE: The panel width reduction will vary depending on the board thickness.



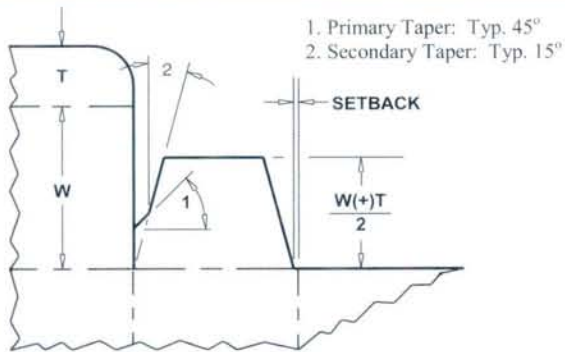
Variation No 1: Friction Lock Tuck Dust Flap



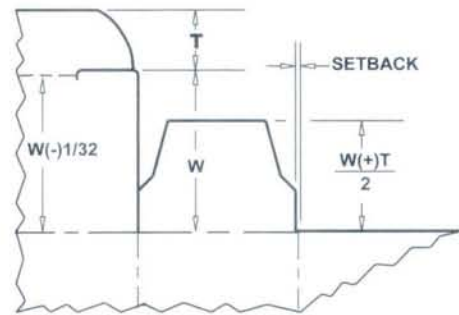
Variation No. 1: Slit Lock Tuck Dust Flap



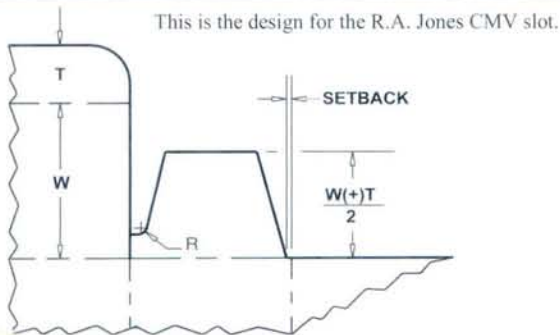
Variation No 2: Friction Lock Tuck Dust Flap



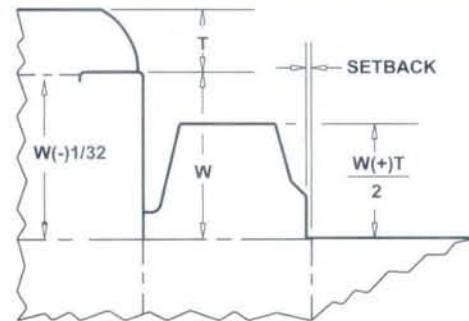
Variation No. 2: Slit Lock Tuck Dust Flap



Variation No. 3: Friction Lock Tuck Dust Flap

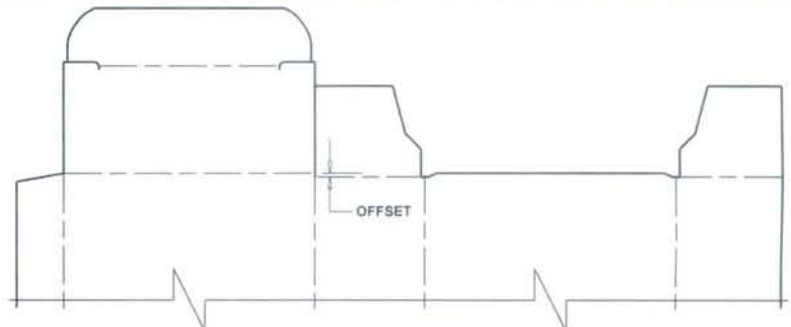


Variation No. 3: Slit Lock Tuck Dust Flap

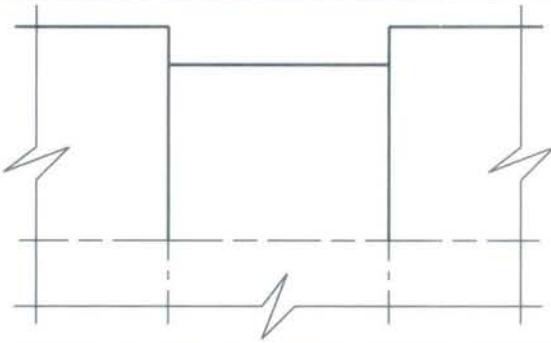


Tuck End Dust Flap Detailing for Heavy Caliber Paperboard: Applicable to all style variations shown above

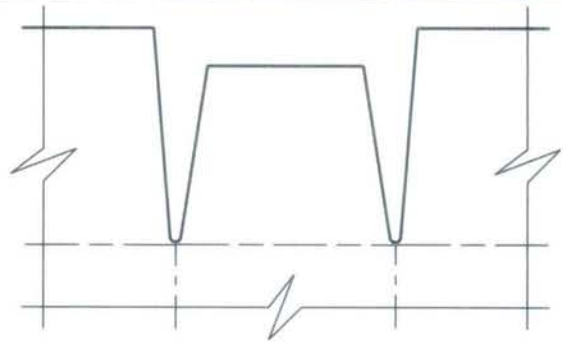
For heavier caliber and small flute paperboard the dust flap scores should be offset to avoid corner distortion or cracked scores. Most converters will begin offsetting dust flap scores on board of 24 point or above. The offset is typically 1/32" or board thickness. It is common, when offsetting the dust flap scores, to contour the free edge of the front panel as shown in the illustration to the right.



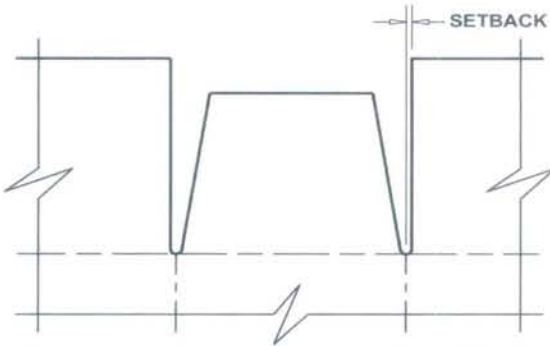
Variation No. 1: Seal End Dust Flap



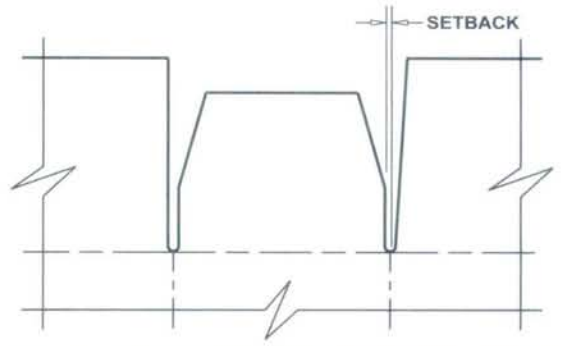
Variation No. 4: Seal End Dust Flap



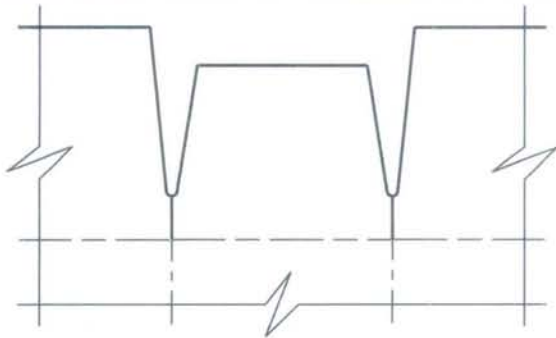
Variation No. 2: Seal End Dust Flap



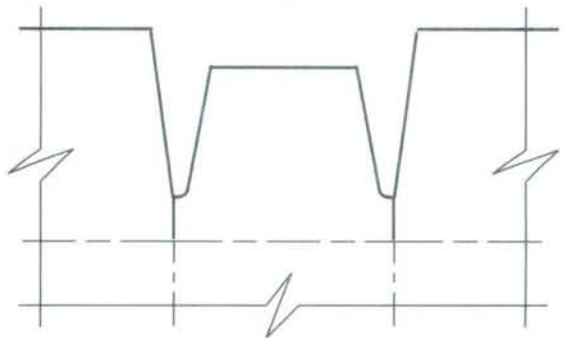
Variation No. 5: Seal End Dust Flap



Variation No. 3: Seal End Dust Flap

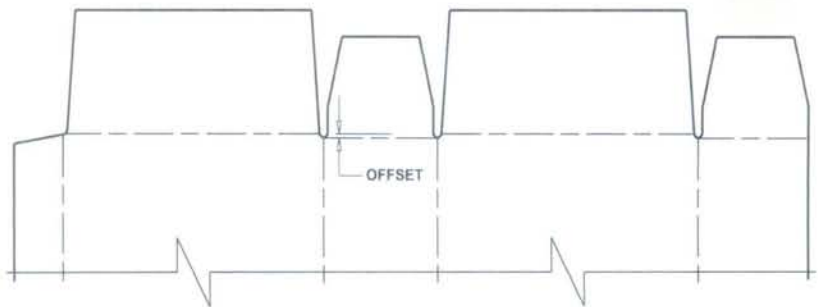


Variation No. 6: Seal End Dust Flap



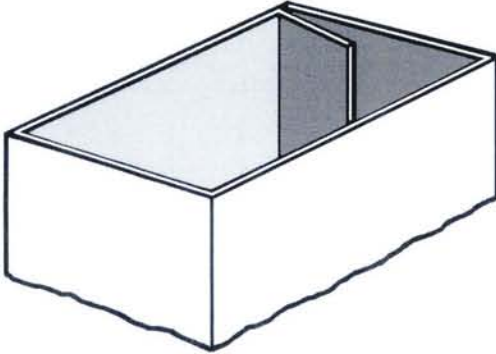
Seal End Dust Flap Detailing for Heavy Caliber Paperboard: Applicable to all style variations shown above

For heavier caliber and small flute paperboard the dust flap scores should be offset to avoid corner distortion or cracked scores. Most converters will begin offsetting dust flap scores on board of 24 point or above.



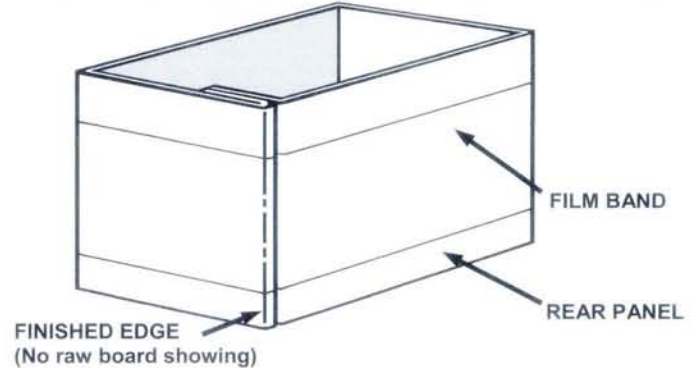
Variation No. 1: CONVENTIONAL GLUE FLAP

This is the most common form of manufacturer's joint. Typically located in the right rear corner of erected carton.



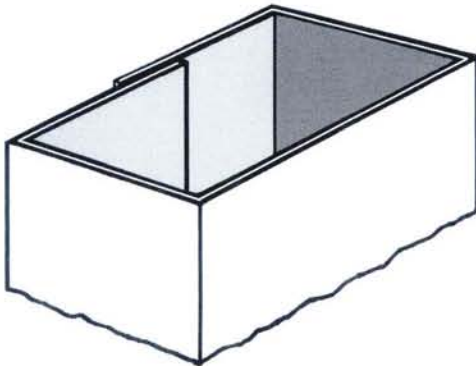
Variation No. 2: FINISHED EDGE

For high-end gift cartons, or used in conjunction with an external film band as illustrated below.



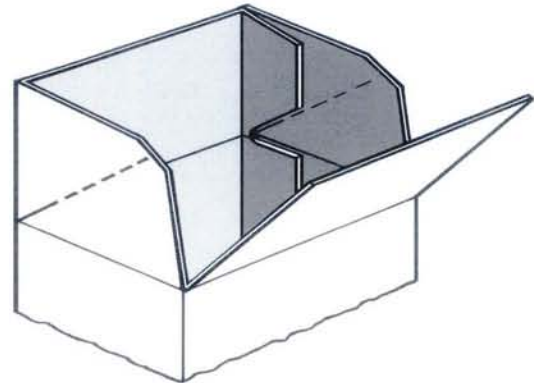
Variation No. 3: SPLIT PANEL

An alternative to No. 1, if other design factors prevent use of conventional corner joint.



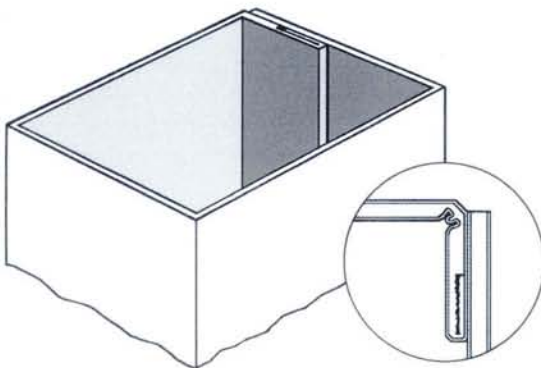
Variation No. 4: EXTENDED GLUE FLAP

Incorporated as a corner reinforcing element or to work in conjunction with a gusset as illustrated below.



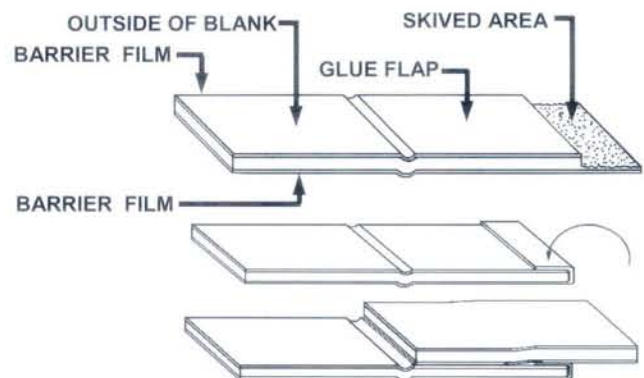
Variation No. 5A: SKIVED GLUE FLAP

Used to prevent liquids from penetrating into raw edge of board. Typically used on juice cartons.



Variation No. 5B: SKIVED GLUE FLAP

This is a slight variation on 5A.



SLEEVE

The simple, preglued rectangular sleeve shown here is the fundamental structure from which most tube styles evolve. It is also a style in its own right. It is frequently used as a slip on cover for a two piece tray and sleeve combination. It is also the basic structure for several proprietary multiple packaging systems, and can be found in both glued and locked side seam forms.

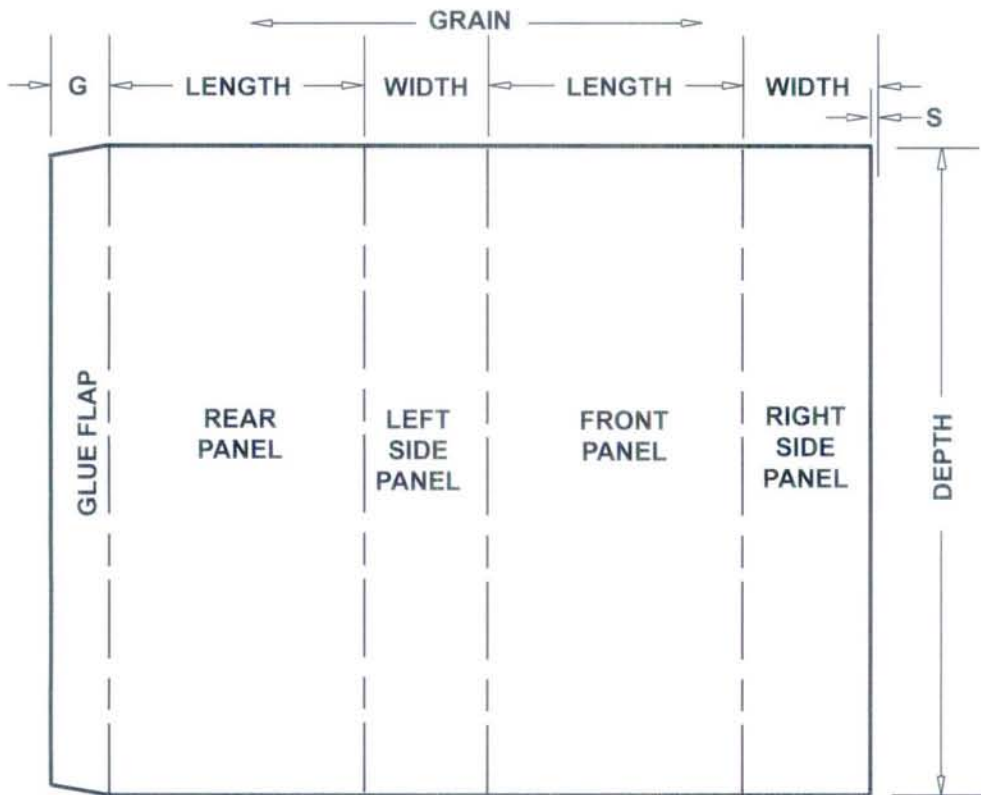


Figure 1

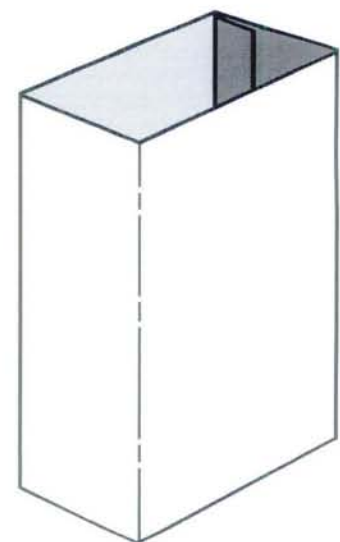


Figure 2



**STANDARD
 REVERSE TUCK
 (SRT)**

The standard reverse tuck has the manufacturer's joint in the right rear corner. The top closure tucks from the rear to the front, and the bottom closure tucks from the front to the rear.

Shown here is a friction lock top closure (easy to open and reclose) and a slit (pie) lock tuck bottom which is more secure and less likely to disengage from product weight. The SRT is effective both as a hand set up and a machine formed carton.

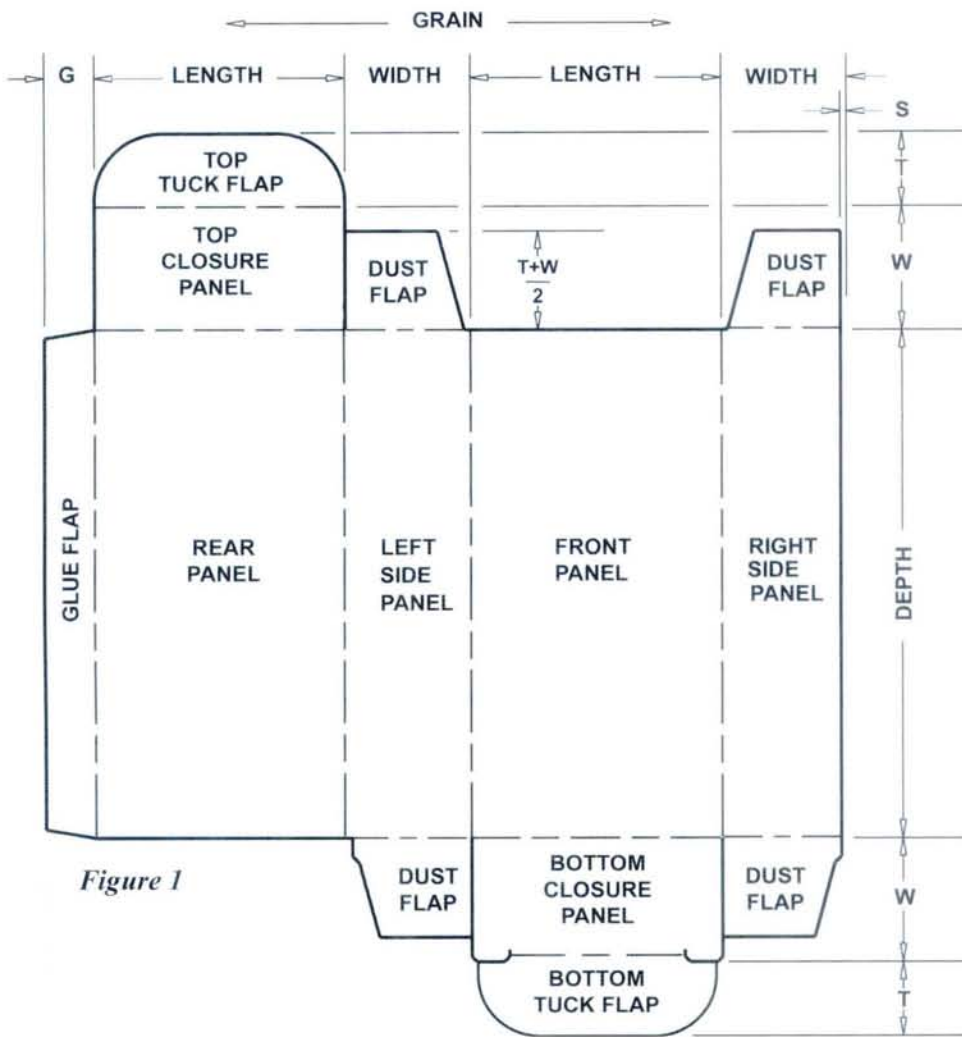


Figure 1

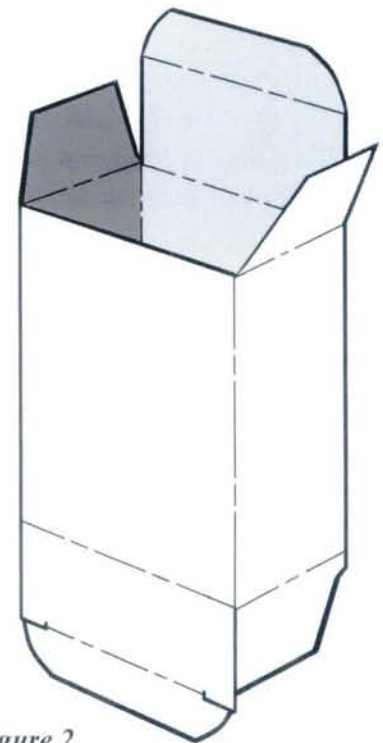


Figure 2



**FRENCH
 REVERSE TUCK
 (FRT)**

The French reverse tuck differs from the standard reverse tuck in that the top closure hinges off the front panel and tucks to the rear, while the bottom closure hinges off the rear and tucks to the front. Shown here is a friction lock top and a slit (pie) lock bottom. Other combinations are common; i.e., slit lock top and bottom, friction lock top and bottom. This style is preferred by the cosmetic industry since it presents a more finished appearance and better graphic design opportunities.

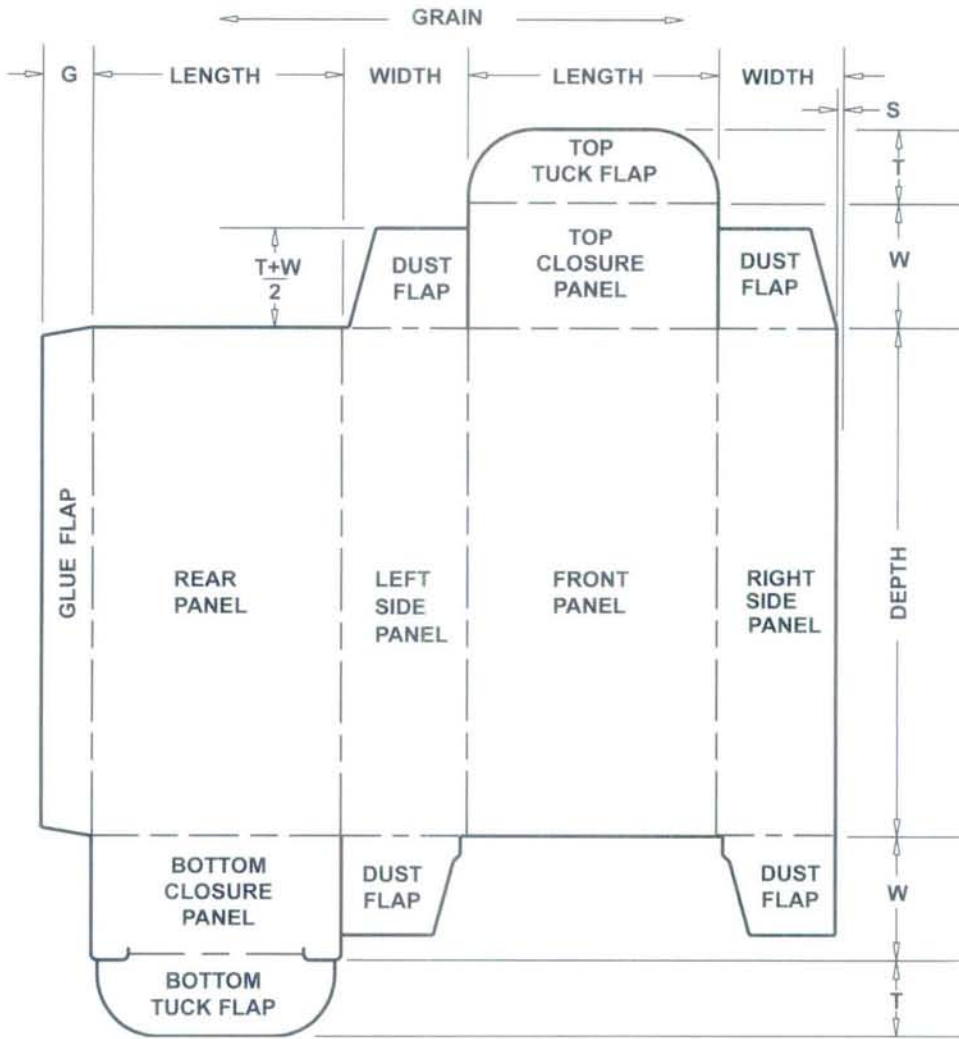


Figure 1

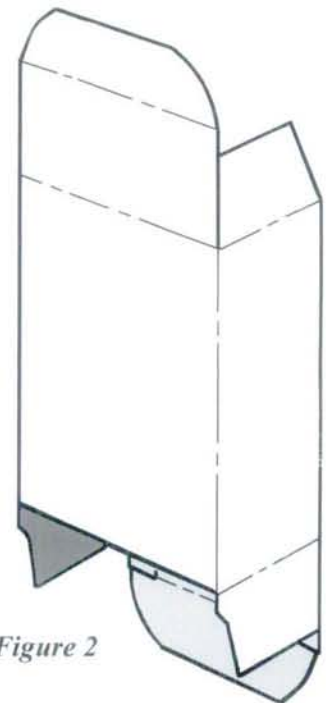


Figure 2



**STANDARD
 STRAIGHT TUCK
 (SST)**

The standard straight tuck is particularly well suited for products requiring a large window in the front display panel. Typically, both closures will tuck from the front to the rear, which avoids a raw edge showing at either end of the primary display panel. It also prevents possible interference between the tuck and the window film material, which could occur with a reverse tuck. This style is equally well suited for hand erecting and closing, or machine forming and closing.

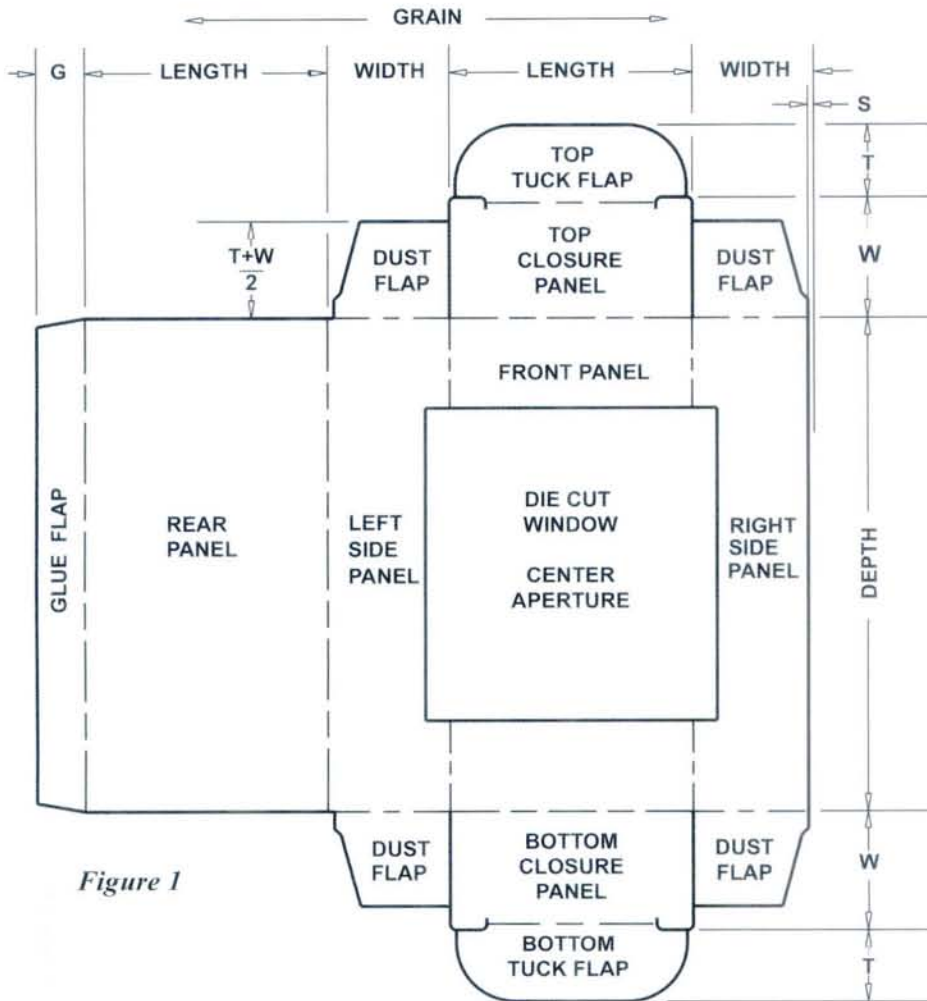


Figure 1

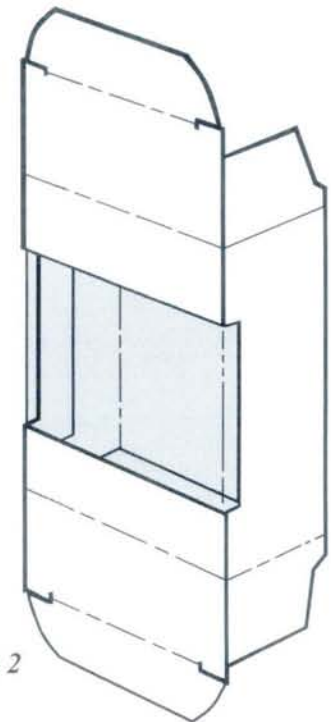


Figure 2



Slit Lock Tuck Top
 Slit Lock Tuck Bottom

AIRPLANE STYLE
 STRAIGHT TUCK

The airplane style straight tuck differs from the standard straight tuck in that the top and bottom closure panels tuck from the rear to the front.

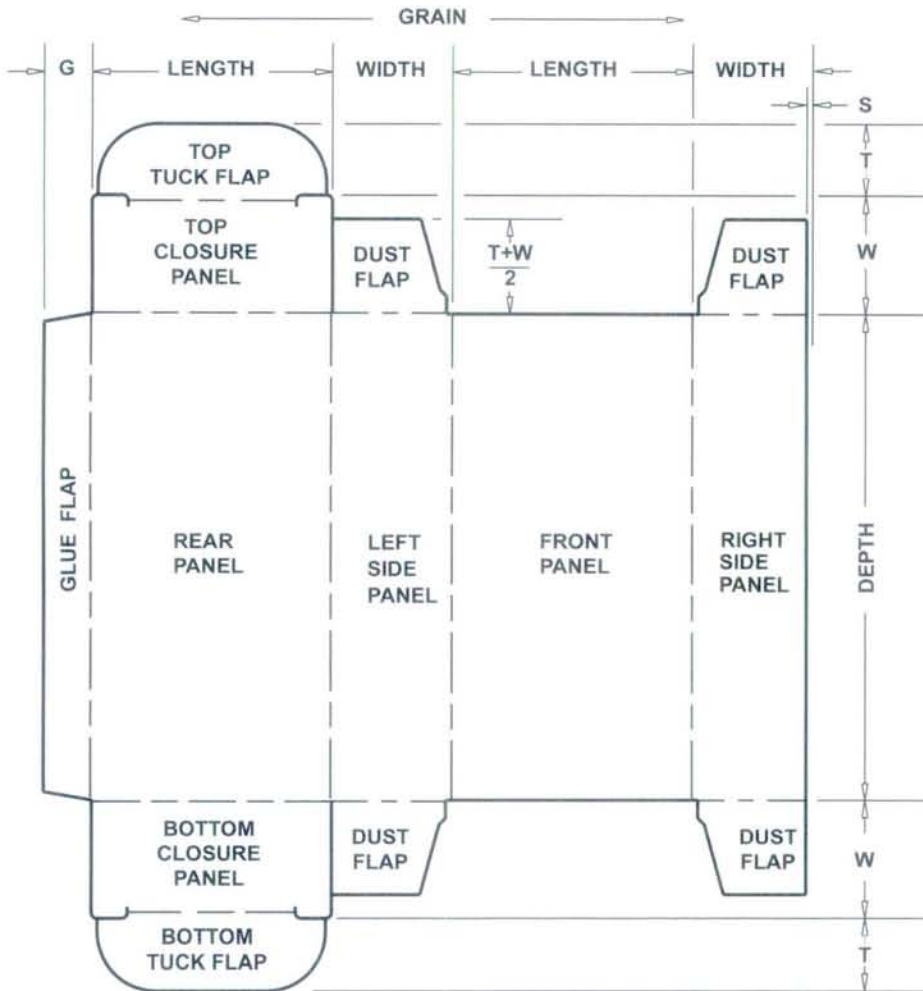


Figure 1

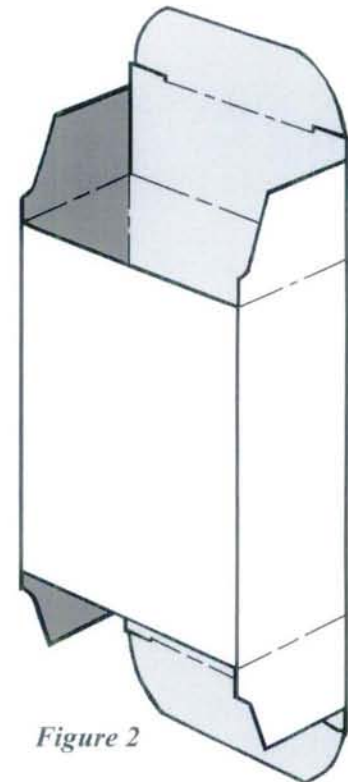


Figure 2



MAILER LOCK

As its name implies, the mailer lock has been used primarily as a means to mail sample products. The closure is designed to be secure and to withstand substantial abuse without disengaging.

It is typically hand erected, loaded and closed. The lock tab (tongue) is used as an added security feature to insure that the carton does not accidentally open in transit.

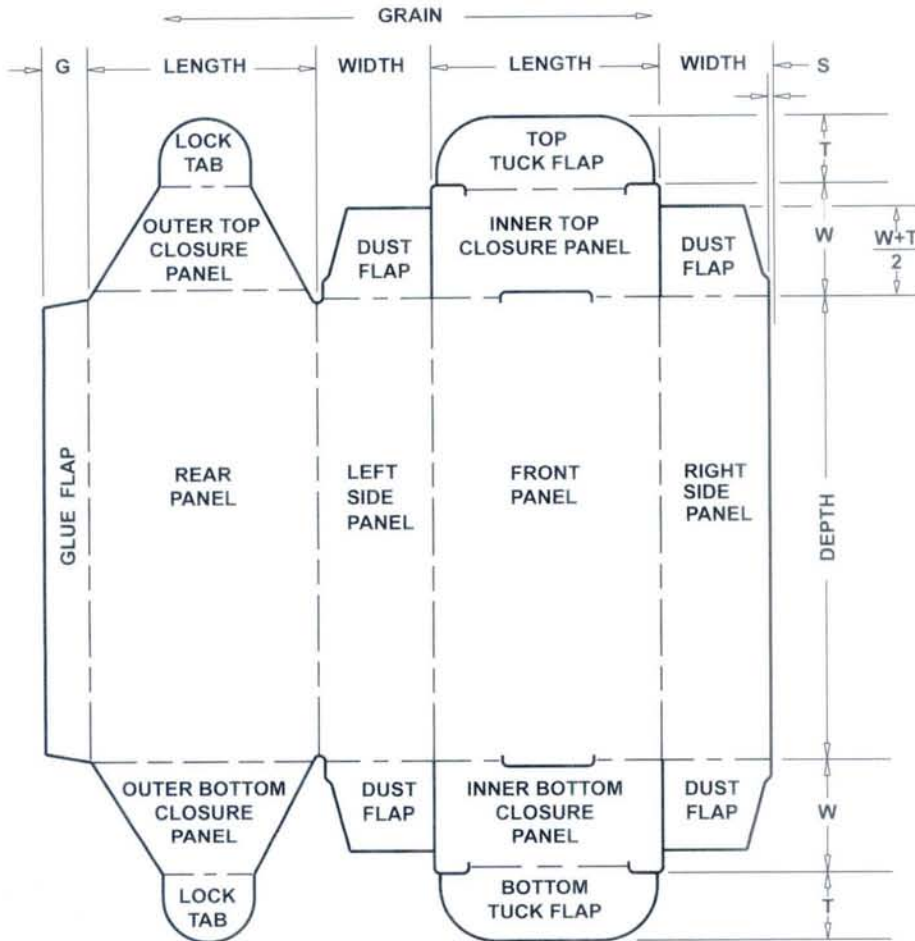


Figure 1

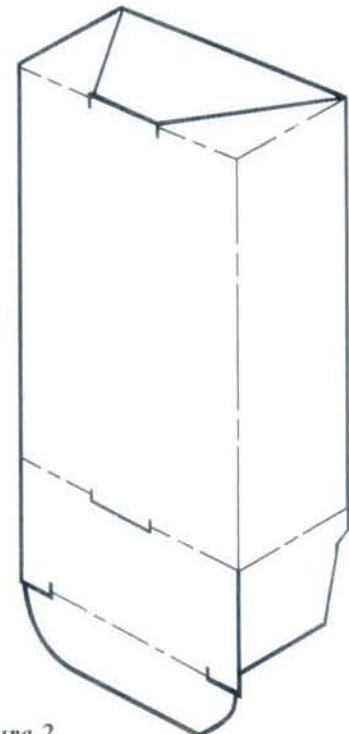


Figure 2



Tuck and Tongue Top
Tuck and Tongue Bottom

TUCK and TONGUE

This style is typically hand set up, filled and closed. An alternative to the mailer lock, it should also withstand substantial abuse without disengaging. In addition to use as a mailer, the tongue lock may be found on retail cartons where the length is substantial as compared to the width, or where a heavy product calls for added security. NOTE: If only bow resistance is required, an alternative to a tongue lock is shown in Figures 3 and 4. Ease of entry can be enhanced by angling the base score of the tongue lock as shown in Figures 5 and 6.

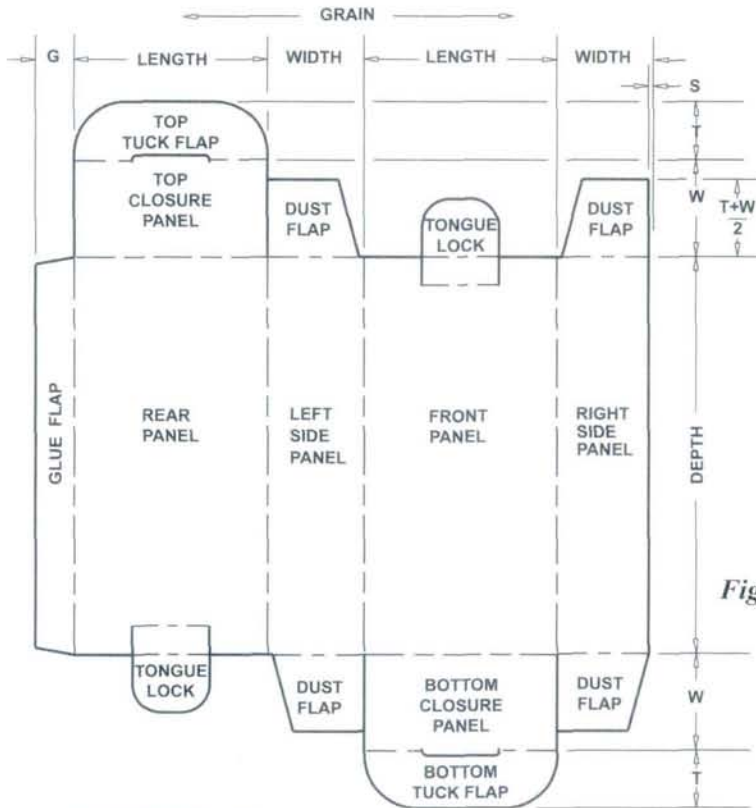


Figure 1

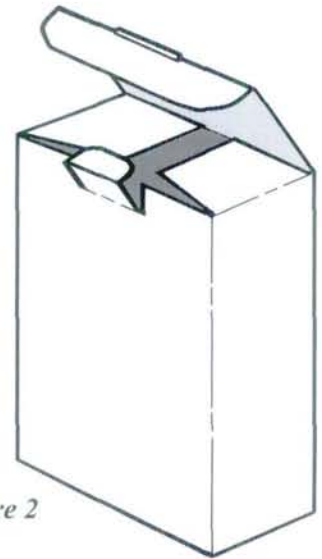


Figure 2

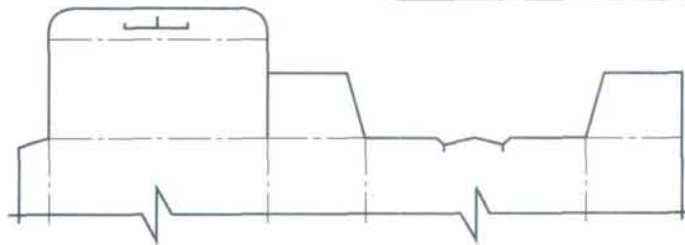


Figure 3

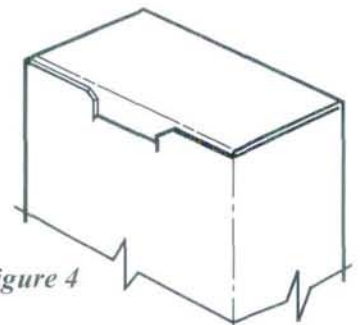


Figure 4

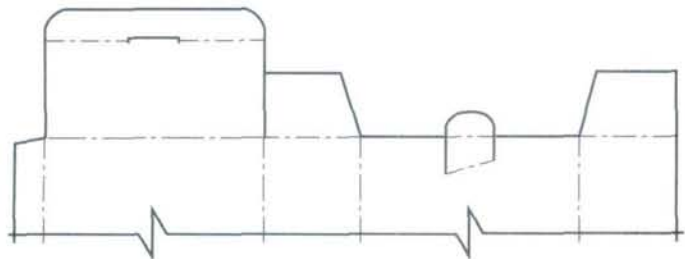


Figure 5

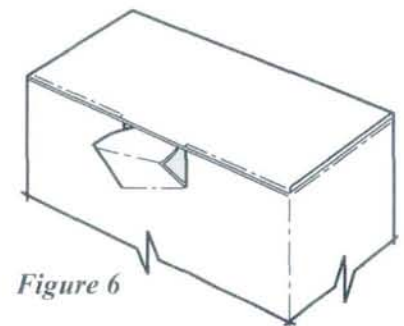


Figure 6



Bellows Tuck and Tongue Top
Bellows Tuck and Tongue Bottom

**BELLOWS (GUSSET)
 TUCK**

This style is typically hand set up, filled and closed. It is an alternative to the mailer lock, and like the mailer lock should withstand substantial abuse without disengaging.

The bellows offers an added degree of corner strength and stability over the more conventional dust flap arrangement.

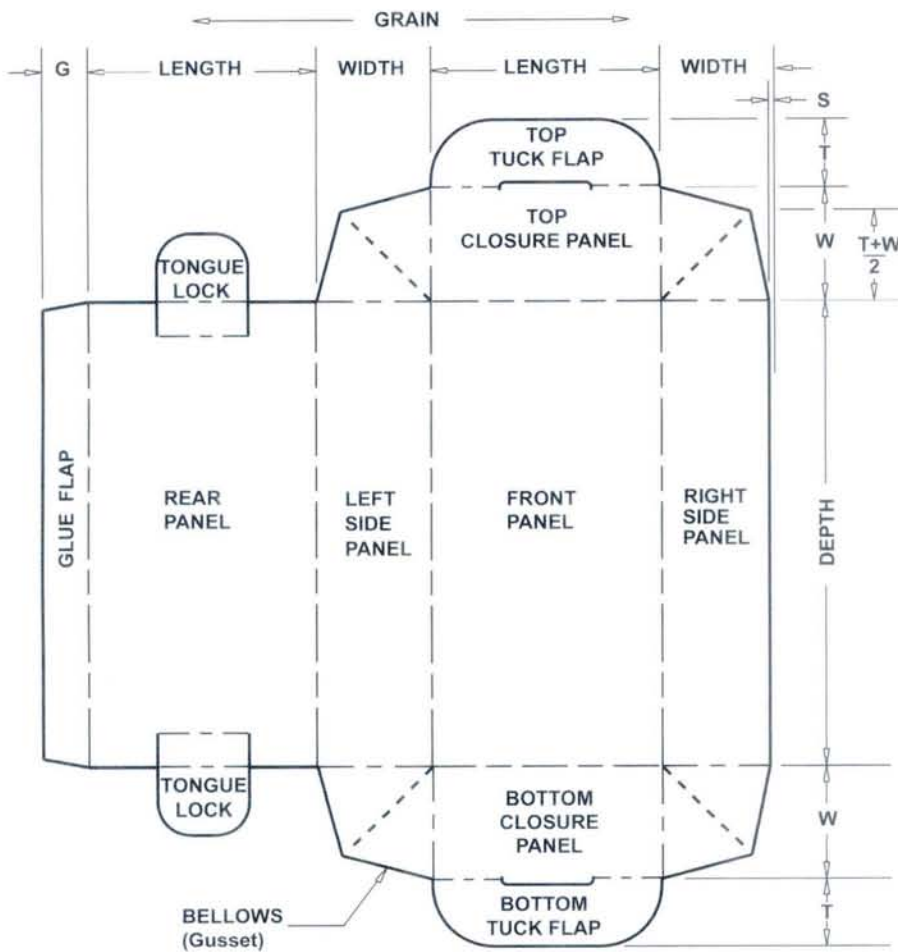


Figure 1

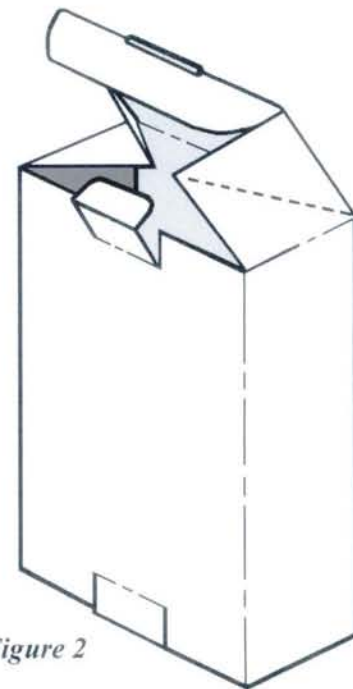


Figure 2



TUBES WITH TUCK END CLOSURES
Friction Tuck/Locking Dust Flap Top Combination
Slit Lock Tuck/Locking Dust Flap Bottom Combination

**REVERSE TUCK/
 ARTHUR LOCK
 DUST FLAPS**

This is typically a hand erected, loaded and closed style. The Arthur lock dust flaps add a measure of security for heavy products, yet still permit the carton to be opened and reclosed with ease.

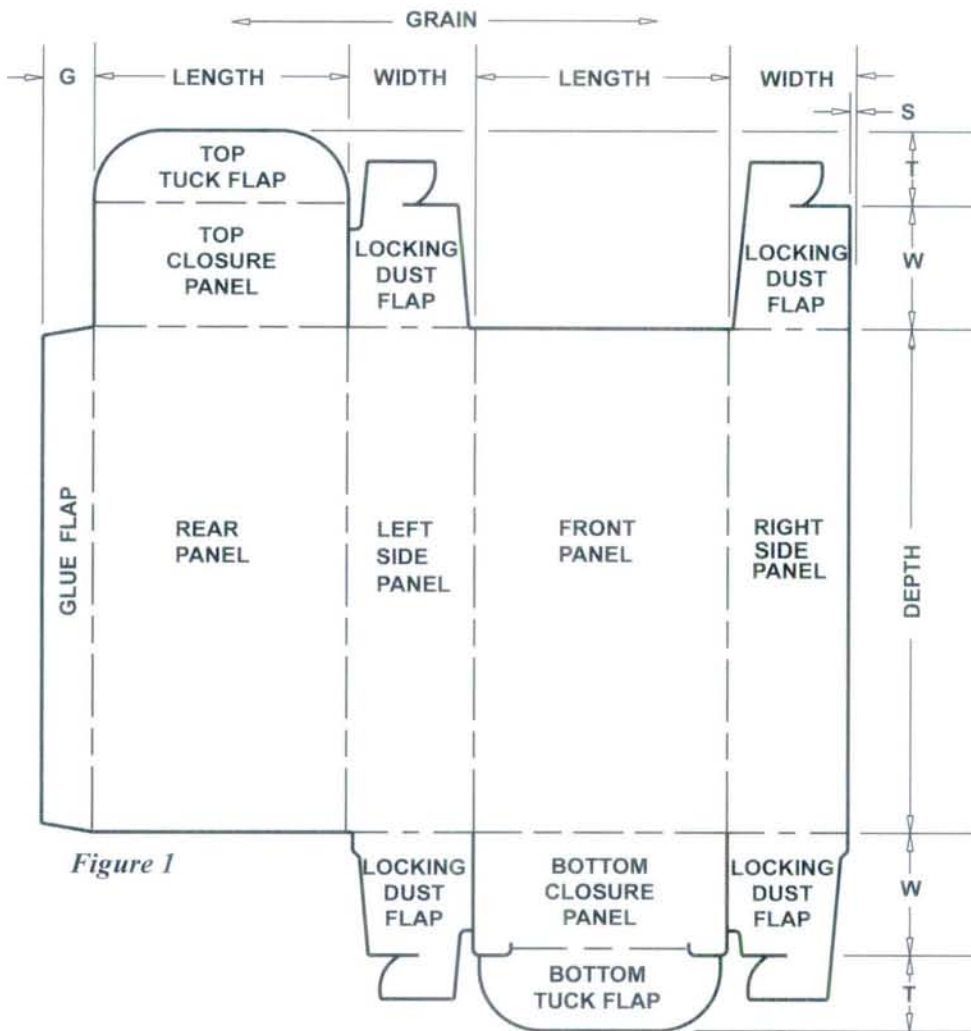


Figure 1

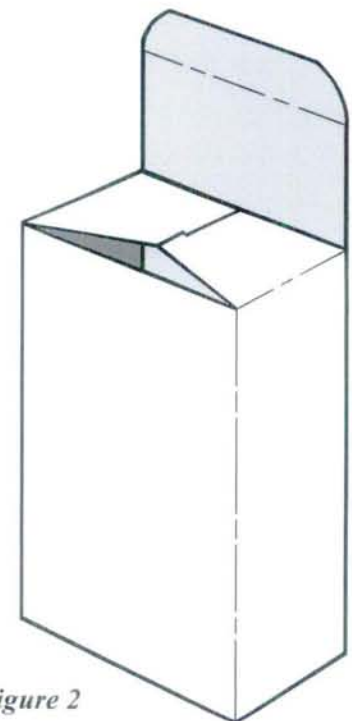


Figure 2



Full Panel Top Closure
Full Panel Bottom Closure

**FULL OVERLAP
 SEAL END
 (FOSE)**

The full overlap seal end (FOSE) is typically erected, filled and closed on automatic horizontal or vertical packaging equipment. The normal closing sequence is: Dust flaps in first, inner closure panels (off the rear panel) down next, and outer closure panels (off the front panel) down last (Figure 2). The sift resistant characteristics of the FOSE may be enhanced by making minor changes to the design and folding sequence of the end closure and flaps. Refer to pages 7.301, 7.302 and 7.303 for details.

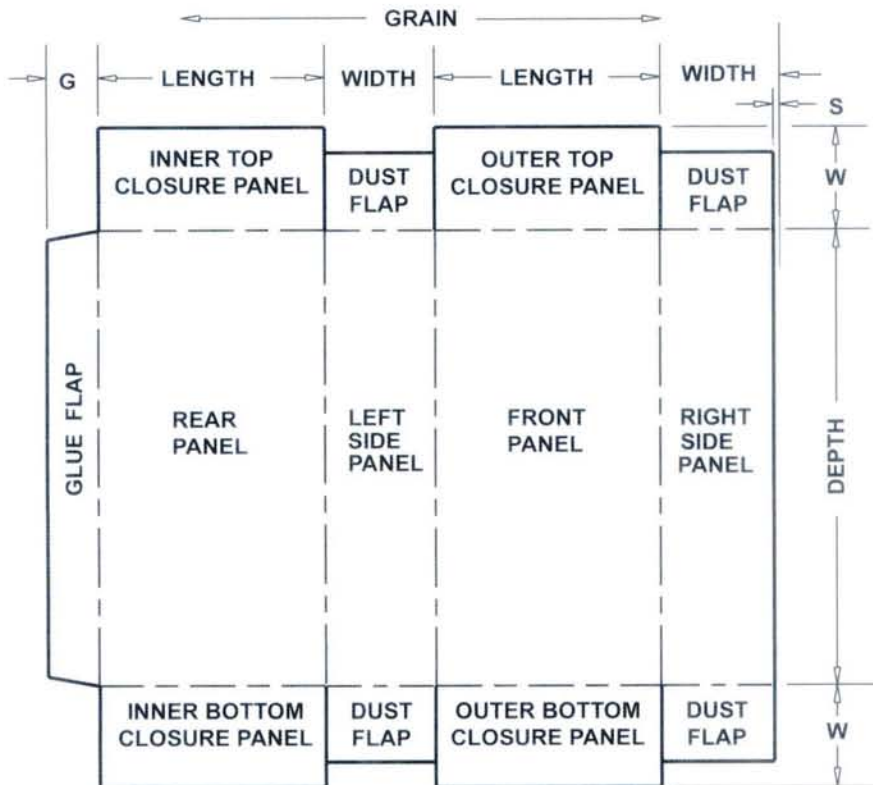


Figure 1

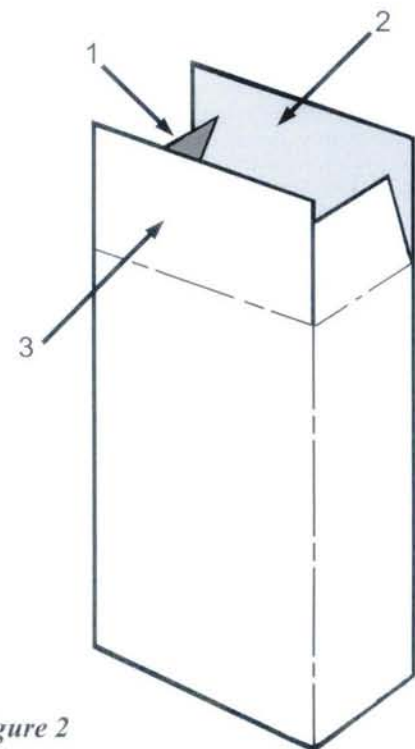


Figure 2



Partial Panel Top Closure
 Partial Panel Bottom Closure

**PARTIAL OVERLAP
 SEAL END
 (POSE)**

As opposed to the FOSE which has full width major closure panels, the partial overlap seal end major closure panels are just wide enough to permit a proper overlap for gluing. Figure 2 illustrates the partial overlap of the inner and outer major panels. Figure 3 illustrates the "cereal closure" commonly used on POSE dry cereal cartons. In this variation, the lock tab on the outer top closure panel is nested into the outer bottom closure panel of the adjacent carton.

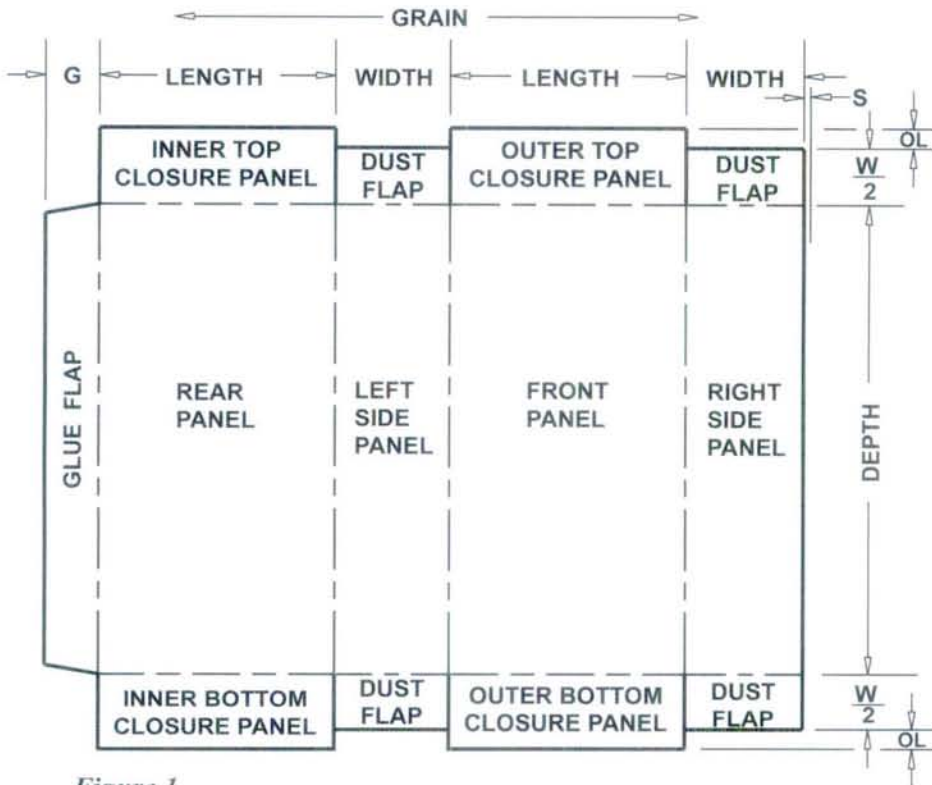


Figure 1

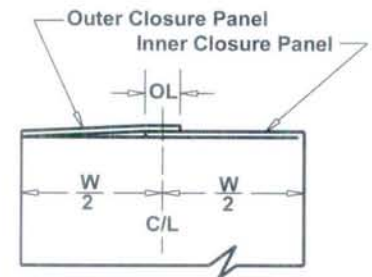


Figure 2

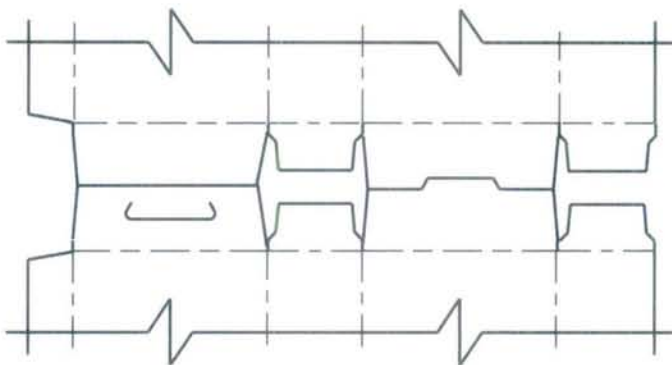


Figure 3

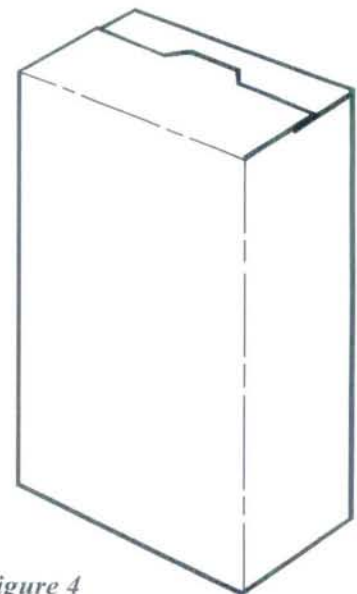


Figure 4



ECONOMY OVERLAP SEAL END (EOSE)

The economy overlap seal end (EOSE) combines the graphic advantage of the FOSE with some of the economic advantage of the smaller POSE blank.

As shown in Figure 1, by reversing the positions of the bottom inner and outer major panels, the carton can be nested straight back.

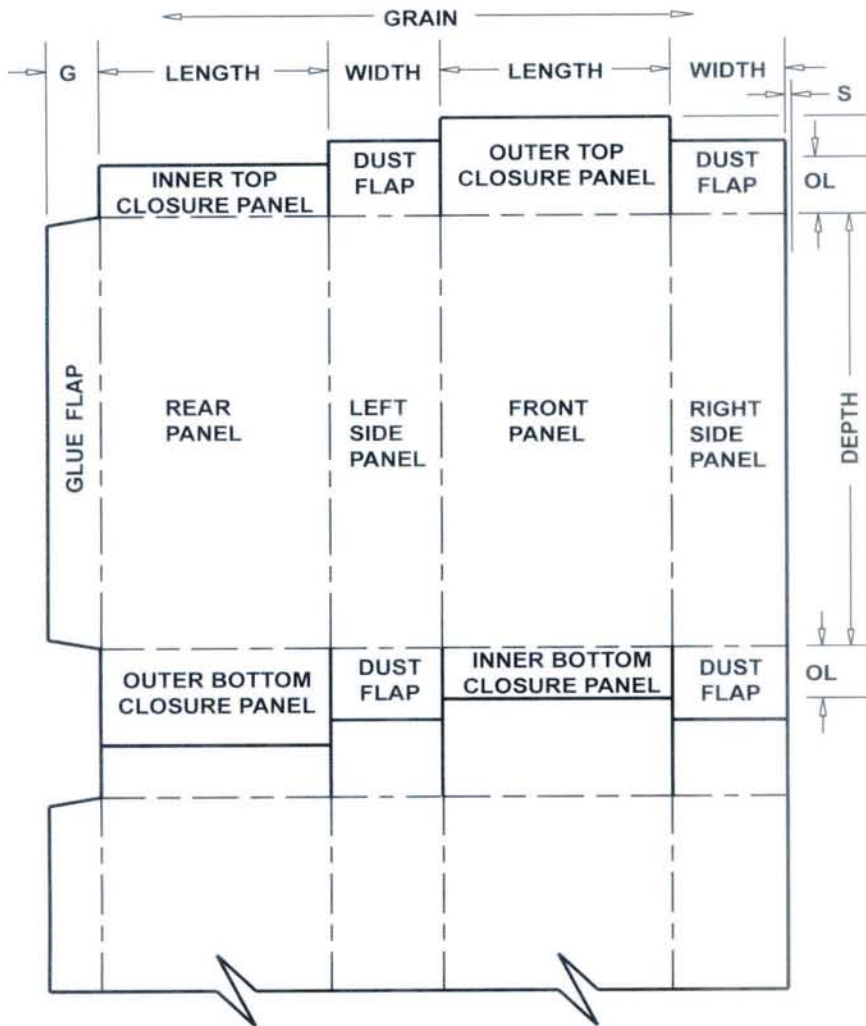


Figure 1



Figure 2



Slit Lock Tab Top
 Slit Lock Tab Bottom

EDGE LOCK

The most familiar use of this style is as a retail package for frozen prepared foods. It can be erected and closed by hand; but it is typically formed, filled and closed on automatic cartoning equipment.

The edge lock is frequently nested to minimize board usage. Figure 3 shows one possible nesting configuration.

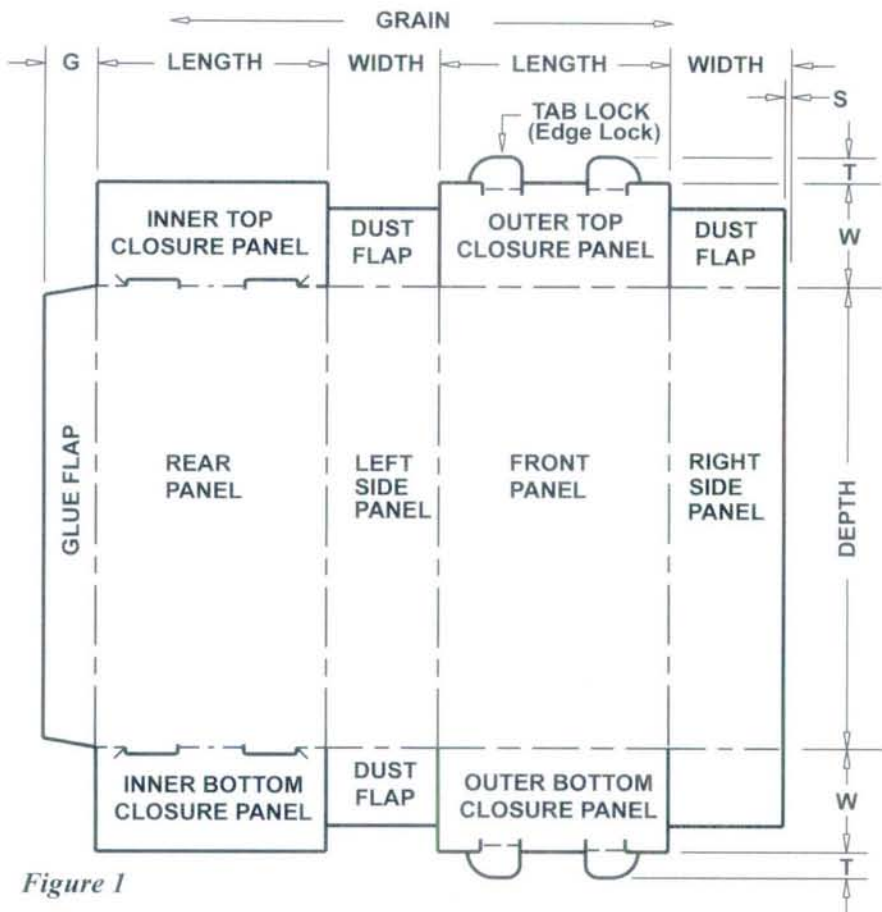


Figure 1

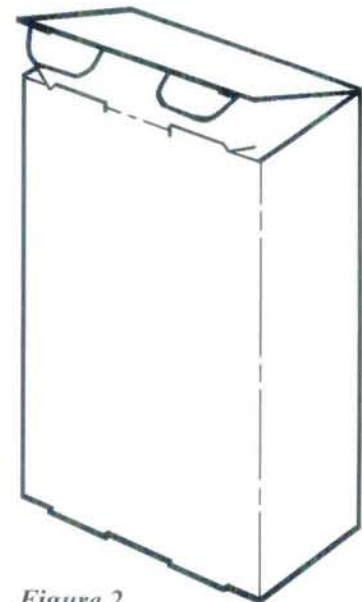


Figure 2

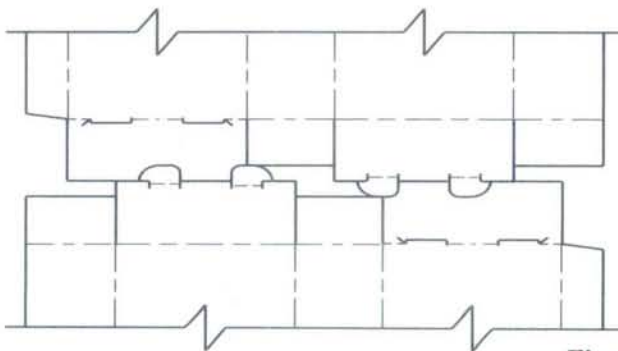


Figure 3



ZIPPER LOCK

This is a very economical nested, lock end tube used almost exclusively in the frozen food industry as an overwrap shell (an unprinted carton with a printed paper overwrap). It is automatically formed, filled and locked prior to overwrapping. Figure 1 illustrates the straight back nest typical of this style.

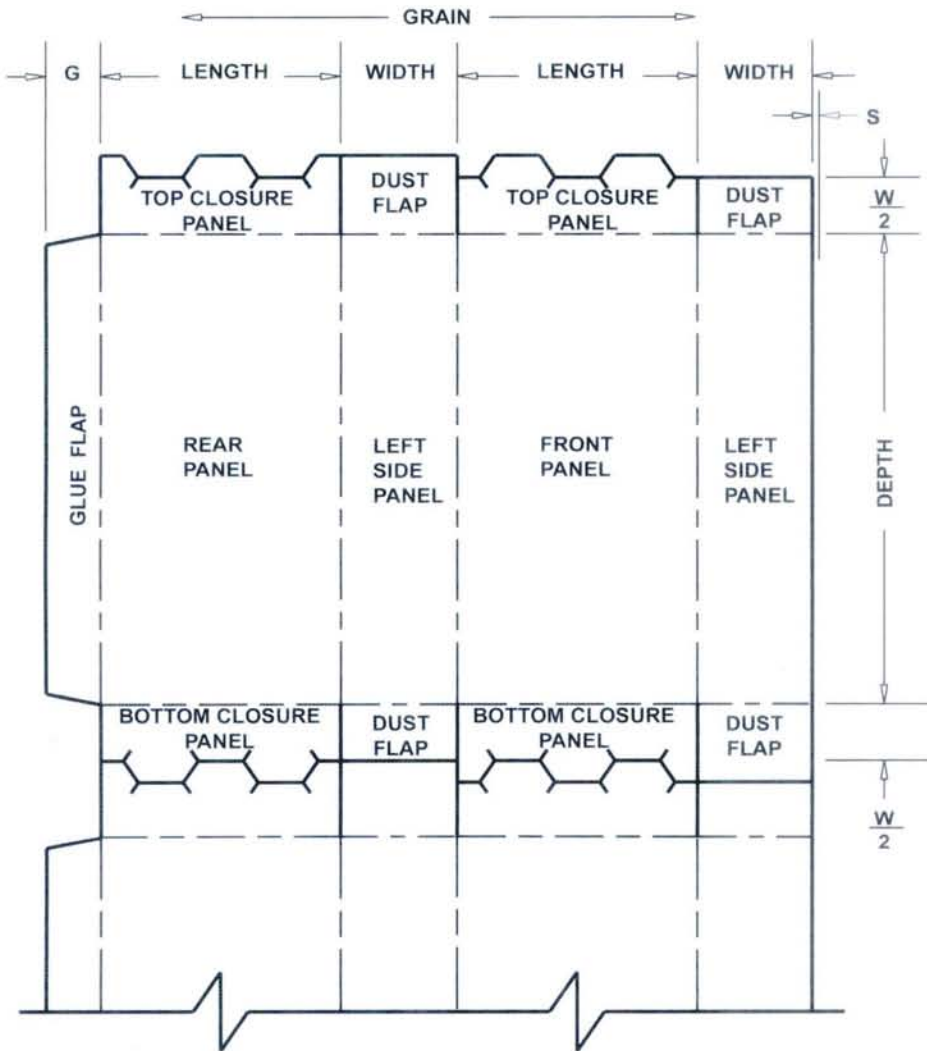


Figure 1

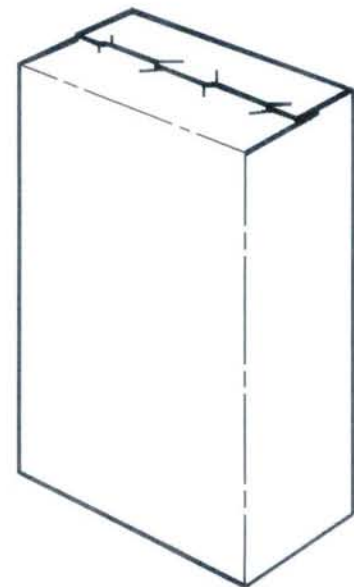


Figure 2



Friction Lock Tuck Top Closure
Non-Glued, Interlocked Flap Bottom Closure

1-2-3 BOTTOM
(a.k.a) HOUGHLAND
or
SNAP LOCK BOTTOM

This style originally identified by the inventor's name (Houghland) is today more frequently referred to as the 1-2-3 closure. It is used almost exclusively as a bottom closure, generally in combination with a tuck top closure. This is a hand erected and closed style. In addition to use in the variation shown below, the 1-2-3 closure is frequently used as the bottom closure for a shallow depth tube style counter display carton. The variation illustrated in Figure 2 offers additional security and is the preferred detailing for heavy products.

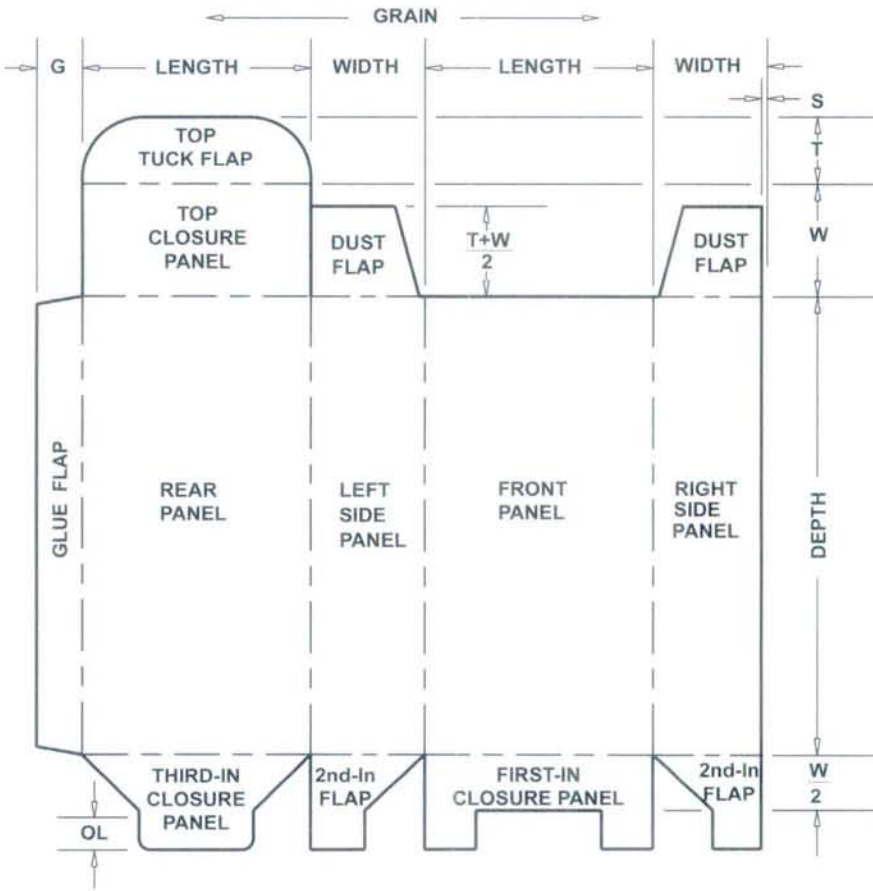


Figure 1

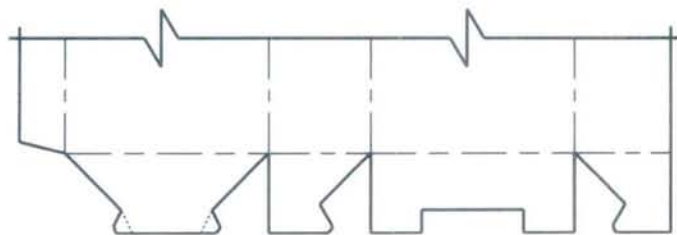
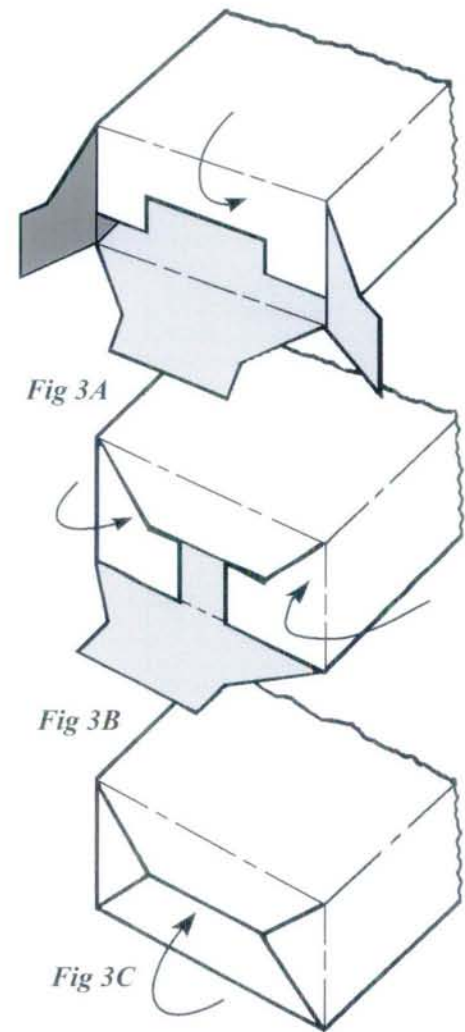


Figure 2

Figure 3—Closing Sequence



1-2-3-4 BOTTOM

For cartons with a square or near-square cross-section, this or the quad lock (page 1.503), are preferred alternatives to the Houghland (1-2-3) bottom shown on page 1.501. The closure panels are folded over one another in sequence as illustrated in Figure 2. This is typically used as a bottom closure but it can be adapted for use as a decorative top closure if there is no possibility of product interference as the flaps are folded past 90° to interlock with one another.

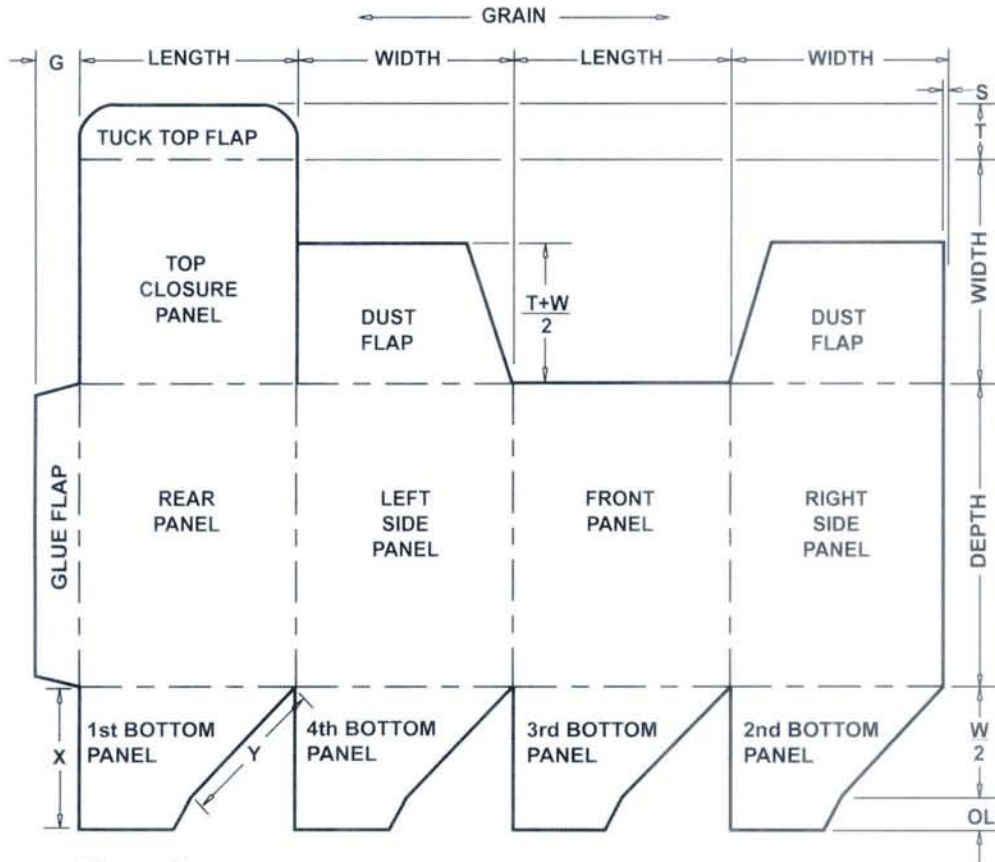


Figure 1

Note: This closure works best when (X) is equal to or less than (Y).

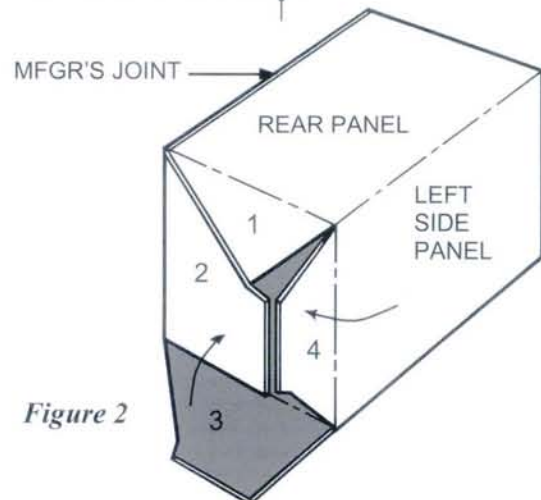


Figure 2



QUAD LOCK BOTTOM
 (a.k.a.)
DOUBLE LOCK or
EAR HOOK BOTTOM

The quad lock is a hand erected style. Like the 1-2-3 style, it is used almost exclusively as a bottom closure, commonly in conjunction with a tuck top as shown below.

In a square configuration, both lock tabs engage into a common set of lock slots (see Figure 3).

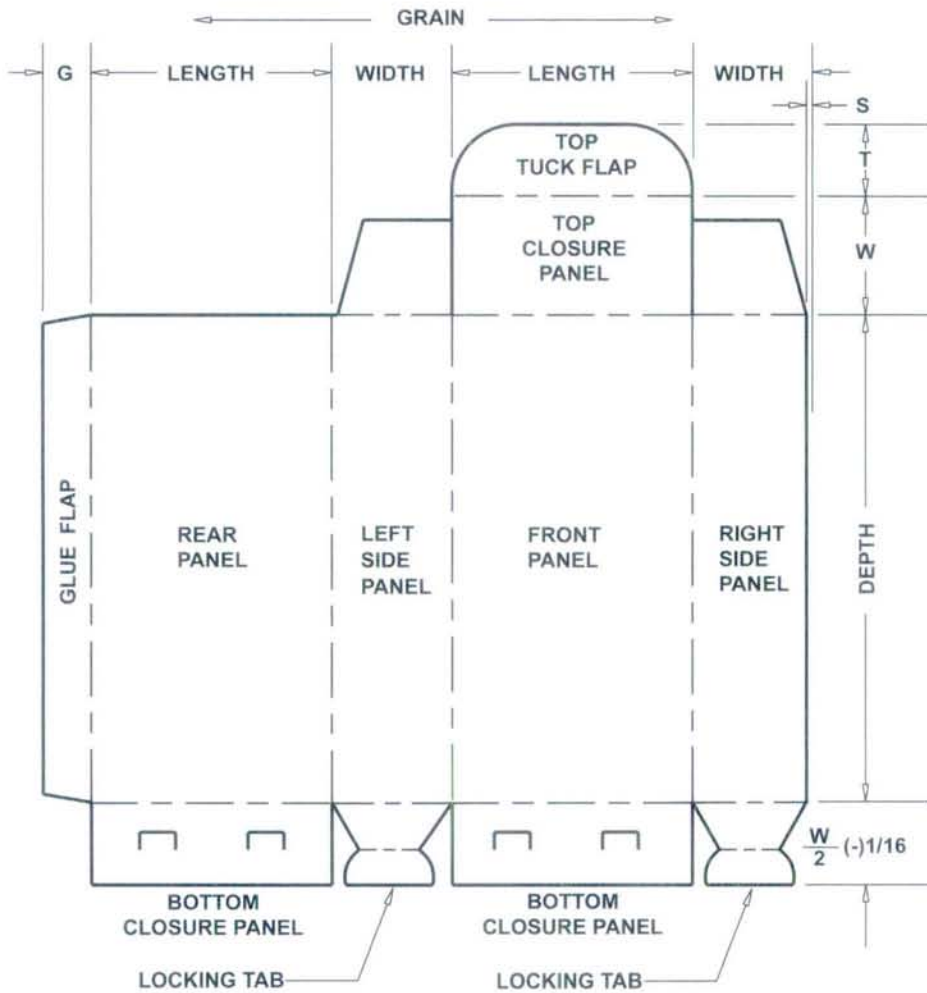


Figure 1

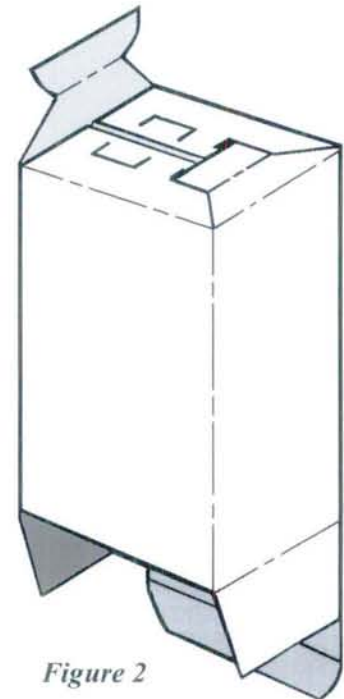


Figure 2

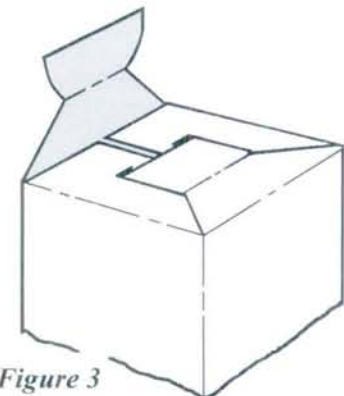


Figure 3



**HIMES LOCK,
 AUTOMATIC BOTTOM
 (a.k.a) CRASH LOCK,
 ECONOMY or
 POPCORN BOTTOM**

The Himes or crash lock automatic bottom is preglued in the converter's plant. It is hand erected and typically used where fast set up is critical, but production volume does not justify an investment in automatic packaging equipment.

Figure 2 shows an alternative detailing of the strip out area for heavy caliper board.

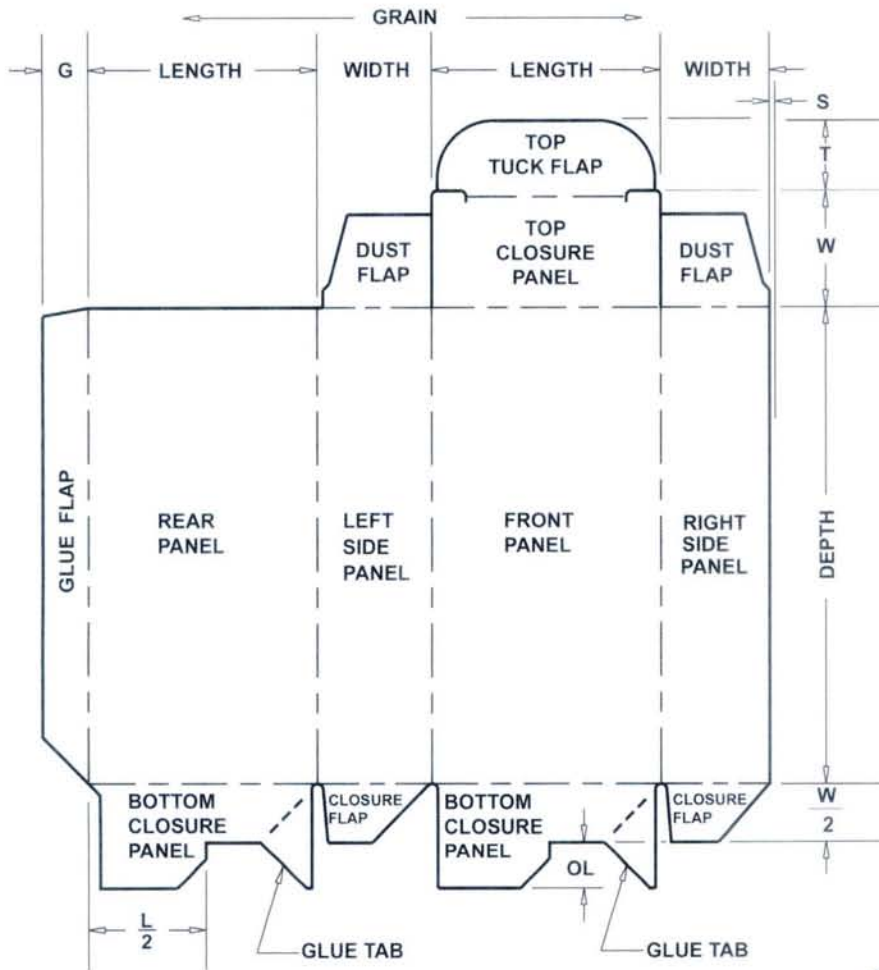


Figure 1

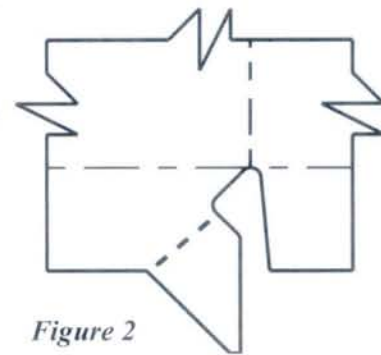


Figure 2

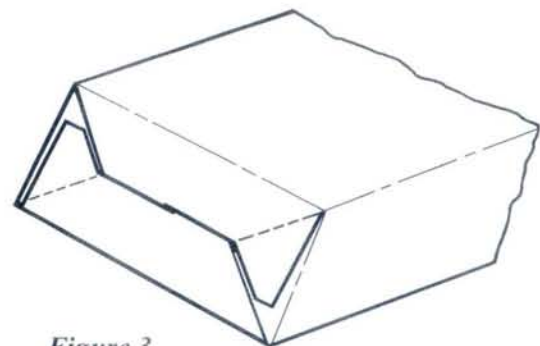


Figure 3



Slit Lock Tuck Top
Preglued, Auto-Erect Bottom

**FULL FLAP
 AUTOMATIC
 BOTTOM**

The full flap automatic bottom is a preferred alternative to the Himes (or crash lock) for heavier products, or where the product weight is concentrated along the longitudinal centerline.

Like all automatic bottoms, this is a hand erected style used primarily in situations where quick set up is a requirement, but where production volume does not justify automatic packaging equipment.

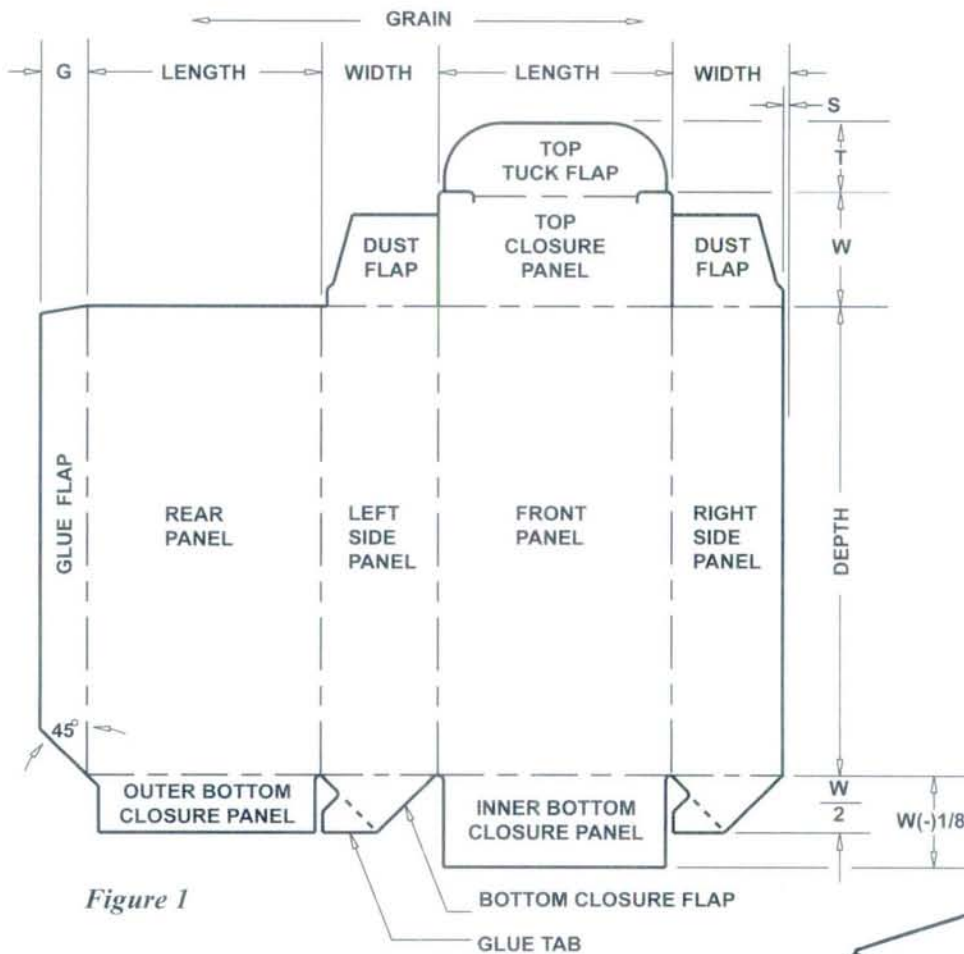


Figure 1

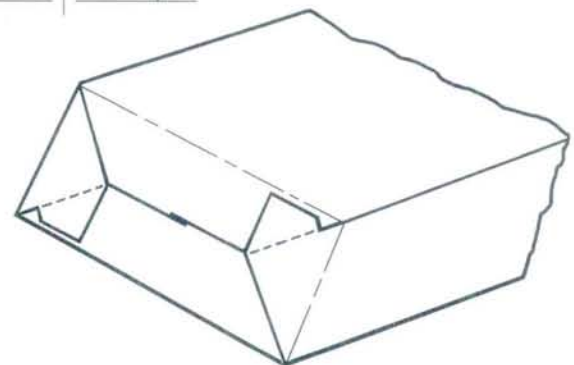


Figure 2



Slit Lock Tuck Top
Preglued, Auto-Erect Bottom

**INFOLD
 AUTOMATIC
 BOTTOM**

This is similar in configuration to the Himes (or crash lock) except for the location of the diagonal fold line. On the Himes, the diagonal fold line is on the major closure panel. On the infold, the diagonal fold line is on the minor end closure flap.

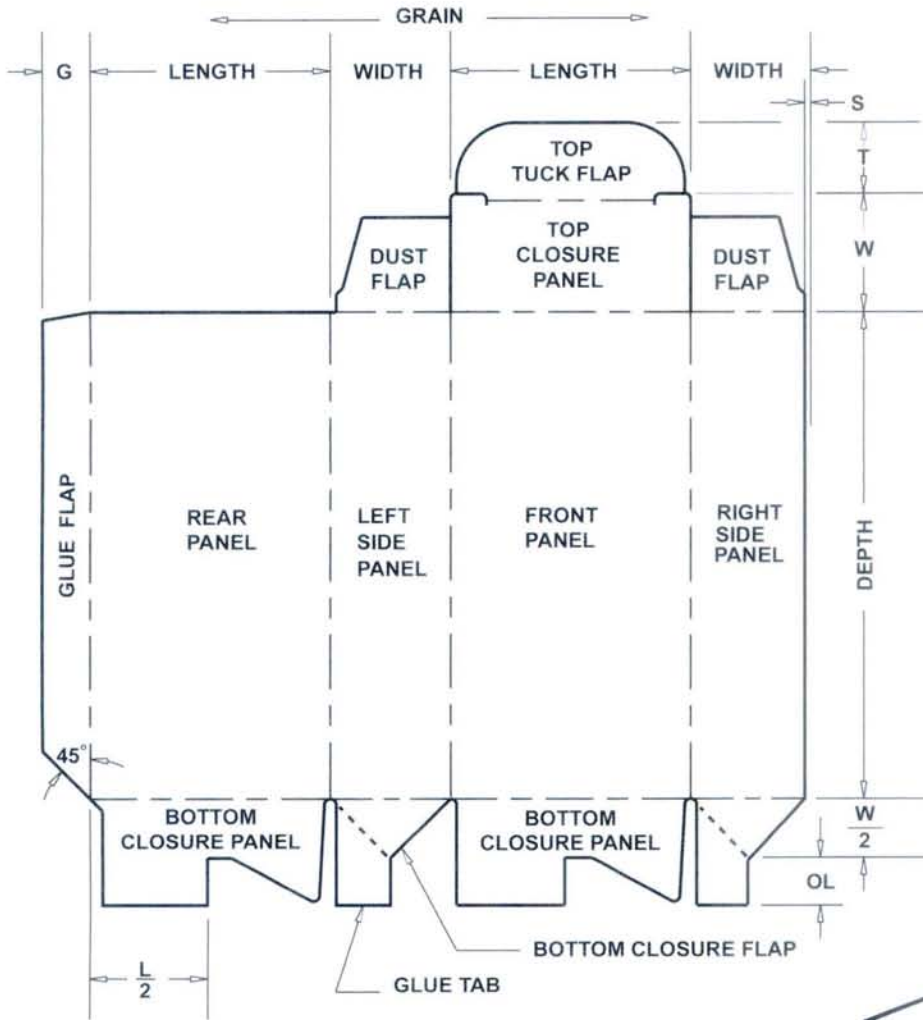


Figure 1

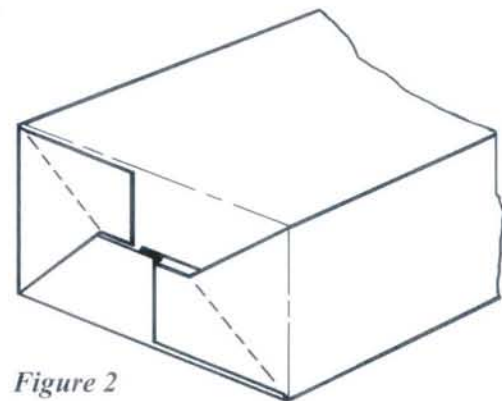


Figure 2



TUCK and SEAL END COMBINATION with ZIPPER

The tuck and seal end combination is an alternative to the FOSE (page 1.301), where it is desirable to have a good reclosure in addition to a secure initial seal.

The style typically includes a zipper tear strip in the outer closure panel (see Figures 2 and 3).

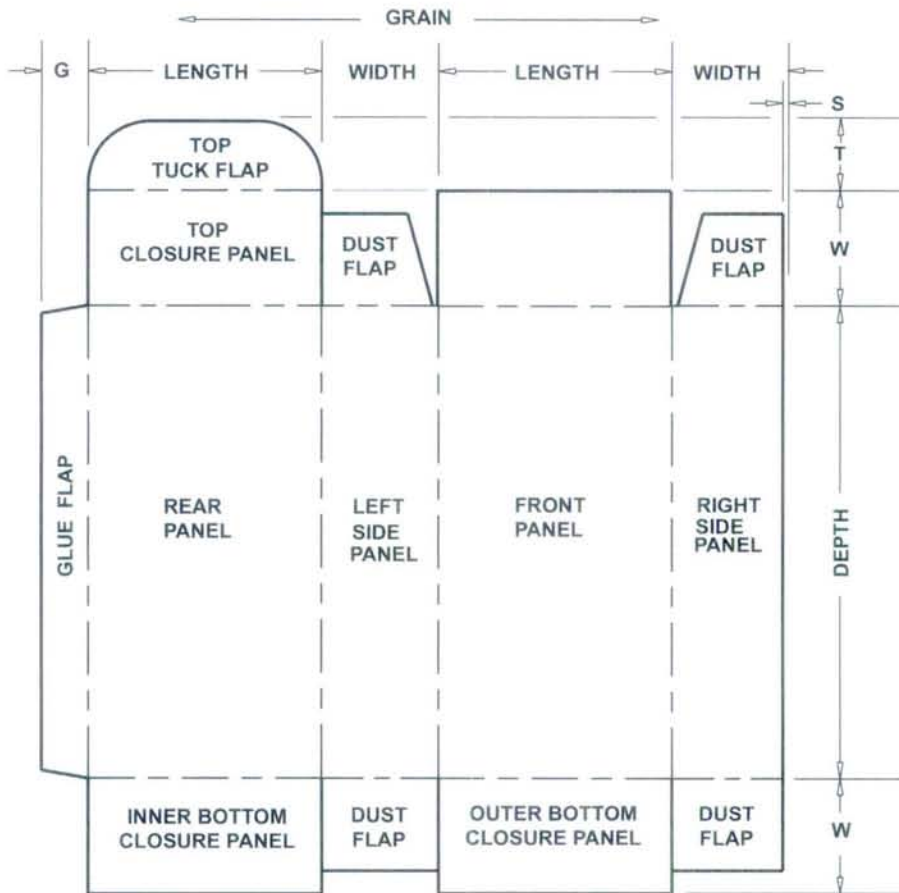


Figure 1

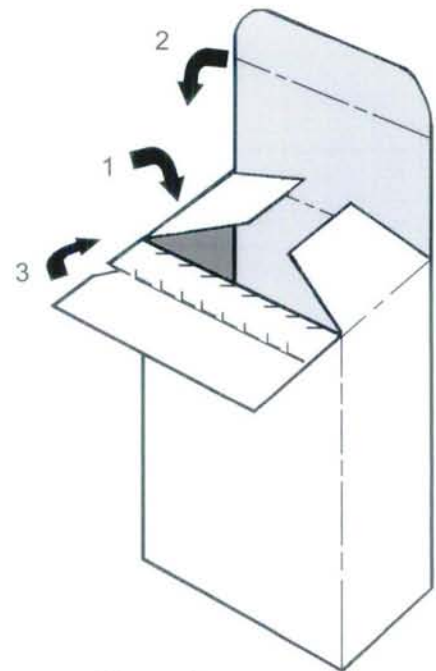


Figure 2

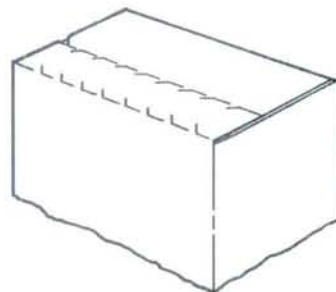


Figure 3



Lock Top
Auto-Erect Bottom

GUSSET
FLAT TOP CLOSURE
HIMES AUTO-ERECT
BOTTOM

This is a hand set up, loaded and closed structure. It is primarily used in the fast food industry as a carton for complete meals; however, it has application where a very stable structure which is quick and easy to erect and close is required.

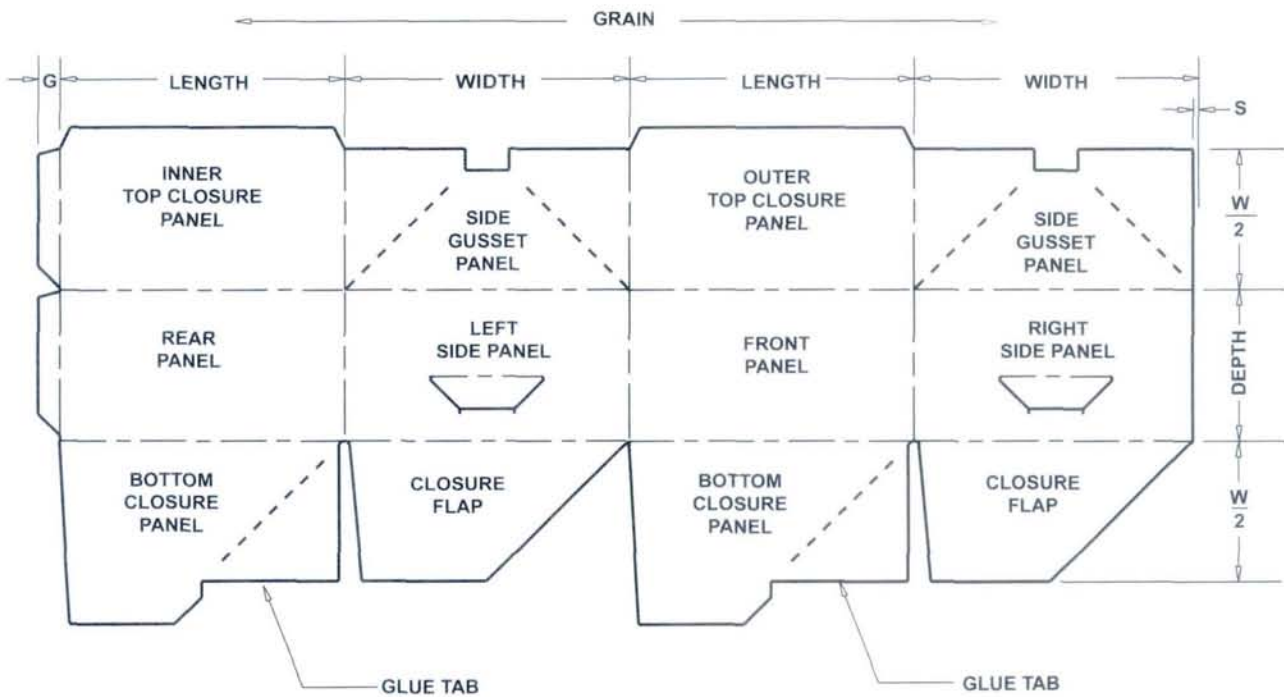


Figure 1

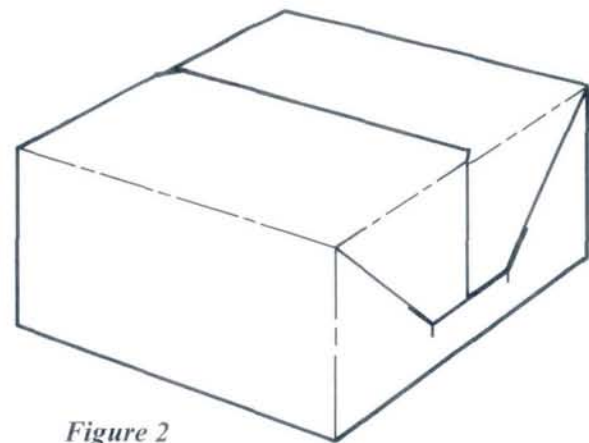


Figure 2



TUBES WITH COMBINATION END CLOSURES

Lock Top with Integral Handle

Auto-Erect Bottom

GUSSET FLAT TOP CLOSURE with HANDLE HIMES AUTO-ERECT BOTTOM

This is a hand set up, loaded and closed structure. It is primarily used in the fast food industry as a convenient carry-out carton for compete meals. It closes in a similar fashion to the example on page 1.508; however, this carton also has an integral carrying handle.

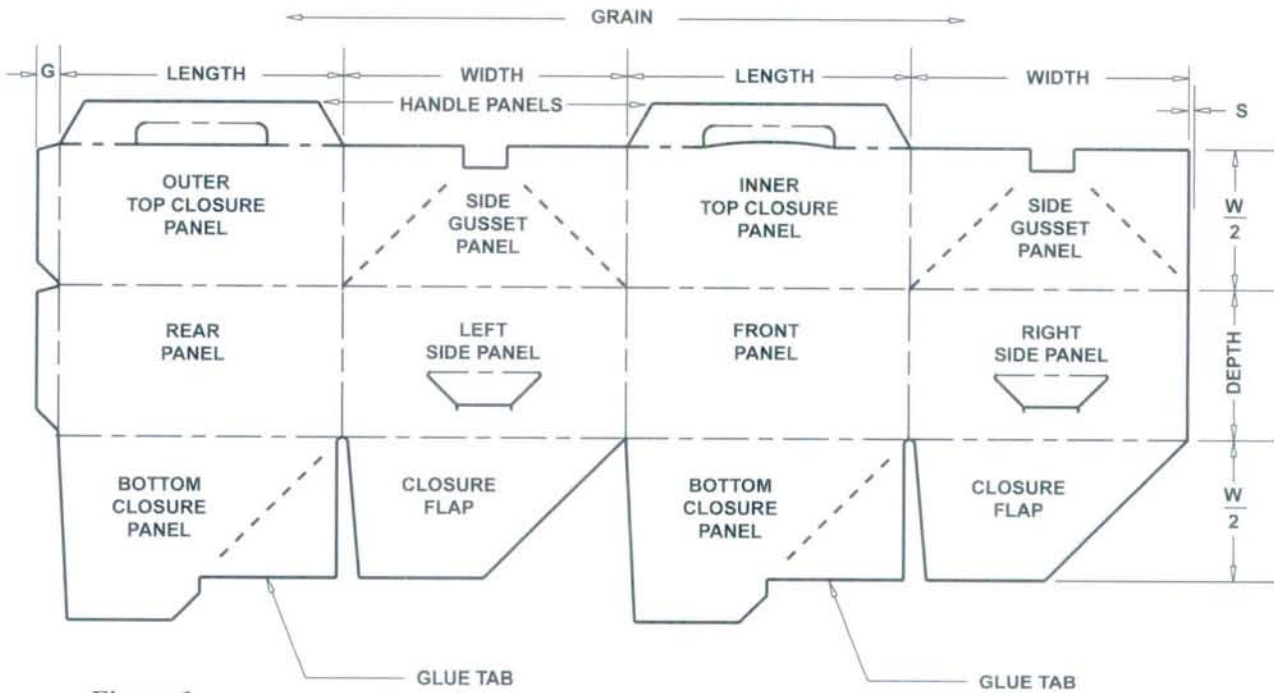


Figure 1

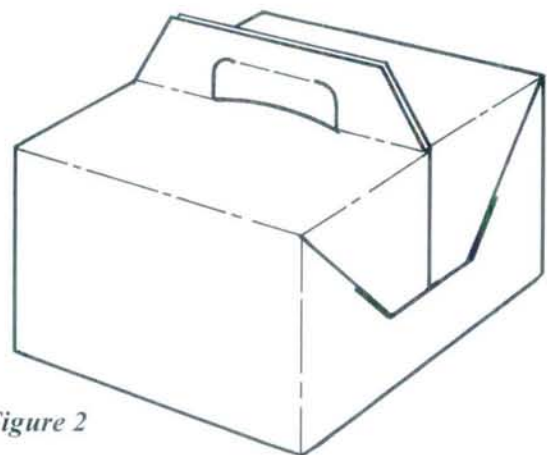


Figure 2



Lock Top
Auto-Erect Bottom

GABLE TOP with
INTEGRAL HANDLE
HIMES AUTO-ERECT
BOTTOM

Like the examples on pages 1.508 and 1.509, this is a hand set up, loaded and closed structure with its primary use in the fast food industry. It differs from the other two in that it has a gabled top. It is quick and easy to erect and close, plus it has a convenient carrying handle.

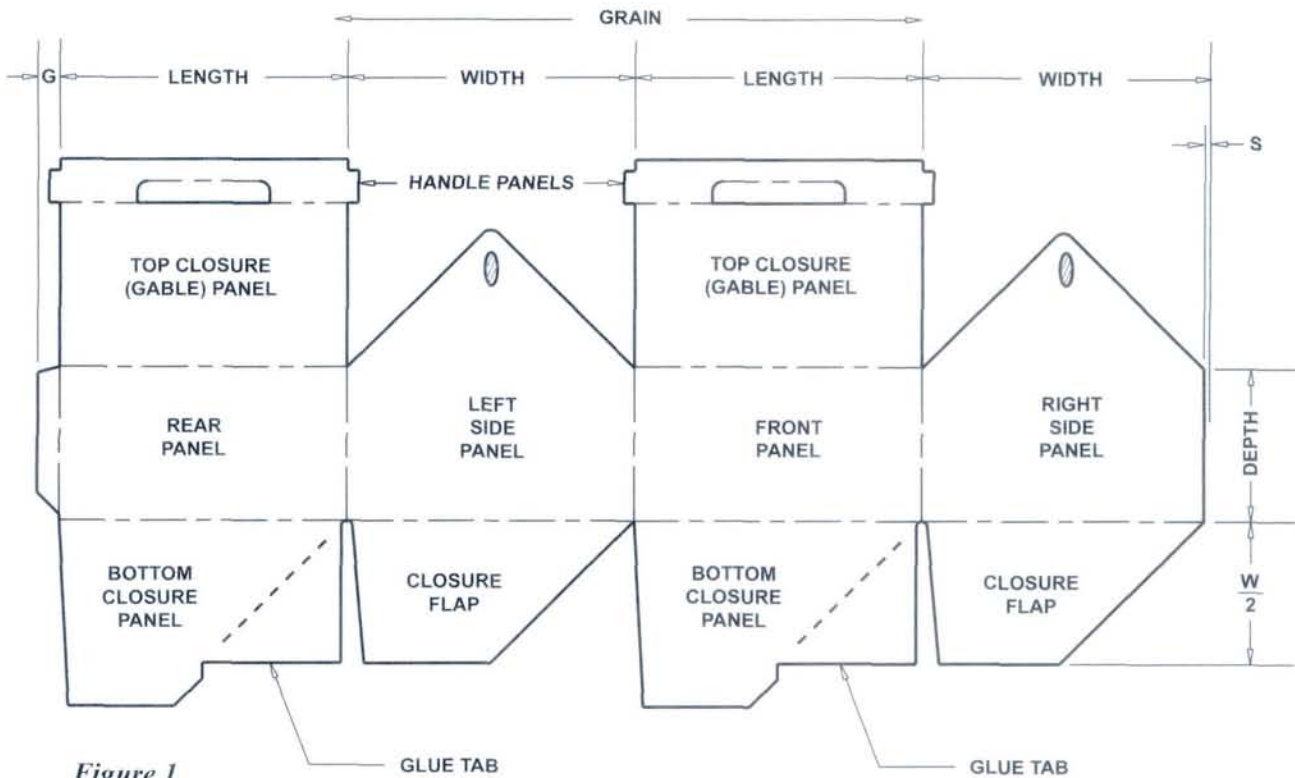


Figure 1

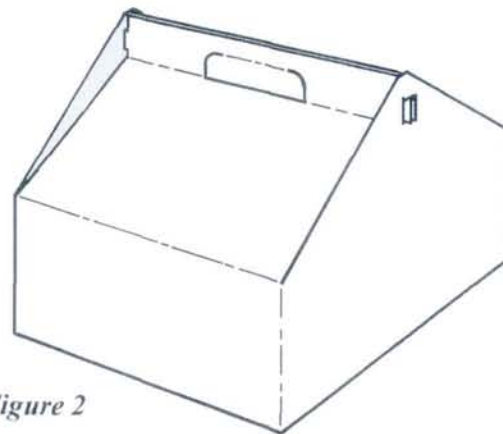


Figure 2



Seal End Top with Integral Handle
 Seal End Bottom

**FULL OVERLAP
 SEAL END TOP with
 HANDLE
 ECONOMY OVERLAP
 SEAL END BOTTOM**

This is one of the most simple tube style handle arrangements. This two ply handle is suitable for light to medium weight products. It can be glued on most packaging equipment with only minor changes to the reverse folding of the inner top closure panel handle flap.

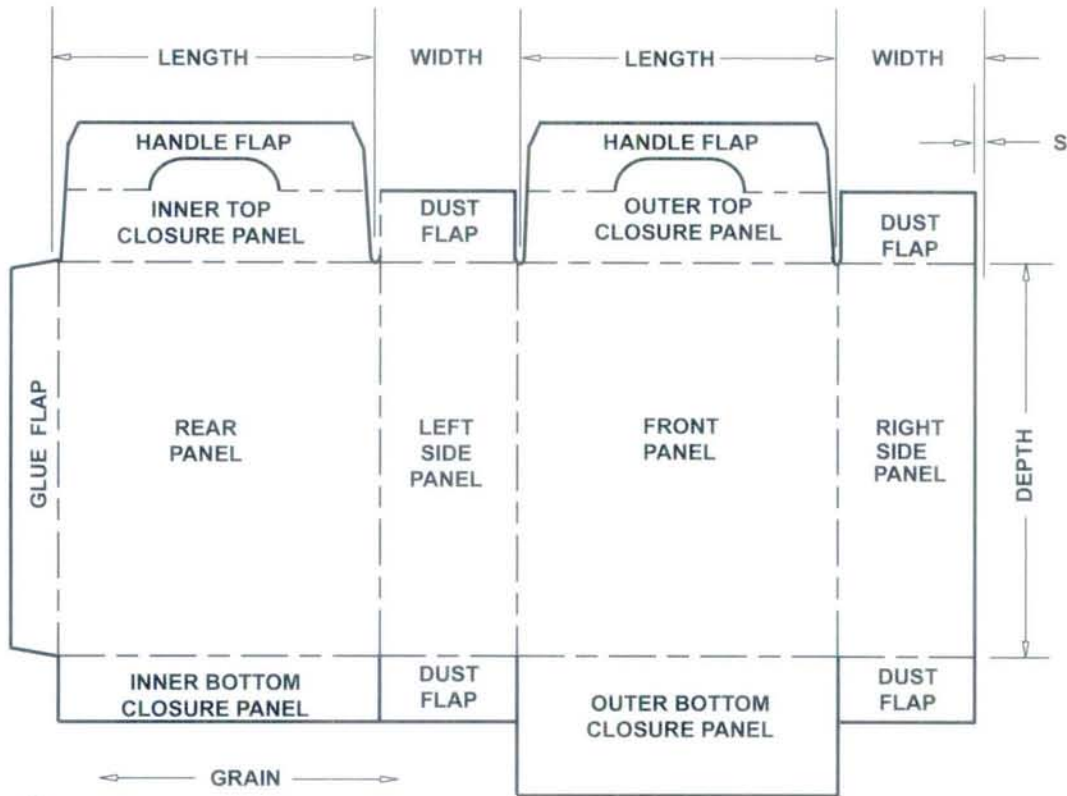


Figure 1

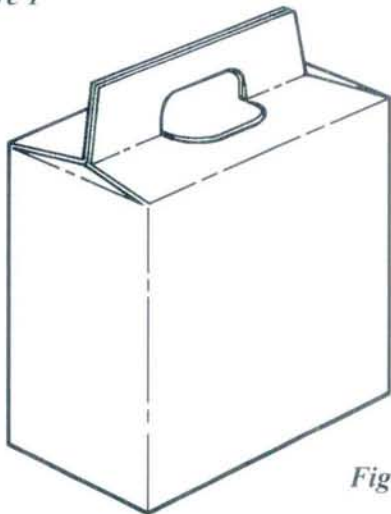


Figure 2

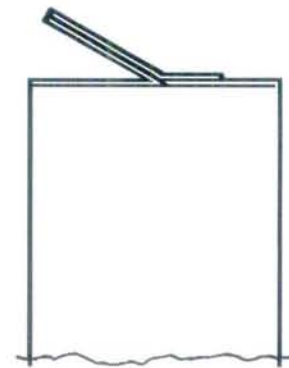


Figure 3



BEYOND THE RECTANGULAR TUBE: CROSS-SECTION ALTERNATIVES

The preceding section details a number of end closure options and component part shape options for the classic rectangular cross-section tube style carton. Most of these closure and component part designs can be manipulated to adapt to other cross-section shapes as well.

The common denominator in “Cross-Section Alternatives” is that, like the more familiar rectangular styles, these design variations also fold flat on the gluer and deliver flat to the customer.

For example, the even-sided diamond, hexagon and octagon symmetrical shapes fold on conventional working scores just as the rectangle does. The same is possible for other shapes such as asymmetric four, five, six, or seven sided polygons; so long as the combined length of the overlying panels is equal to the combined

length of the underlying panels. Figure 1 below illustrates this point.

By introducing extra working scores (more commonly referred to as false working scores and designated as “FWS” in this publication), symmetrical shapes with an uneven number of sides, such as triangles or pentagons, can also be folded flat.

Once this concept is understood, the possibilities are almost limitless. Through the creative efforts of the designer and the converter’s manufacturing personnel, the final product can be modified in appearance to the point that it is hardly recognizable as a tube.

A few of the design possibilities are illustrated on pages 1.601 through 1.606.

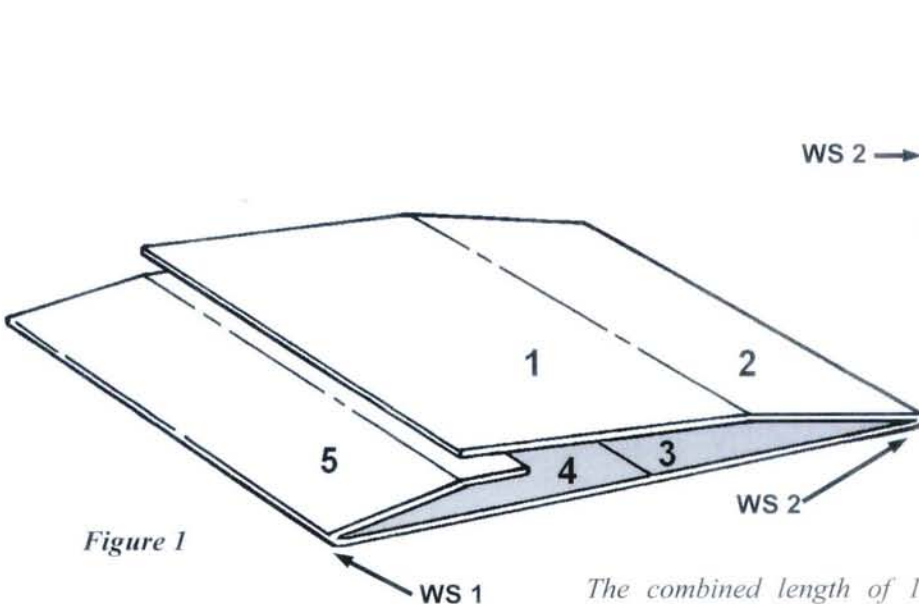


Figure 1

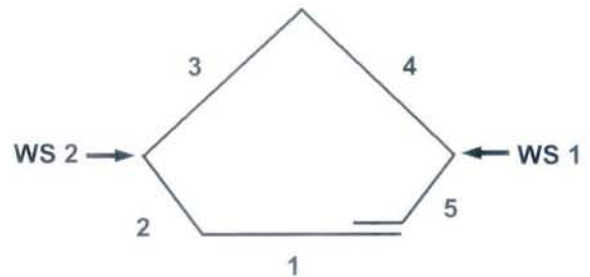


Figure 2: Cross-Section

The combined length of 1, 2 and 5 is equal to the combined length of 3 and 4. Therefore, this asymmetric shaped polygon will fold flat off of WS1 and WS2.

NOTE: Most of the cross-section alternatives shown on the following pages are detailed with simple friction lock tuck closures. It should be noted that seal end, slit lock tuck, and in most cases even auto-erect end closures are equally viable.



Shape Options
Cross-Section Alternatives

**TRIANGULAR TUBE
with
TUCK END CLOSURE**

Hinging the dust flaps off the panel with the false working score reduces panel bow when the dust flaps are folded inward.

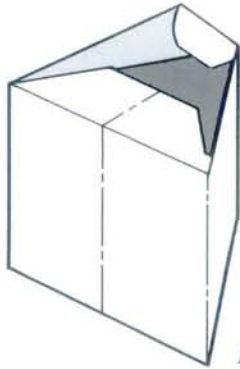


Figure 1

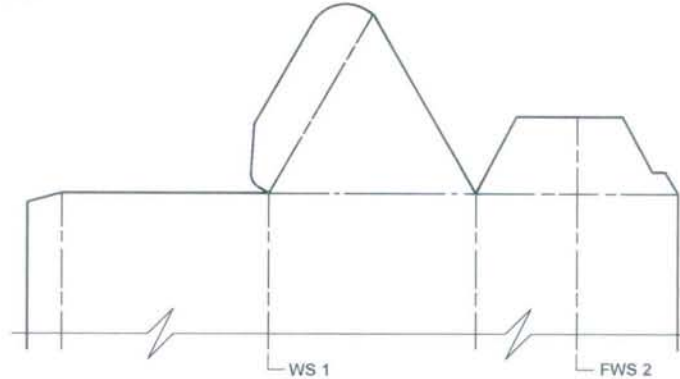


Figure 2

**TRIANGULAR TUBE
with
1-2-3 END CLOSURE**

Normally a bottom closure, the 1-2-3 can be a decorative top closure as well, provided the product permits the flaps to deflect inward to interlock.

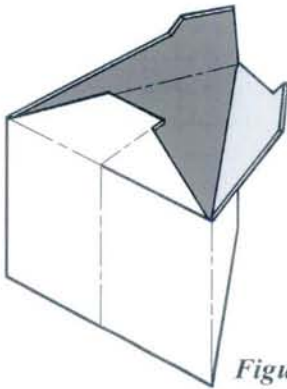


Figure 1

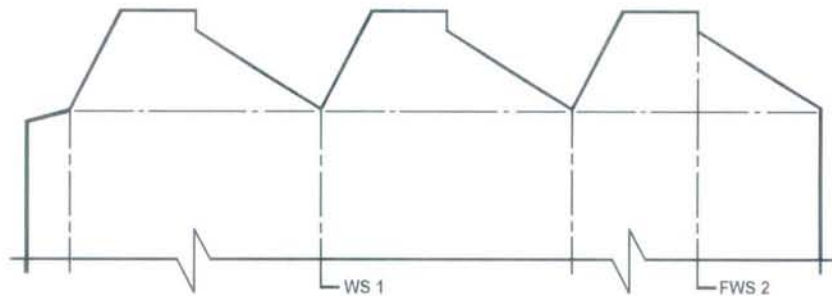


Figure 2

**TRIANGULAR TUBE
with
SEAL END CLOSURE**

Like the tuck version, the false working score is on one of the dust flap panels. This normally becomes the rear panel as displayed on the retail shelf.

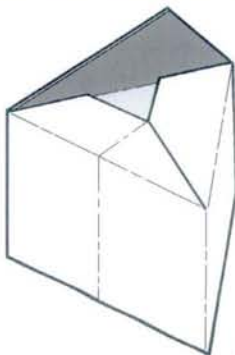


Figure 1

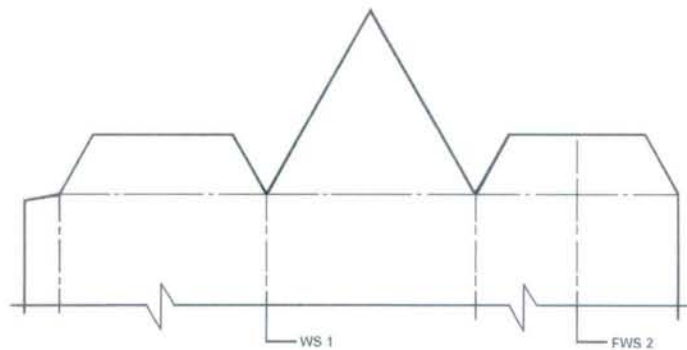


Figure 2



**TRIANGULAR TUBE
with
HIDDEN FALSE SCORE**

In the erected form the false working score is not visible. The visual impact is good but it requires more board than the triangular tubes illustrated on page 1.601.

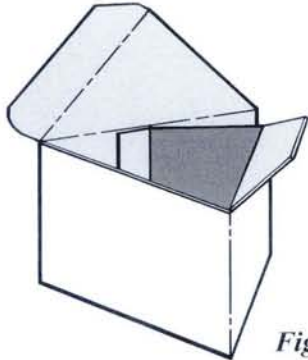


Figure 1

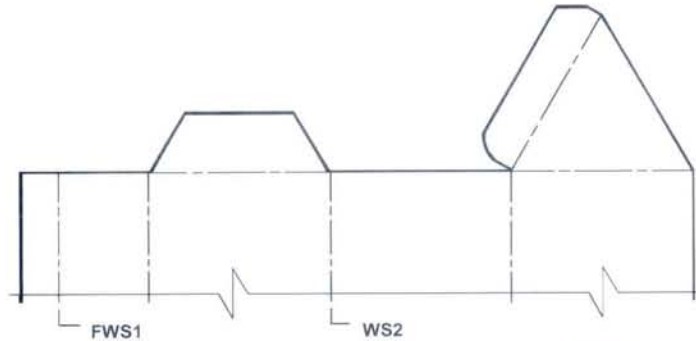


Figure 2

**DIAMOND SHAPED
FOUR SIDED TUBE**

Shown here with a tuck closure, adaptations of the auto-erect bottom closures shown in section 1.500 are also applicable to the diamond cross-section.

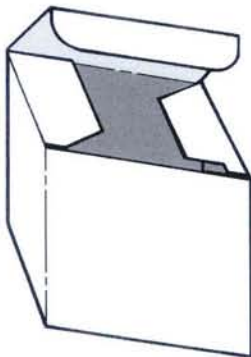


Figure 1

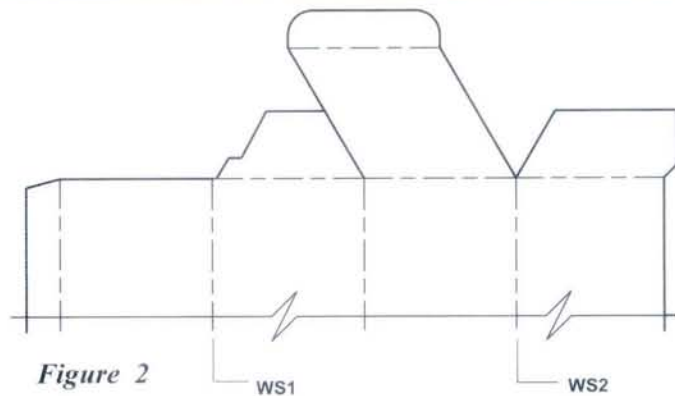


Figure 2

**ASYMMETRIC
FOUR SIDED
POLYGONAL TUBE**

No false working score is required for this configuration since the sum of the lengths of panels 1 and 4 equal the sum of the lengths of panels 2 and 3.

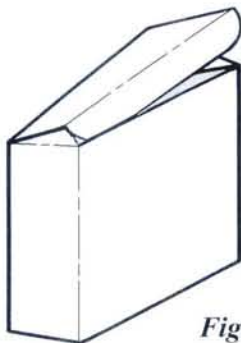


Figure 1

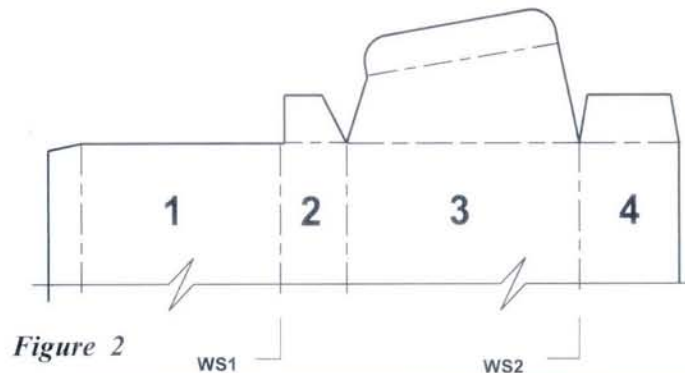


Figure 2

Shape Options
Cross-Section Alternatives

**TRAPEZOIDAL
 FOUR SIDED
 TUBE**

Shown below with a tongue lock closure, a conventional tuck or seal end would be just as applicable. As illustrated, the false working score is typically in the rear panel.

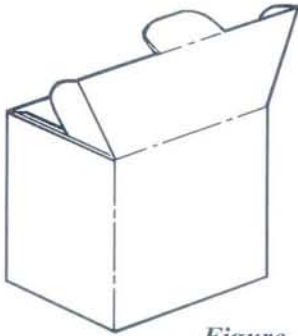


Figure 1

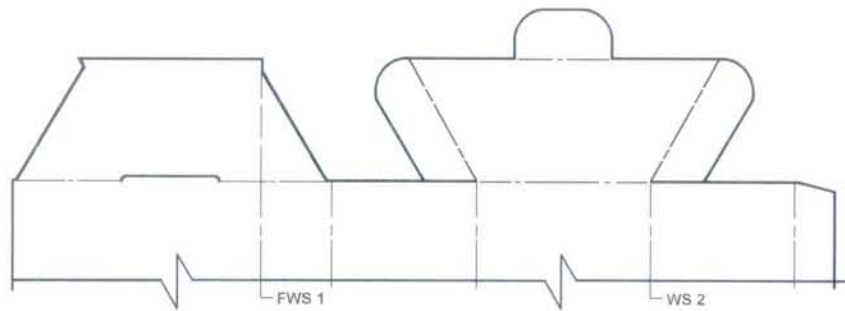


Figure 2

**EQUILATERAL
 PENTAGONAL
 TUBE**

A tuck closure as shown in Figures 1 and 2 is typical but a five flap, sequentially folded interlocking closure as illustrated in Figure 3 is also an option.

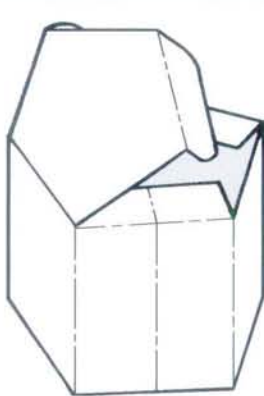


Figure 1

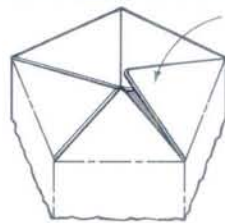


Figure 3

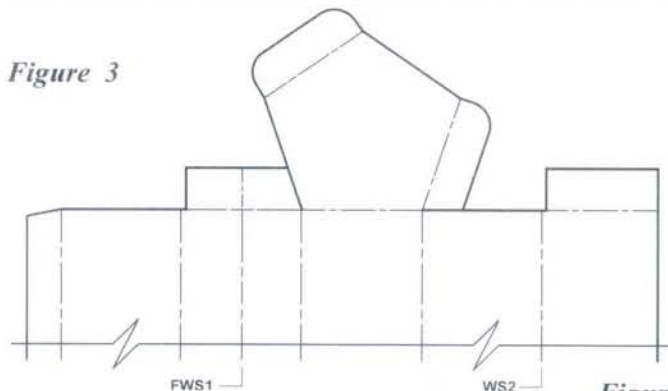


Figure 2

**ASYMMETRICAL
 PENTAGONAL
 TUBE**

To fold flat, the symmetrical pentagon shown above must incorporate a false working score. The asymmetrical pentagon below can be manipulated to fold on conventional score lines.

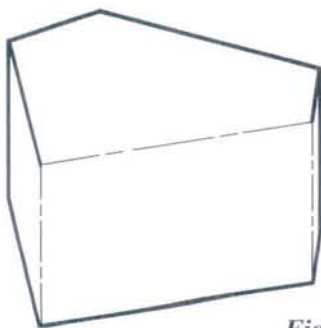


Figure 1

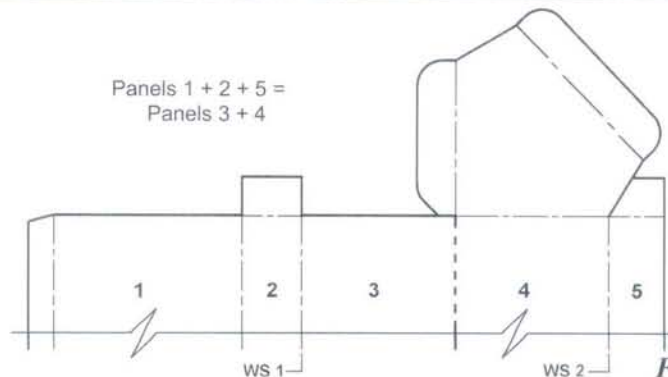


Figure 2



Shape Options
Cross-Section Alternatives

SIX PANEL
PENTAGON

A method of hiding the false score required to fabricate a conventional pentagon is to add a sixth panel which is folded in behind one of the remaining body panels in the erected form. This sixth panel is divided by a reverse fold into panels 6a and 6b.

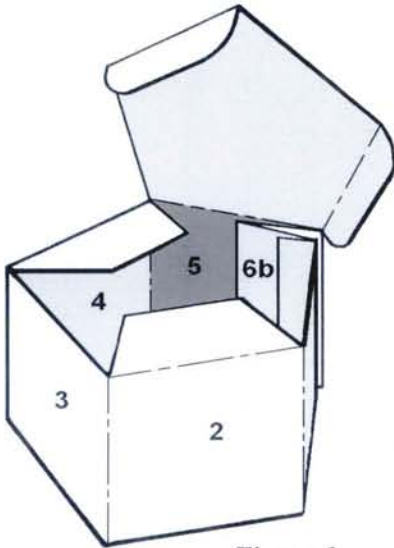


Figure 1

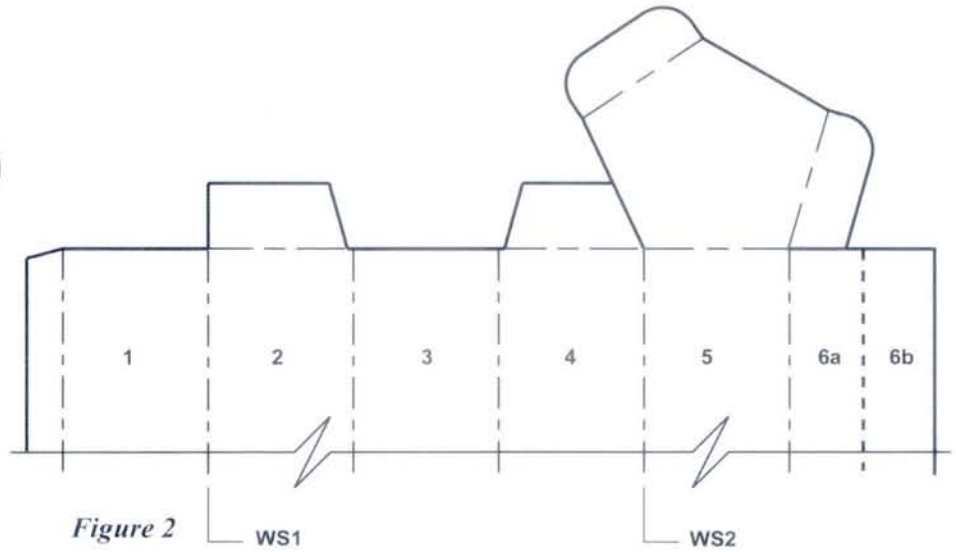


Figure 2

HEXAGON

As shown here, all six sides are the same dimension, but the hexagon is frequently produced with front and rear panels of a substantially greater length than the left and right side panels (Fig. 3). Either way, it will fold flat along conventional corner working scores. Figure 2 shows a tuck top/automatic bottom. Other closures such as seal ends or interlocking flaps are possible. See page 1.629 "Flower Closure".

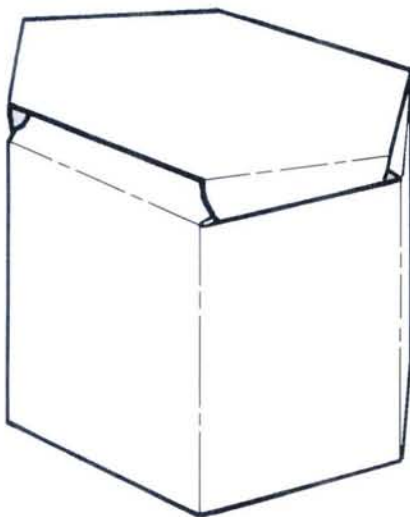


Figure 1

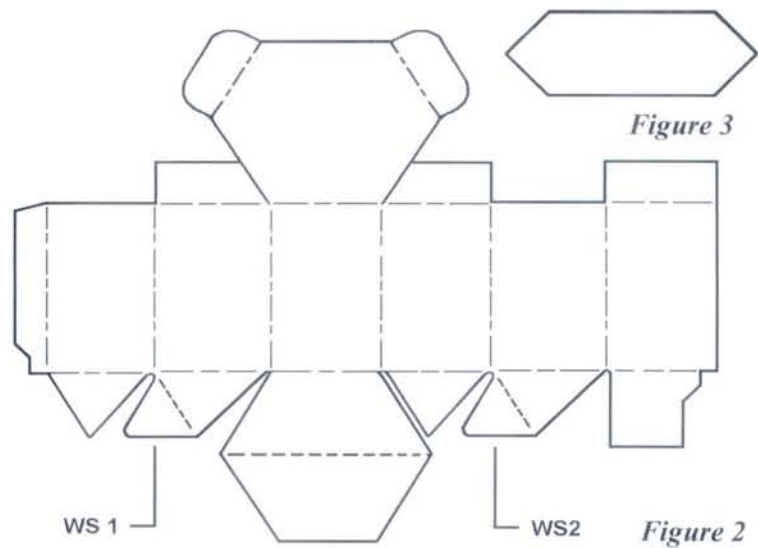


Figure 3

Figure 2



Shape Options
 Cross-Section Alternatives

**ASYMMETRIC
 SEVEN SIDED
 POLYGON**

No extra working score is required for the seven sided polygon as illustrated, since the combined length of panels 1, 5, 6 and 7 is equal to the combined length of 2, 3 and 4.

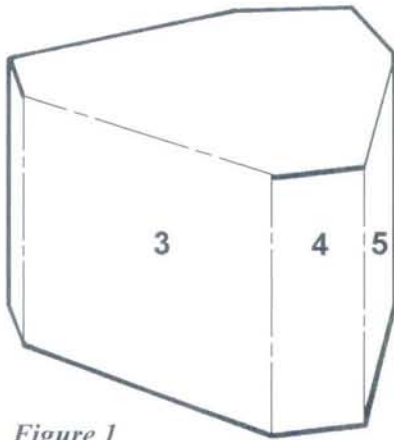


Figure 1

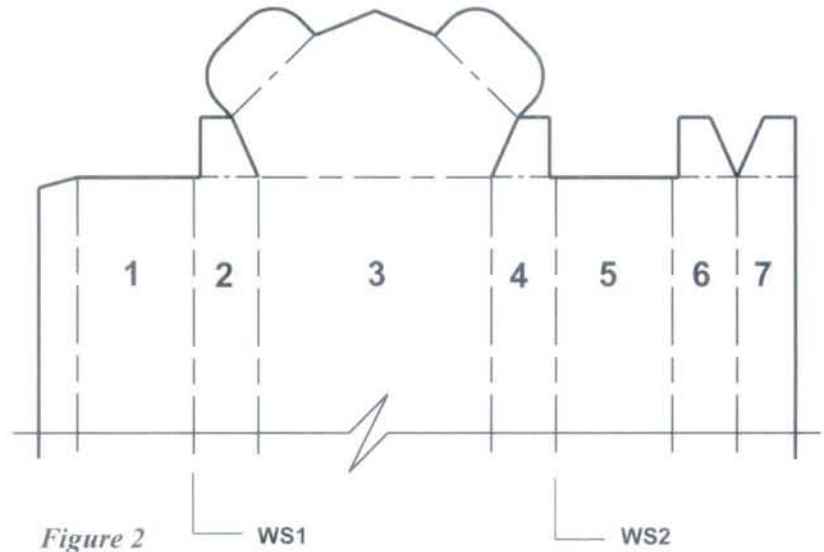


Figure 2

OCTAGON

Here the front, rear, left and right side panels are the same dimension and the remaining intermediate four are a smaller dimension. It may also be produced with all eight sides of the same dimension (Figure 3) or two (front and rear) larger than the other six (Figure 4). All three variations will fold flat along conventional corner working scores.

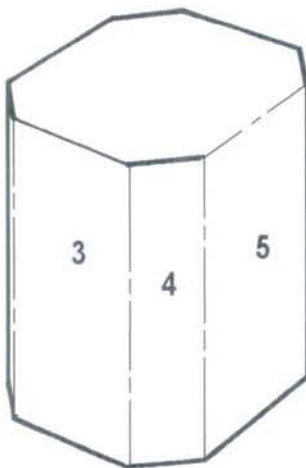


Figure 1

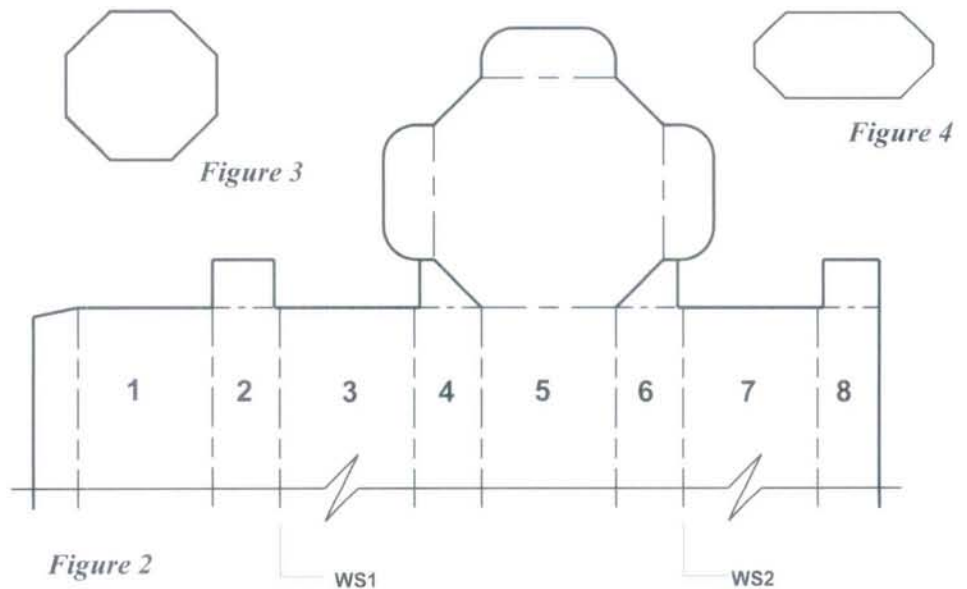


Figure 2

Figure 3

Figure 4



**SLANTED
CARTON**

This is an attractive variation on the classic French reverse tuck (page 1.202). Incorporating a slanted top and bottom presents a dramatically sloped front panel display. A simple tuck carton takes on a whole new retail shelf look. Used primarily for cosmetics, it is certainly not limited to this product line.

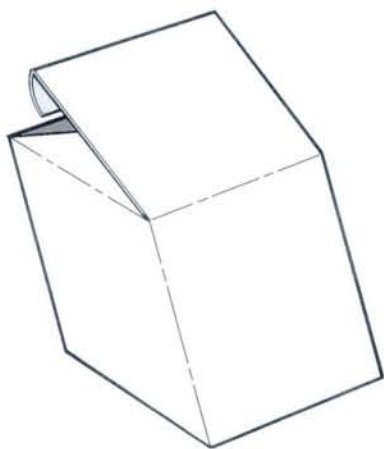


Figure 1

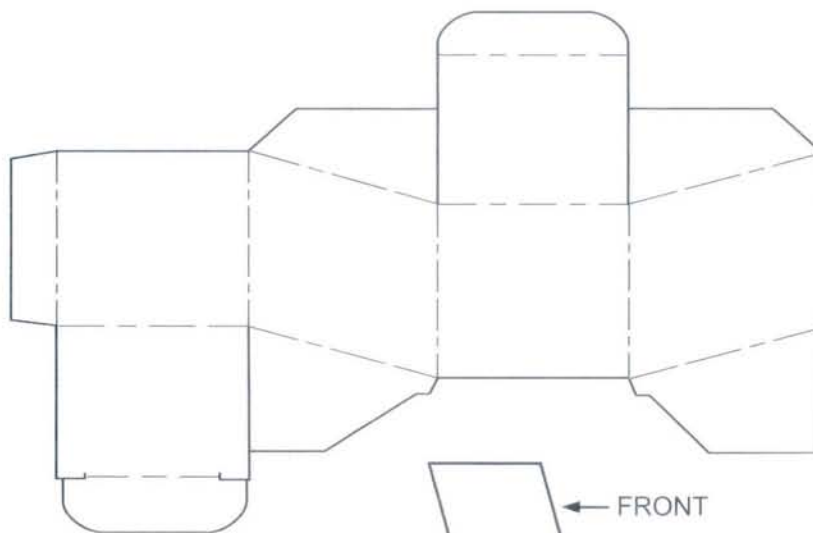


Figure 2



Figure 3—Side Elevation



Shape Options
Sculpted Body Panels

BEYOND THE RECTANGULAR TUBE: SCULPTED BODY PANELS

The shape options possible in a paperboard carton are almost limitless insofar as what can be designed and fabricated by the converter. The examples shown in this section of the manual demonstrate some basic directions the designer may choose to pursue.

The major restraint is neither design nor manufacturing, but factors such as requirements or limitations in the customer's packaging line, product shape or weight, or how the carton is case packed for proper handling through the distribution cycle.

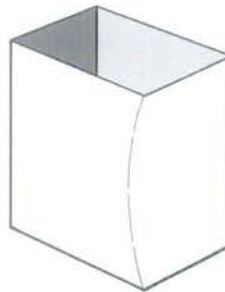
There are several techniques for sculpting paperboard cartons. Three of the more common are illustrated here in their simplest form:

1. Curving one or more of the corner scores.
2. Substituting planed or curved corner facets for one or more of the corner scores.
3. Collapsing one or more panels to create a peaked or gabled tube end.

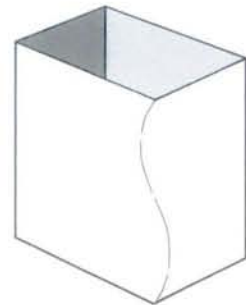
By introducing false working scores or working scores that become non-functional in the finished package, the curved or faceted corner concept can be used on all corners.

Many of the styles illustrated in this section use one or more of these techniques.

CURVED SCORE CORNERS

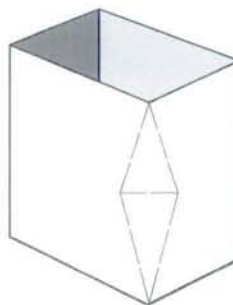


Simple Curve

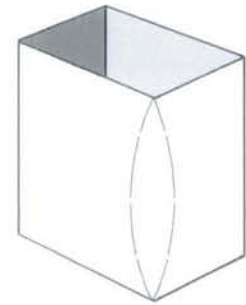


Compound Curve

FACETED CORNERS



Simple Planed Facet

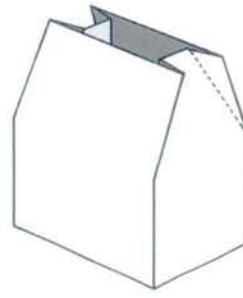


Curved Concave Facet

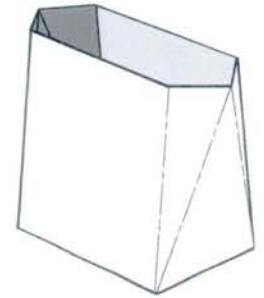
COLLAPSED PANELS



Inward Fold



Inward Fold



Outward Fold



Shape Options
Sculpted Body Panels

FOUR CORNER FACETS
Dual False Working Scores

In this structure the false working scores have been integrated into the design of the sculpted end panels. Illustrated below with a tuck end bottom closure; seal end or 1-2-3 closures are applicable as well.

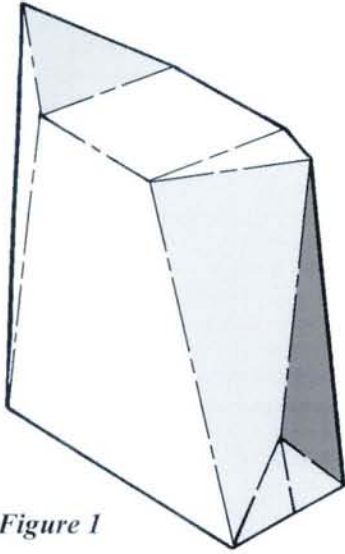


Figure 1

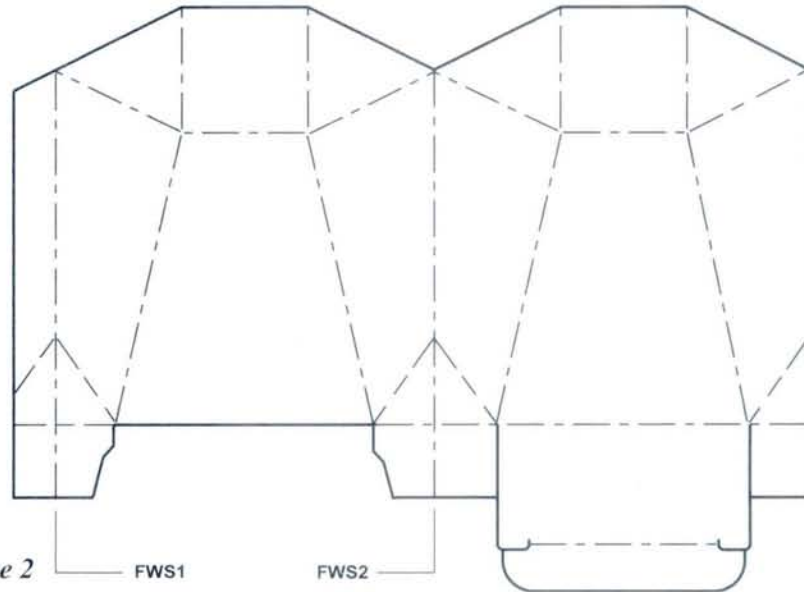


Figure 2

FOUR CORNER FACETS
Dual False Working Scores
Arcuate Corner Scores

Concave and convex panels and a 90° twist to the major axis of the top and bottom closure result in a very interesting structure. Shown here as a seal end style, it can also be developed with tuck end closures.

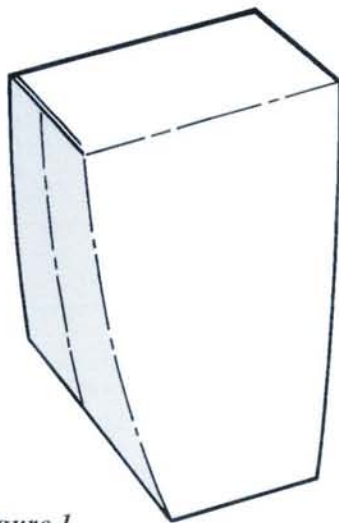


Figure 1

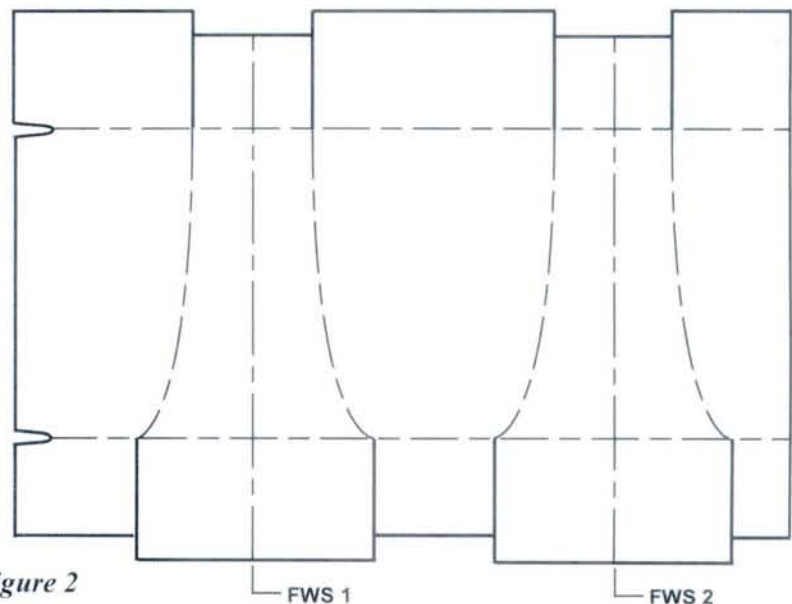


Figure 2



Shape Options
Sculpted Body Panels

FOUR CORNER FACETS
Dual False Working Scores

This illustration details a unique style. Note that in the erected form, the axis of the top is twisted 45° relative to the axis of the base.

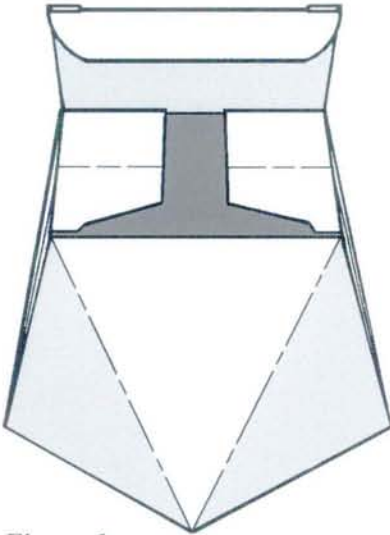


Figure 1

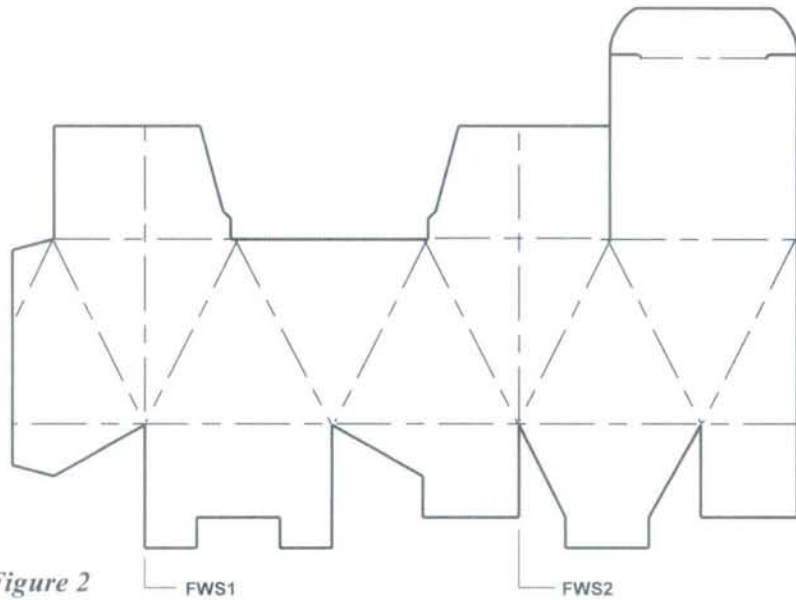


Figure 2

FOUR CORNER FACETS
Dual False Working Scores

While this may not look like a conventional tube, it is folded and glued along conventional corner working scores that crease to function as corners when the carton is erected. Its appearance is changed dramatically when, as part of the set up process, the corners are pushed in to create a multi-facet tube.

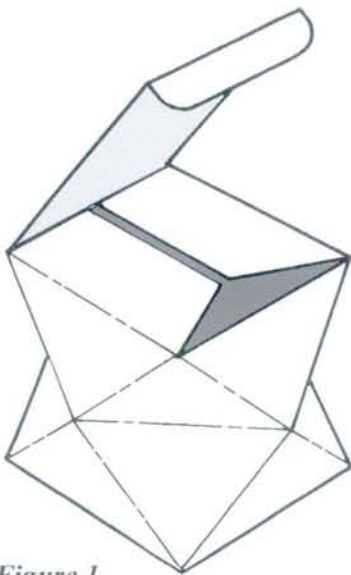


Figure 1

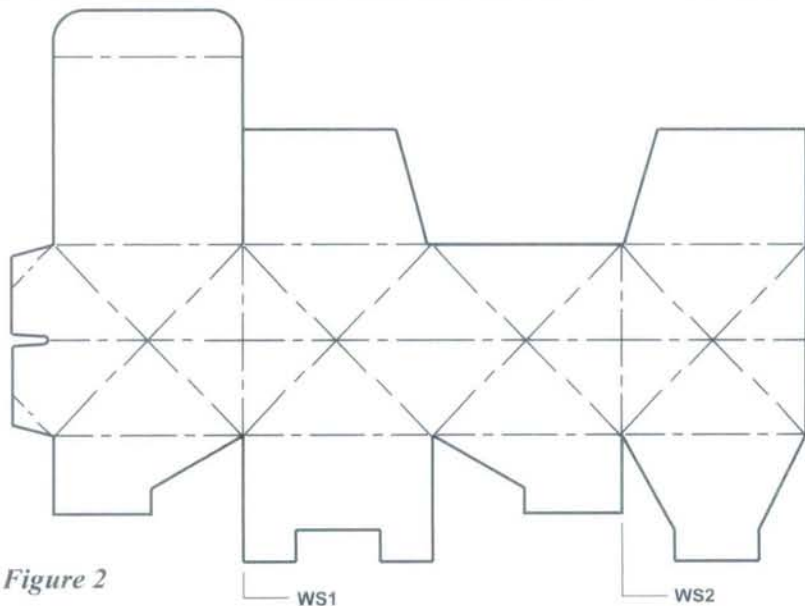


Figure 2



Shape Options
Sculpted Body Panels

FOUR CORNER FACETS
Dual False Working Scores

Illustrated are two examples of double false working scores which permit uninterrupted sculpting of all four corners. Figures 1A and 1B are shown with angled straight scores. This structure may also be produced with “S” curve corner scores. Either way, it is strikingly different.

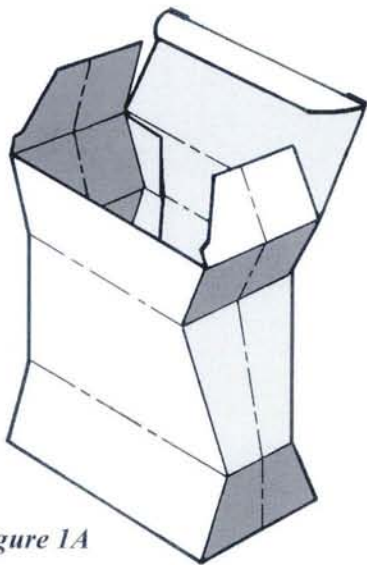


Figure 1A

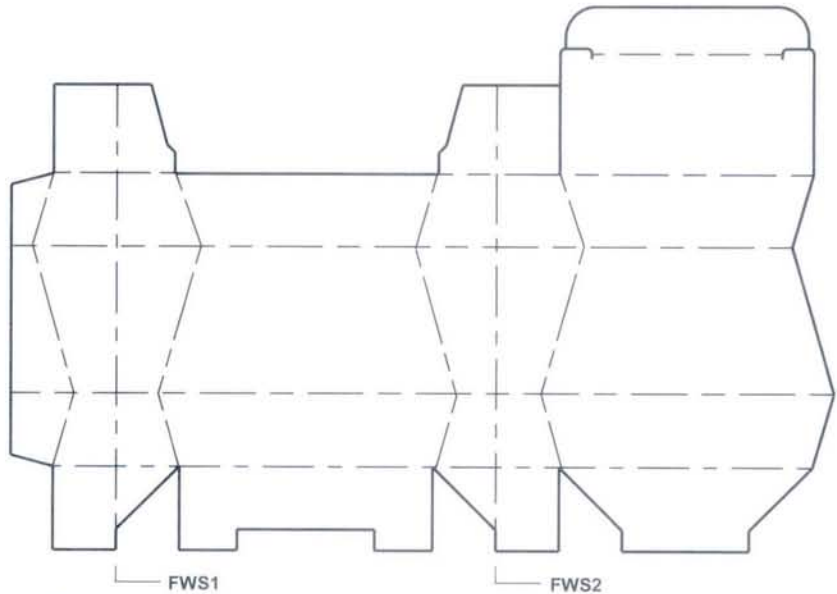


Figure 1B

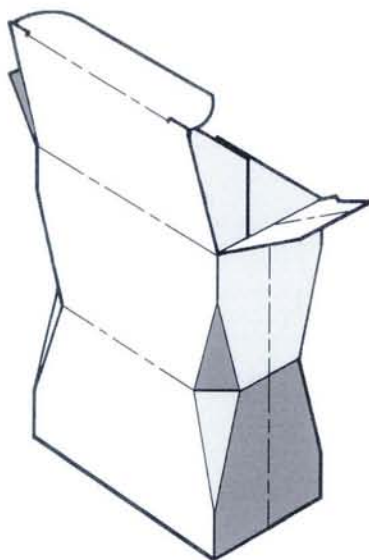


Figure 2A

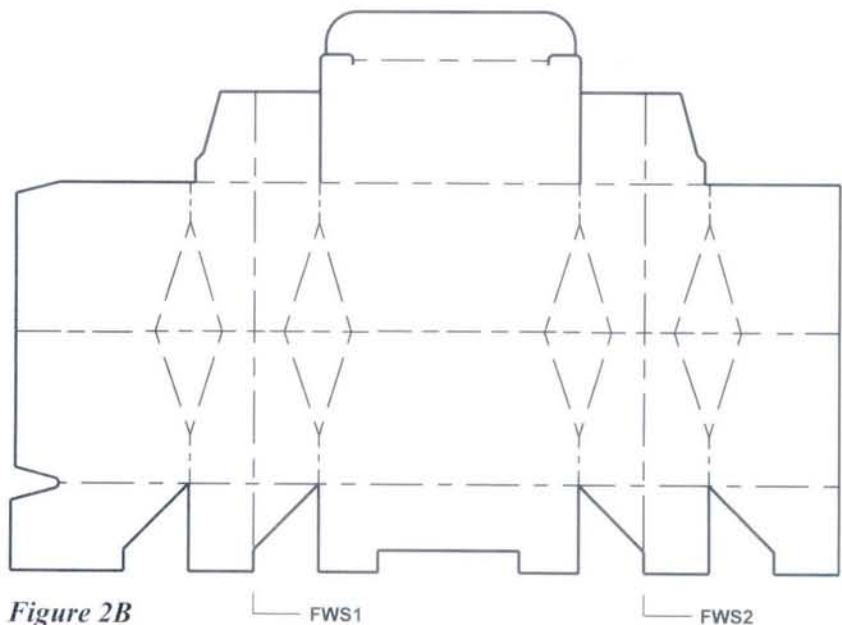


Figure 2B

**SINGLE
CORNER FACET**
Conventional
Working Scores

This very simple adaptation of a tuck top sleeve substitutes a pair of angled scores for the usual non-working scores to create an unusual visual impact.

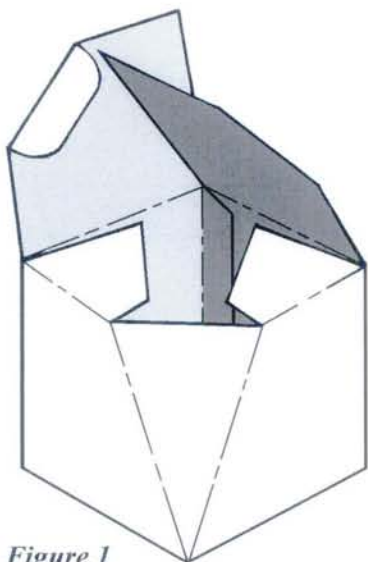


Figure 1

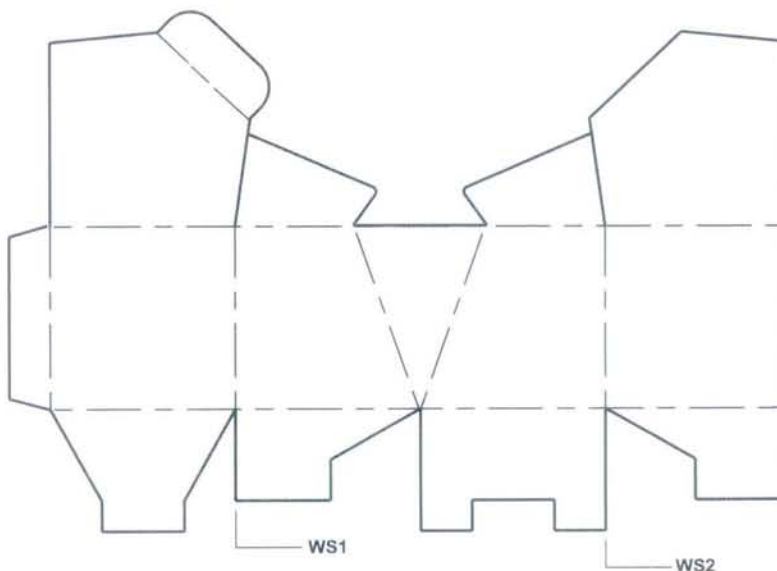


Figure 2

**DOUBLE
CORNER FACETS**
Conventional
Working Scores

This structure is typically loaded from the bottom and dispensed from the top. A bottom tuck is also a viable closure style. The top closure may include an integral handle.

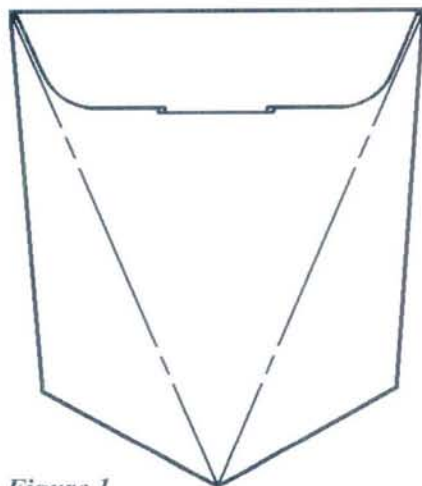


Figure 1

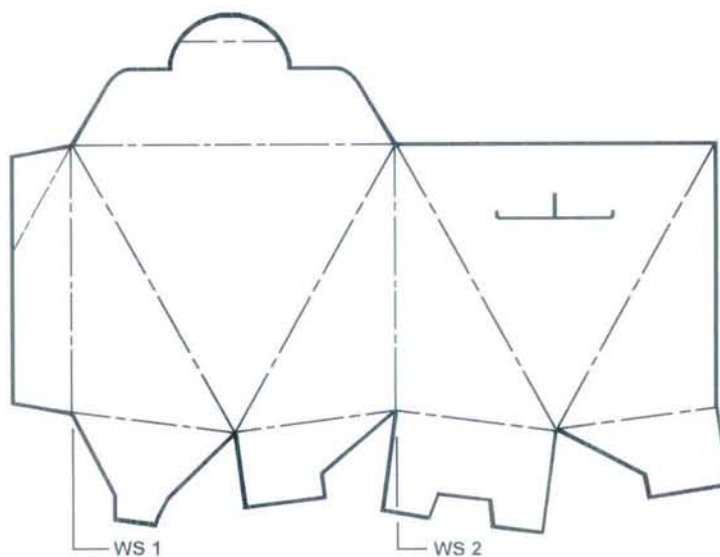


Figure 2



Shape Options
Sculpted Body Panels

FOUR SIDED TAPER
Angled Working Scores

The tapered tube can be glued with relative ease if longitudinal and transverse guide edges are incorporated into the carton design as shown below in Figure 2.

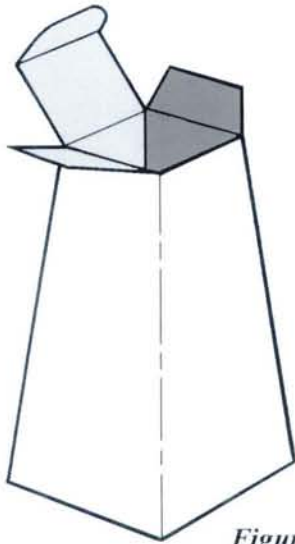


Figure 1

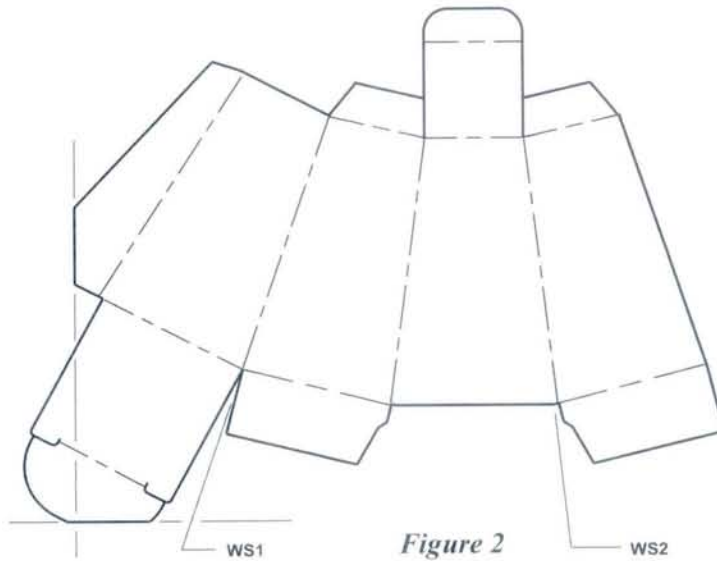


Figure 2

**TRAPEZOIDAL
POLYGON**

This is a simple but attractive alternative to the conventional straight tuck carton. It is shown here in a vertical orientation but is just as likely to be in a horizontal orientation.

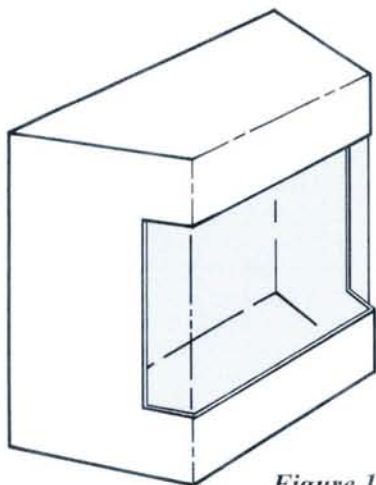


Figure 1

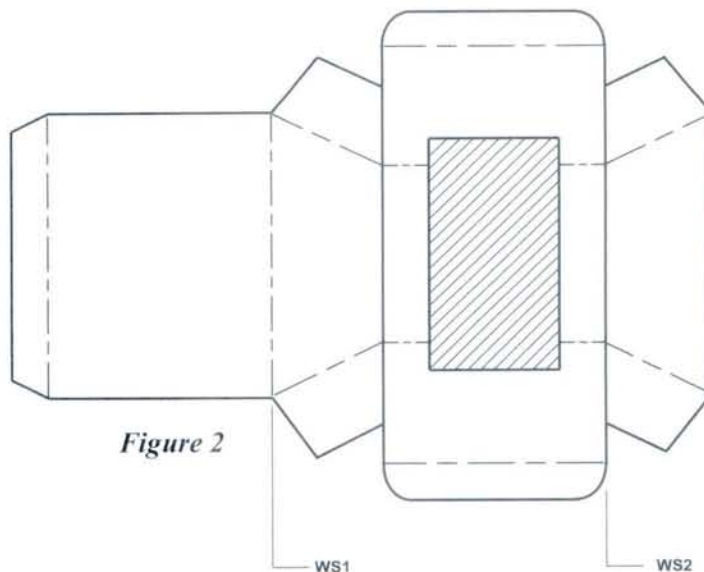


Figure 2



Shape Options
Sculpted Body Panels

“TWIST” CARTON

This structure illustrates the design range for the common tuck end carton while maintaining sound manufacturing practices. By adding diagonal scores and a “twist” when erecting the carton, a conventional straight line glued reverse tuck carton becomes a decorative structure with a unique look.

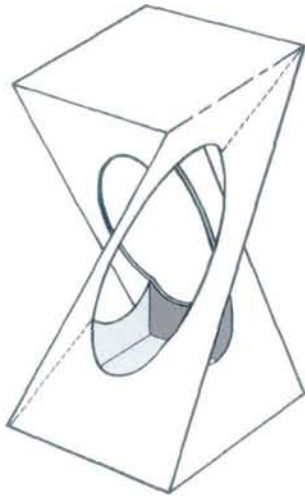


Figure 1

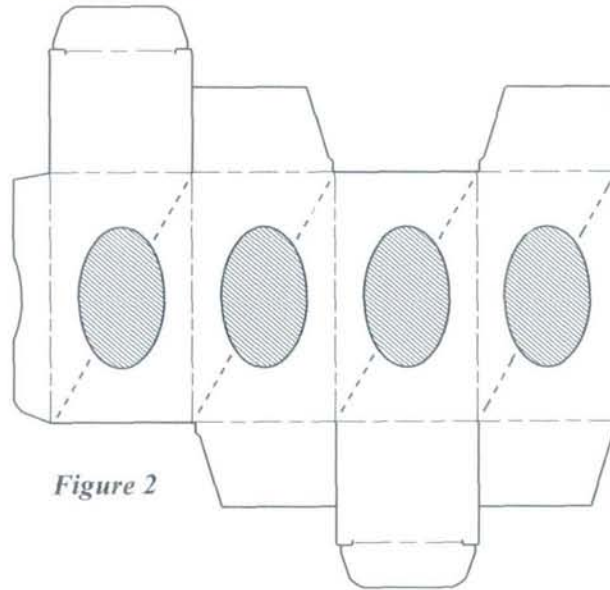


Figure 2

**FOUR SIDED
ARCuate
RECESSED
FACETS**

This is a simple full overlap seal end carton (FOSE), folding on conventional working scores. Adding a series of curved scores radiating from the corners and depressing the corners during erecting, results in a highly sculpted carton with a very unconventional appearance.

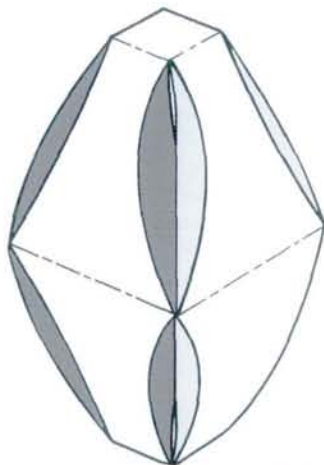


Figure 1

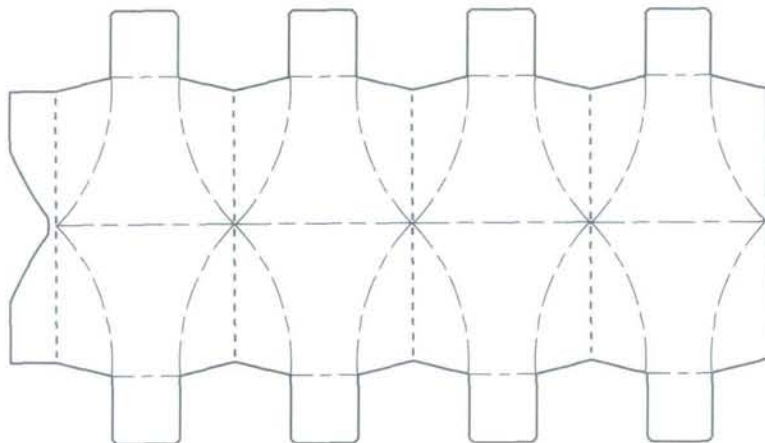


Figure 2



TETRAHEDRON
Dual
False Working Scores

One of the most simple paperboard structures, the tetrahedron is generally a single service package for holding liquids, semi-viscous or granular products. It is illustrated below with a sealed bottom and tack-sealed top.

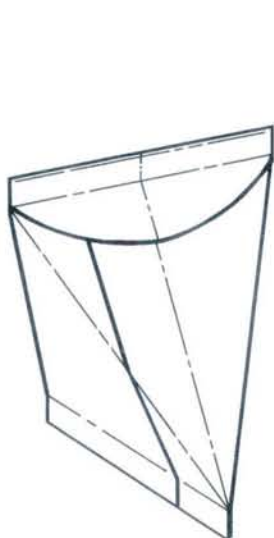


Figure 1

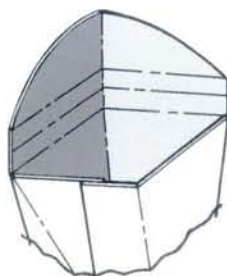


Figure 2: Top opens along false working scores

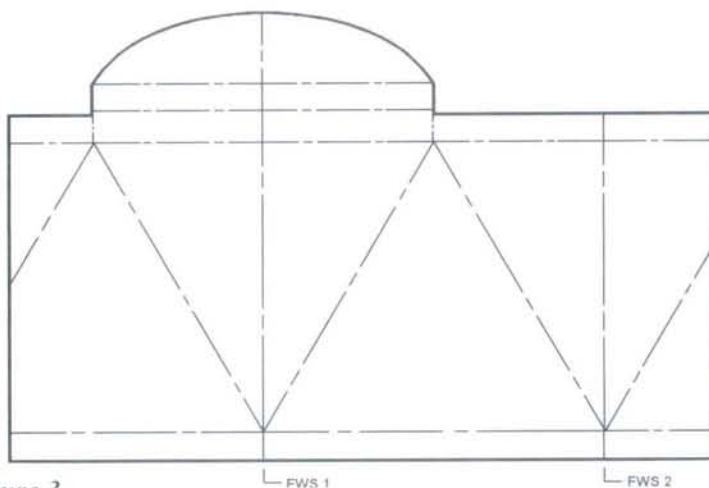


Figure 3

MULTI-FACETED
OCTAGONAL TUBE
Conventional
Working Scores

This is labor intensive to assemble, but for certain high value specialty items the striking appearance may justify the cost.

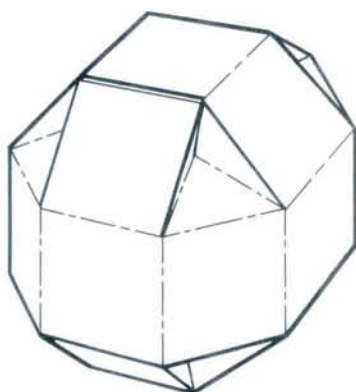


Figure 1

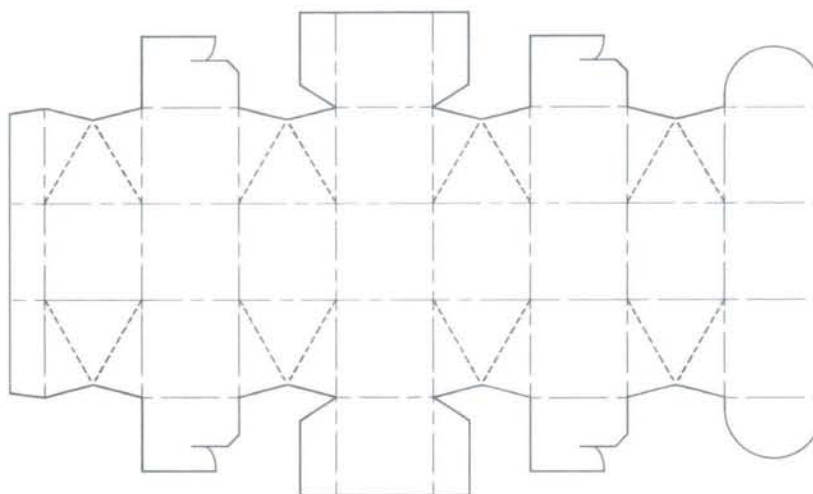


Figure 2



Shape Options
Sculpted Body Panels

RECESSED SIDE PANELS
Conventional
Working Scores

The two styles shown below are variations on what is commonly referred to as the "Pocket Book" style. While fabricated as conventional rectangular tubes, in erected form they look quite different.

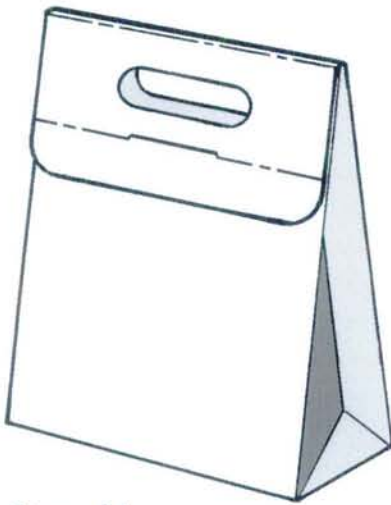


Figure 1A

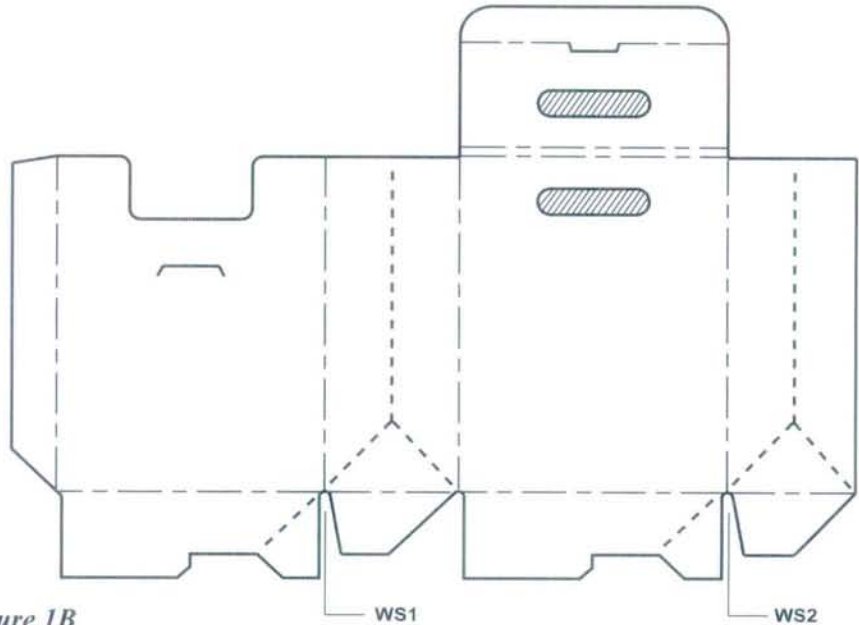


Figure 1B

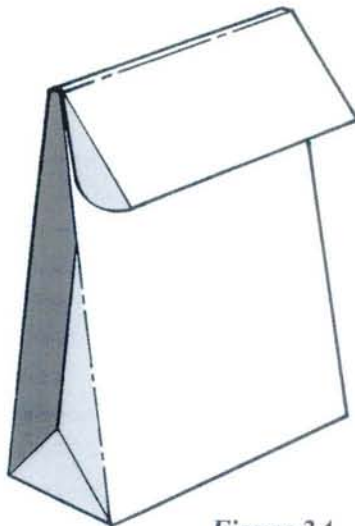


Figure 2A

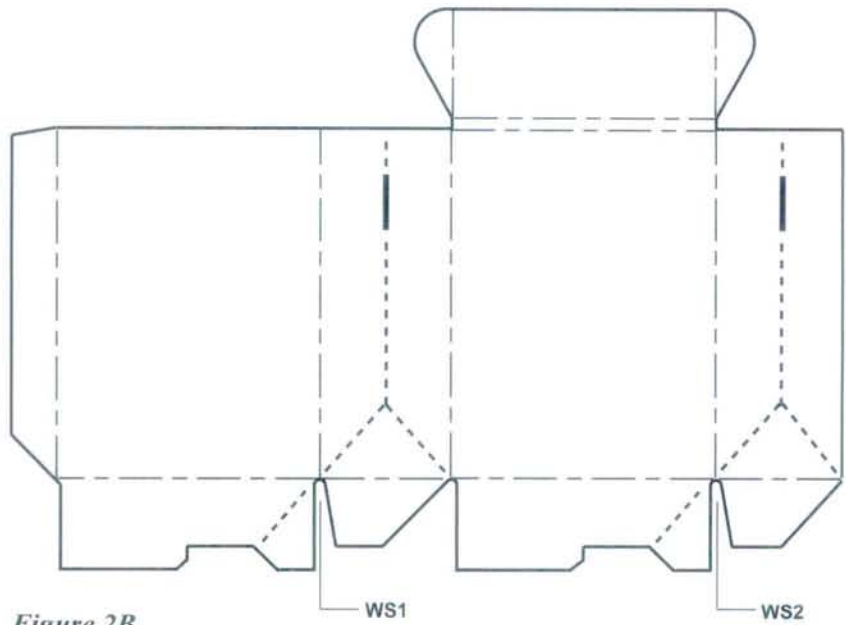


Figure 2B



Shape Options
Sculpted Body Panels

**TRUNCATED,
FACETED CORNER
PYRAMID**

Adding corner facets to this tapered tube transitions the package from a square at the base to an octagon at the top. The end result is a structure with exceptional sculptural qualities, yet one which maintains sound converting, packaging line and distribution system design principles.

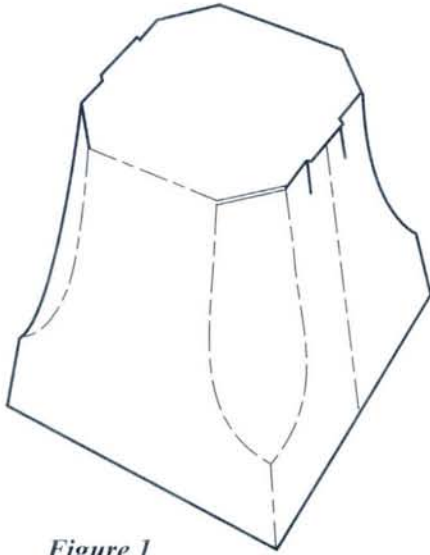


Figure 1

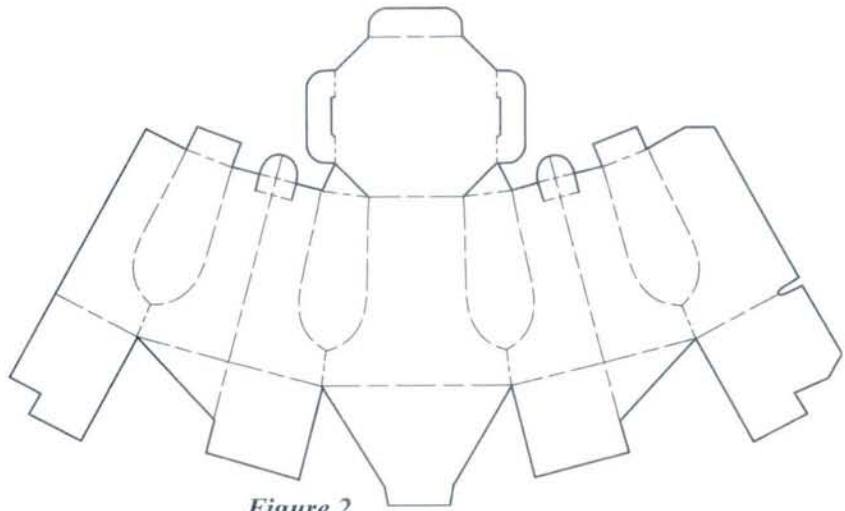


Figure 2



BEYOND THE RECTANGULAR TUBE: END CLOSURE ALTERNATIVES

All the end closures in Sections 1.100 through 1.500 are illustrated as straightforward rectangular panels at right angles to the side and end panels of a rectangular cross-sectioned tube.

Section 1.620 deals with a few alternatives to the conventional. By introducing angled scores, arcuate scores, or by simply manipulating the size or shape of

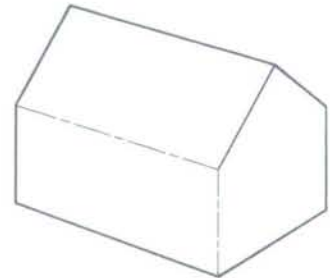
the end closure panels, the aesthetics of the tube can be changed dramatically.

The tuck end closure offers almost endless possibilities, as does the basic 1-2-3 closure. Potential designs range from a simple tapered tuck to the sequentially interlocked or "flower" closure as illustrated on page 1.629.

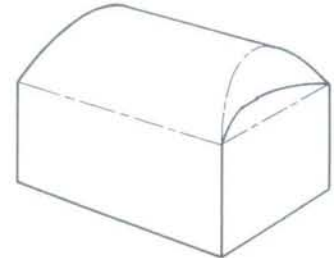
There are many ways to build upon the classic end closures to give a paperboard structure a distinctive look while maintaining sound manufacturing processes and without making the structure unnecessarily complex or difficult to close.

Most of the existing alternatives to the conventional tube closures will fit into one of the categories illustrated on this page.

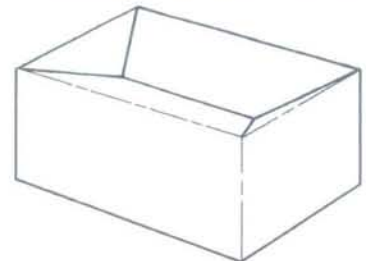
PEAKED CLOSURE



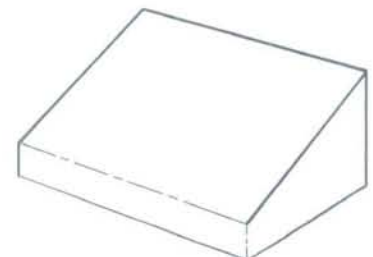
ROLLED or
DOMED CLOSURE



RECESSED CLOSURE



TAPERED CLOSURE



CURVED SCORE TUCK

The curved score results in a concave end closure and a convex front panel. Shown here in a vertical mode, the closure is equally effective when used at both ends with the carton in a horizontal orientation.

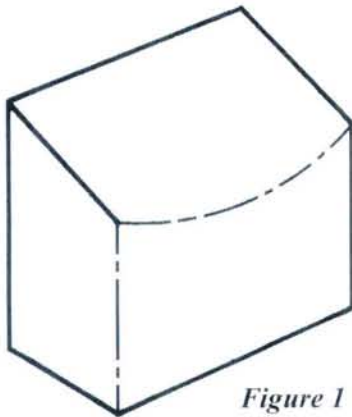


Figure 1

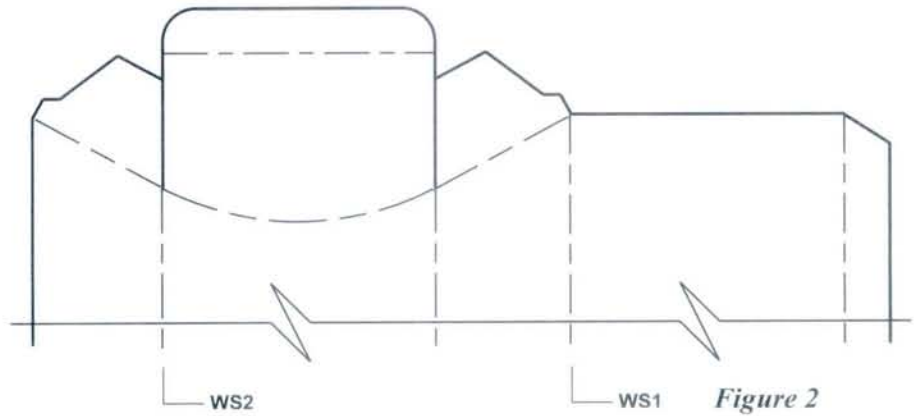


Figure 2

TAPERED TUCK

Like the curved score end closure noted above, this partial taper tuck end works equally well as a decorative top closure in the vertical mode, as seen in Figure 1, or in a horizontal orientation with the tapered tuck used at both ends.

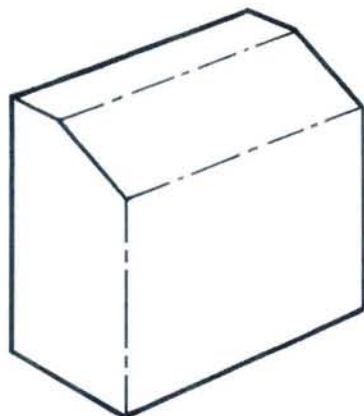


Figure 1

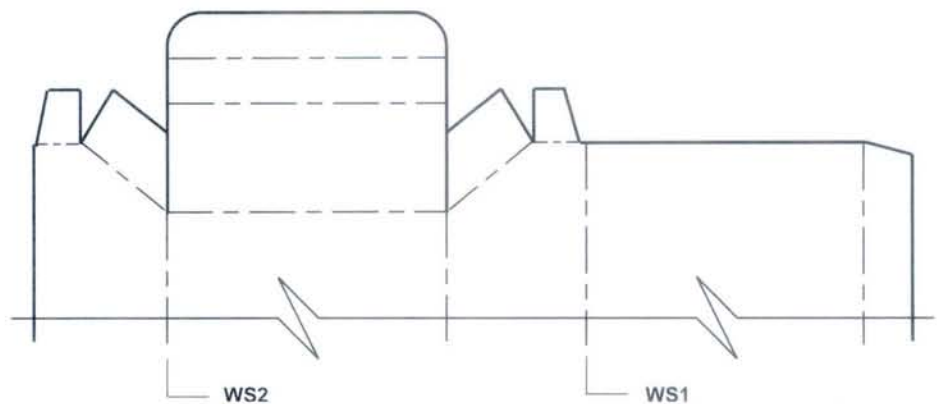


Figure 2



180° ROLLED END CLOSURE

A simple reverse lock secures this rolled top closure creating a very attractive visual impact.

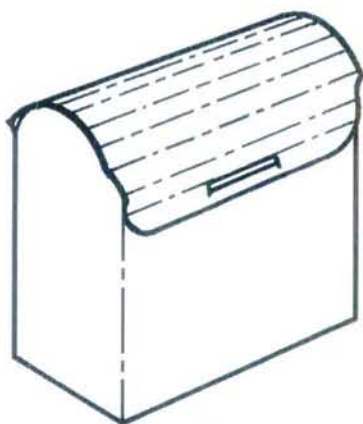


Figure 1

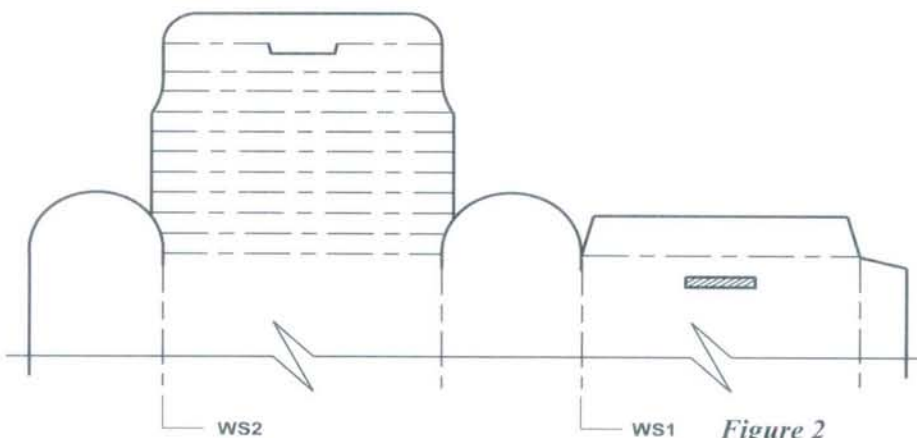


Figure 2

90° ROLLED END CLOSURE

Similar in basic concept to the 180° rolled end closure illustrated above, the finished look is distinctly different.



Figure 1

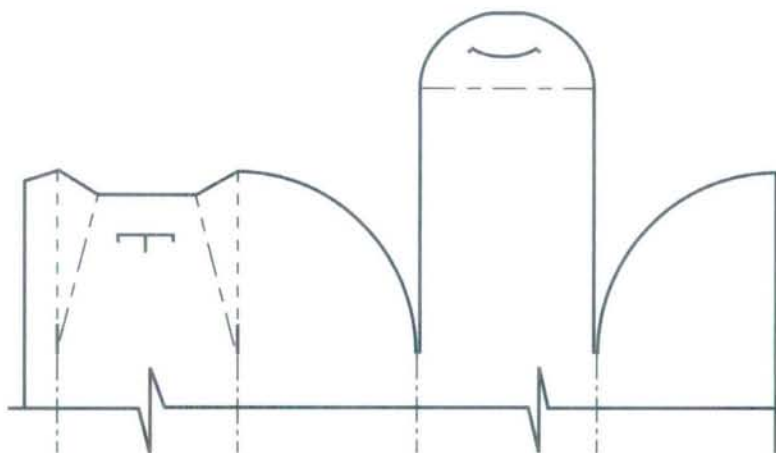


Figure 2



**RECESSED 1-2-3
CLOSURE**

It has been noted that the 1-2-3 closure is used almost exclusively as a hand locked bottom closure. However, by manipulating dimensions slightly, the result is a simple but attractive recessed end closure.

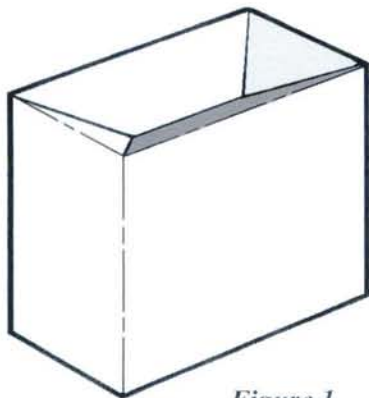


Figure 1

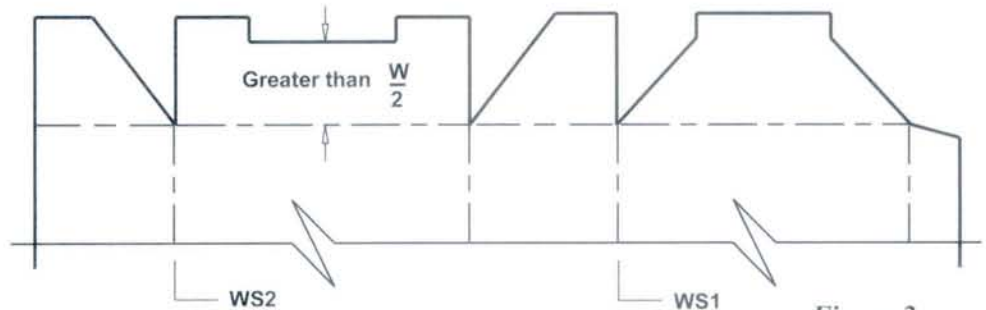


Figure 2

**RECESSED
GUSSET CLOSURE**

This variation on the peaked or gabled top tube has a flat top panel. It may be locked as shown here or closed with a variation on a friction lock tuck.

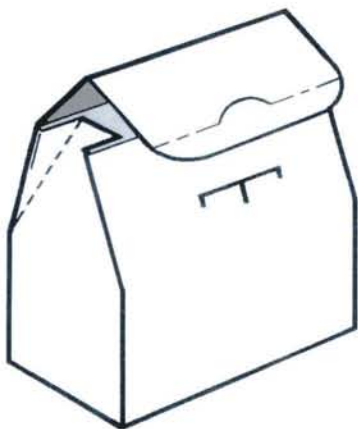


Figure 1

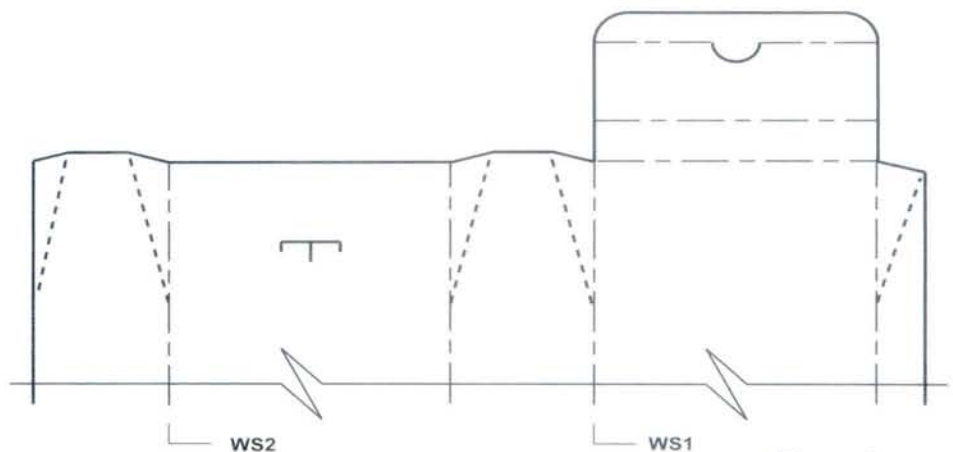


Figure 2



**RECESSED
GUSSET CLOSURE**

This recessed gusset detailing is used almost exclusively as end closures for a horizontally oriented tube. It is frequently used as a closure for frozen pies and the like. An alternative recessed gusset style for this type of product is shown at the bottom of this page.

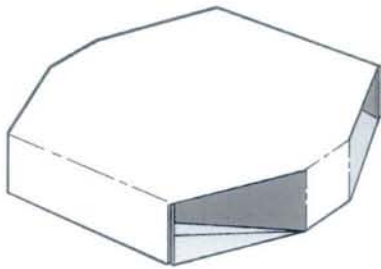


Figure 1

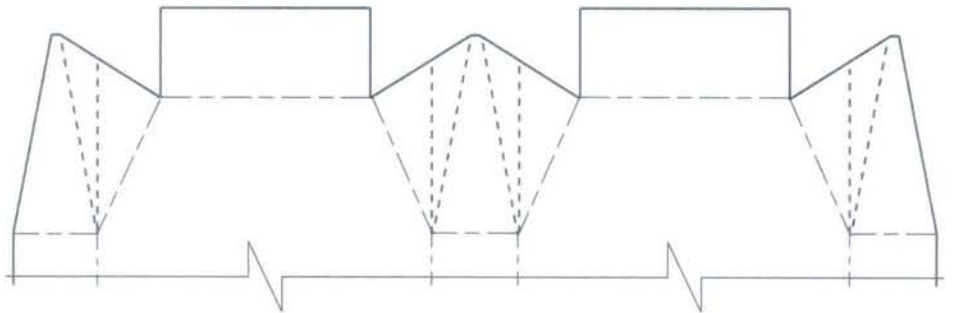


Figure 2

**RECESSED
GUSSET CLOSURE**

This is an attractive alternative to the recessed end closure gusset shown above. It, too, is used almost exclusively as an end closure for horizontally oriented tubes containing tapered tubs, cups, or trays.

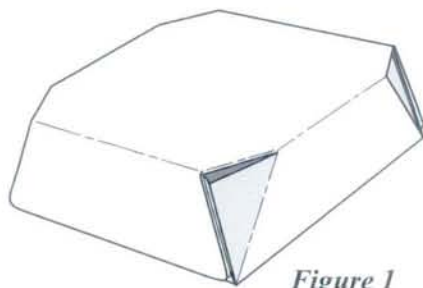


Figure 1

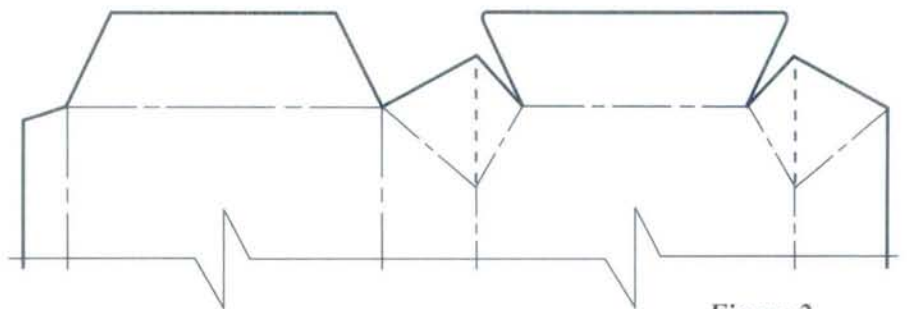


Figure 2



**GUSSETED
PYRAMID (TOP)
CLOSURE**

Finished with a decorative lacing or stretch band, the consumer presentation is unique and very attractive; yet this shape is fairly practical to handle in transit.

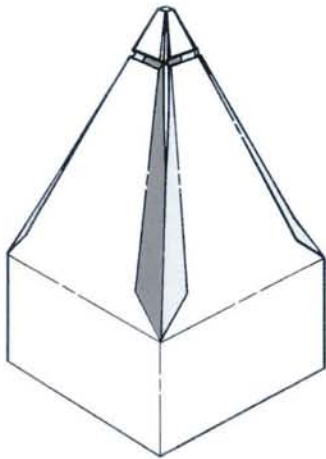


Figure 1

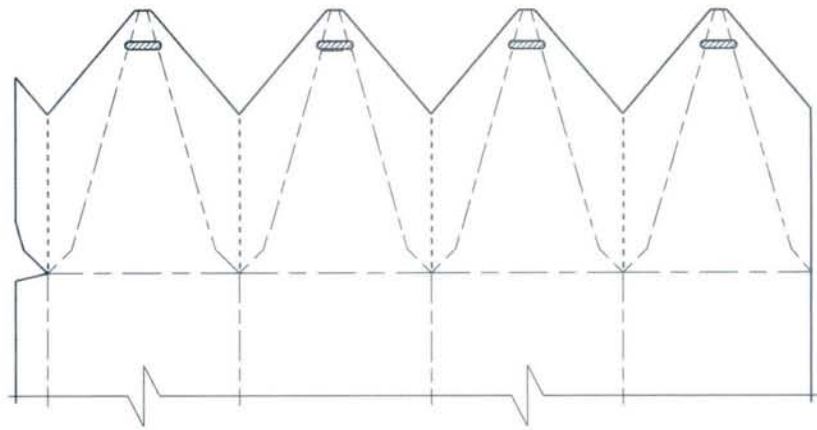


Figure 2

**GUSSETED
PYRAMID (TOP)
CLOSURE**

While similar to the gusseted pyramid above, changing from four to six sides and reversing the corner gusset folds gives this package a completely different look. It is typically finished with a decorative stretch band or ribbon.

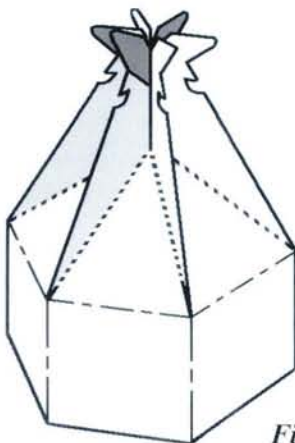


Figure 1

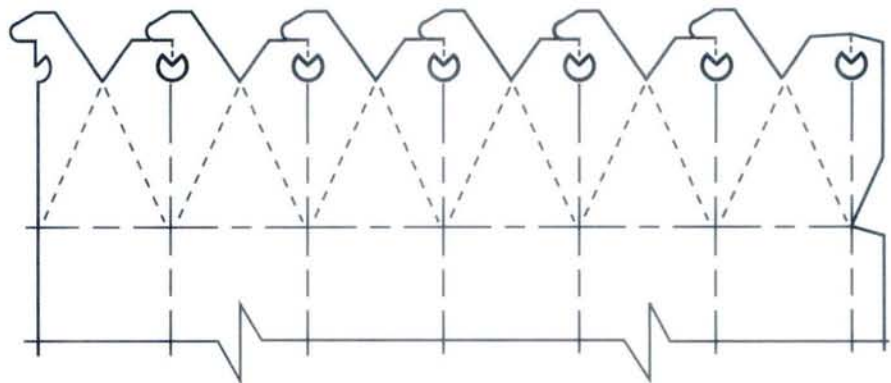


Figure 2



**RECESSED
GUSSET (TOP)
CLOSURE**

Similar in concept to the sculpted body panel on page 1.616, here the arcuate recessed facets are used as a top closure. It can be secured with a touch of hot melt. An embossed adhesive foil label is another option.

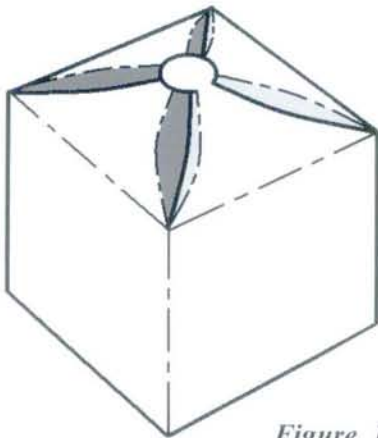


Figure 1

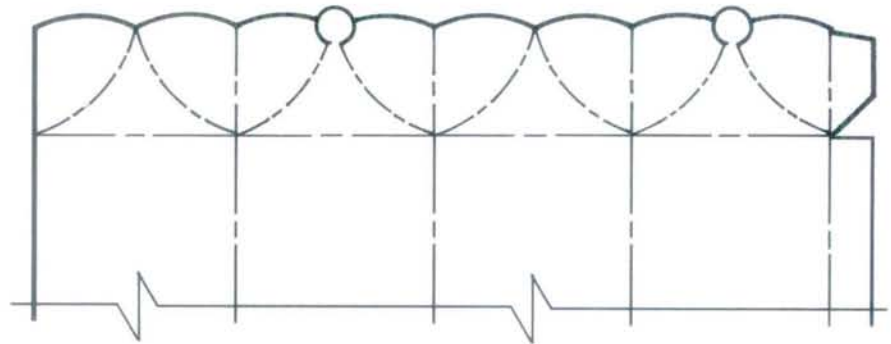


Figure 2

**RECESSED
UPPER BODY
PANEL CLOSURE**

This simple but decorative closure works well for a necked-in bottle with a decorative cap. The body panels are pulled in and secured with a ribbon or decorative stretch band.

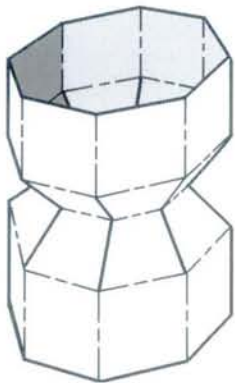


Figure 1

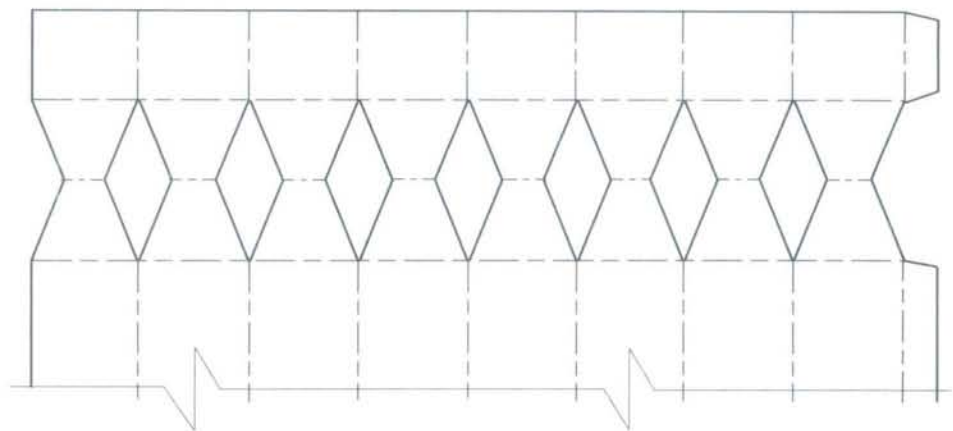


Figure 2



**TUCK and TONGUE
with INTEGRAL
CUSHIONING
PLATFORM**

This closure combines the security of the tuck and tongue (page 1.206) with the cushioning characteristics of an integral end platform (page 1.633). Commonly used as a book mailer but applicable to other products requiring extra protection, this shape is fairly practical to handle in transit.

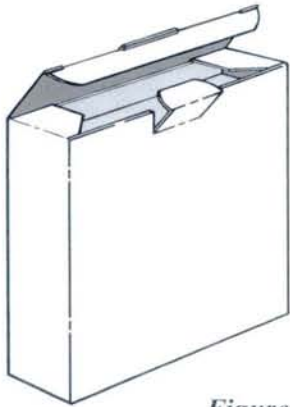


Figure 1

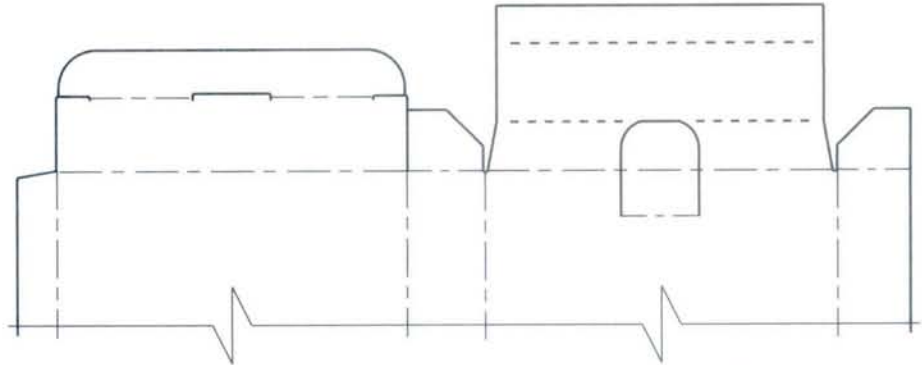


Figure 2

**SIDE LOADED
TOP OPENING HOOD/
FRICTION RECLOSURE**

This structure is erected, loaded and closed as a side filled partial overlap seal end (POSE). The manufacturer's joint is integrated into the hood front panel.

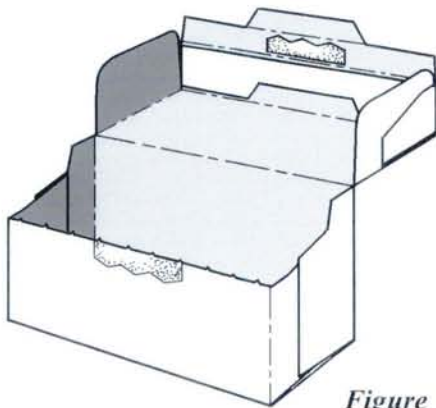


Figure 1

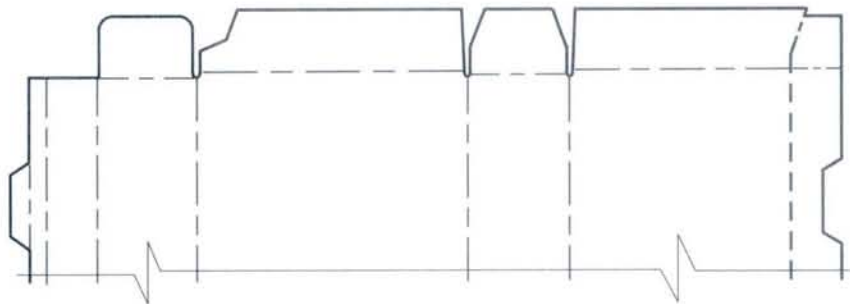


Figure 2



Figure 3: End view cross section



**SIDE LOADED
TOP OPENING HOOD/
MECHANICAL RELOCK**

This structure is erected, loaded and closed as a modified partial overlap seal end (POSE). It is applicable to products such as cookies and crackers where the carton is opened and closed to dispense product over a period of time.

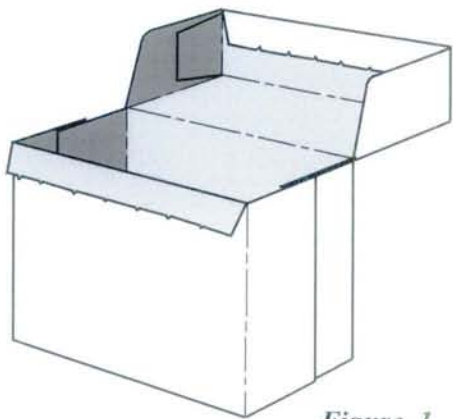


Figure 1

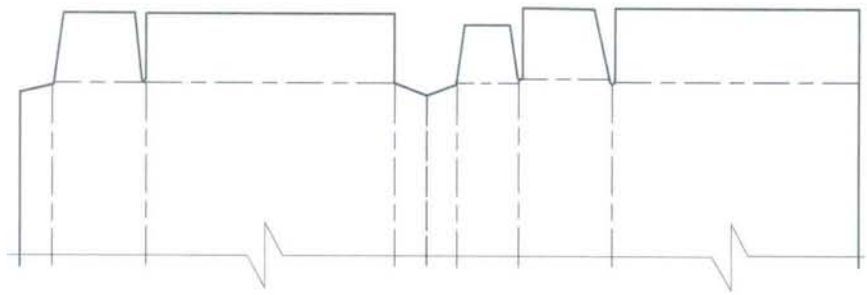


Figure 2



Figure 3: End view cross section

**TOP LOADED
TOP OPENING HOOD/
RELOCKING FEATURE**

This structure is erected, filled and closed as a top load, modified seal end.

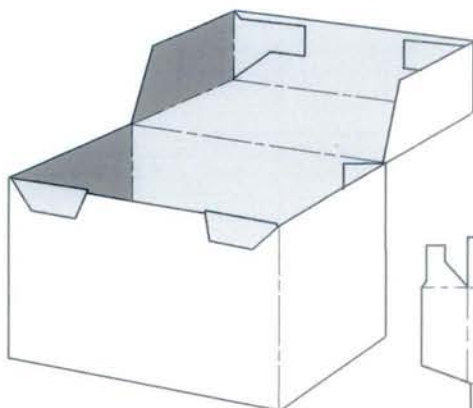


Figure 1

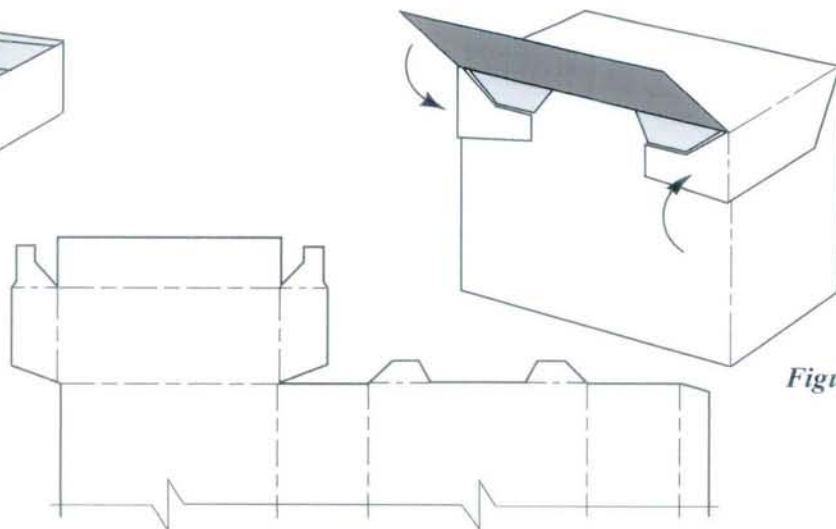


Figure 2

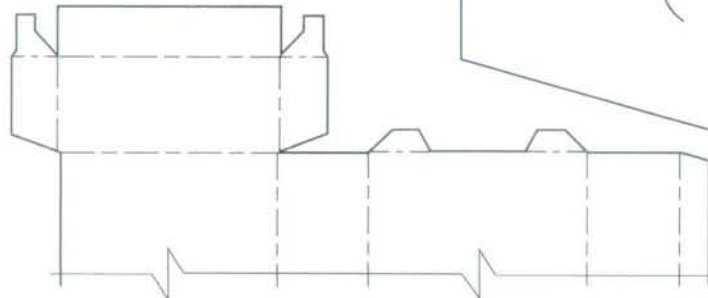


Figure 3



“FLOWER” CLOSURE

Sequentially folding in one closure panel after another results in an unusual, very dimensional end closure. This style is closely associated with the confectionery and cosmetic industries.

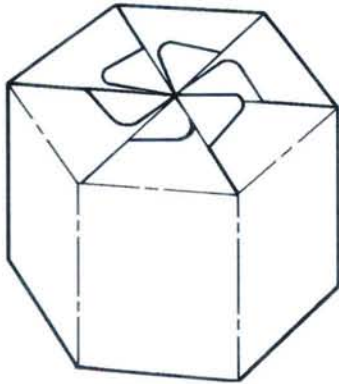


Figure 1

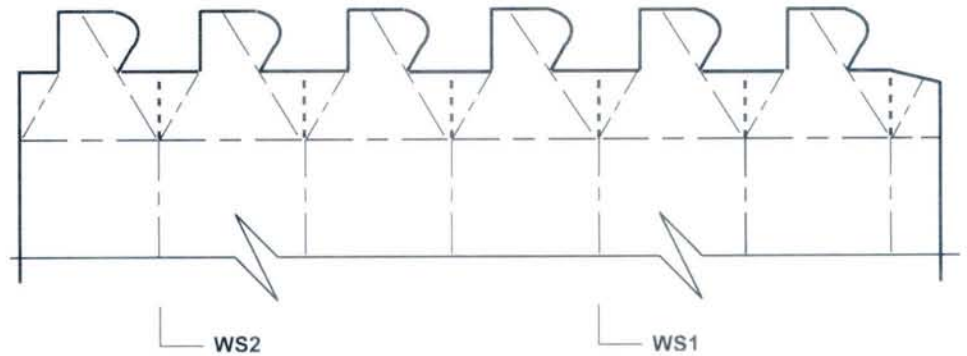


Figure 2



BEYOND THE RECTANGULAR TUBE: PARTITION and PLATFORM OPTIONS

The following pages illustrate the most fundamental partition or platform styles. Many variations can be developed from these basic structures.

Figures 1A and 1B show a simple variation of the twin cell longitudinal partition illustrated on page 1.631.

The internal partition elements may be diecut to position and secure the product or to create internal tabs

or struts to further separate and protect the product. (Figures 2A and 2B)

Many of the end closures detailed in the previous pages can be adapted to these structures, although the most commonly found will be some form of tuck end or seal end closure.

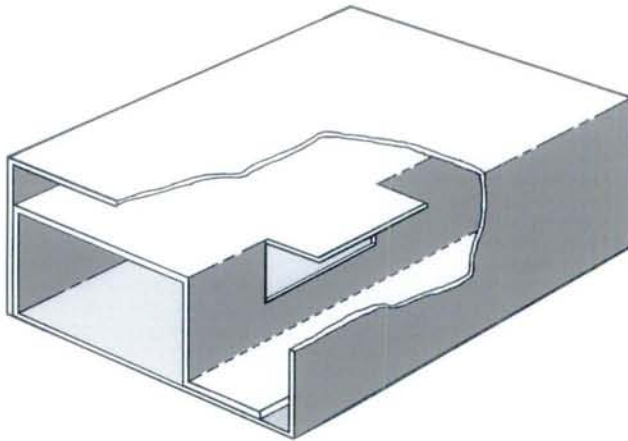
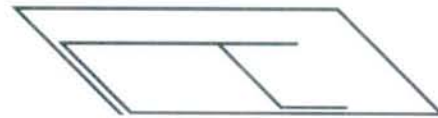


Figure 1A



*Figure 1B: Folding Sequence
End Elevation View*

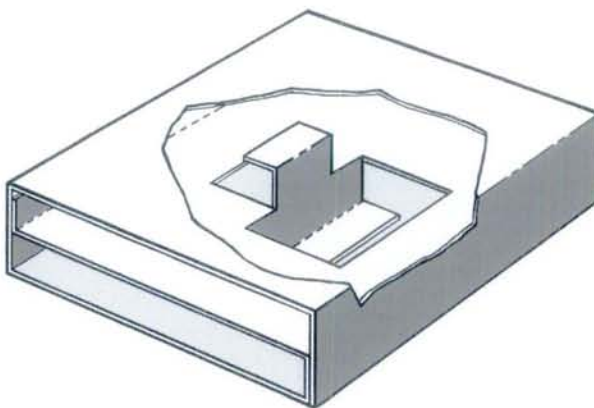
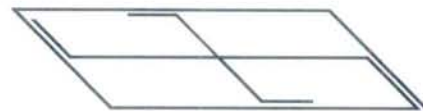


Figure 2A



*Figure 2B: Folding Sequence
End Elevation View*



TWIN CELL
 Single Longitudinal Partition

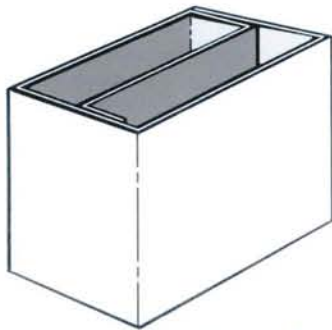
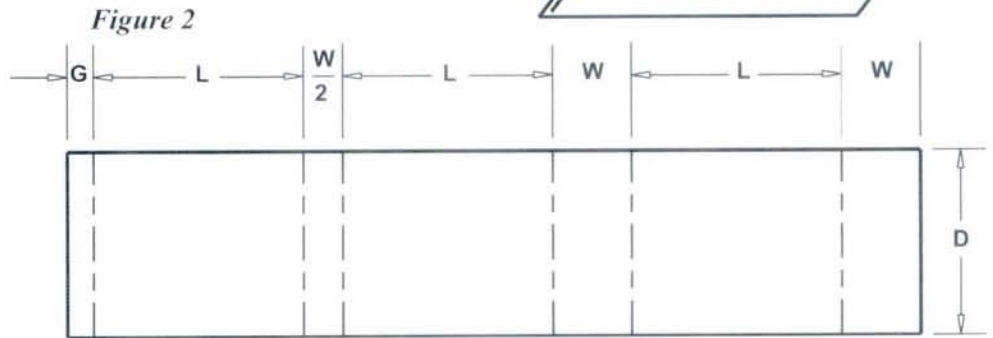


Figure 1



TRIPLE CELL
 Double Longitudinal Partition

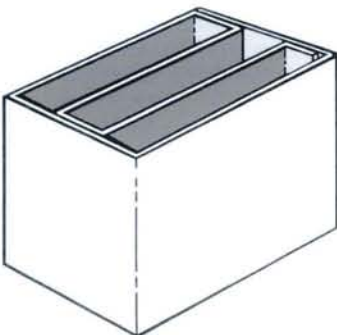
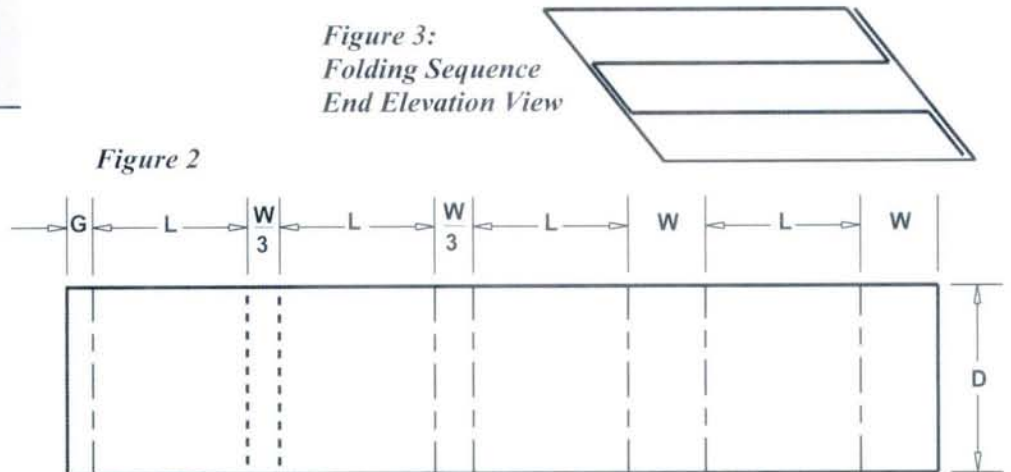


Figure 1



DOUBLE CELL
 Diagonal Partition

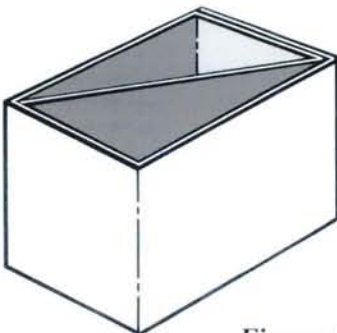
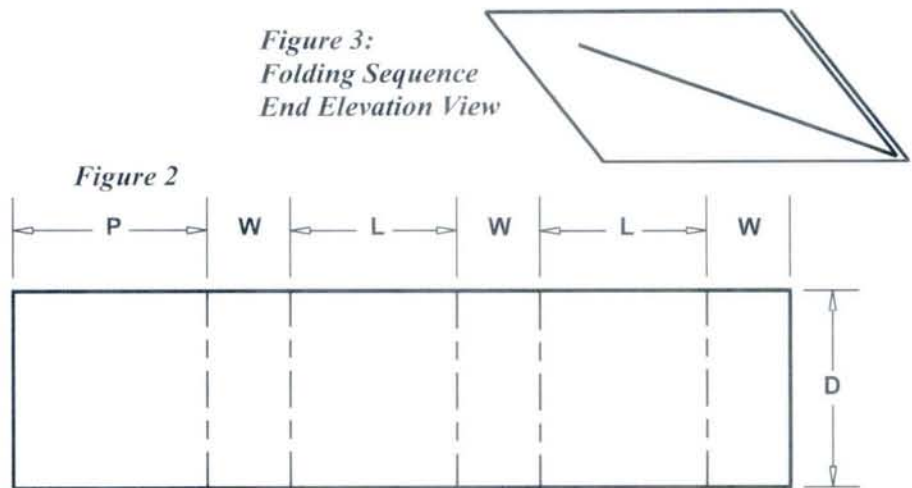


Figure 1



TWIN CELL
 Single Transverse Partition

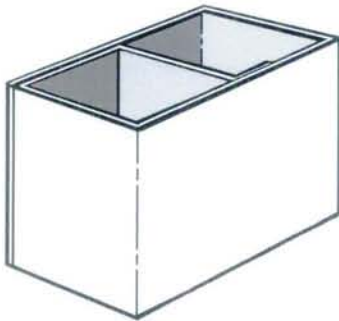
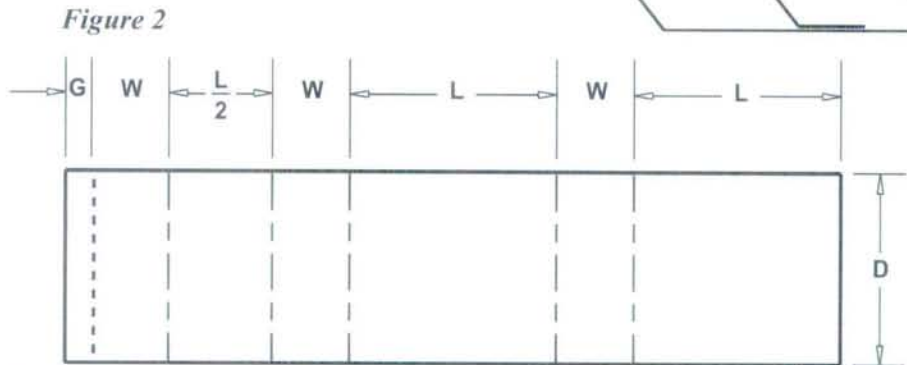


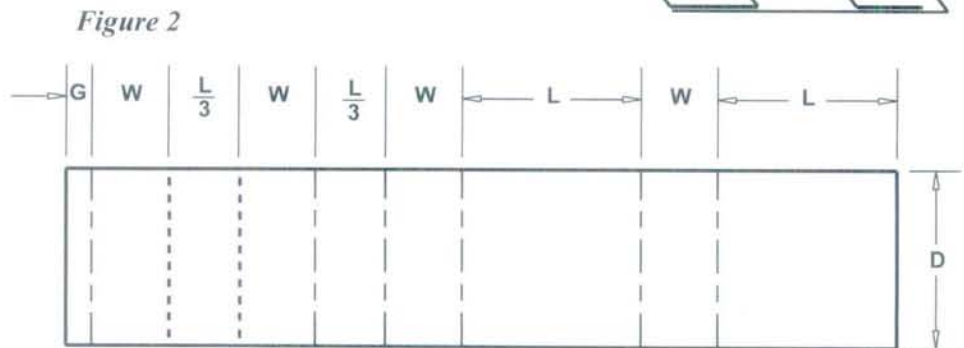
Figure 1



TRIPLE CELL
 Double Transverse Partition



Figure 1



DOUBLE CELL
 Irregularly Shaped Partition

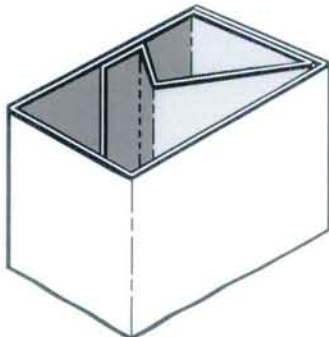
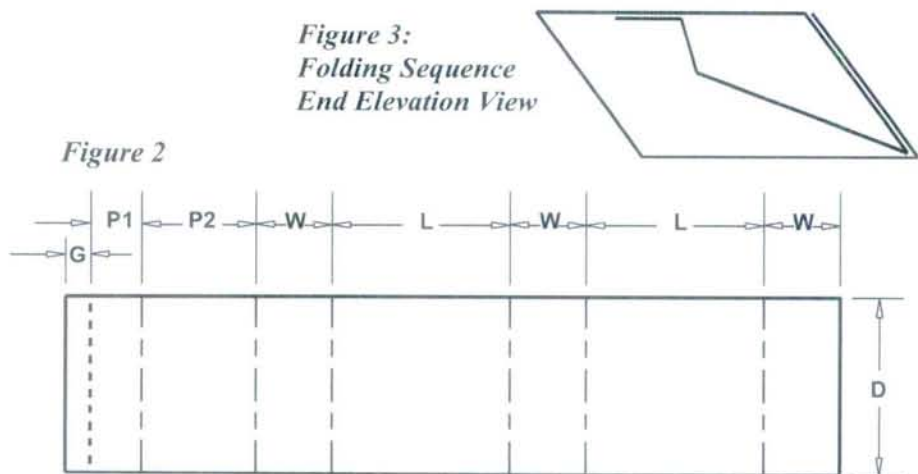


Figure 1



**DOUBLE
TRANSVERSE
PARTITIONS with
INTEGRAL
DIE CUT WINDOW**

This is similar to the triple cell double transverse partition shown on page 1.632, except here one of the transverse partitions is generated from the front panel window material, thus reducing the blank size. The transverse partitions can be generated entirely from the front and rear panel material, if a rear panel window is acceptable.

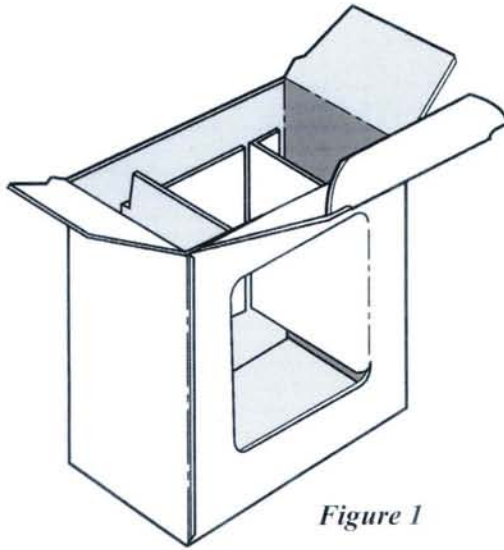


Figure 1

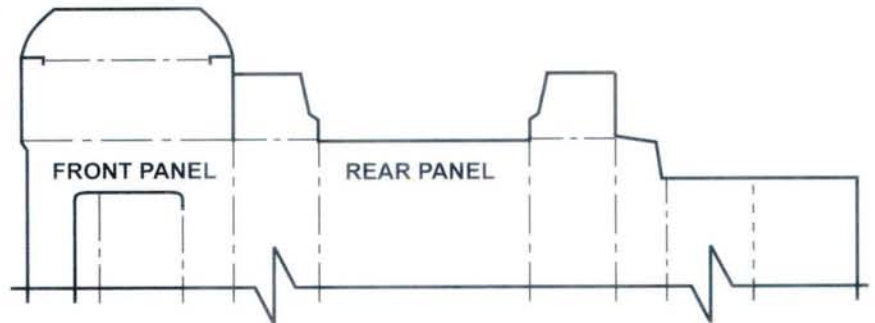


Figure 2

**LONGITUDINAL
PLATFORM and
END PLATFORM
COMBINATION**

The structure shown below can be modified by adding a longitudinal partition and product securing apertures in both the partition and platform, plus a window (film) aperture in the front panel. This combination results in an excellent display carton for products such as toys, hollow chocolate confections, cosmetics, etc.

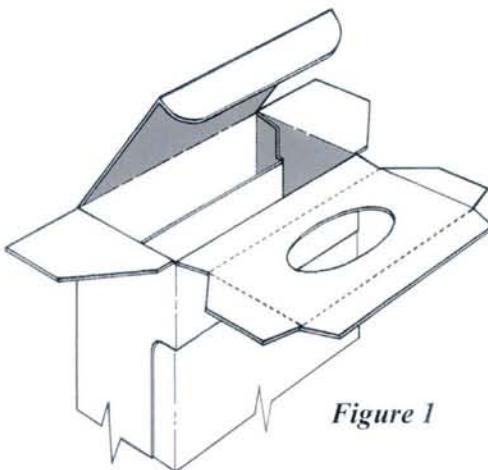


Figure 1

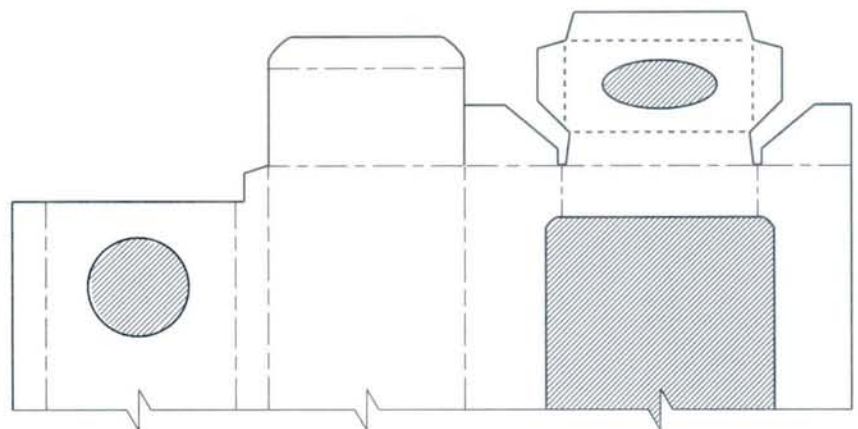


Figure 2



**PLATFORM with
POSITIONING
APERTURE**

As illustrated, the platform serves as a positioning device to restrain the end portion of a product such as a bottle or vial. This style is effective with or without the side flanges (reinforcing flaps).

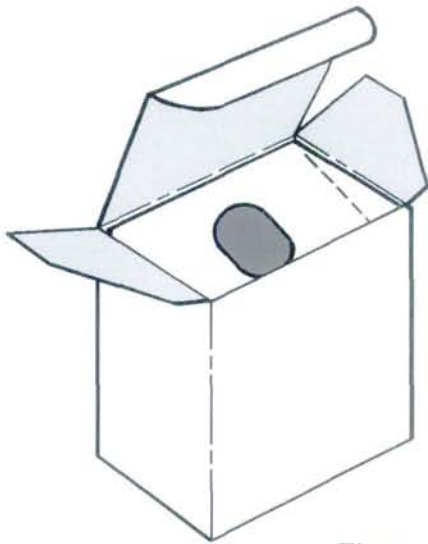


Figure 1

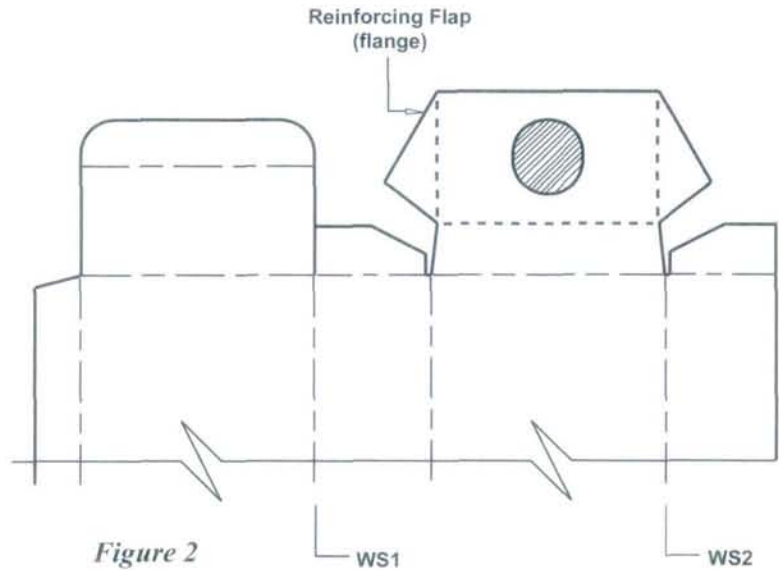


Figure 2

**MULTIPLE CELL
TRANSVERSE STRAP
STYLE PARTITION**

This is the same partition concept used in the soft drink industry as an integral part of a basket carrier for returnable bottles. (Refer to page 3.201) The partition element may be hinged off the bottom or top edge of the body panel; or in deeper tubes, off both.

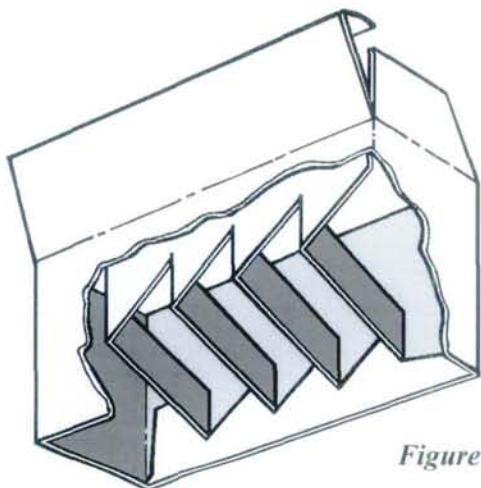


Figure 1

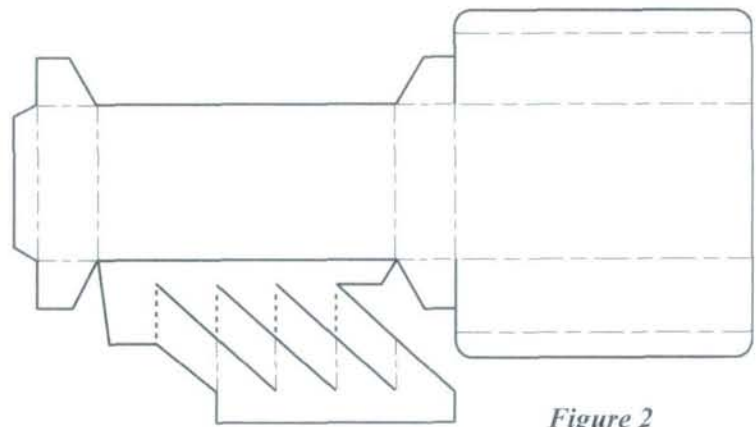


Figure 2



**GLUED
DOUBLE WALL
DUST FLAPS**

As illustrated, the apertures would be used to position and stabilize the top of a primary container such as a tapered bottle or jar (see Figure 3). Without the apertures, the same structure could provide cushioning means for a fragile item.

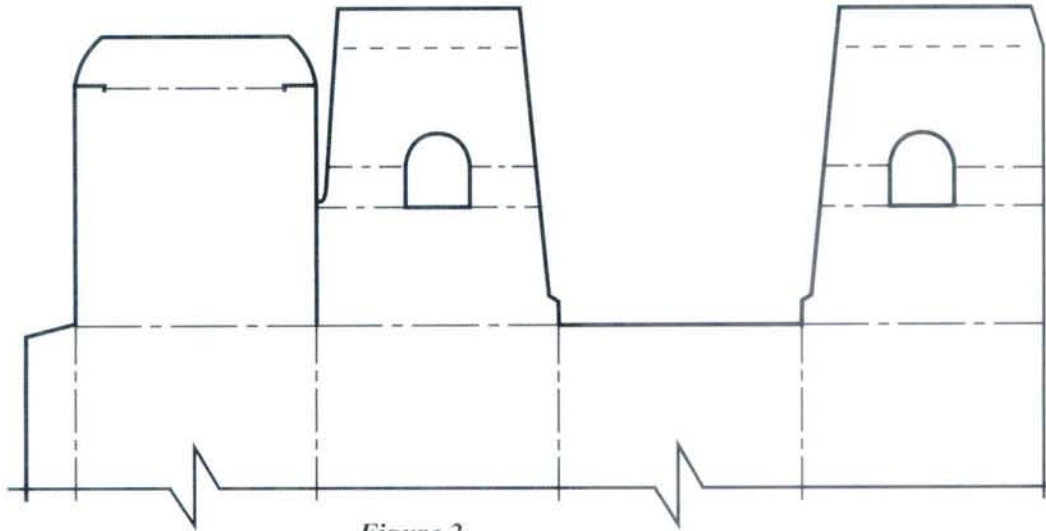


Figure 2

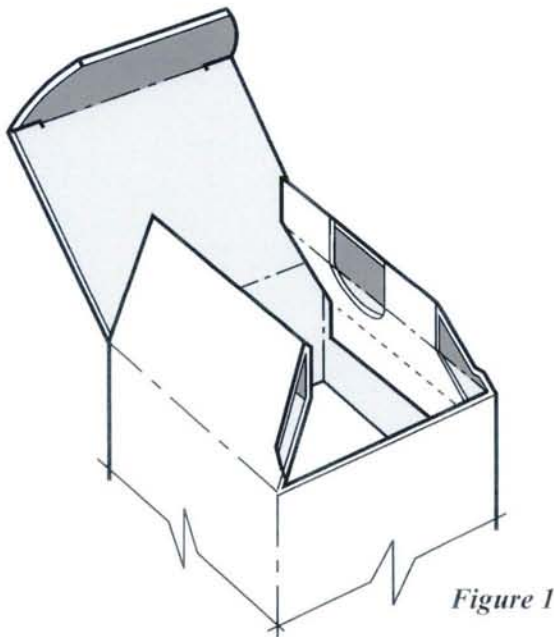


Figure 1



Figure 3

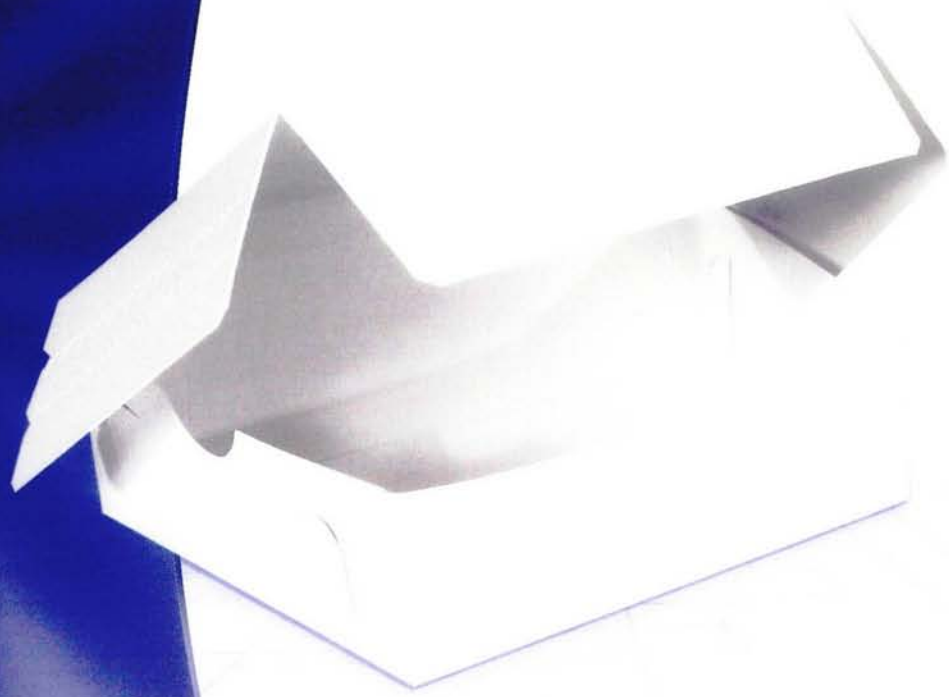




2.000

PAPERBOARD PACKAGING:
TRAY STYLES

2.000
TRAY STYLES



2.000

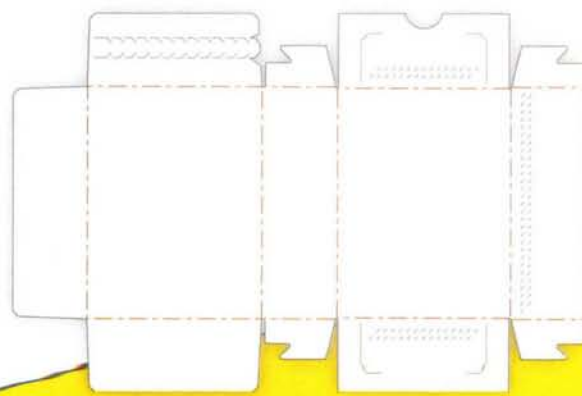
COMPONENT PARTS + DESIGN DETAILING

- 2.100 *Single Sidewall / Single Endwall*
- 2.200 *Single Sidewall / Single Endwall / Hinged Cover*
- 2.300 *Single Sidewall / Double Endwall*
- 2.400 *Double Sidewall / Double Endwall*
- 2.500 *Double Sidewall / Double Endwall / Hinged Cover*
- 2.600 *Hollow Sidewall / Hollow Endwall*

2.700

DESIGN VARIATIONS

- Shape Options*
- Hollow Wall and Platform Options*



IDEAS AND
INNOVATION
SECOND EDITION



Trays, like tubes, make up one of the largest categories of folding cartons. The diversity within the category is just as far reaching as with tubes. It ranges from the simple single sidewall/single endwall glued or locked corner rectangular tray to highly sculpted, hinge cover, asymmetric structures which are scarcely recognizable as trays. The following pages will identify and detail

the component parts of the typical tray. Figure 1 on page 2.001 uses the Simplex (Kwikset) tray as a point of reference to describe and assign design parameters to the major parts of a conventional tray. Figure 3 on page 2.001 identifies additional elements not shown on Figure 1.

Many trays are shipped flat and unglued from the converter. All assembly is performed by the customer, either by hand or on semi- or fully automated packaging equipment.

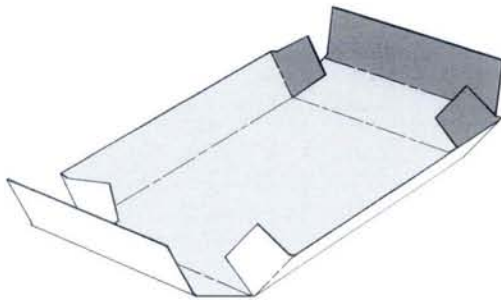


Figure 1: This illustrates the typical customer assembly steps for a machine formed single sidewall/double endwall, glued corner Brightwood tray.

A large percentage of trays are partially assembled (finished) by the converter, who ships glued flat blanks to the customer for final assembly.

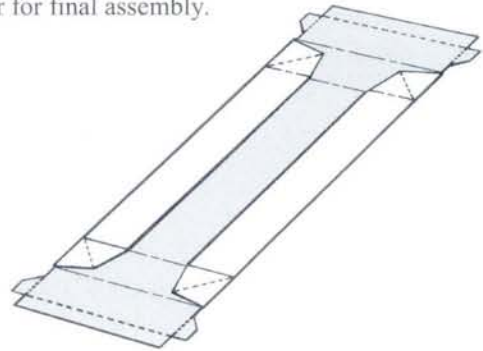


Figure 2A: This shows a Simplex tray with glued and folded sidewalls as it would typically be delivered to the customer if final assembly were to be done by hand.

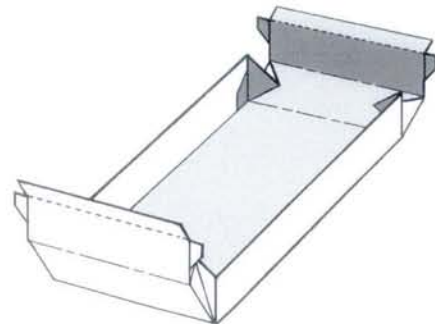


Figure 2B: This shows the customer assembly steps. The Simplex is typically hand assembled, but most of the glued corner styles are likely to be machine assembled.

Pertinent Terms and Definitions:

SIDEWALL (ENDWALL) - Term used to describe the total assembly of panels and flaps that make up the side or end of a tray. Example: The outer end panel, inner end panel and foot flap make up the ENDWALL of the Simplex tray. (Page 2.001-Figures 1 and 2)

CHARLOTTE - Term unique to hinged cover trays used to identify the cover side panels (Page 2.001-Figure 3)

FOOT (FOOT FLAP) - A flap hinged to the lower edge of the inner end panel of many double endwall trays (Page 2.001 - Figure 2) or off the lower edge of the inner side and endwalls of certain lock style double sidewall/double endwall trays. (Page 2.402)

FLANGE - Term used to describe a narrow flap hinged to the top edge of single sidewall or endwall trays. (Page 2.001-Figure 3)



**DOUBLE SIDEWALL/
 DOUBLE ENDWALL
 SIMPLEX TRAY**

1. Inner End Panel: Typically depth minus 1/32 inch (or board thickness).
2. Inner End Panel: Typically 1/32 inch offset.
3. Inner Side Panel: Typically depth minus 1/8 inch to 1/4 inch.
4. Outer Side Panel/Gusset Offset: Typically 1/32 inch.
5. Gusset Angle: 45°.
6. Locking Tab Angle: 45°.

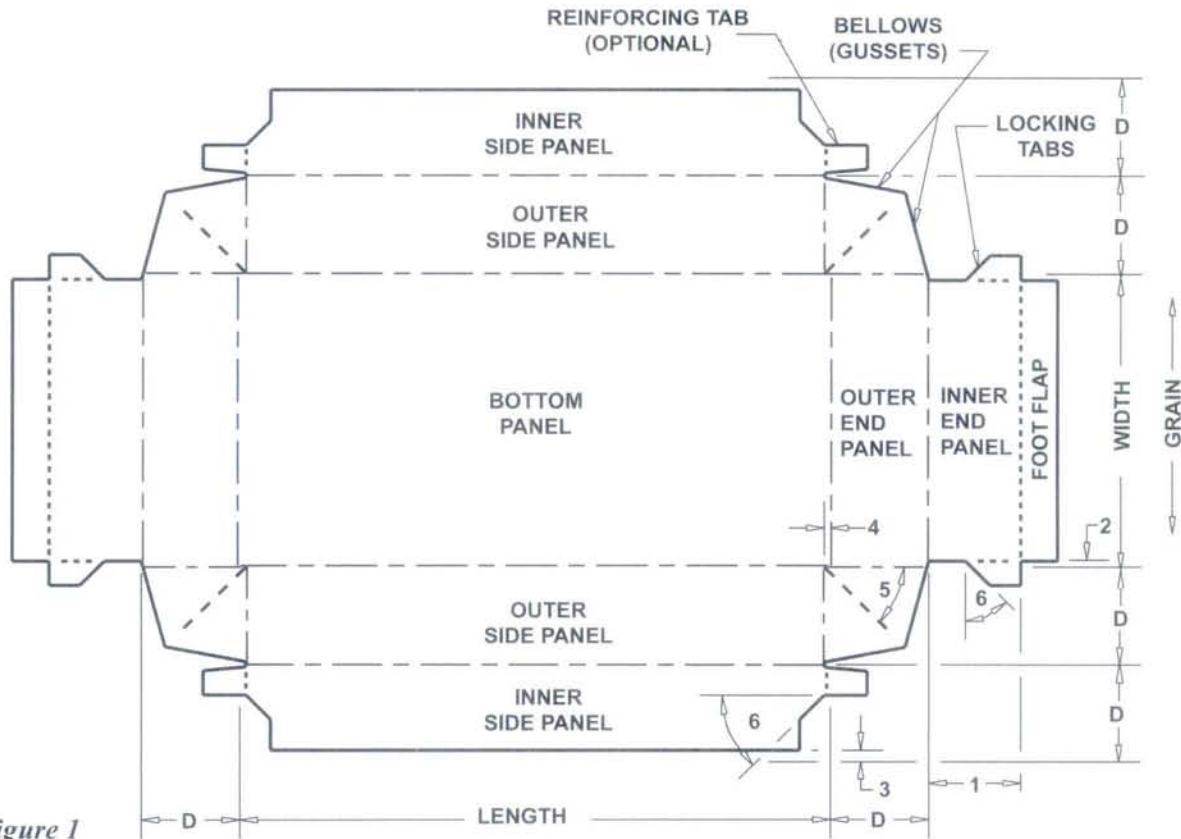


Figure 1

Illustration of terms from page 2.000

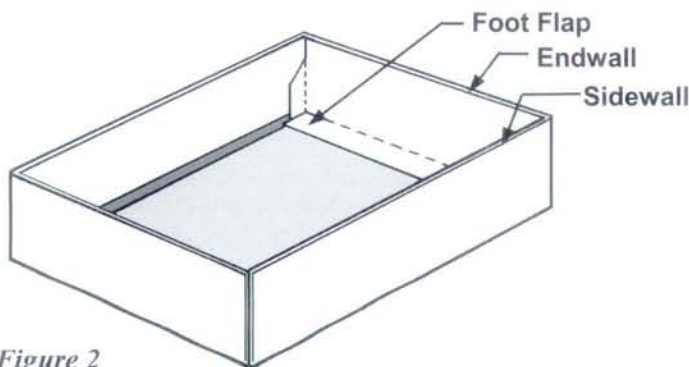


Figure 2

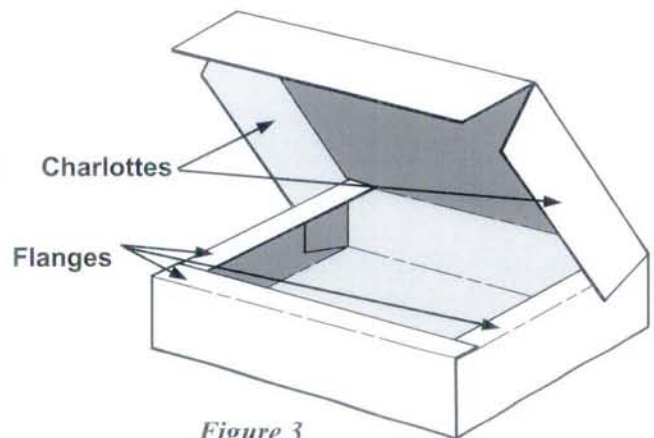
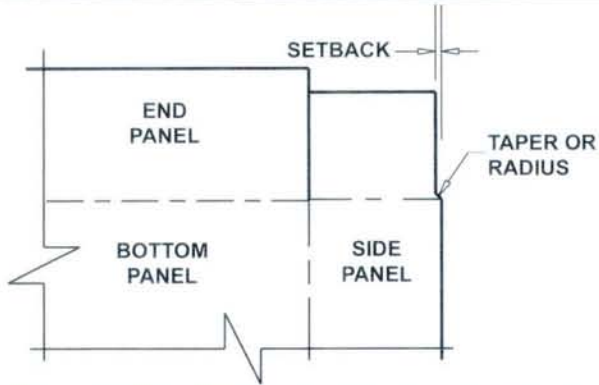


Figure 3



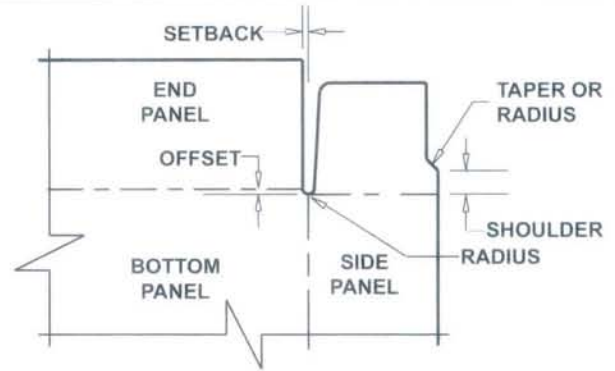
LIGHT CALIPER PAPERBOARD OPTIONS

Variation No. 1



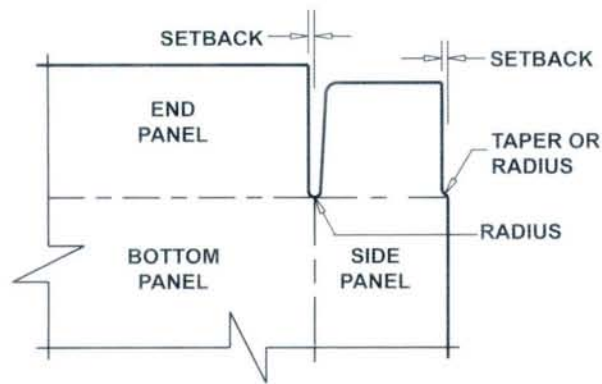
HEAVIER CALIPER PAPERBOARD OPTIONS

Variation No. 1



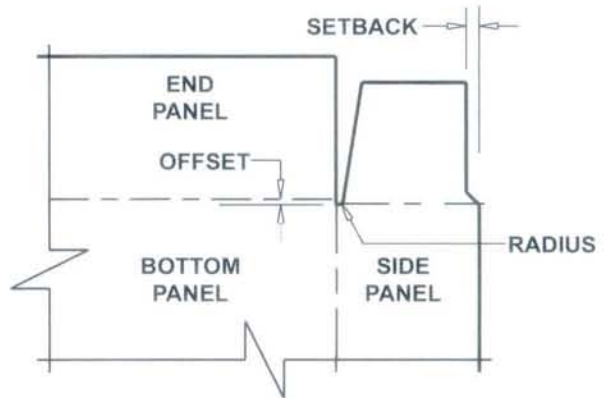
LIGHT CALIPER PAPERBOARD OPTIONS

Variation No. 2



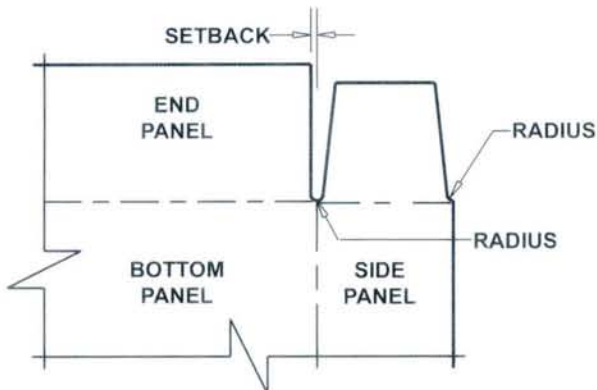
HEAVIER CALIPER PAPERBOARD OPTIONS

Variation No. 2



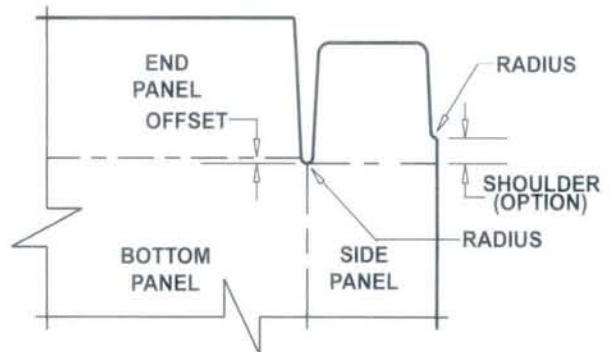
LIGHT CALIPER PAPERBOARD OPTIONS

Variation No. 3 (For Single Knife Dies)

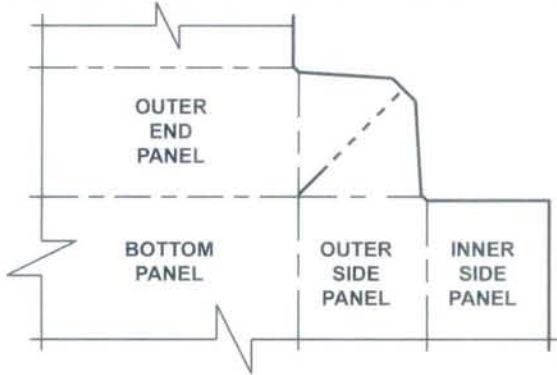


HEAVIER CALIPER PAPERBOARD OPTIONS

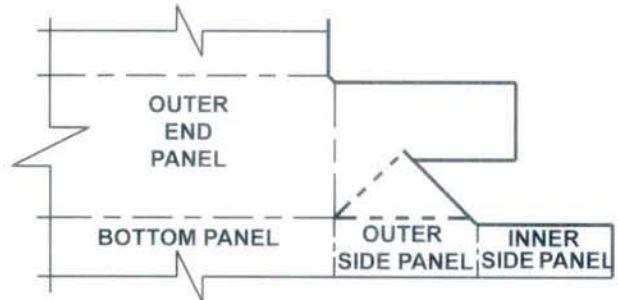
Variation No. 3 (For Single Knife Dies)



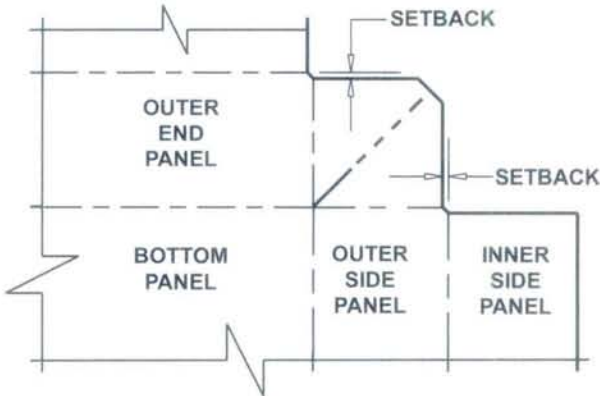
Variation No. 1
Typical Gusset Corner for
Double Sidewall / Double Endwall Tray



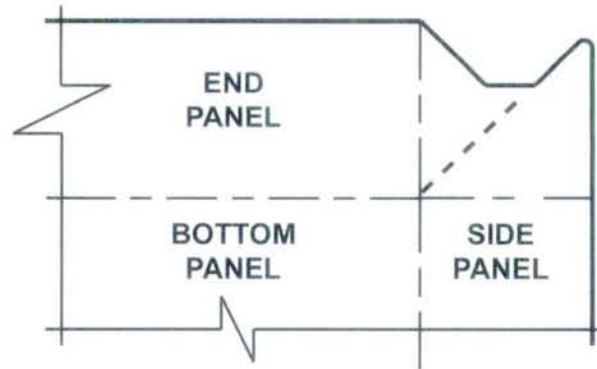
Variation No. 4
Glued Corner Gusset
 (Offers larger glue area versus conventional gusset corner)



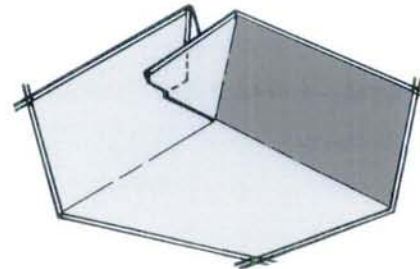
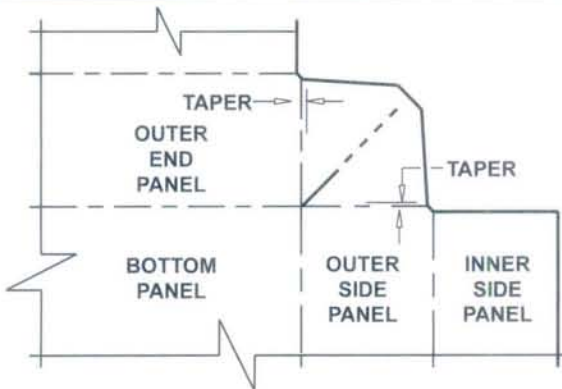
Variation No. 2
Setbacks vs. Tapered Edge Gussets
 (Resists sidewall/endwall flare of doublewall trays)



Variation No. 5
Heat Sealed Gusset Corner for Single Sidewall /
Single Endwall Tray (Single side poly coated board)



Variation No. 3
Tapered Gusset (Compensates for outward flare in shallow depth or heavy caliper gusset corner trays)



**FOUR CORNER
BEERS TRAY
(a.k.a.) BIERS TRAY**

The Beers tray is glued by the converter and shipped flat to the customer. It is typically set up and loaded by hand. Figures 1 and 3 show the conventional Beers. Figure 2 shows the “stay-up” or “full drag” version. Combination of a side panel diagonal angle of less than 45° ($43\text{-}1/2^\circ$ typically) and a non-tapered glue flap causes the glue flap to “drag” across the bottom panel. Natural friction causes the carton to resist collapsing once erected.

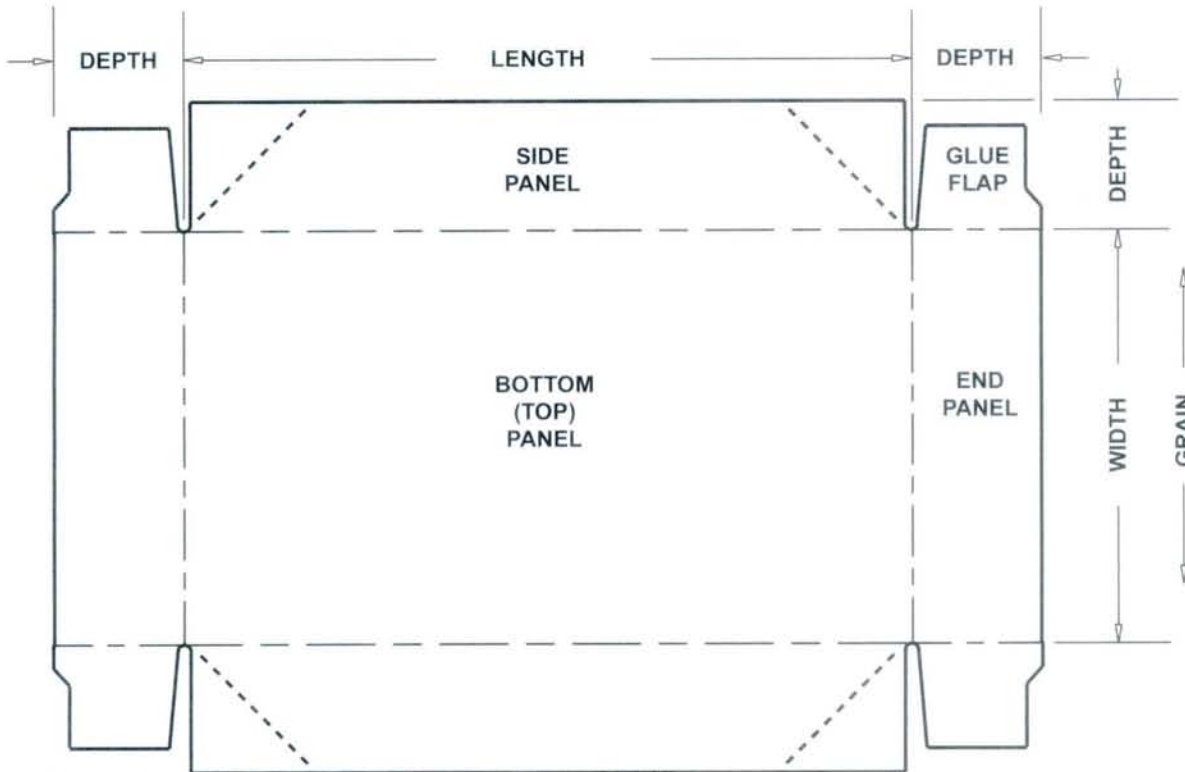


Figure 1

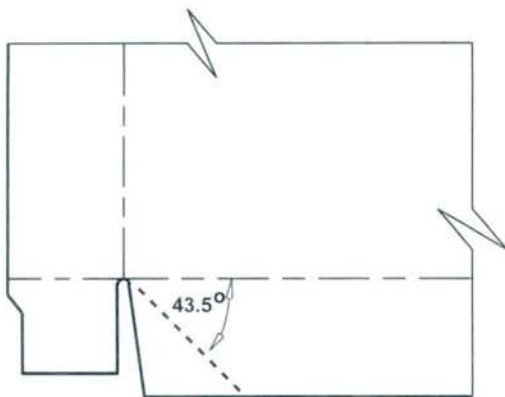


Figure 2

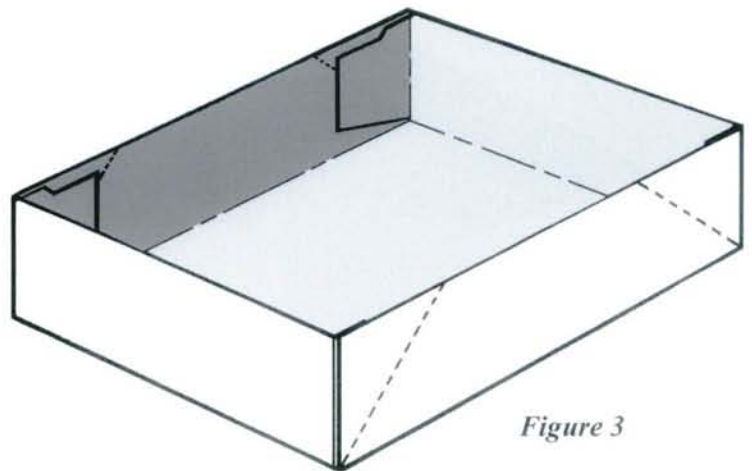


Figure 3



**INFOLD/OUTFOLD
TRAY**

The Infold/Outfold tray is glued by the converter and shipped flat to the customer. It is typically hand erected and loaded. Figure 3 shows the style folded and glued as an infold. Figure 4 shows the same style folded and glued as an outfold. A typical commercial use would combine an outfold bottom, which is easy to load, with an infold lid because it collapses inwardly resulting in a good friction fit between the lid and base.

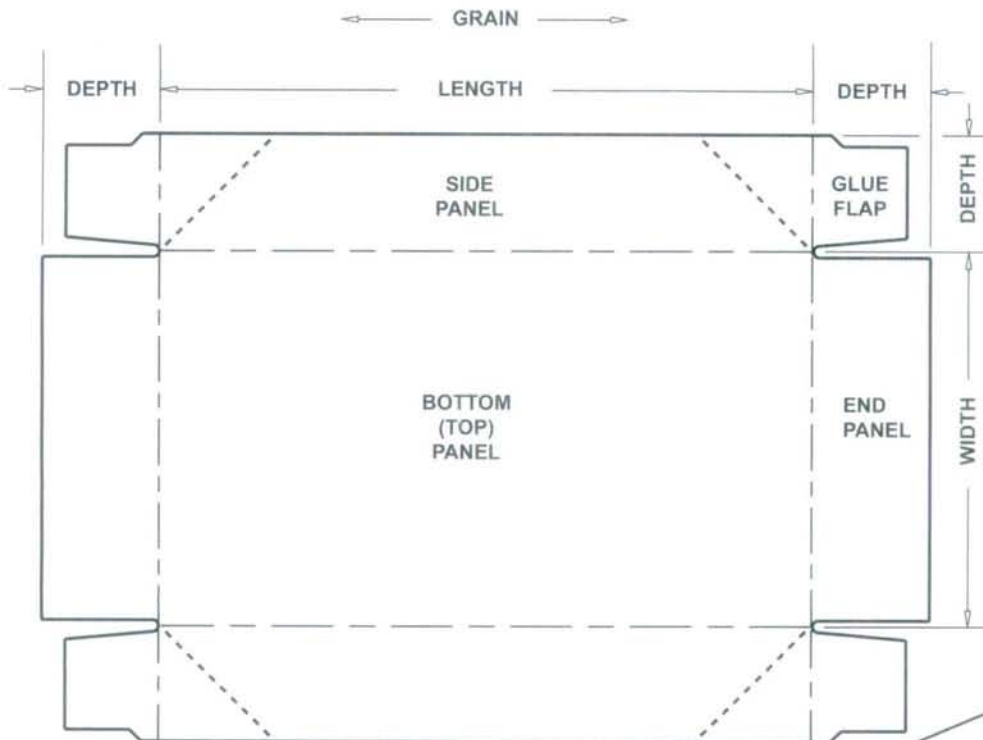


Figure 1

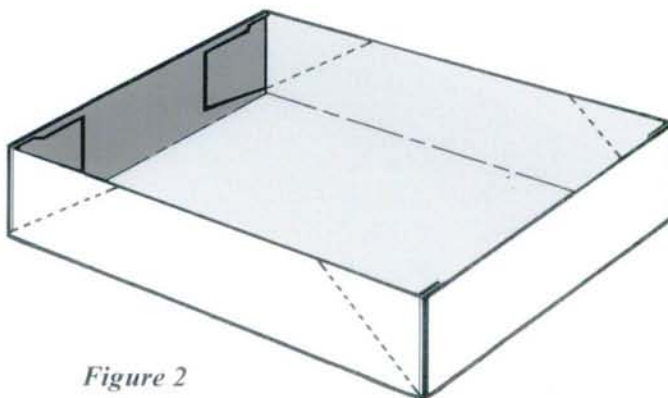


Figure 2

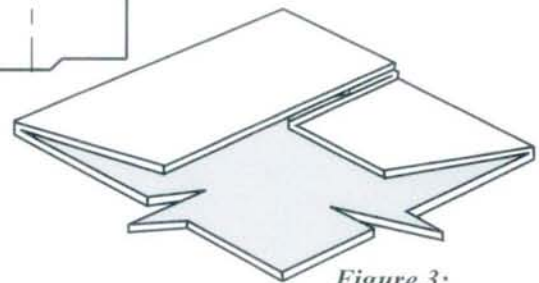


Figure 3:
Infold Corner

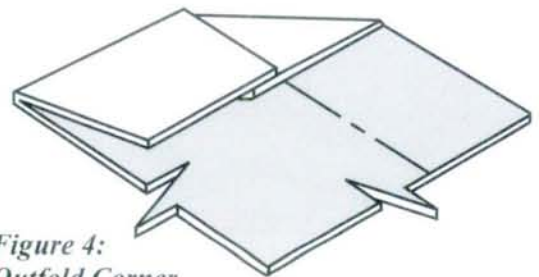


Figure 4:
Outfold Corner



**FOUR CORNER
BRIGHTWOOD
TRAY**

The Brightwood style tray is shipped flat and non-glued. It is machine formed and glued by the customer on automatic packaging equipment.

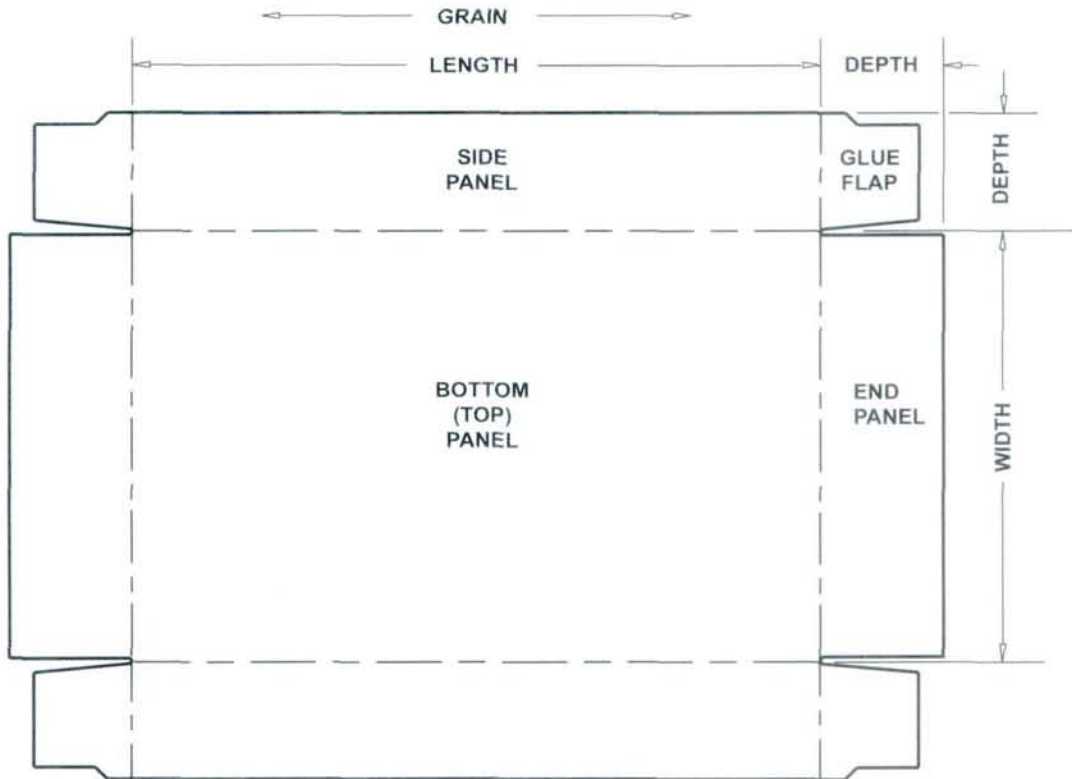


Figure 1

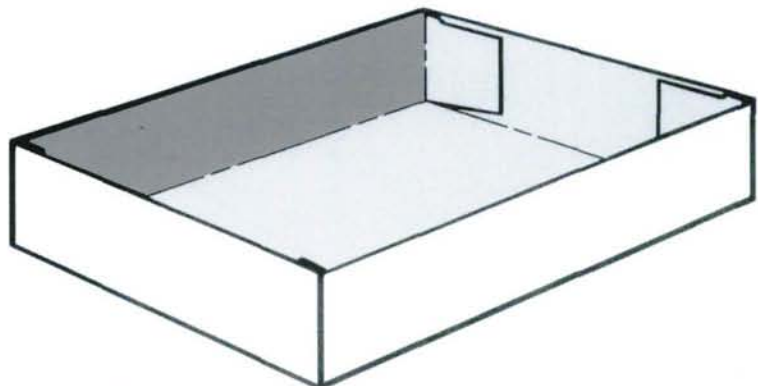


Figure 2



**STRIPPER LOCK
TRAY**

This is a machine erected and locked style. There are a number of lock variations as well as numerous equipment suppliers.

As best seen in Figure 2, the male lock is “stripped” through the female locking slot. The upper tip of the lock extends above the upper edge of the locking slot. For “packed wet” products it may be preferable to move the locking slot up and away from the base, as shown in Figures 1A and 2A, to add a degree of leak resistance. The flange adds rigidity to the tray.

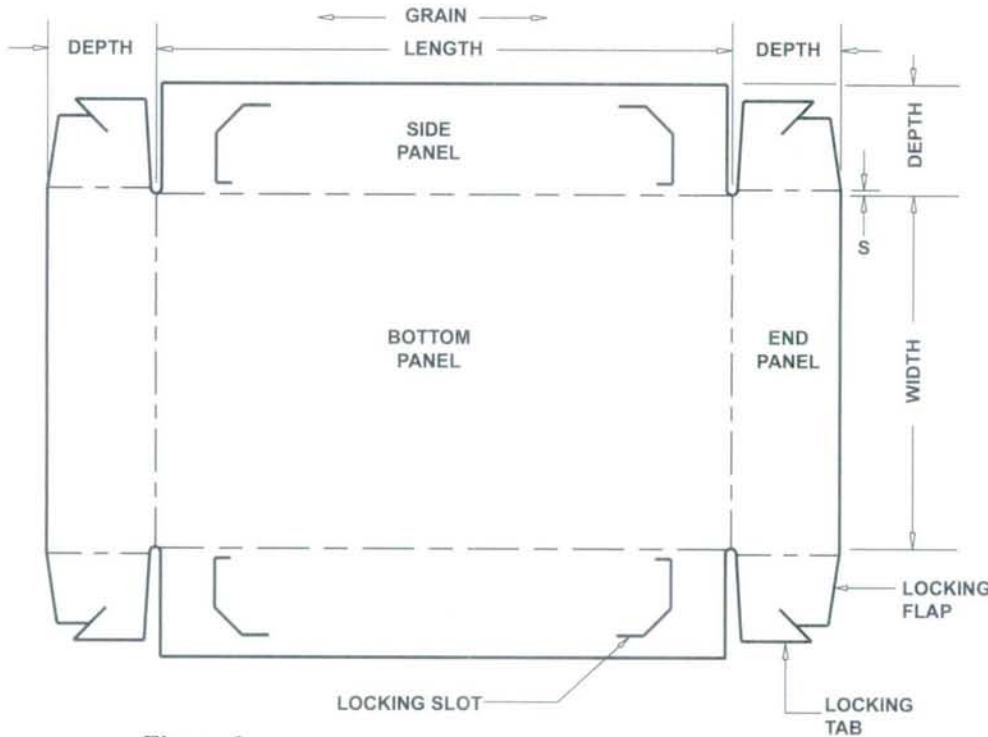


Figure 1

Figure 1A

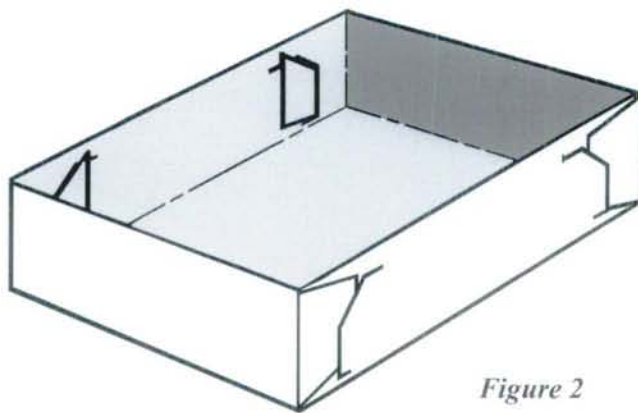


Figure 2

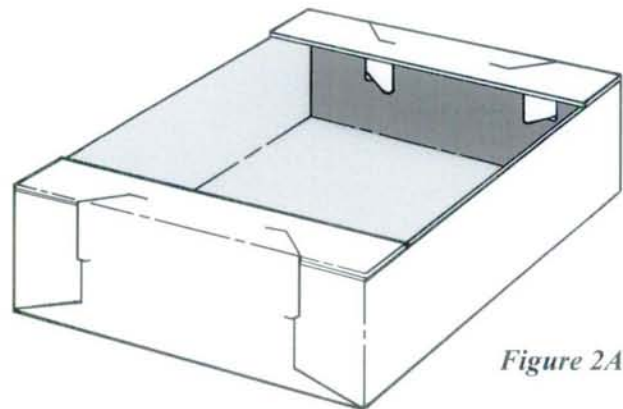
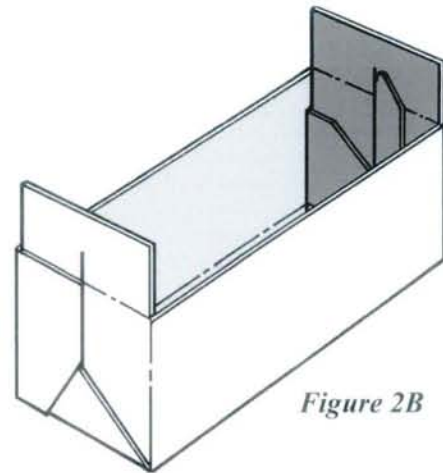
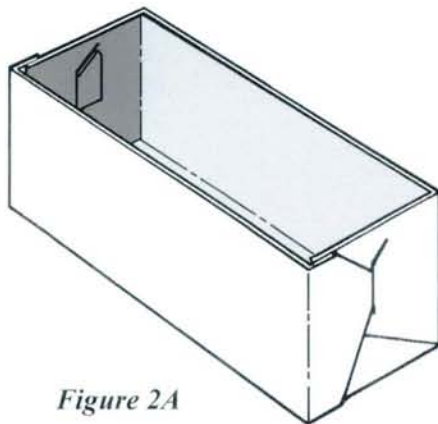
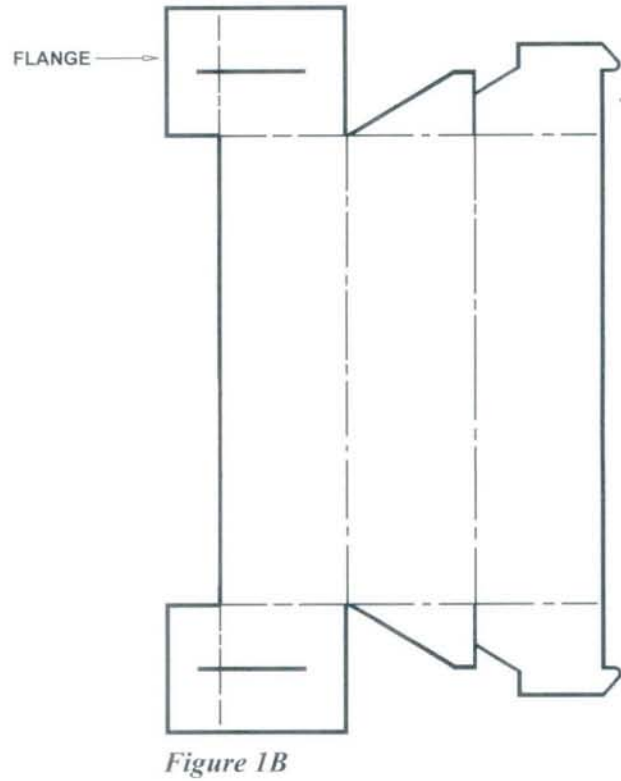
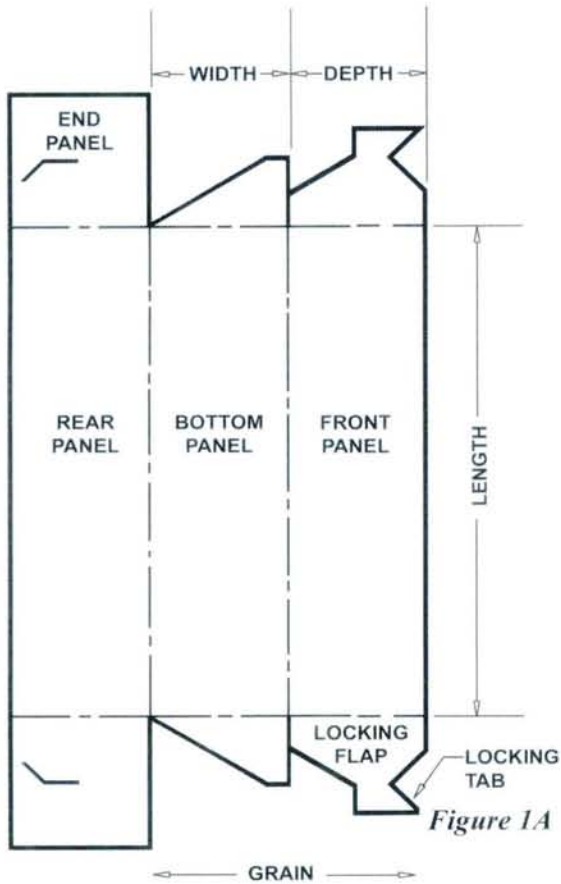


Figure 2A



**STRIPPER LOCK
TRAY**

For trays where the depth and width are equal or nearly equal, this is a viable alternative to the stripper lock styles shown on page 2.104. Two variations are shown below. They are typically machine erected and locked.



**PUNCH LOCK
TRAY**

The punch lock tray is an alternative to the stripper lock style variations shown on page 2.104. It would typically be shipped from the converter as a flat blank to be erected, locked and filled on the customer's packaging line.

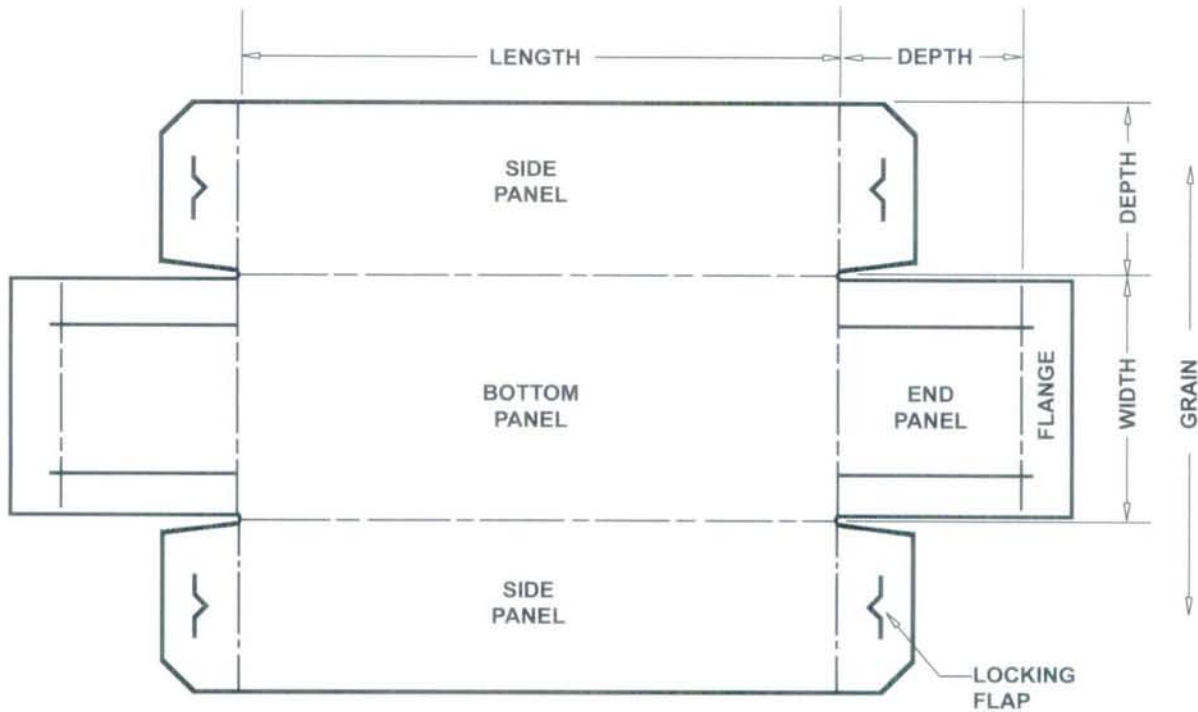


Figure 1

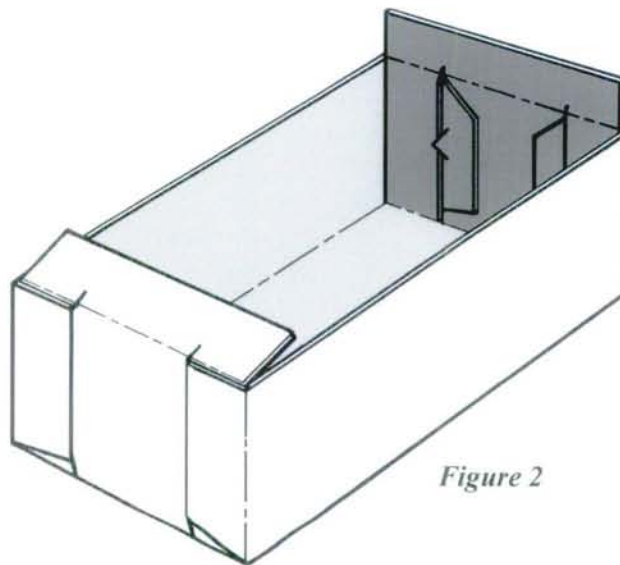


Figure 2



**SIDE LOCKING
TRAY
(RETAIL CARTON)**

This style is generally used as a retail box. It is typically shipped flat from the converter to a distributor, who in turn ships it to retail outlets. It is commonly found in department stores, gift shops and florists, where it is erected by store personnel.

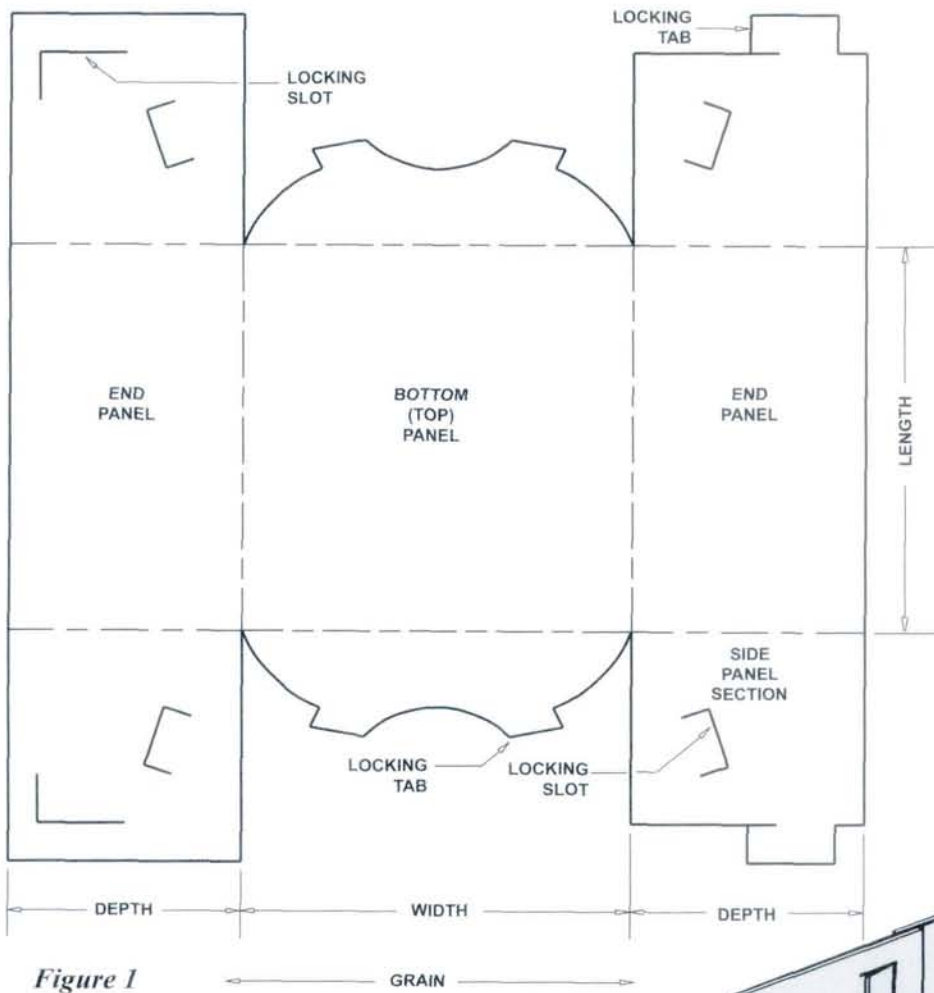


Figure 1

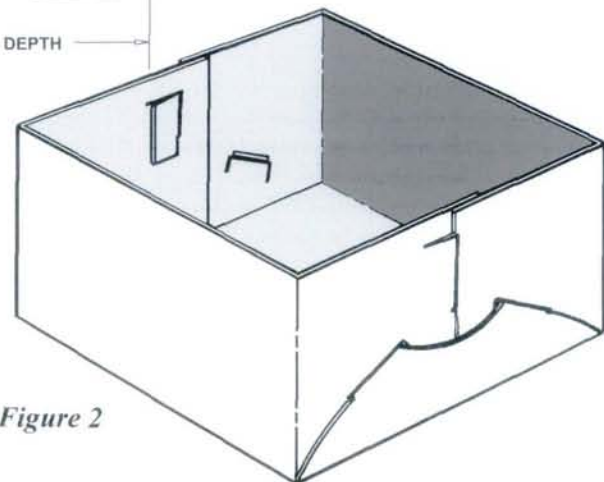


Figure 2



**FOUR CORNER (POINT)
BEERS with
TUCK TOP CLOSURE
(a.k.a.) BIEBS**

This style is typically set up, loaded and closed by hand. It is suitable for a broad range of relatively light products.

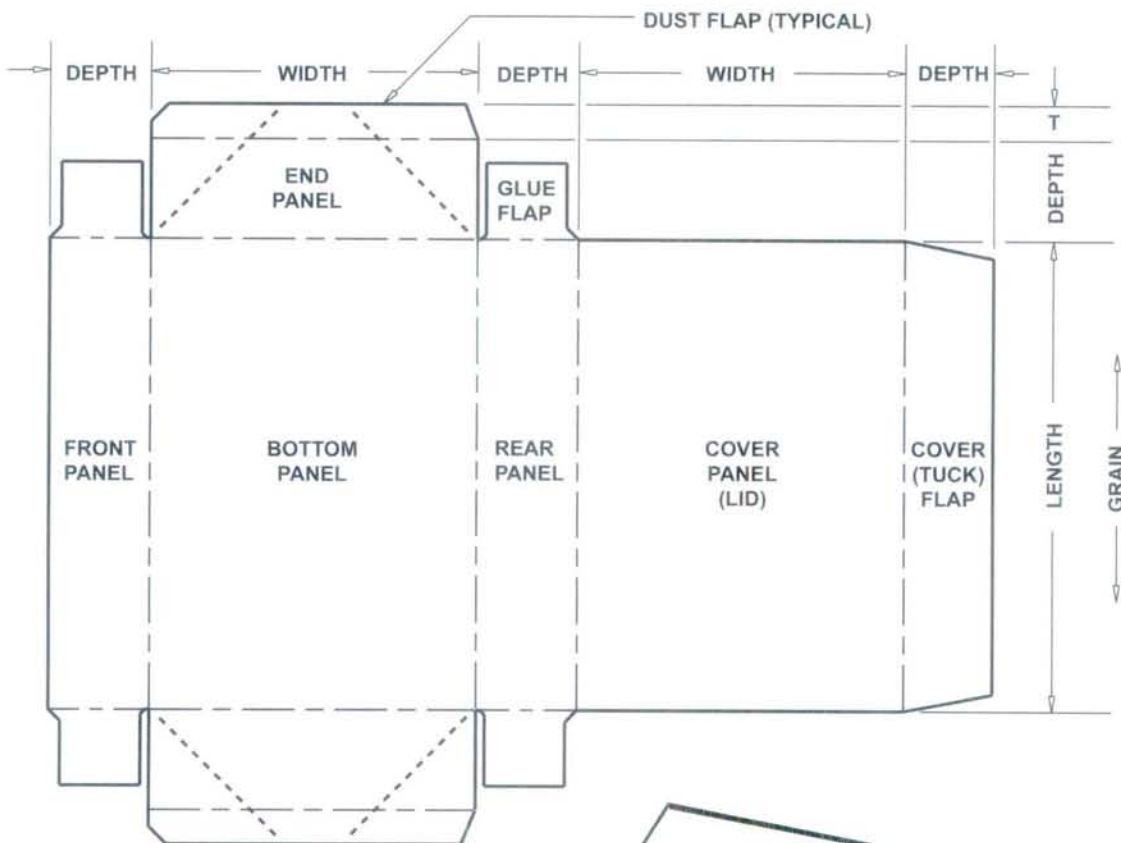


Figure 1

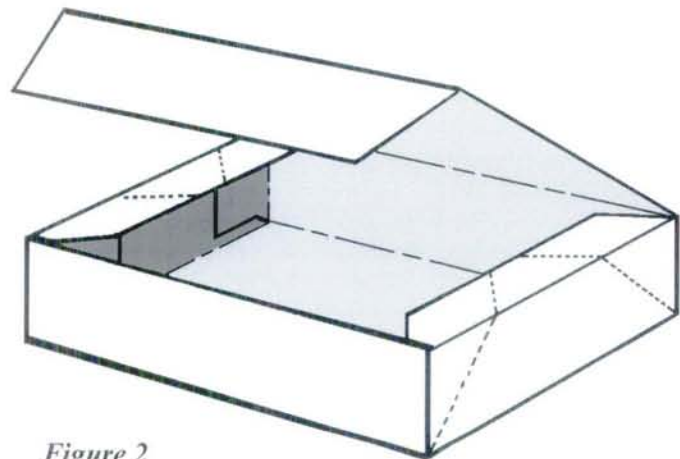


Figure 2



**SIX CORNER (POINT)
BEERS
(a.k.a.) BIERS**

The six corner Beers tray as shown in Figures 1A and 2A is glued by the converter and shipped flat to the customer. It is typically set up and loaded by hand.

A variation on this basic style includes conventional Beers corners at the front of the base tray and front cover. There are bellows or gussets in the rear corners. This variation is illustrated in Figures 1B and 2B.

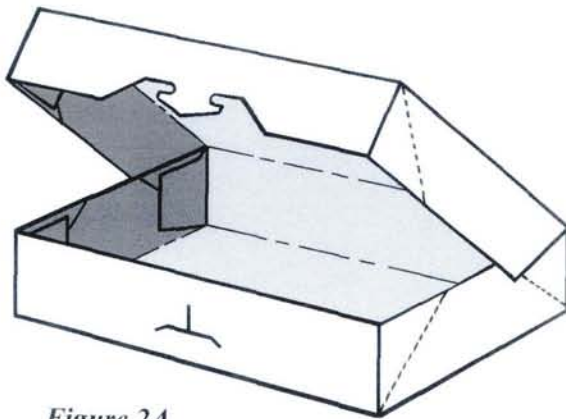
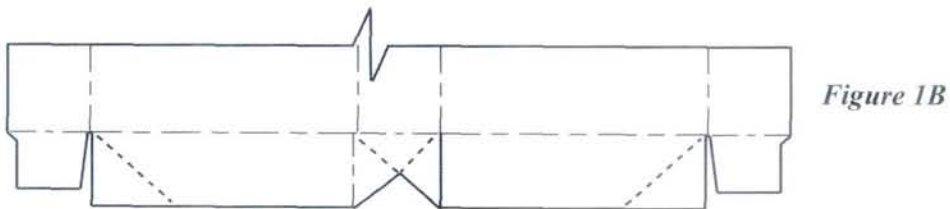
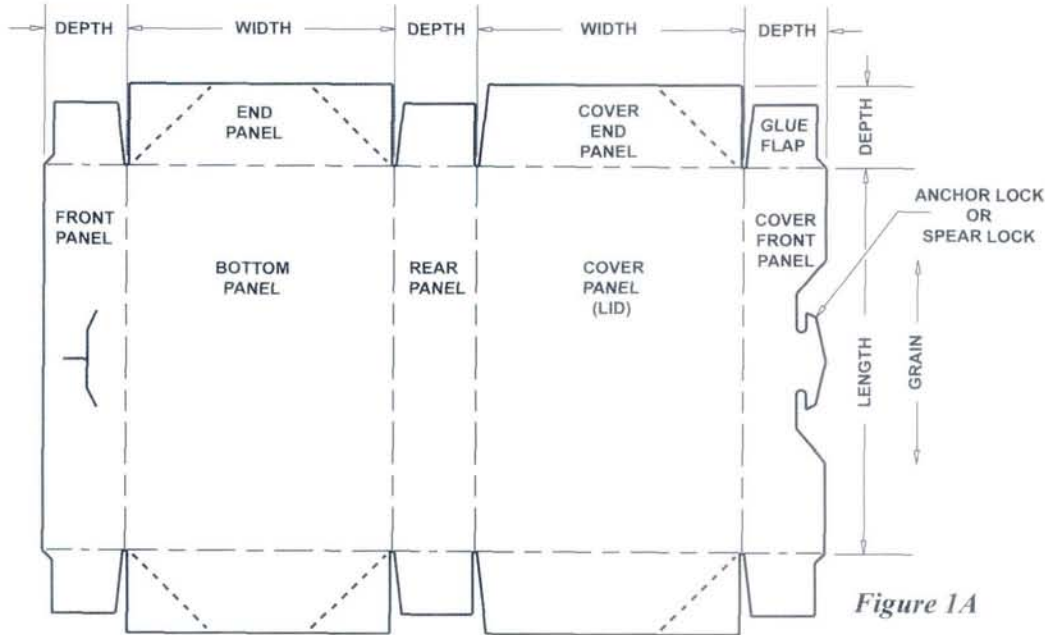


Figure 2A

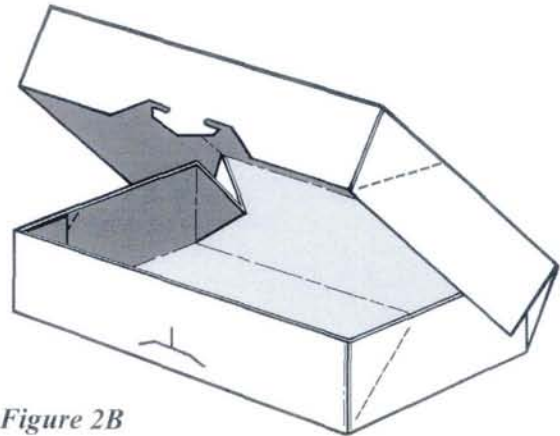


Figure 2B



**SIX CORNER
BRIGHTWOOD TRAY**

The six corner Brightwood tray is shipped flat and non-glued. It is machine formed and glued by the customer on automatic packaging equipment.

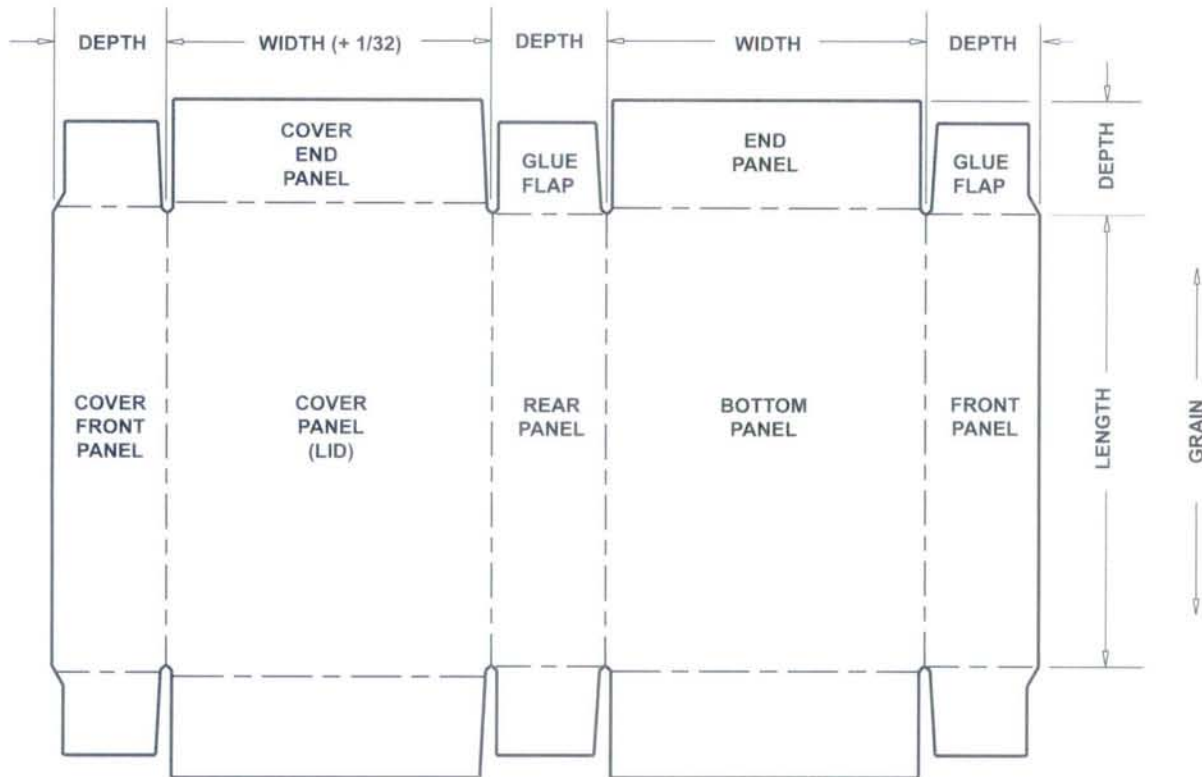


Figure 1

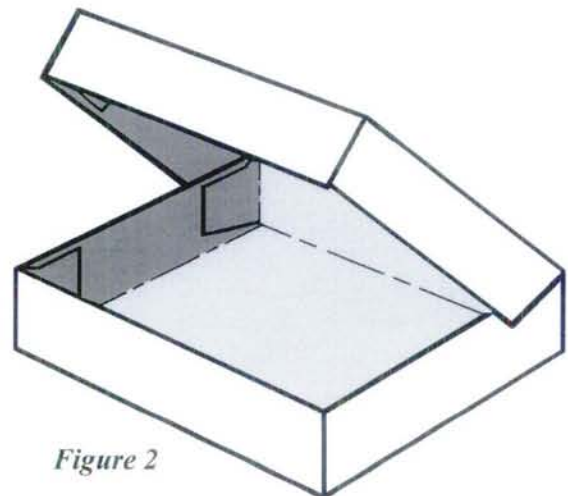


Figure 2



**STRIPPER LOCK TRAY
with
HINGED COVER**

This is a machine formed and closed style. The cover tuck and charlottes are either heat sealed or adhesive sealed to the tray front and side panels.

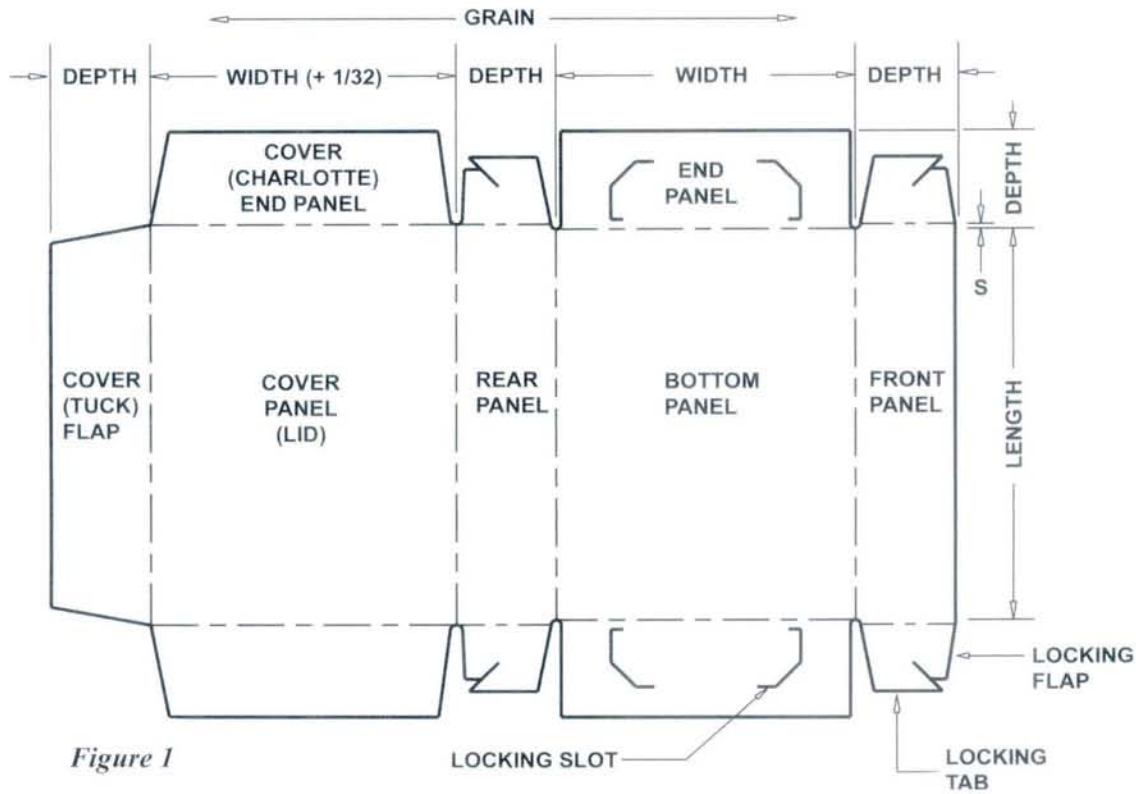


Figure 1

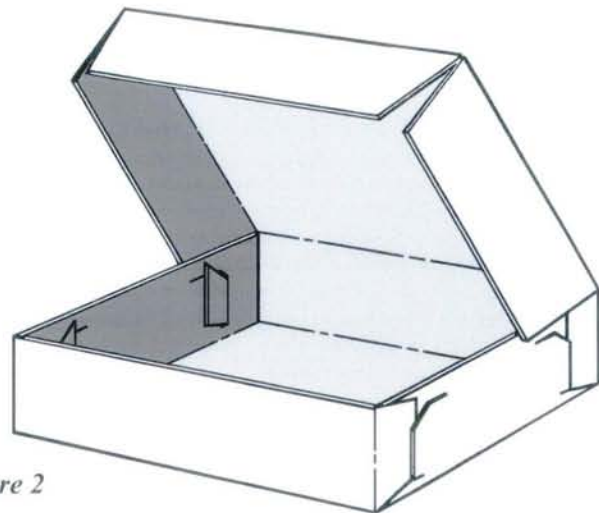


Figure 2



**DIAGONAL FOLD TRAY
with
TOP CLOSURE**

This is most commonly a machine formed and locked carton. In Figures 1 and 2, it is configured as a locked corner, unprinted and overwrapped shell for the frozen food industry; but there is potential beyond this commodity use. With glued corners and a decorative label to keep the end closure flaps secure, it could make an interesting gift carton, as illustrated in Figure 3. Another option (not shown) is to secure the overlapping outer closure panels with locking means as opposed to glue sealing or labeling.

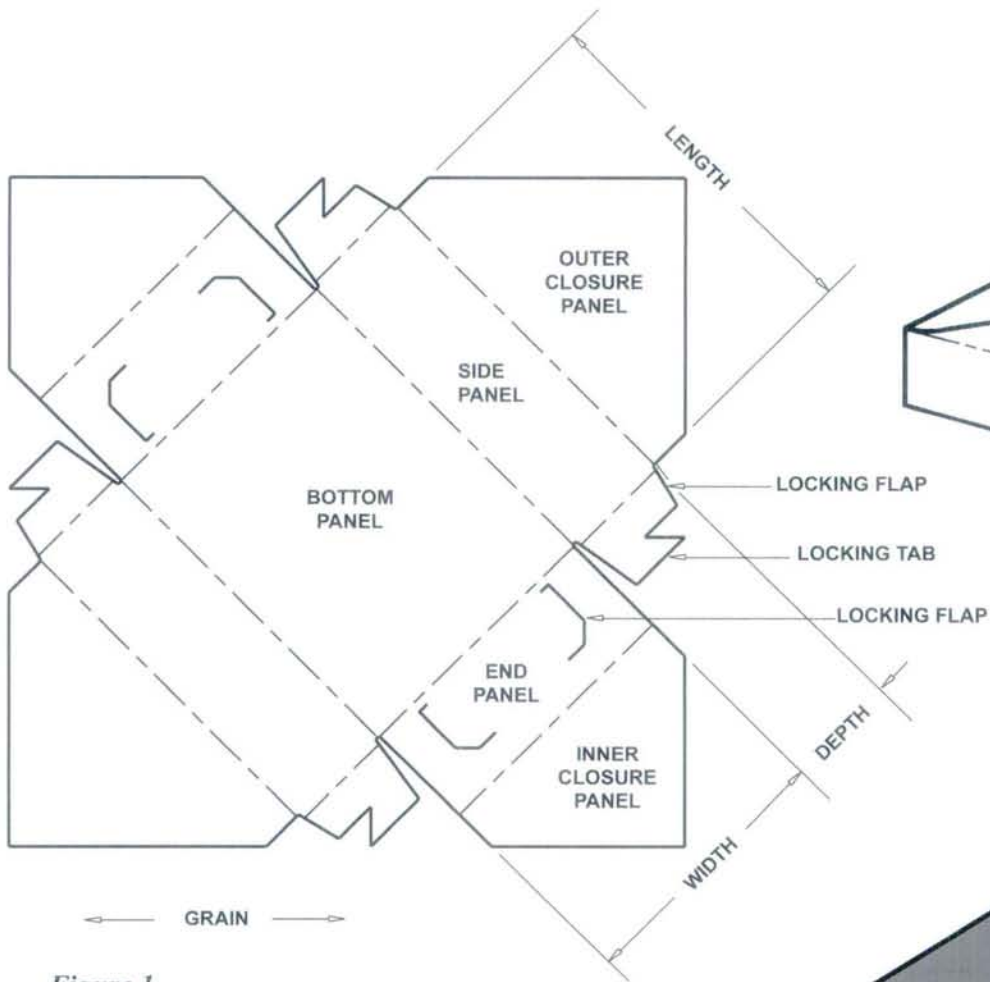


Figure 1

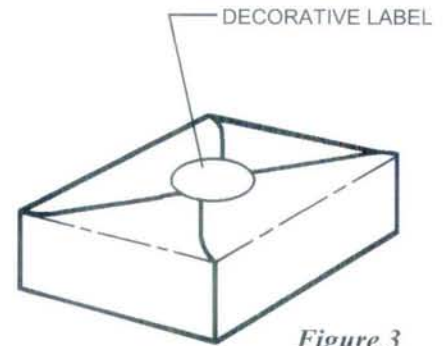


Figure 3

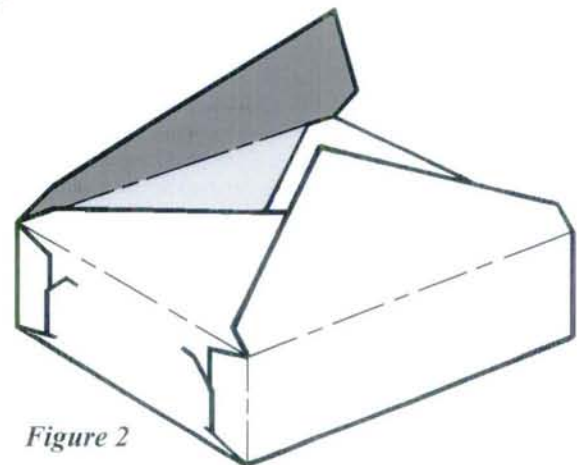


Figure 2



CAKE LOCK TRAY
 with
HINGED COVER

While it has other uses, this style is generally associated with the retail bakery trade. It is frequently referred to as the “cake box” style. It is typically shipped flat from the converter to a distributor, who in turn ships to retail outlets where it is erected “on demand” by a clerk.

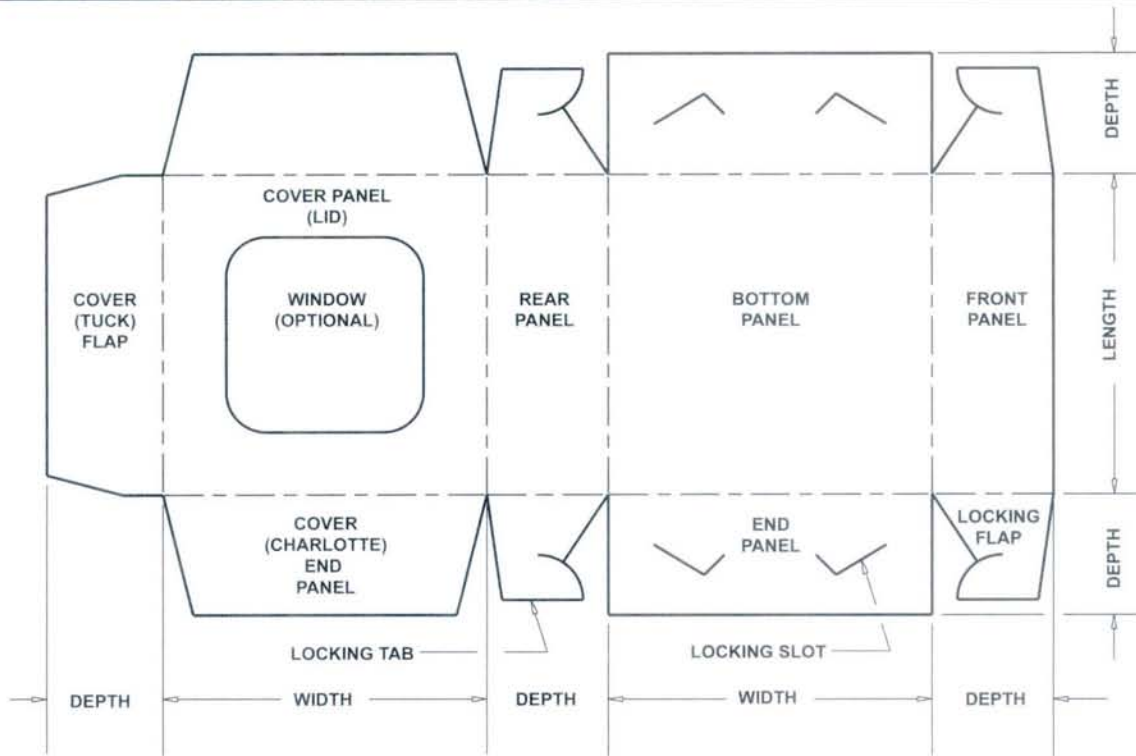


Figure 1

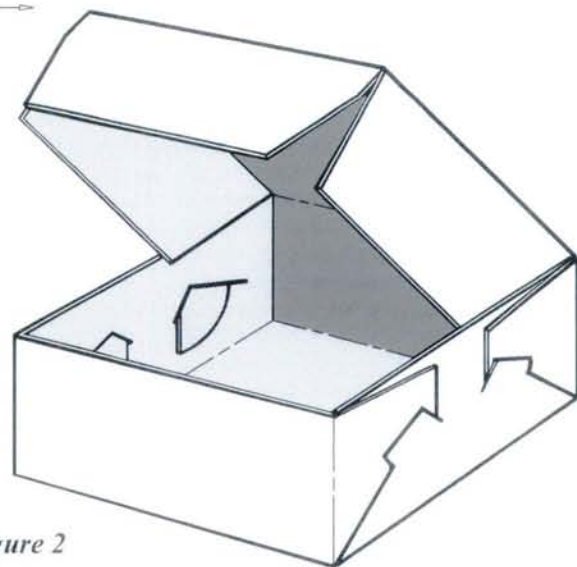


Figure 2



**FOUR CORNER
BRIGHTWOOD TRAY
with HINGED COVER**

This style is essentially the same as the four corner Beers (page 2.201) but without the diagonal scores. This Brightwood variation is shipped flat and unglued, and is typically machine formed and glued by the customer on automatic packaging equipment.

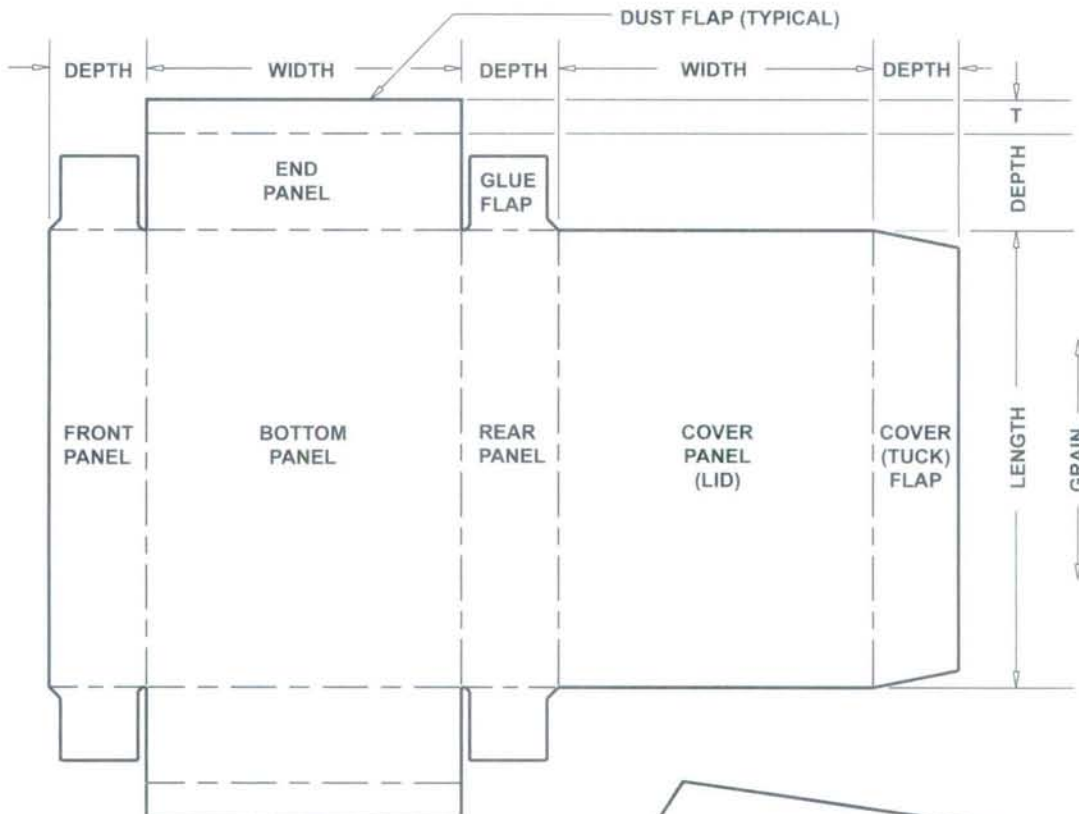


Figure 1

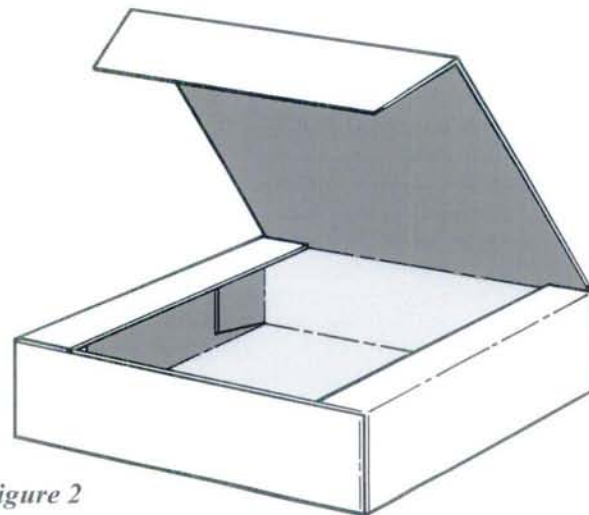


Figure 2



**FOUR CORNER
BRIGHTWOOD TRAY
with
DOUBLE ENDWALLS**

This customer machine glued style is sometimes produced in combination with a lid of similar style, except that the lid will have single endwalls and double sidewalls. This results in a finished package which has triple thick side and endwalls for excellent vertical stacking strength.

Figure 1 shows the classic Brightwood style. Figure 1A shows a gusset corner alternative. It also shows a flange option off the upper edges of the side panels. The flange option is further illustrated in Figure 3.

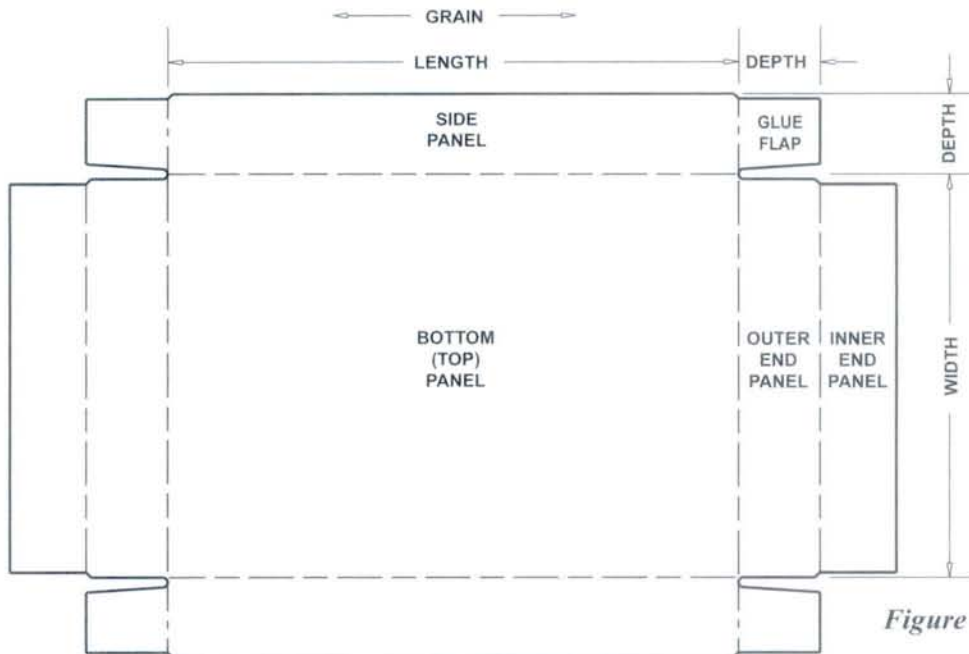


Figure 1

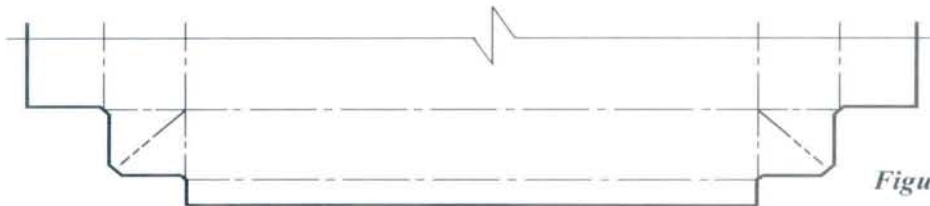


Figure 1A

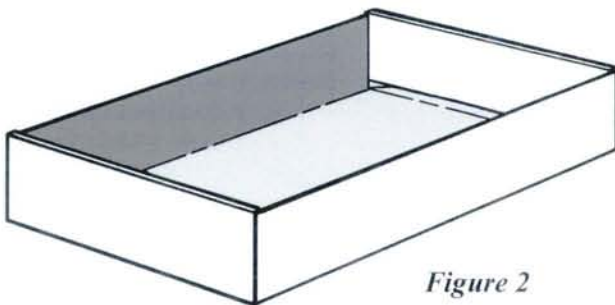


Figure 2

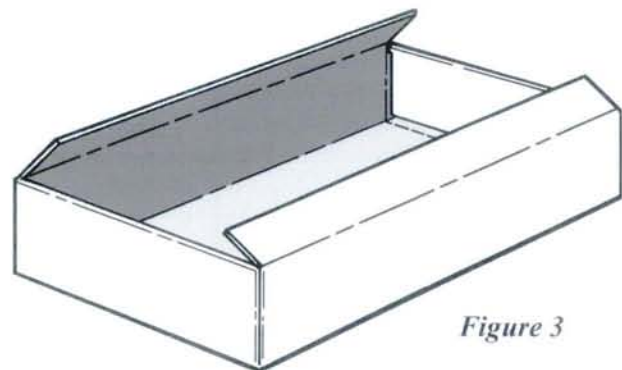


Figure 3



PINCH LOCK TRAY

The pinch lock tray is erected and locked by hand.

Figure 1 shows the more common single corner flap variation. Figure 2 shows a bellows (gusset) corner variation.

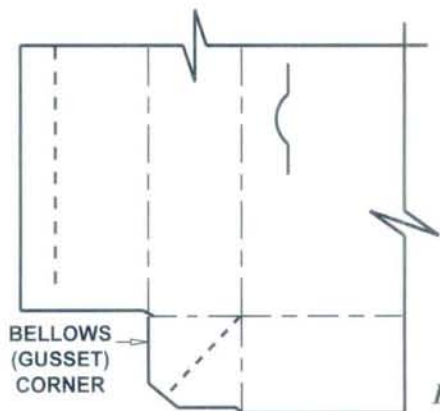
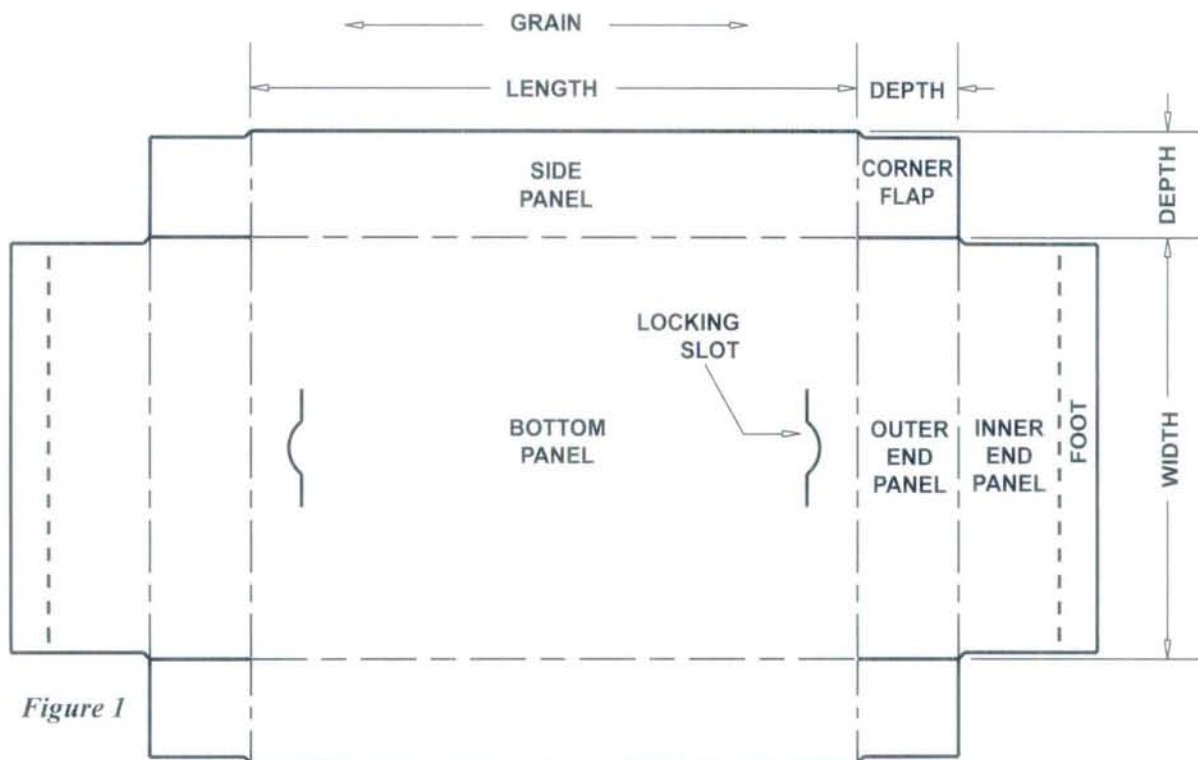
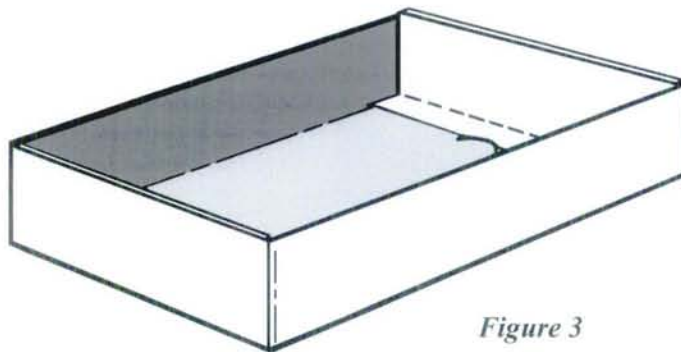


Figure 2



WALKER LOCK TRAY

The Walker lock tray is typically erected and locked by hand.

Figure 1 shows the more common single corner flap variation. Figure 2 shows a bellows (gusset) corner variation.

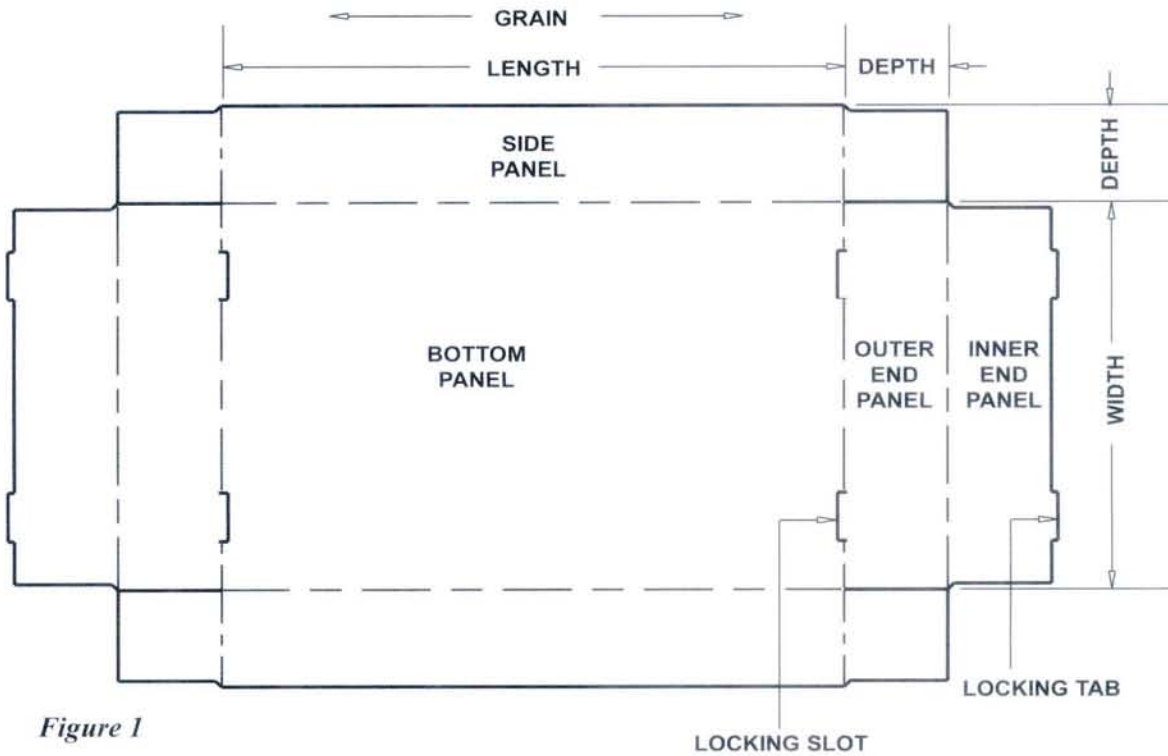


Figure 1

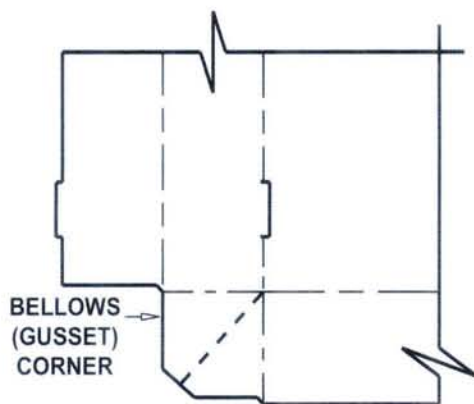


Figure 2:

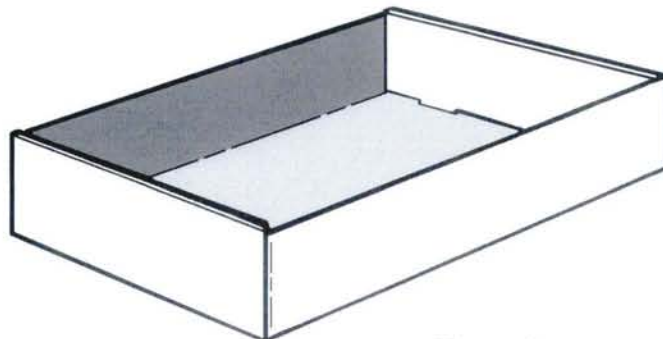


Figure 3



ARTHUR LOCK TRAY
(a.k.a.)
JONES LOCK TRAY

The Arthur lock tray is hand erected and used primarily as a component of a wholesale package. It is seldom seen as a retail package.

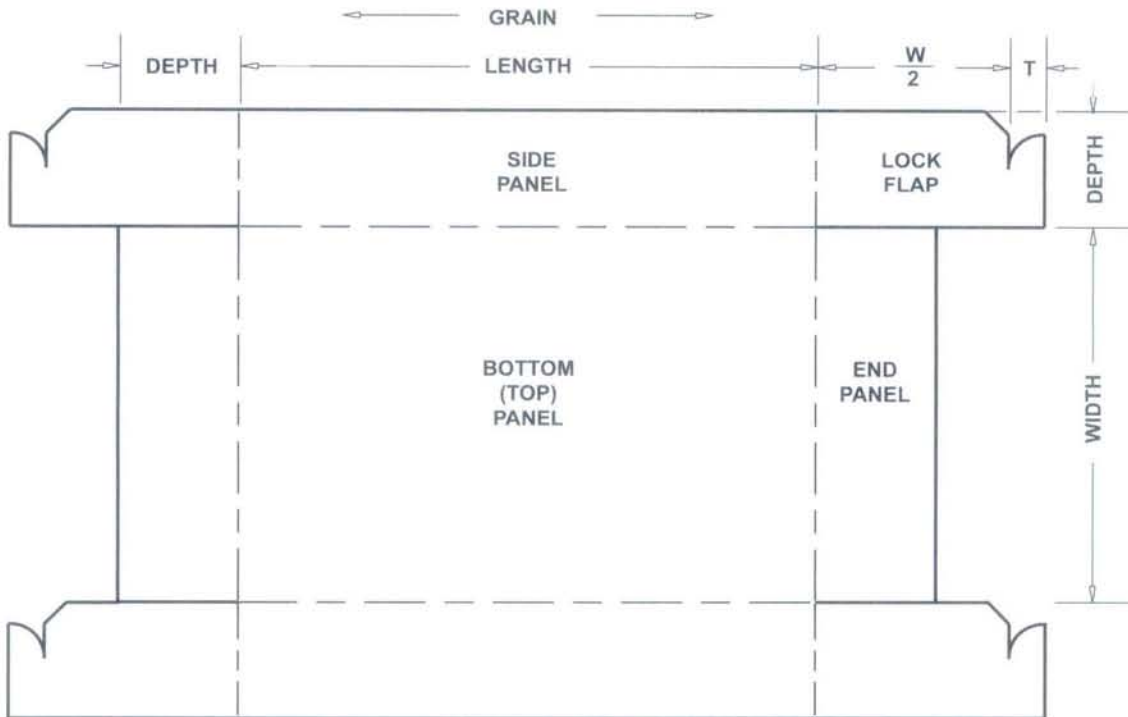


Figure 1

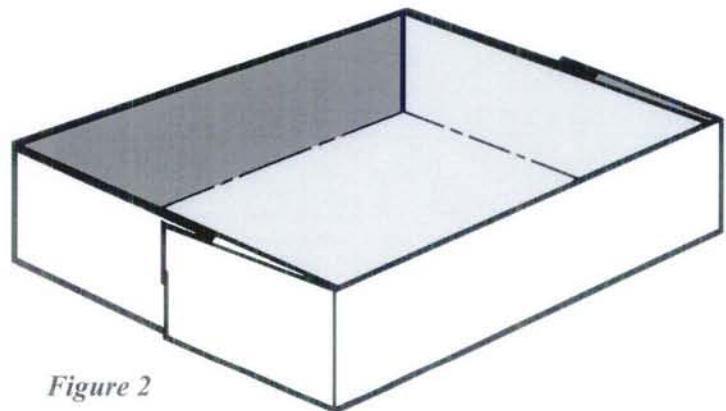


Figure 2



**OUTSIDE
GUSSET LOCK
TRAY**

In this tray, the inner end panels are folded up, then the gussets folded out and around the inner end panels. The end panels are folded down and the locking tabs at the lower edges are engaged behind the gussets. This style is useful for packaging viscous products where standard inner gussets might interfere with product removal.

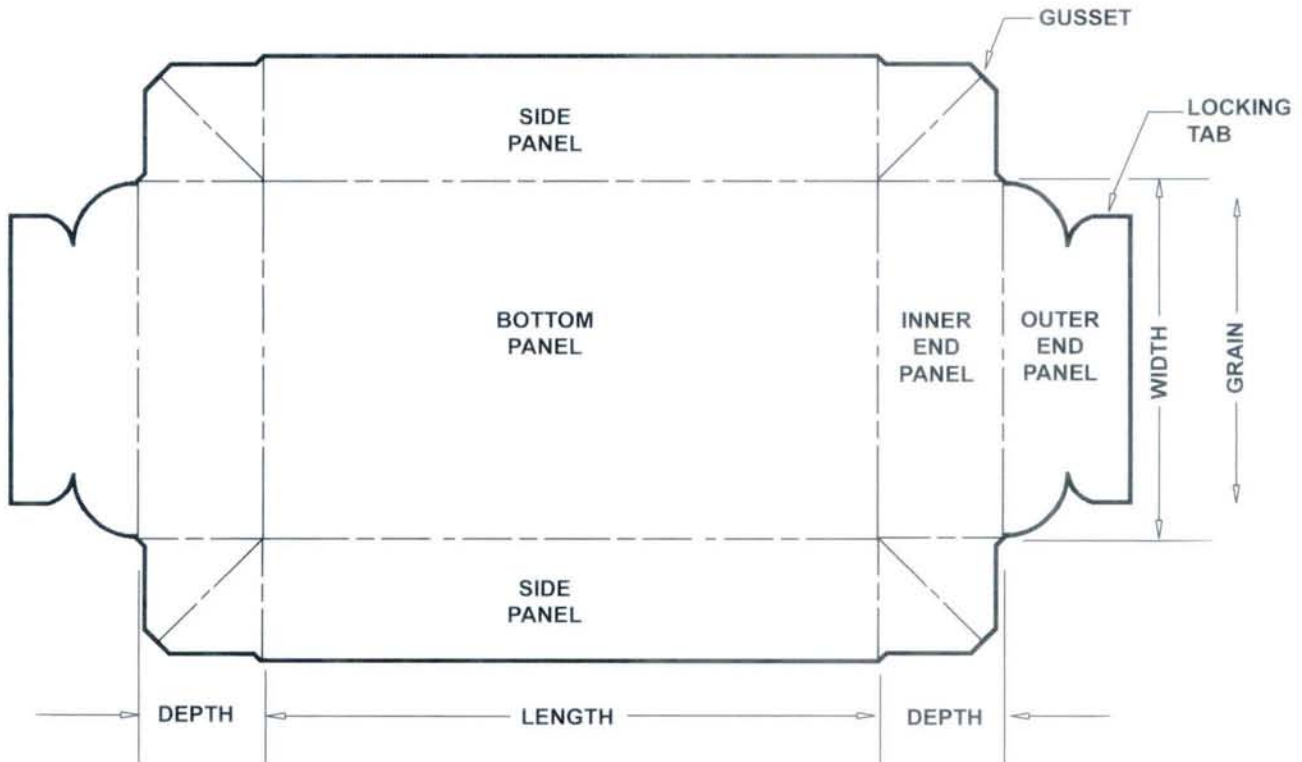


Figure 1

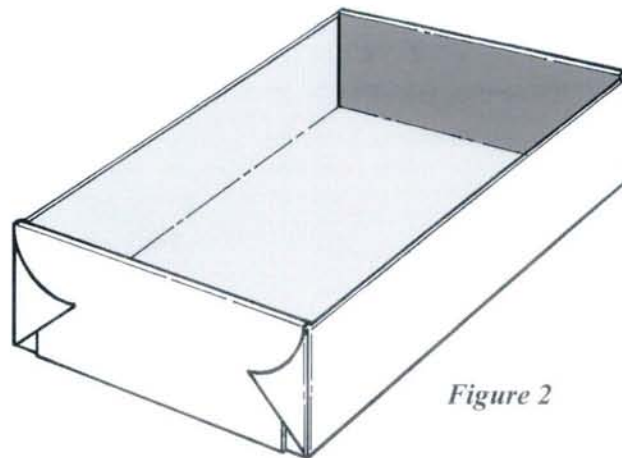


Figure 2



**FLIPLOK TRAY
(FLIPLOCK)**

The Fliplok tray is glued on either a timed straight line or right angle gluer. It is a style popular as a retail box because it is easy to erect and very attractive in the erected form.

Note the glue pattern on the inner end panel (Figure 1).

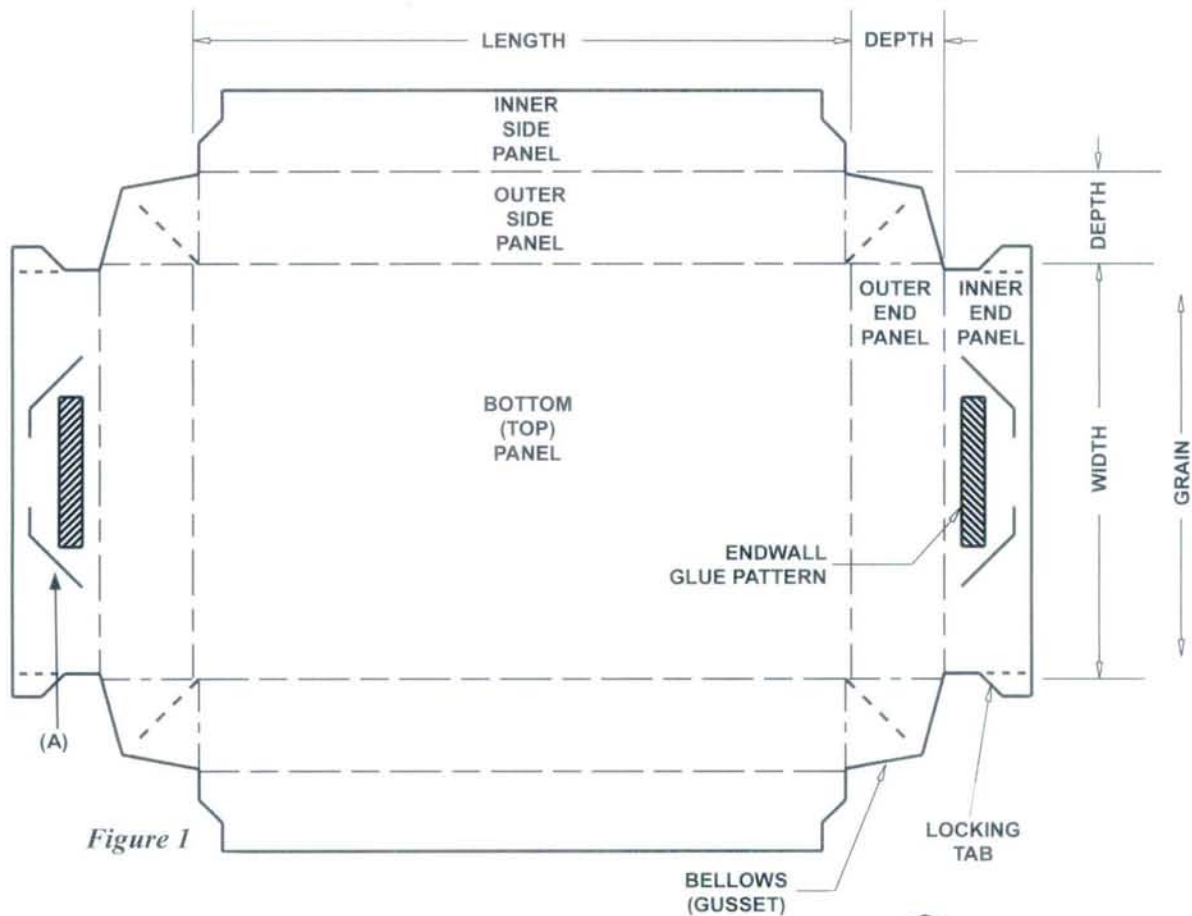


Figure 1

(A) Optional cut or diagonal crease to assist in folding inner end panels over bellows

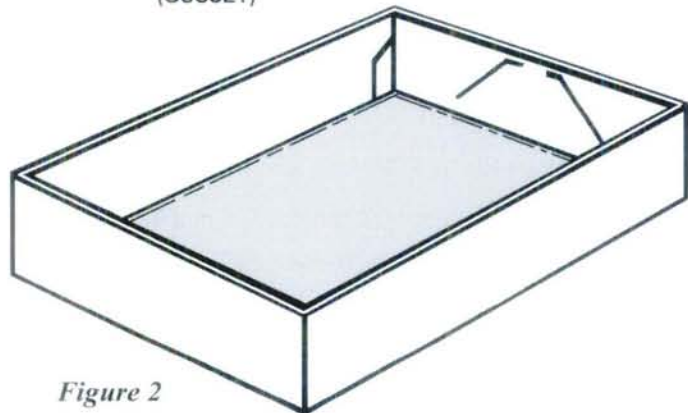


Figure 2



**FOOT LOCK
DOUBLE WALL TRAY**

This style requires a larger blank than the commonly used double sidewall/double endwall Simplex style (page 2.403), but does not require a finishing pass over a straight line gluer as does the Simplex. This is typically a hand set up style.

Figure 1 shows the single corner flap variation. Figure 2 illustrates a bellows (gusset) corner option.

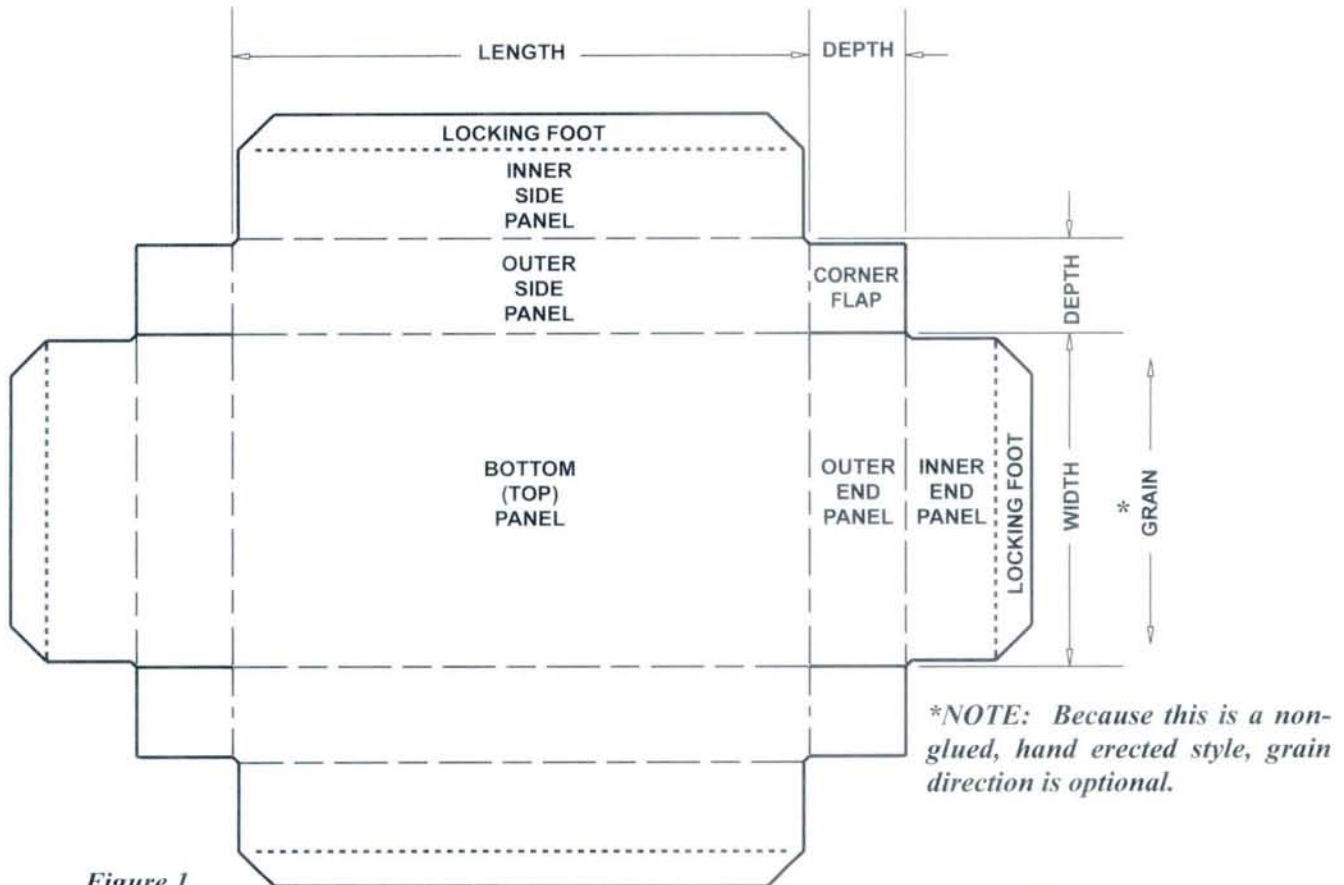


Figure 1

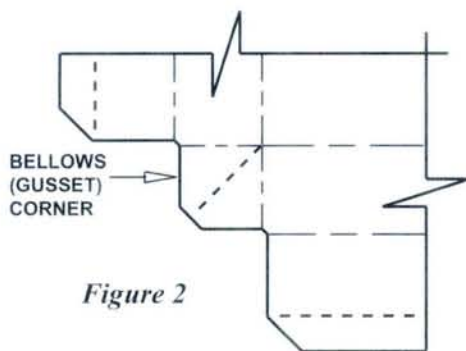


Figure 2

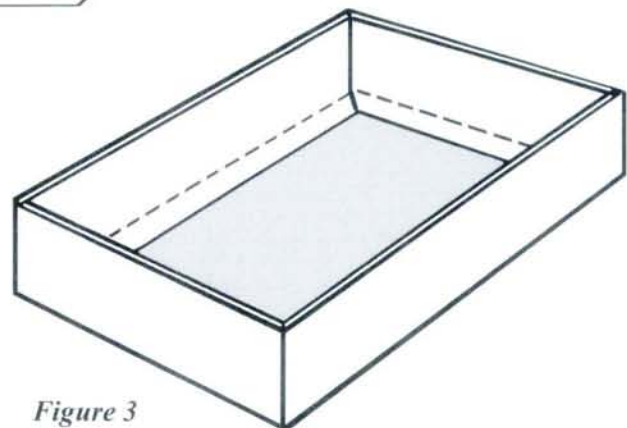


Figure 3



SIMPLEX TRAY
(a.k.a.) KWIKSET

The sidewalls of the Simplex tray are glued by the converter. It is typically hand erected by the customer but can be machine formed as well.

Figure 1 shows the most common form of the Simplex. Figure 2 illustrates an alternative which is frequently used in shallower depths. As best seen in Figure 3, the inner side panel is not as wide as the outer side panel.

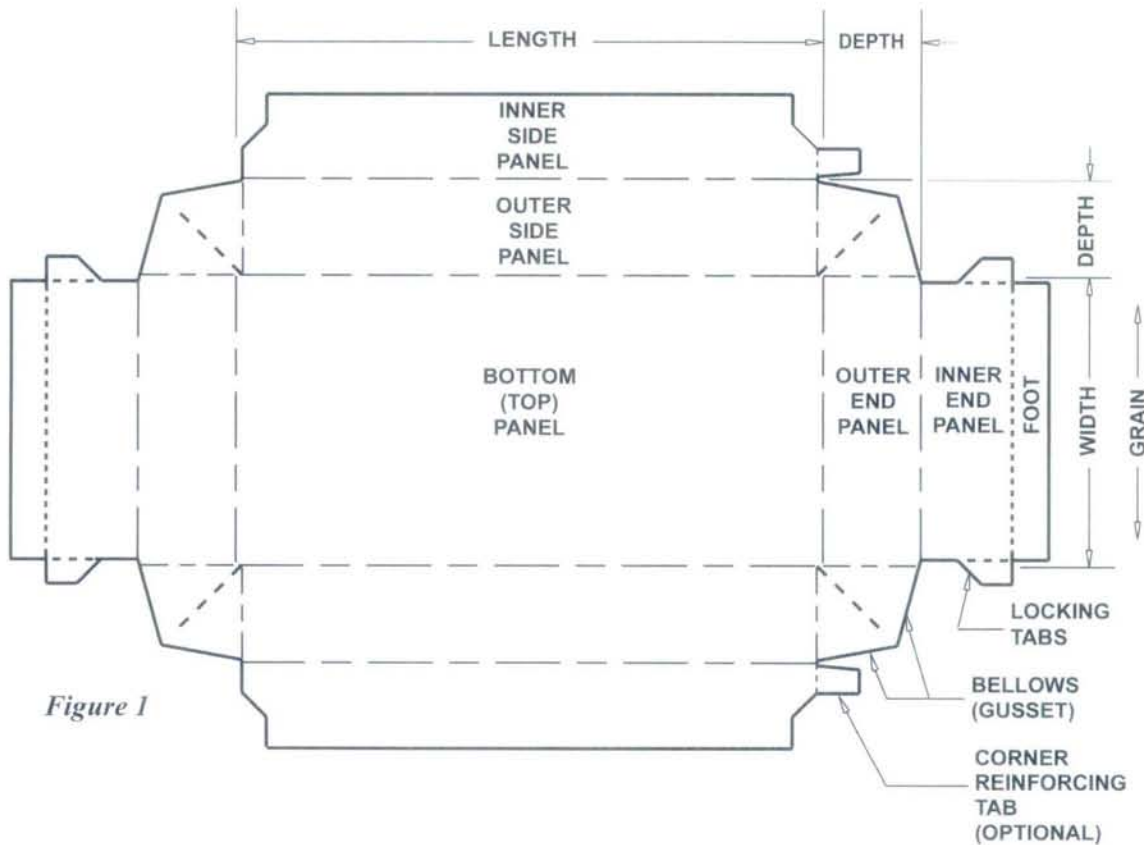


Figure 1

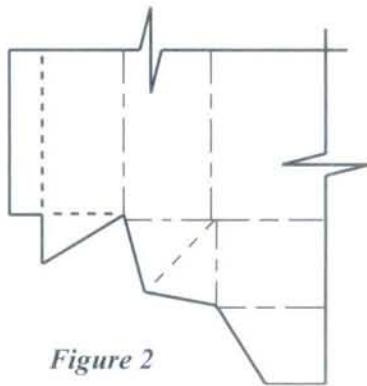


Figure 2

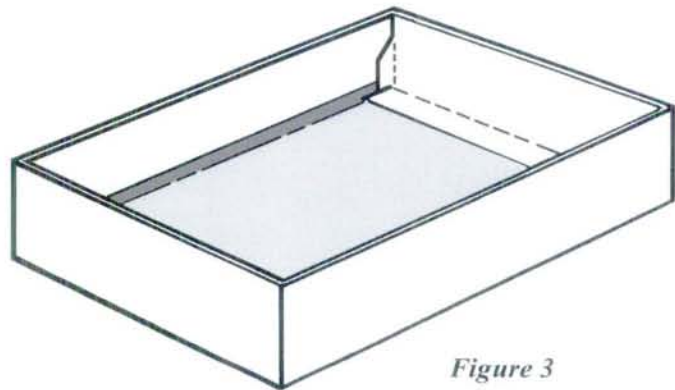


Figure 3



TRAY STYLE CARTONS

Double Sidewall / Double Endwall Converter Glued/Customer Locked

SIMPLEX TRAY with GLUED GUSSETS

This is a Simplex (Kwikset) tray with extended gusset flaps. The extended flaps provide a target for straight line or spot application of adhesive to secure the gussets to the inside surface of the outer end panels.

Gluing the corner tab assists in erecting the carton, adds corner strength and contributes to a more finished corner appearance when compared to the conventional Simplex tray (page 2.403).

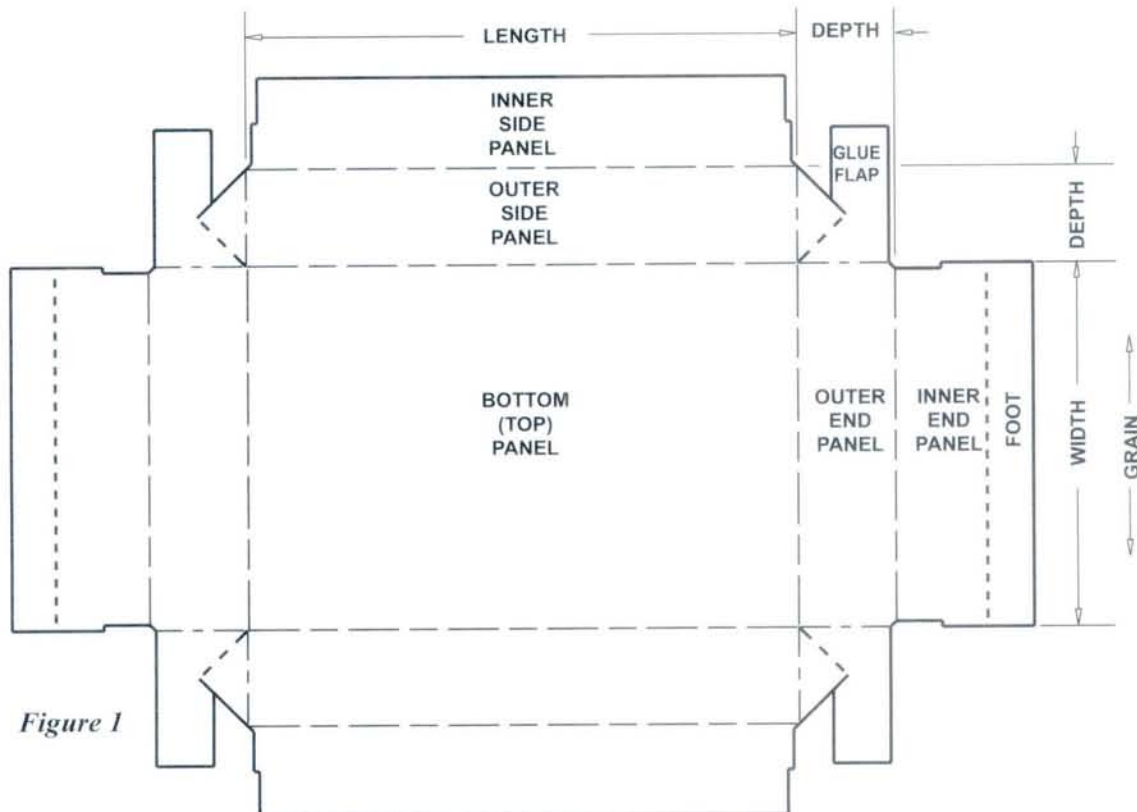


Figure 1

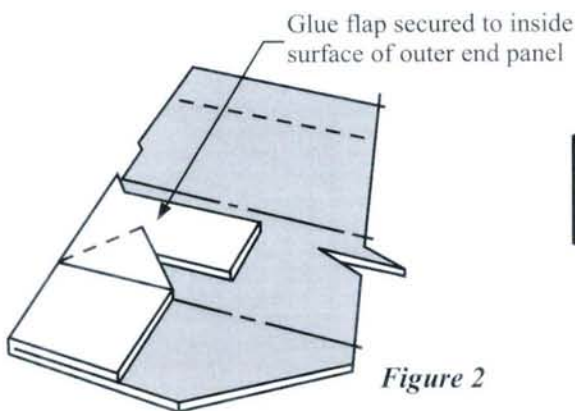


Figure 2

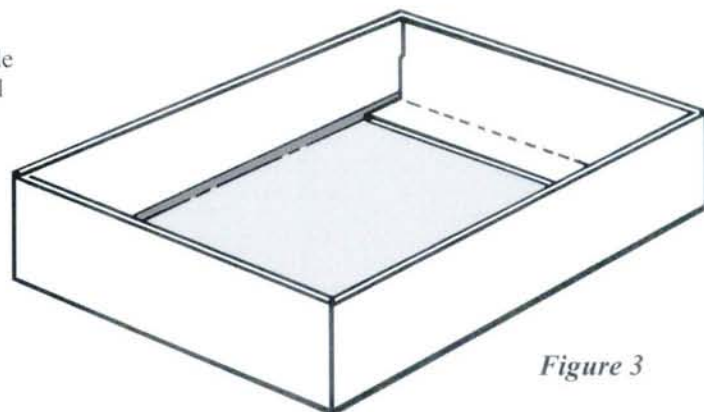


Figure 3



RIGIDWALL TRAY

The Rigidwall tray is a good alternative to the Simplex double wall tray in shallower depths.

As best seen in Figure 2, the sidewalls are infolded. The foot off the base of the inner side panel is glued to the bottom. A slight triangulation caused by a reduction in the depth of the inner side panel resists the outward bowing tendency of most shallow depth trays.

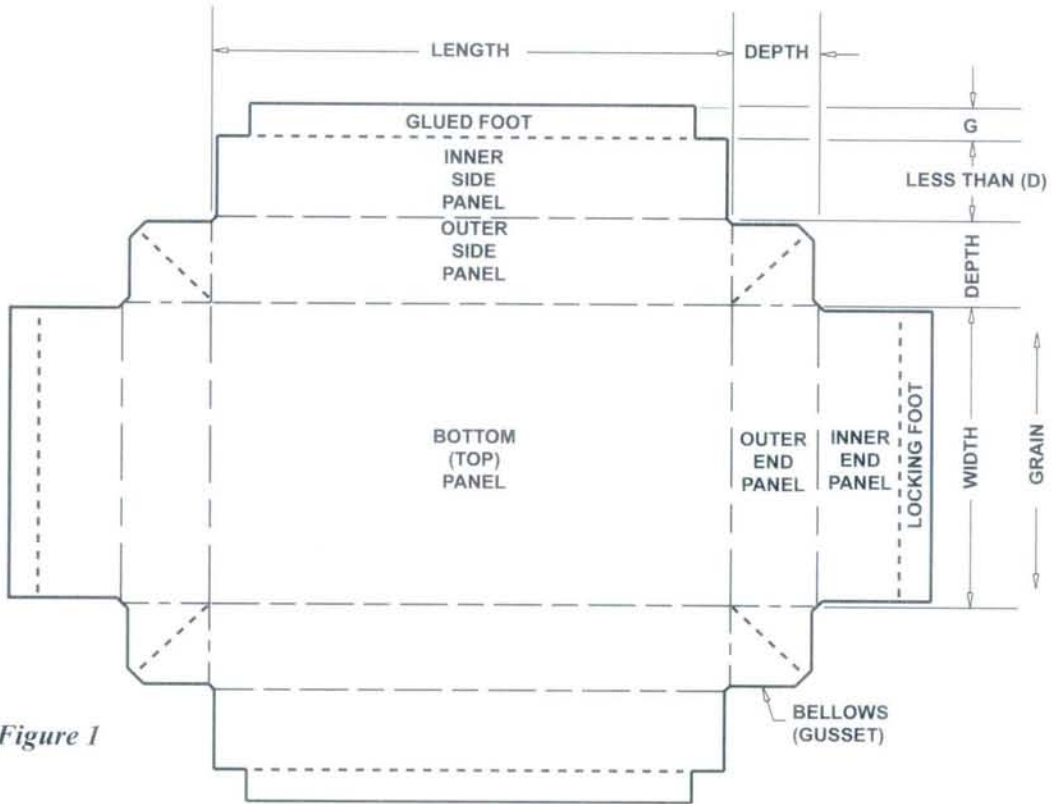


Figure 1

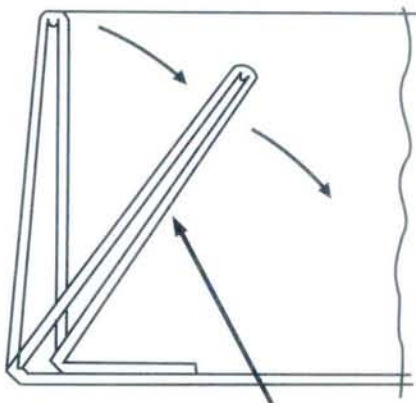


Figure 2 Sidewalls infolded for gluing

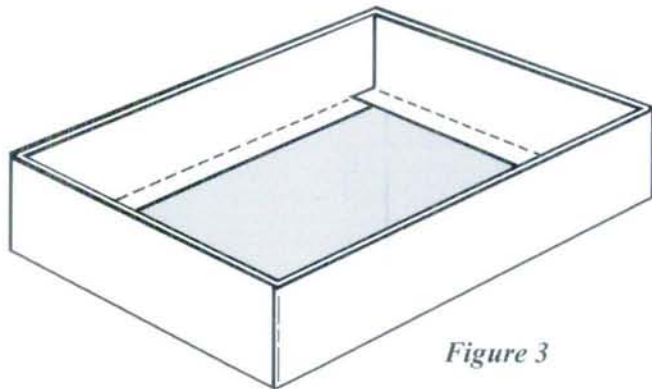


Figure 3



TRAY STYLE CARTONS
Double Sidewall / Double Endwall
Combination Converter/Customer Glued

**DOUBLE WALL
BRIGHTWOOD
(a.k.a.)
CRANDALL TRAY**

The sidewalls of the double wall Brightwood tray are typically glued by the converter. The carton is usually machine formed and glued by the customer.

As best seen in Figure 2, the inner side and end panels are not as wide as the corresponding outer side and end panels.

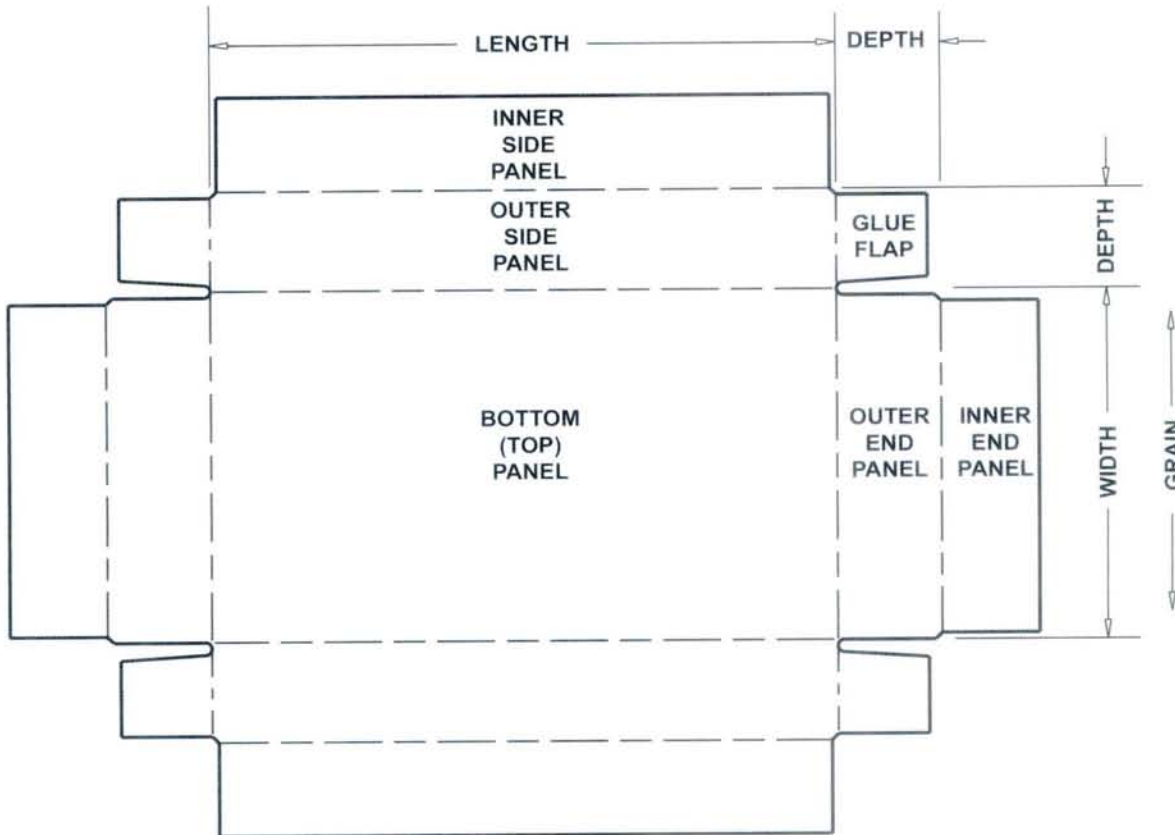


Figure 1

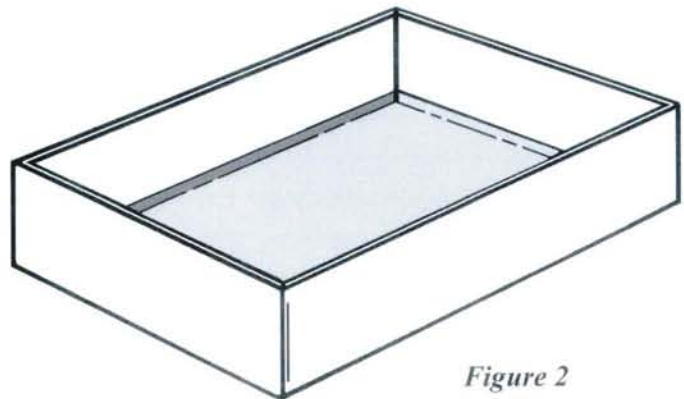


Figure 2



TRAY STYLE CARTONS

**Double Sidewall / Double Endwall / Hinged Cover
 Combination Converter / Customer Glued**

**DOUBLE WALL
 BRIGHTWOOD with
 FULL DEPTH
 DOUBLE WALL
 COVER**

Figures 1A and 1B illustrate a two corner glued cover hinged off the top edge of the base rear panel. Figures 2A and 2B show a four corner glued cover hinged off the rear edge of the base bottom panel. The base and cover front walls are converter glued. After erecting, all end panels are glued on the customer's packaging line.

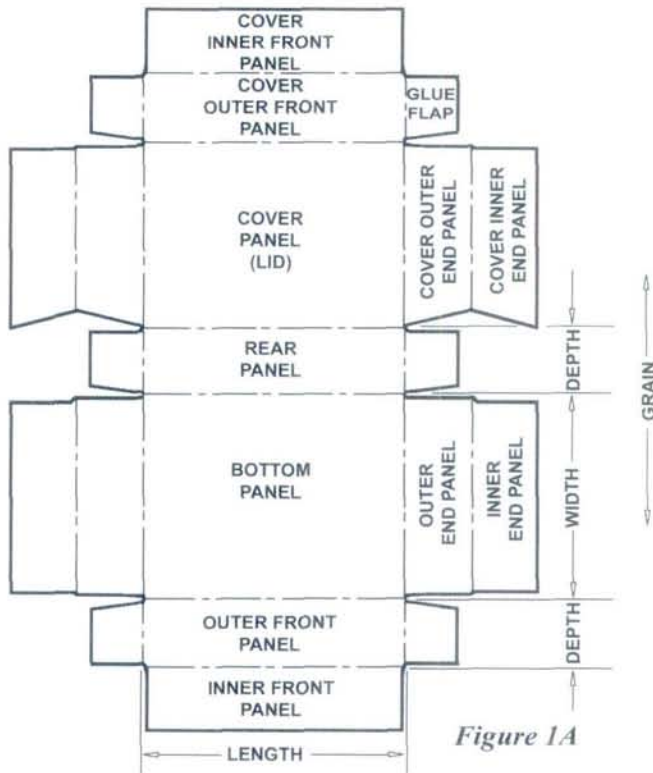


Figure 1A

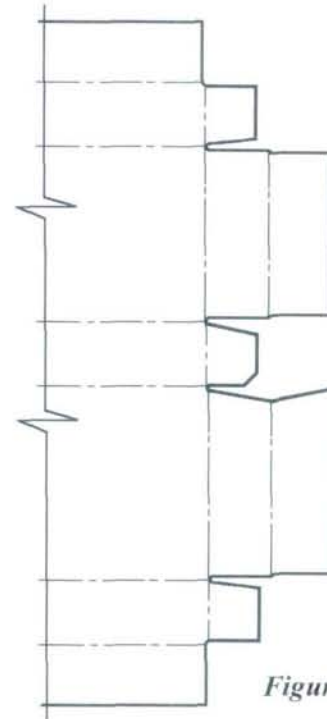


Figure 2A

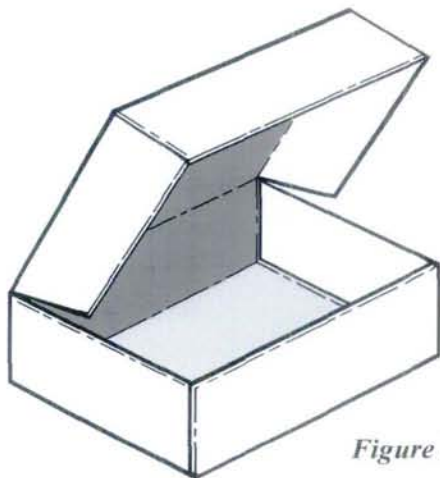


Figure 1B

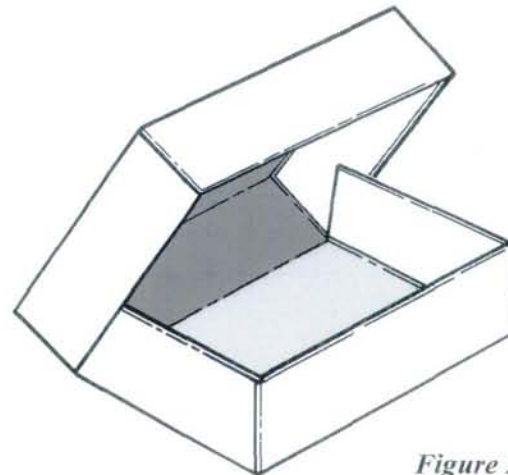


Figure 2B



**DOUBLE WALL
 BRIGHTWOOD with
 PARTIAL DEPTH
 DOUBLE WALL
 COVER**

The intermediate connector strip shown in Figure 1A permits the development of a four corner glued cover hinged to a four corner glued tray. NOTE: This technique can be applied to a full depth cover as well. Figures 2A and 2B show an “economy” four corner glued cover hinged off the midpoint of the tray rear panel.

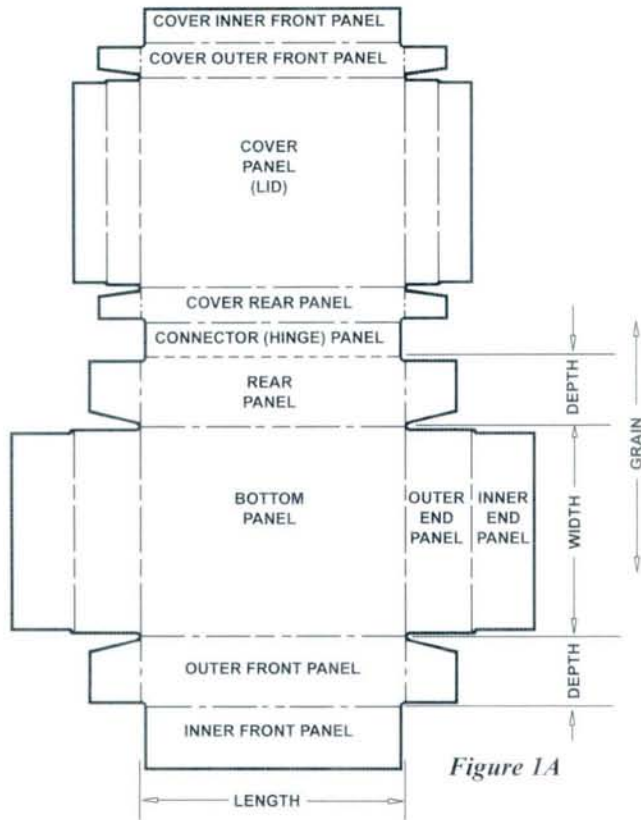


Figure 1A

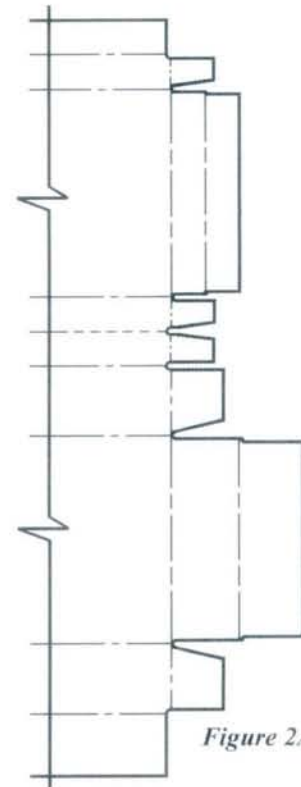


Figure 2A

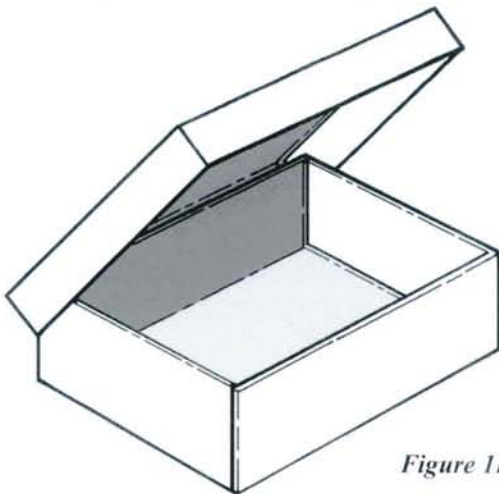


Figure 1B

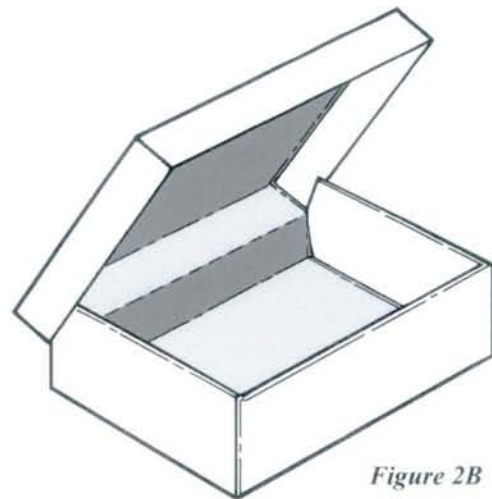


Figure 2B



FRAME-VUE TRAY
(a.k.a) FRAME VIEW

The sidewalls of the Frame-Vue tray are typically folded and glued by the converter. It is generally erected and loaded by hand.

The Frame-Vue tray is used primarily to distinguish premium products from those of average quality and price. Its basic function is product enhancement, not protection.

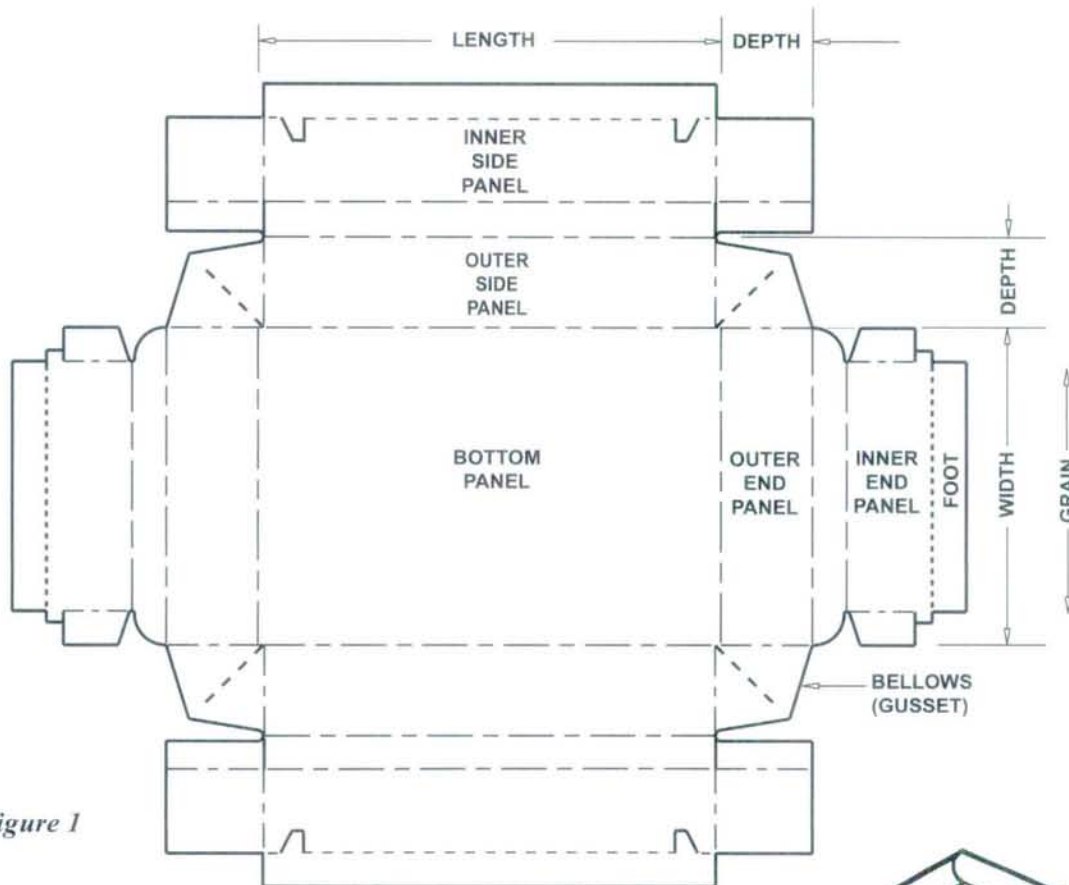


Figure 1

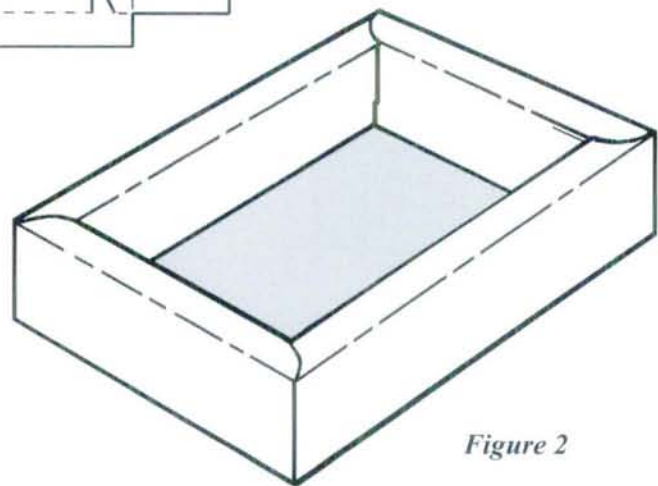


Figure 2



BEYOND THE RECTANGULAR TRAY: CROSS SECTION ALTERNATIVES

As in the Tube Section, the basic rectangular shape has been used to illustrate the many standard tray style variations. Like tubes, the design possibilities for the tray go far beyond this basic shape. Some of the potential alternatives to conventional rectangular cross-section tray designs detailed in sections 2.100 through 2.600 are shown on the following pages.

NOTE: The geometric cross-section trays illustrated in this section are generally shown as simple single wall, glued corner symmetrical structures. However, it should be understood that double wall, gusset or locked corner, hinged cover and/or asymmetrical shaped variations can be developed for most of these alternatives to the rectangle. A few of these options are shown on page 2.702

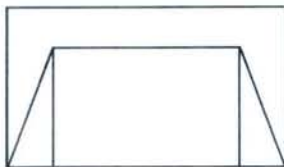
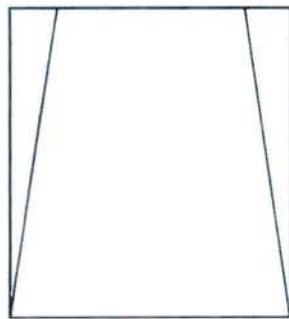
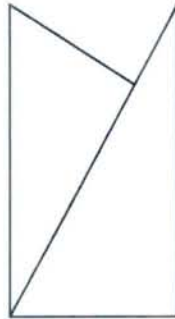


Figure 1

Top View



Front View



Side View

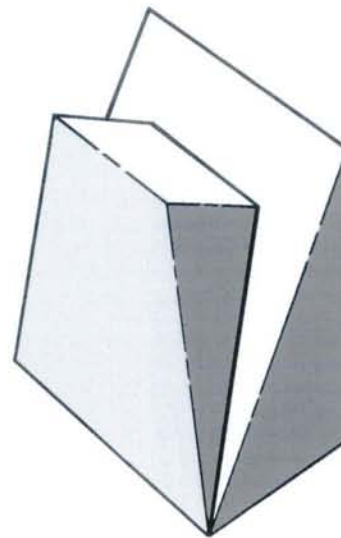


Figure 2

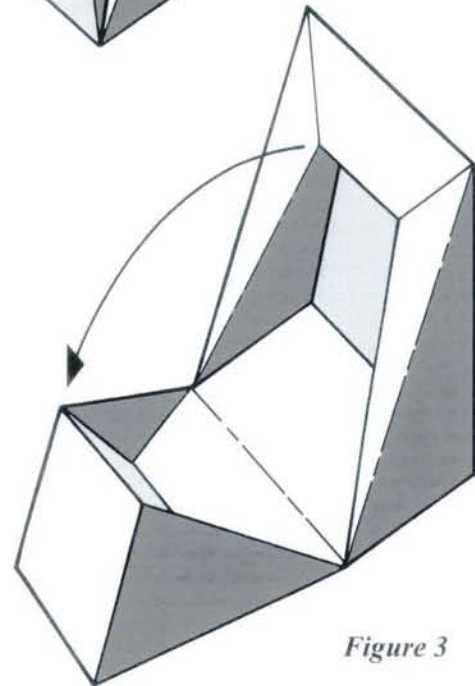


Figure 3

The description of this style is a “trapezoidal hollow wall base with a rectangular, hollow wall, hinged cover lid.” Visually, however, it is hardly recognizable as a tray. It is illustrated here to underscore that cross-section alternatives can deviate substantially from the vertical, single wall geometric alternatives shown on pages 2.701 and 2.702.

This style is further detailed on page 2.716.



Shape Options
Cross-Section Alternatives

TRIANGLE

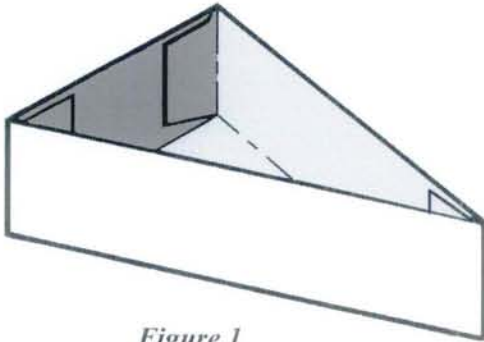


Figure 1

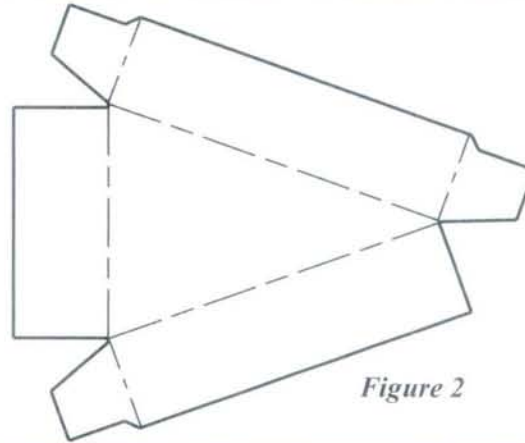


Figure 2

PENTAGON

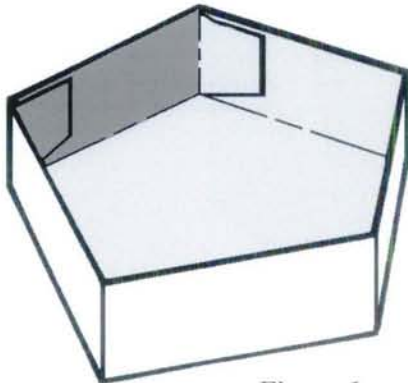


Figure 1

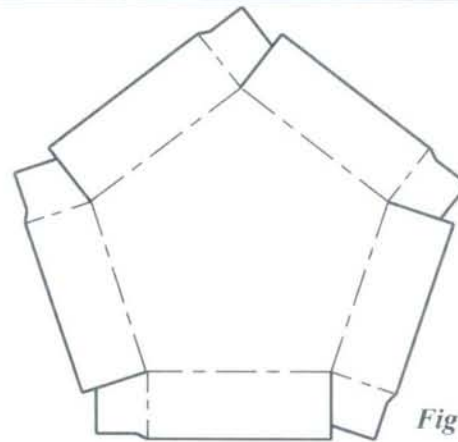


Figure 2

HEXAGON

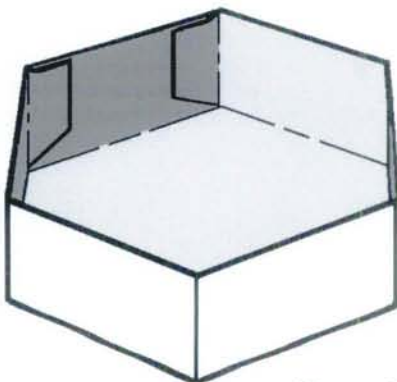


Figure 1

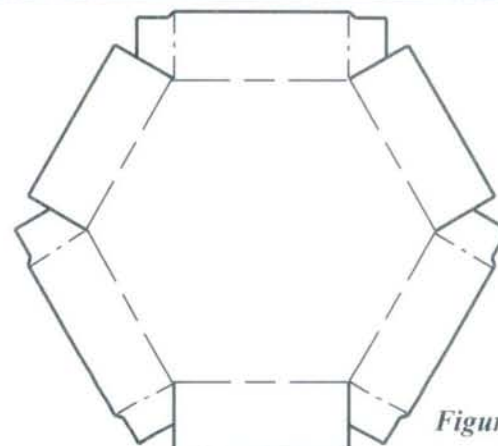


Figure 2



OCTAGON

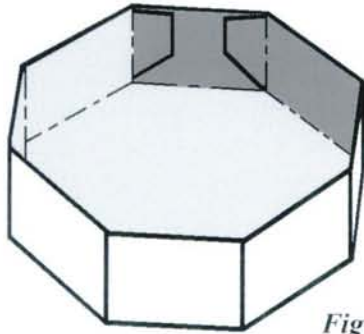


Figure 1

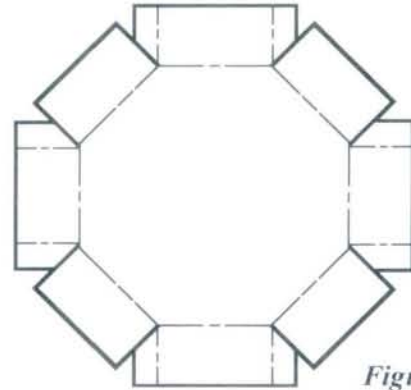
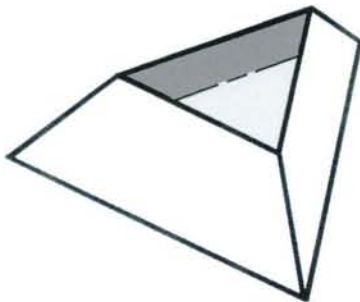


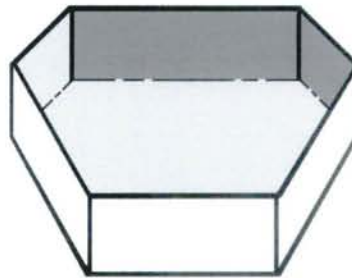
Figure 2

The shapes illustrated below can be produced with sealed, locked or gusseted corners; straight or tapered sides; single or double walls; and with or without integral hinged covers. Most are readily adaptable to either hand or machine assembly.

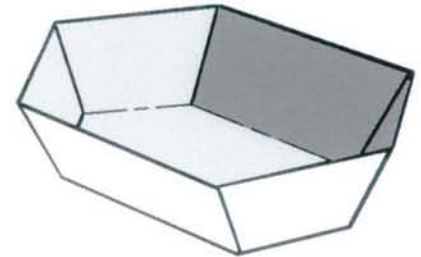
INVERTED TAPERED TRIANGLE



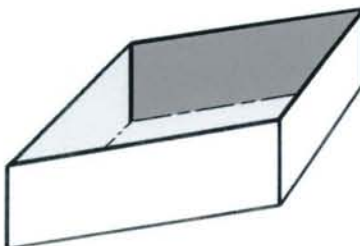
ASYMMETRIC HEXAGON



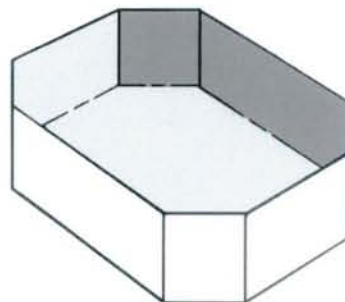
TAPERED SYMMETRIC HEXAGON



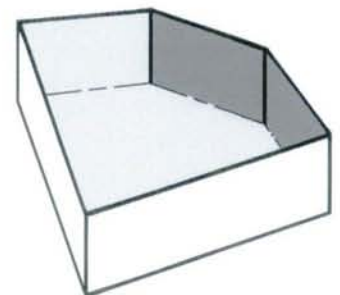
DIAMOND



CHAMFERED RECTANGLE (OCTAGON)



ASYMMETRIC PENTAGON



Shape Options
Sculpted Body Panels

BEYOND THE RECTANGULAR TRAY: SCULPTED BODY PANELS

The previous section introduced geometric shape alternatives to the rectangular tray. This section demonstrates the many ways the tray can be manipulated to create a different look.

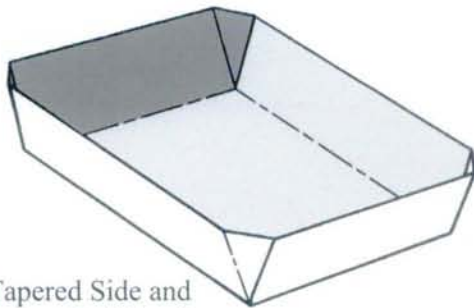
By introducing tapered walls, curved score and/or multi-faceted base, side, endwalls and corners, the visual impact of the tray can be enhanced significantly.

The styles illustrated in this section are a small sampling of shape possibilities for paperboard. The talents and skills of the industry's design and

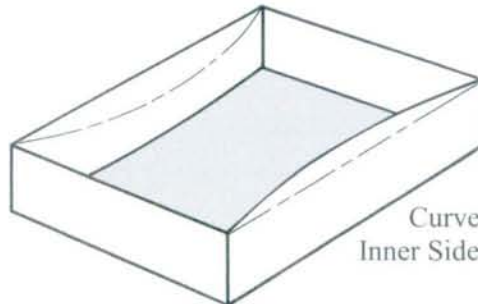
manufacturing personnel can create an almost limitless array of design options.

Downstream issues such as packaging line constraints, product vulnerability, packaging costs or compatibility of product to carton shape are likely to be the limiting factors in the use of sculpted trays.

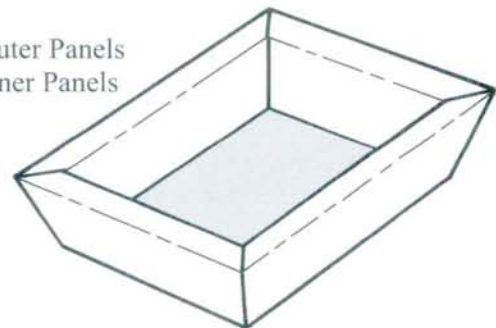
Regardless of these considerations, when the product and package shape are compatible and marketing advantages warrant, the potential for creating a sculpted paperboard solution exists.



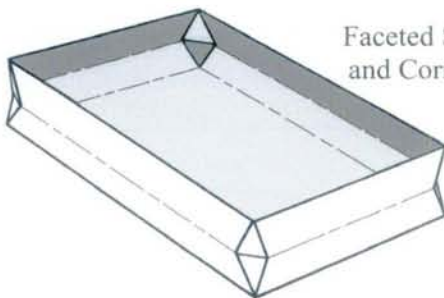
Tapered Side and
End Panels:
Chamfered Corners



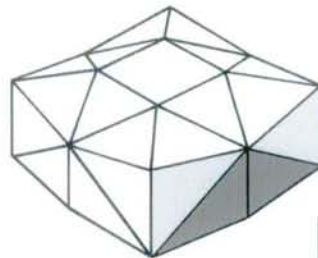
Curved Facet
Inner Side Panels



Tapered Outer Panels
Vertical Inner Panels



Faceted Sides, Ends
and Corners



Faceted Base (Top),
Side and End Panels



End Elevation



Shape Options
Sculpted Body Panels

OUTWARD TAPER TRAY

Glued, locked and heat sealed corner variations are common in the industry. This style lends itself to machine forming; and trays frequently will be formed, nested and bulk wrapped for shipping to retail outlets. Typical users of this type of tray include supermarket meat departments and fast food restaurants.

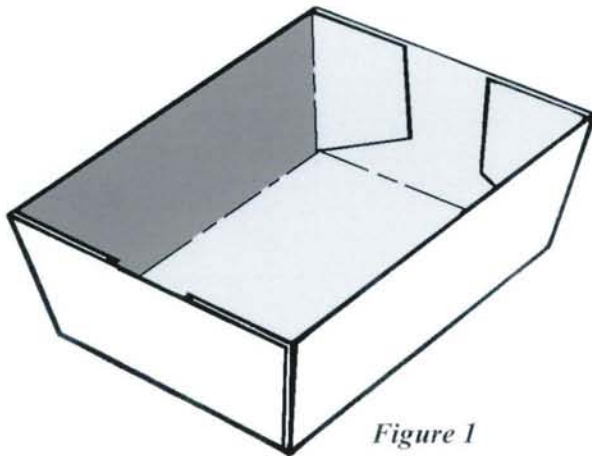


Figure 1

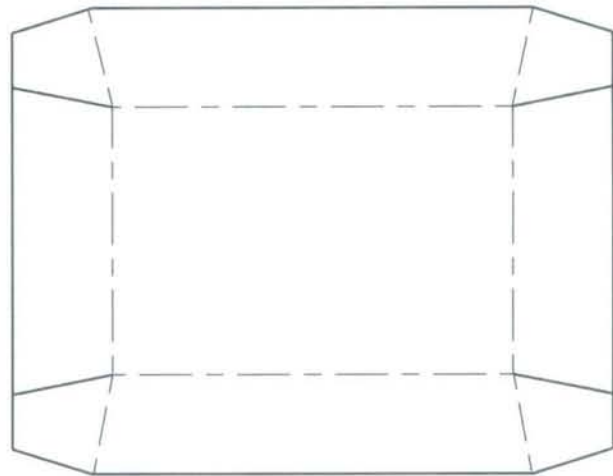


Figure 2

INWARD TAPER TRAY

Less common than the outward taper, the inward taper tray is typically hand-erected as a single or double sidewall/double endwall tray. Shown below as double sidewall/double endwall glued corner tray (Figure 2A) or as a gusseted locked corner tray (Figure 2B).

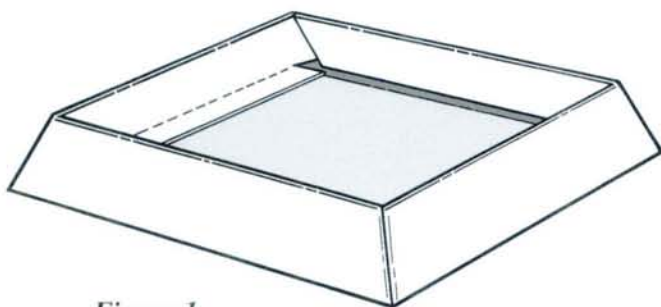


Figure 1

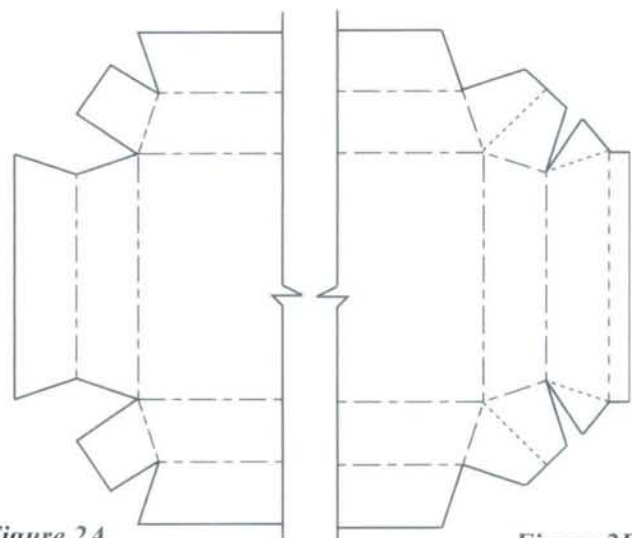


Figure 2A

Figure 2B



Shape Options
Sculpted Body Panels

**ARCUATE SCORE
CONCAVE TOP/
CONVEX END TRAY**

This style is best suited as a lid for an upscale gift item. It is shown here detailed as a Simplex double sidewall/double endwall tray, but it can be developed as a single sidewall/single endwall glue corner tray as well.

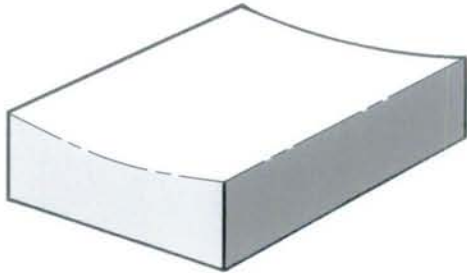


Figure 1

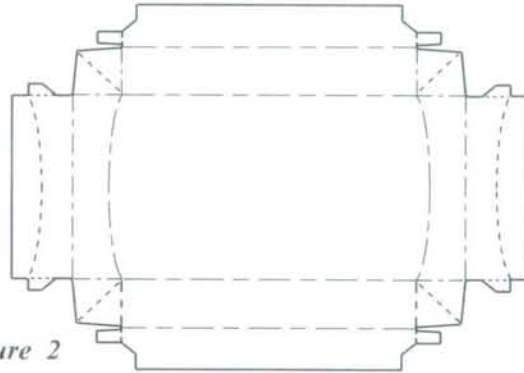


Figure 2

**ARCUATE SCORE
CONVEX TOP/CONCAVE
ENDS & SIDES**

Both the side and end scores of the top (lid) panel are arced inward to form a tray with a convex top and concave side and end panels. This would typically be used as a lid for a conventional straight wall base tray.



Figure 1

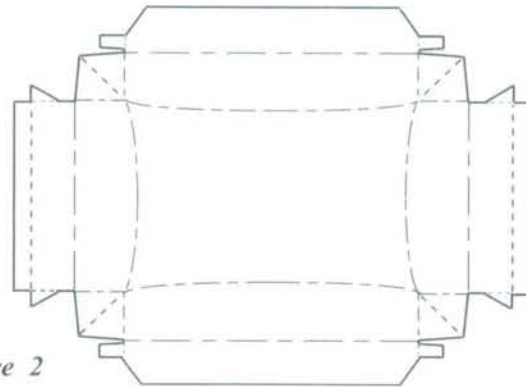


Figure 2

**ARCUATE SCORE
CONCAVE FACETED
TOP EDGE TRAY**

This may not look like a tray, but it is a Simplex tray with several conventional scores changed to double arcuate scores. It is best suited for use as a high visual impact lid for specialty items such as cosmetics or liquor gift cartons.

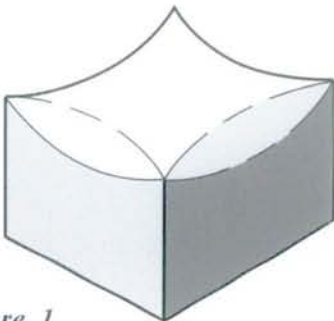


Figure 1

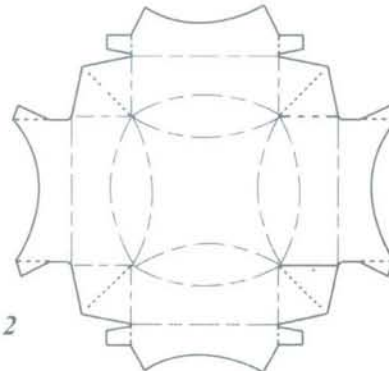


Figure 2



Shape Options
Sculpted Body Panels

CHAMFERED EDGE TRAY

This style can be used either as a base or a cover. It is shown here as a glued corner, double sidewall/double endwall tray. This style can also be developed as a hand erected, gusset corner variation on a Simplex style tray.

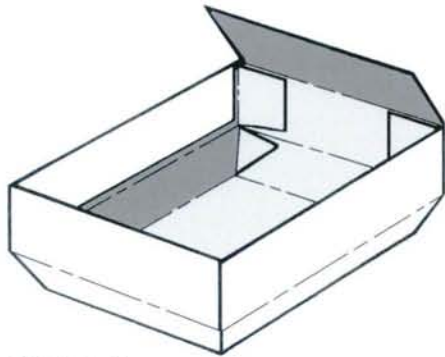


Figure 1

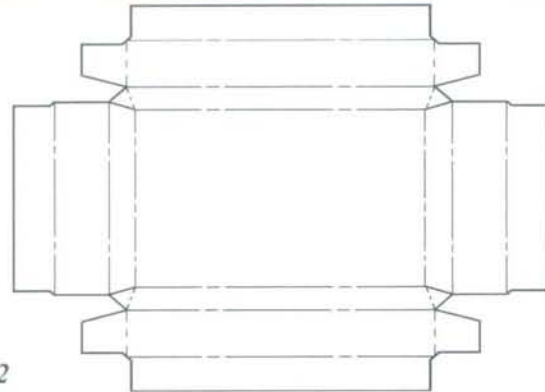


Figure 2

TAPERED HOLLOW ENDWALL TRAY

Tapering the ends of the Simplex tray gives it a different look. The normally inward extending foot becomes a tuck flap in this hollow endwall configuration. The tuck helps stabilize the inner endwall's erected position.

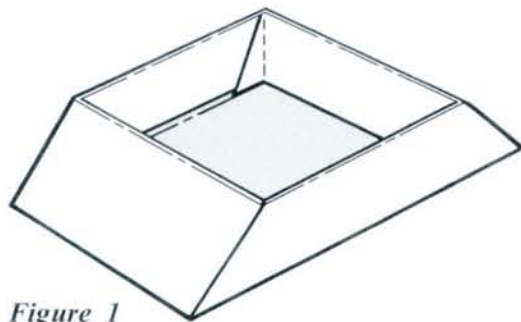


Figure 1

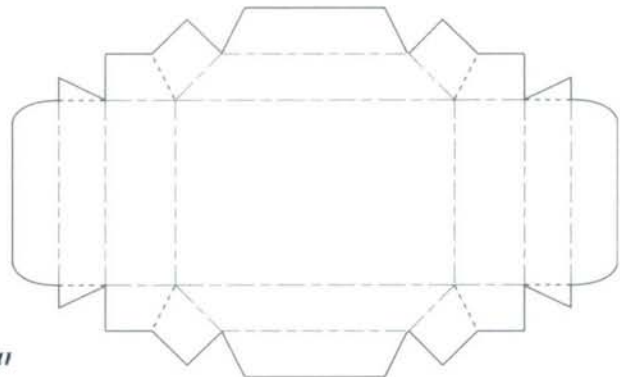


Figure 2

FACETED END & TOP PANEL HINGED COVER TRAY

This structure illustrates the potential for creating an entirely different look to a very conventional carton style. Shown here is a Brightwood tray with a hinged cover.

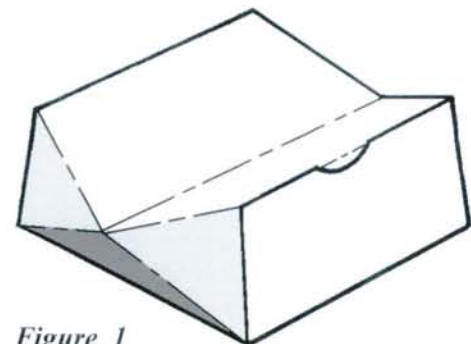


Figure 1

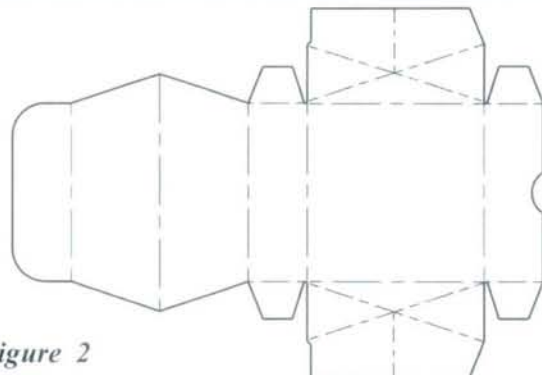


Figure 2



Shape Options
Sculpted Body Panels

**FACETED END
SIMPLEX
BASE and LID**

Shown here are additional examples of how dramatically different a conventional carton can look by simply sculpturing selected panels. Figures 1A, 1B and 1C show a base and lid with straight score faceted end panels. Figure 2 illustrates an equally interesting impact substituting curved scores for the straight score facets.

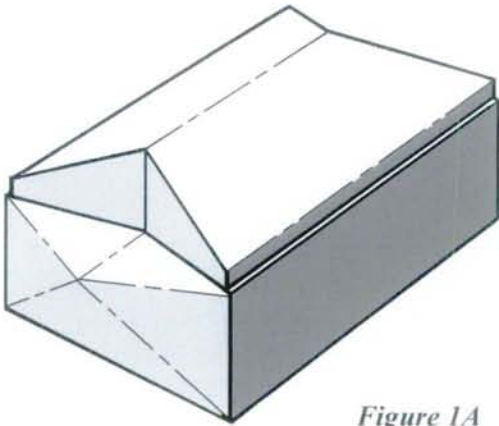


Figure 1A

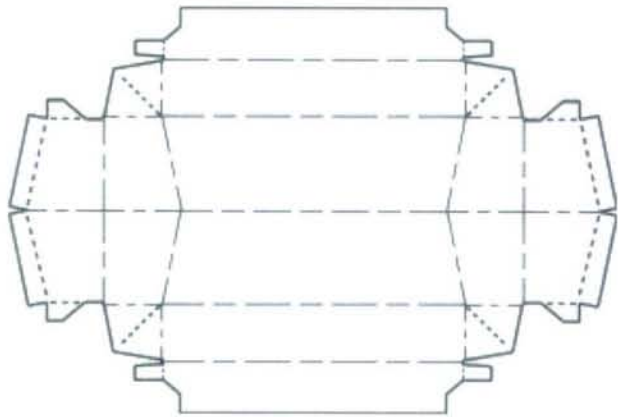


Figure 1B: Lid Unit

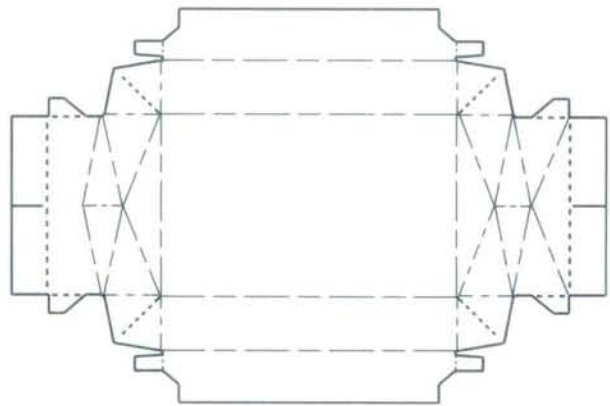
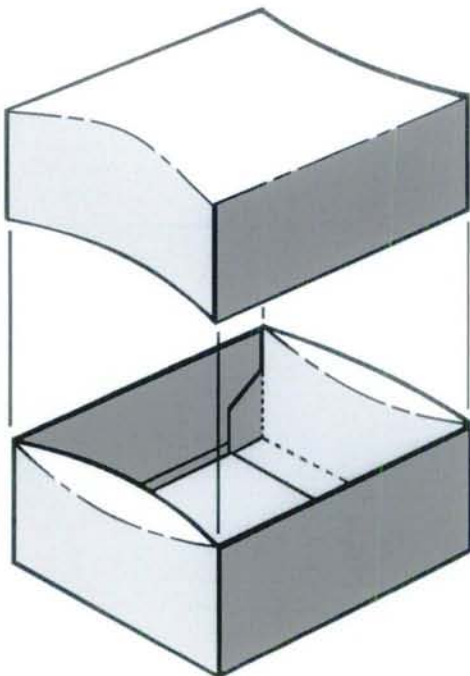


Figure 1C: Base Unit

Figure 2: The curved score gives a softer look; but the structure, a conventional gusset corner Simplex, is the same as illustrated above.



Shape Options
Sculpted Body Panels

**INWARD TAPERED
SIDEWALL & ENDWALL
with
GUSSET CORNERS**

It may be a stretch to call this a tray, but it does have a bottom, sidewalls and endwalls; although it does not have an open top nor is it proportioned like a typical tray. It is a striking structure for a product which can readily adapt to an irregularly shaped cell such as hosiery, gloves, bagged candy, etc. It can be closed as a tuck carton as in Figure 2 or with an outside glue flap as in Figure 3.

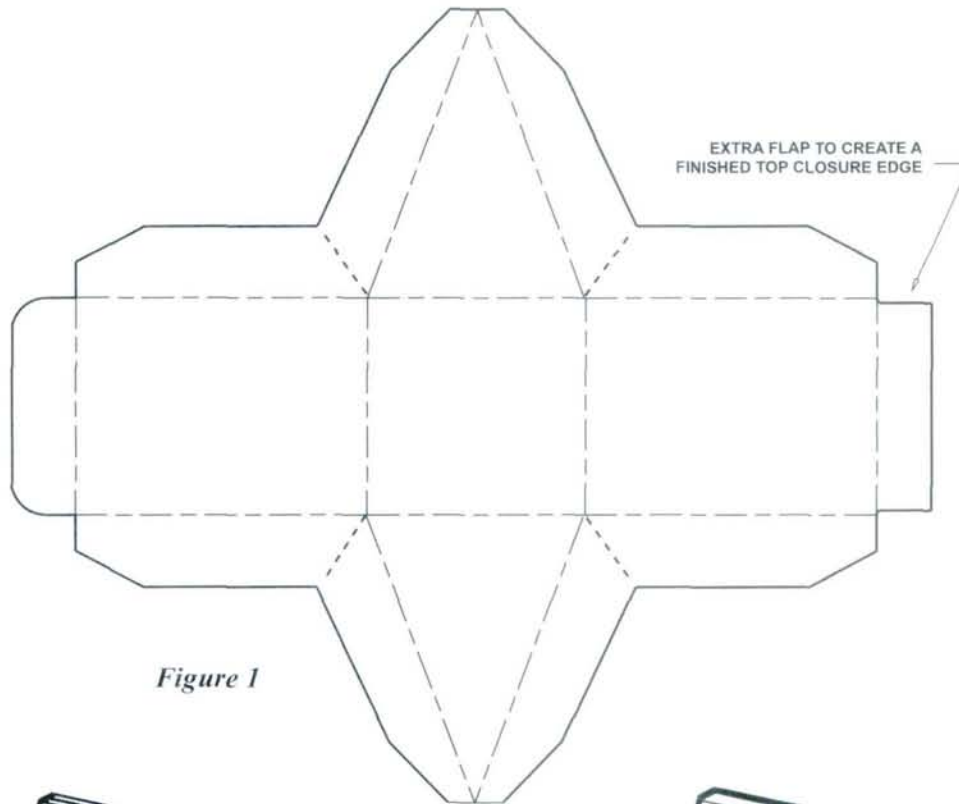


Figure 1

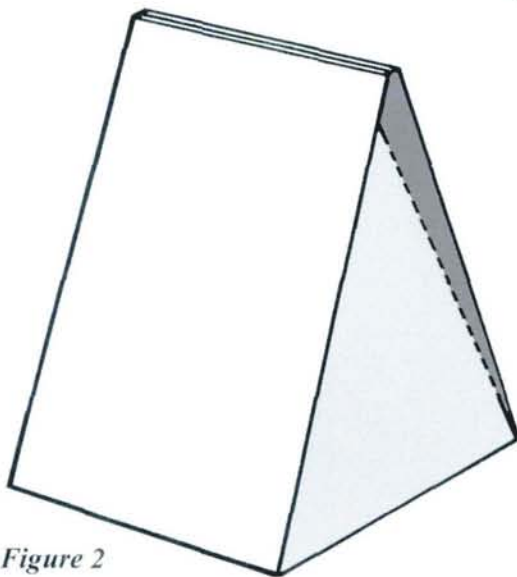


Figure 2

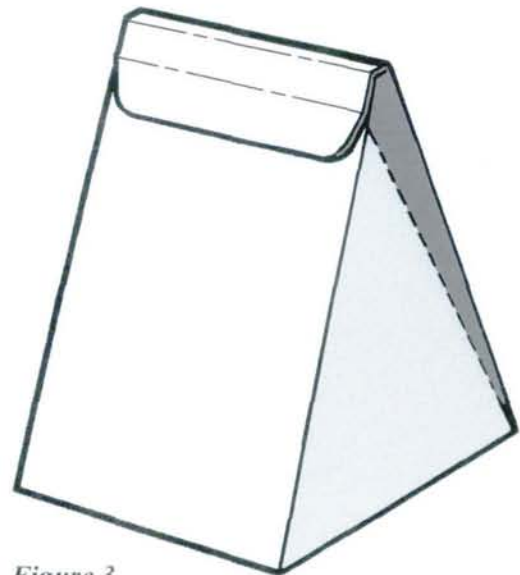


Figure 3

Shape Options
Sculpted Body Panels

**TAPERED
RECTANGULAR
HOLLOW WALL BASE /
TRAPEZOIDAL HOLLOW
WALL HINGED COVER**

This structure demonstrates how far the tray can evolve, while staying within sound structural design, manufacturing and distribution practices. Visually, the structure is quite different from the conventional hinged corner single wall rectangular tray, but it erects like any other bellows corner tray. As seen in Figure 3, it fits nicely into a conventional rectangular shipping sleeve.

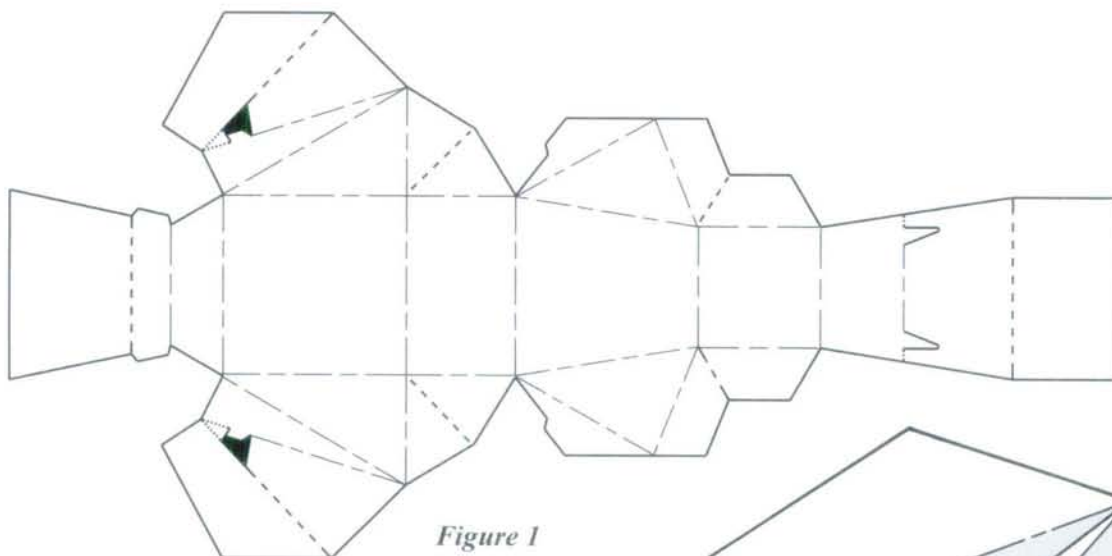


Figure 1

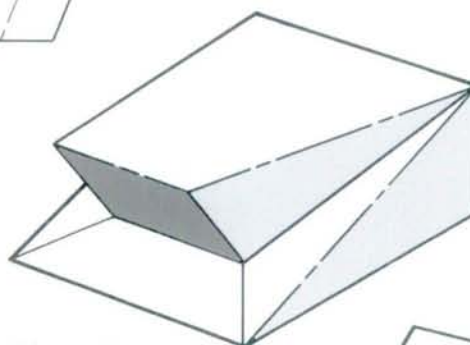


Figure 2

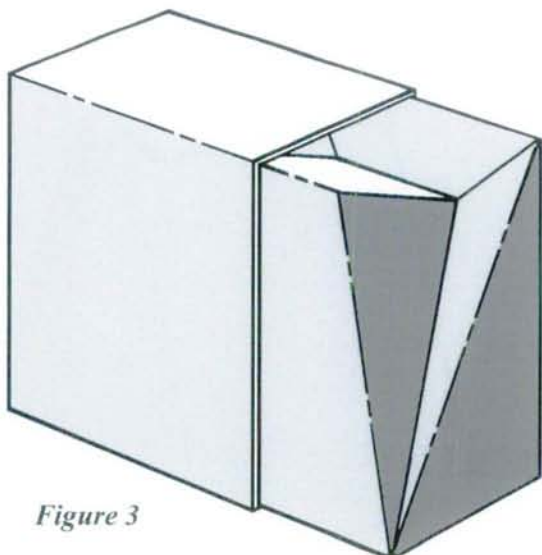


Figure 3

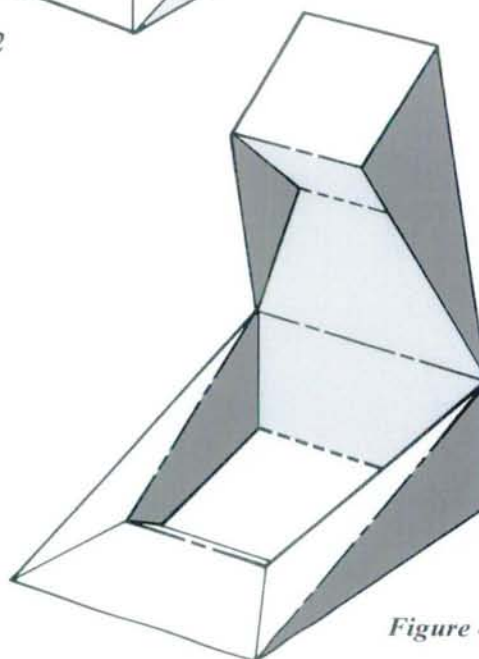


Figure 4



**EXTENDED EDGE
(BRIGHTWOOD)
TRAY**

This style echoes the classic two piece extended edge set up box closely associated with the candy and confection trade (Refer to page 5.202). As shown here it is a one piece glued corner Brightwood tray; however, other corner options are possible.

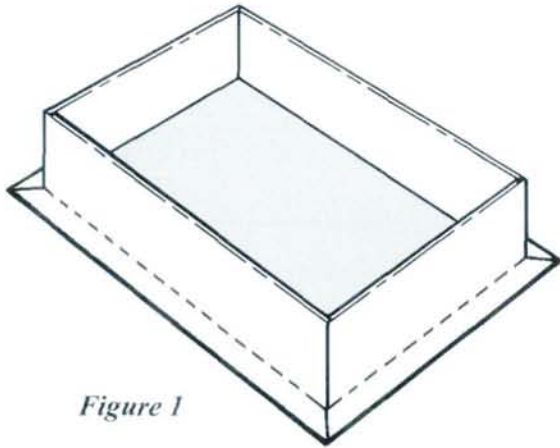


Figure 1

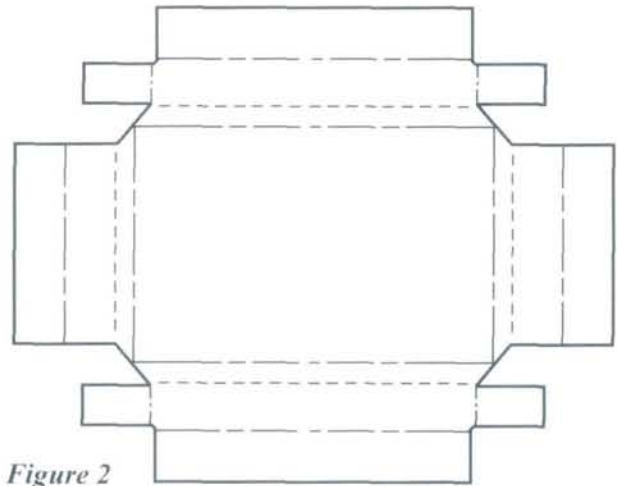


Figure 2



Hollow Wall and Platform Options

Hollow Wall Options

BEYOND THE RECTANGULAR TRAY: HOLLOW WALL AND PLATFORM OPTIONS

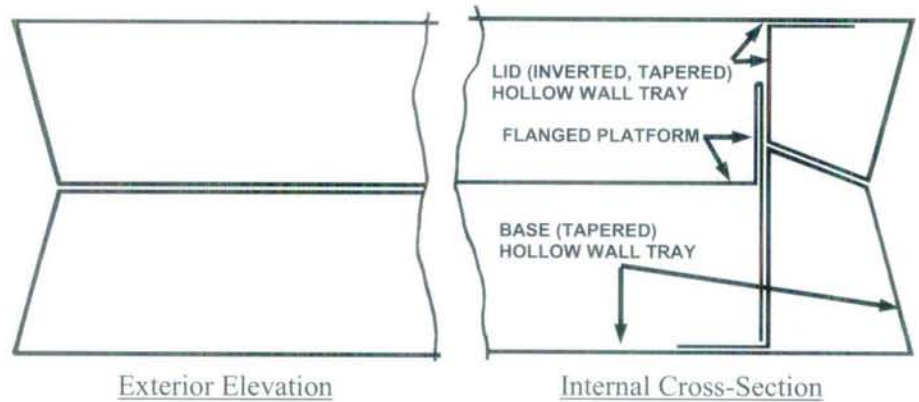
The most common form of the hollow wall tray, the Frame-Vue, is illustrated on page 2.601, however there are a number of additional hollow wall options available. This section illustrates a few of the possibilities.

The following pages show several hollow sidewall variations. These designs can be completed with simple double endwalls by adapting some of the end closures shown in Sections 2.100 through 2.600.

Alternatively, the structure may incorporate both hollow sidewalls and endwalls. Double sidewall, hollow endwall combinations are also possible by adapting design detailing from the basic tray section.

The platform options shown are frequently diecut to position and separate multiple products within the tray. The basic objective is to protect the product from breakage and display it to best advantage.

It is also possible to create multiple plane platforms. Page 2.724 shows two options.



The three piece structure illustrated to the right incorporates several of the concepts detailed on the following pages. The base and lid are variations on the full depth asymmetric hollow wall (page 2.722) plus a variation on the full width platform shown on page 2.723.

The platform, diecut to accept the product, also incorporates upward extensions to secure the telescoping lid.

This structure shows the aesthetic potential for the folding carton tray while staying within sound carton converting, assembly and distribution principles.



Hollow Wall and Platform Options

Hollow Wall Alternatives

**TRIANGULAR
 HOLLOW WALL
 (Non-Glued)**

This is the most simple form of triangular hollow wall tray. The foot flaps are dimensioned to create the desired sidewall cross-section, shown here as having an inner side panel at 90° to the plane of the bottom panel.

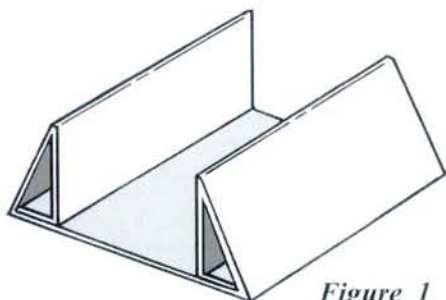


Figure 1



Figure 2: Folding Sequence - End Elevation View

**TRIANGULAR
 HOLLOW WALL
 BEVEL EDGE (Preglued)**

The sidewalls are glued as a conventional rectangular shape. The addition of an extra score in the inner wall allows this panel to collapse inwardly to form a triangular cross-section. This style is commonly referred to as the bevel edge tray.

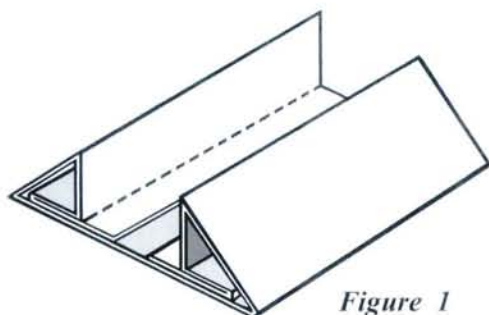


Figure 1

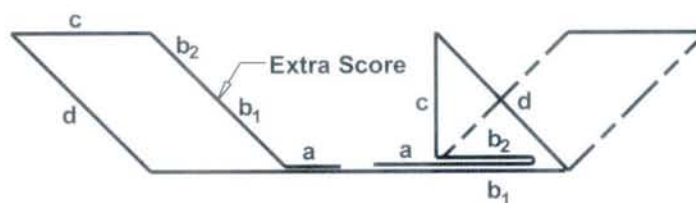


Figure 2: Folding Sequence - End Elevation View

**FULL DEPTH
 RECTANGULAR
 HOLLOW WALL (Preglued)**

This is the most common form of preglued hollow wall tray. In the finished hollow sidewall/hollow endwall configuration it is commonly referred to as a Frame-Vue tray. (Refer to page No. 2.601)

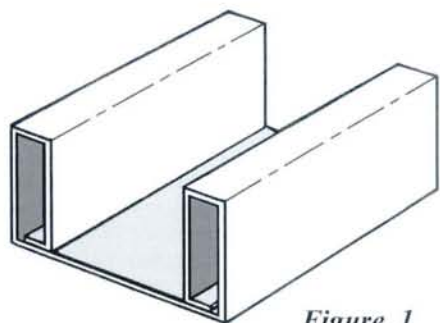


Figure 1



Figure 2: Folding Sequence - End Elevation View



**PARTIAL DEPTH
RECTANGULAR
HOLLOW WALL (Preglued)**

This variation is often used in conjunction with a separate insert. The partial depth hollow walls hold the insert in place and also serve to frame and cushion the product.

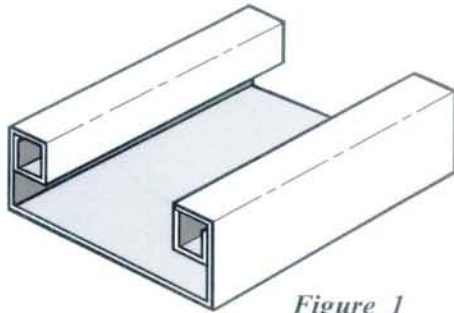


Figure 1

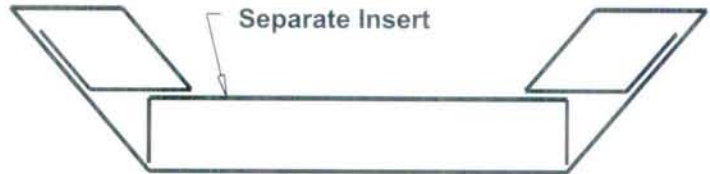


Figure 2: Folding Sequence - End Elevation View

**FULL DEPTH
ASYMMETRIC
HOLLOW WALL (Preglued)**

This is an interesting alternative to the full depth rectangular hollow wall shown on page 2.601. It provides the same protection, but adds a dramatic beveled frame effect.

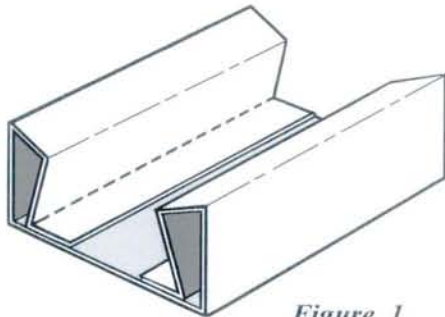


Figure 1



Figure 2: Folding Sequence - End Elevation View

**PARTIAL DEPTH
ASYMMETRIC
HOLLOW WALL (Preglued)**

Like the partial depth rectangular hollow wall shown above, this style works well with a separate insert. It uses less board than the full depth style, but still provides the dramatic beveled frame look.

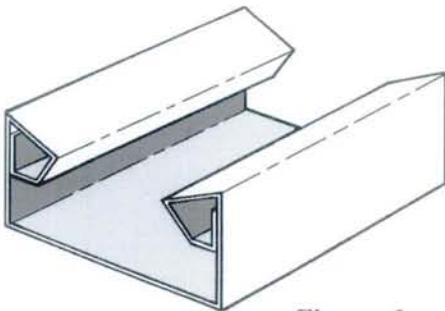


Figure 1

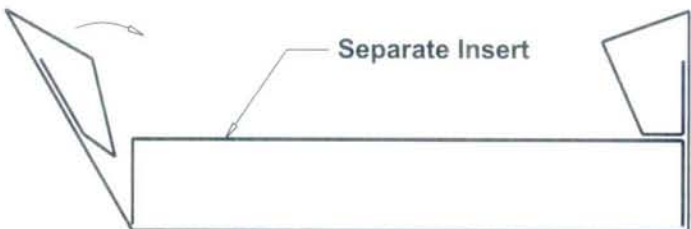


Figure 2: Folding Sequence - End Elevation View



Hollow Wall and Platform Options
Platform Alternatives

FULL WIDTH PLATFORM

This style is most commonly used as the bottom unit in combination with an inverted tray telescoping lid. The platform would typically be diecut to hold and display the product.

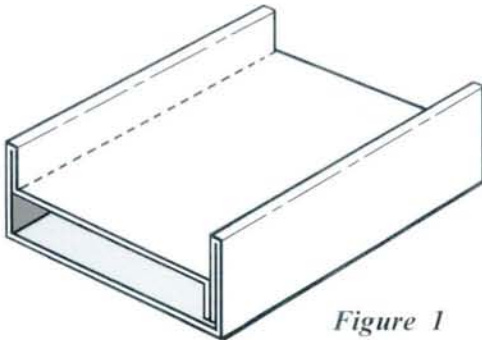


Figure 1



Figure 2: Folding Sequence - End Elevation View

PARTIAL WIDTH PLATFORM

This a good alternative for displaying to advantage products of different depths. Note: The platform may be split into upper and lower planes. Refer to page 2.724.

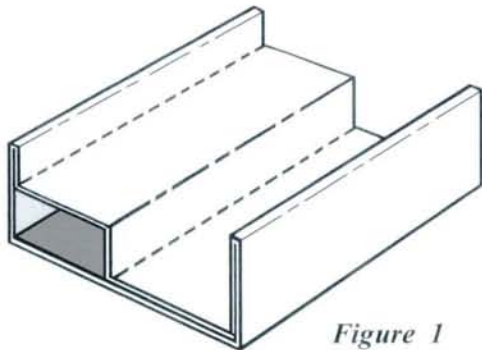


Figure 1



Figure 2: Folding Sequence - End Elevation View

SHOULDER CELL PLATFORM

This style may be used as a base or lid. The cells are frequently diecut to position and display the product.

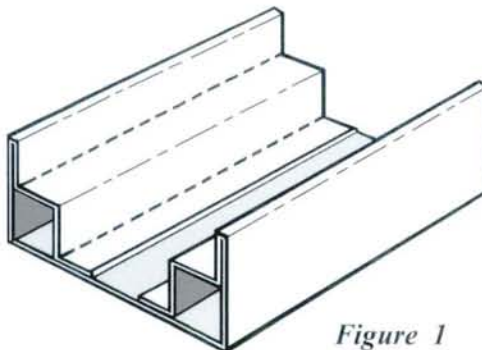


Figure 1



Figure 2: Folding Sequence - End Elevation View



Hollow Wall and Platform Options

Platform Alternatives

**PLATFORM
DIVIDED into
UPPER and LOWER
SECTIONS**

A typical use of this alternative would be to position and support multiple products of different depths, or to provide a cushioning means to protect the product in transit.

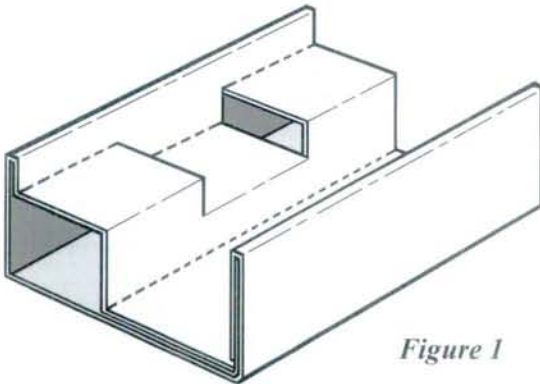


Figure 1

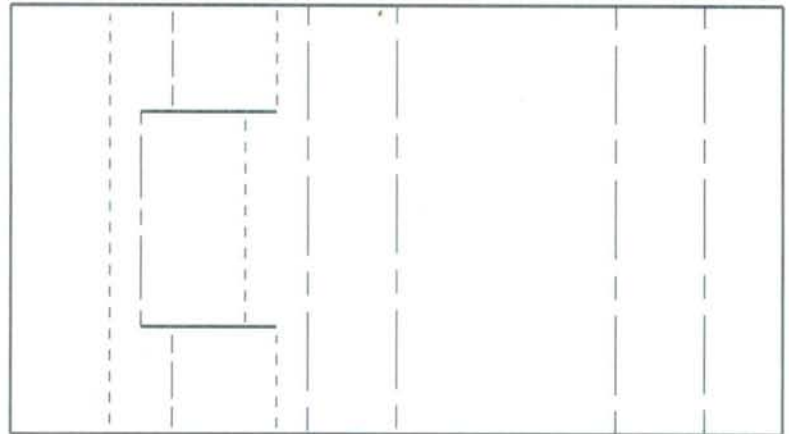


Figure 2

**PLATFORM
DIVIDED into
INNER and OUTER
SECTIONS**

This configuration would typically be used to position and support multiple products of different heights.

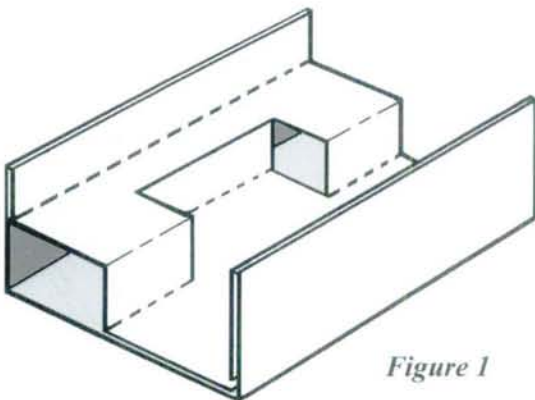


Figure 1

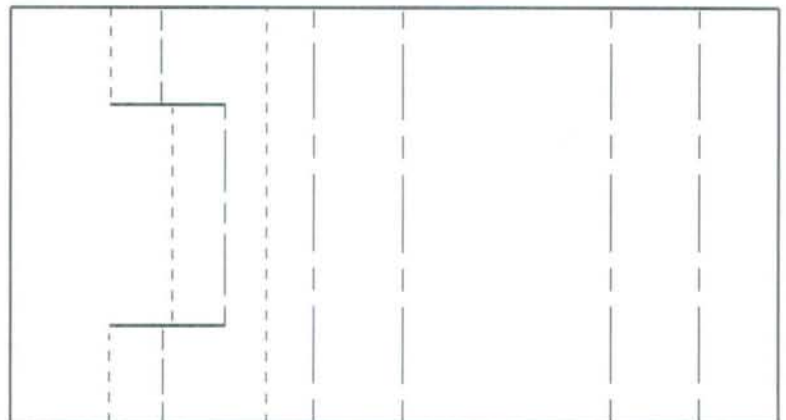
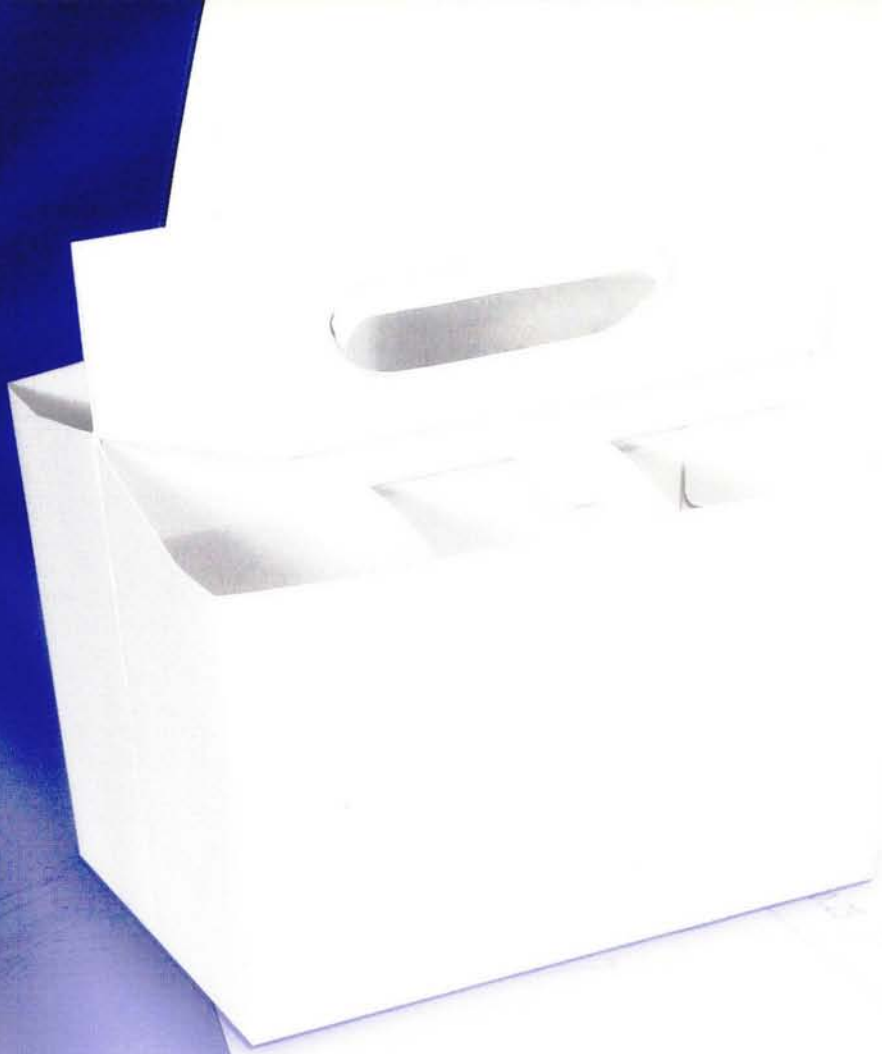


Figure 2



3.000

PAPERBOARD PACKAGING:
MULTIPLE PKG.



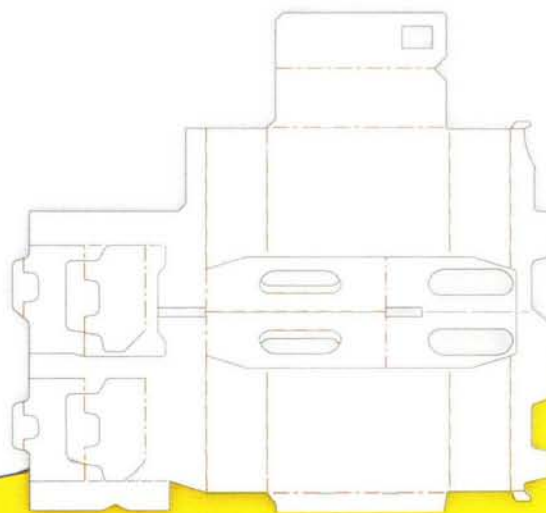
3.000
MULTIPLE PKG.

3.000

COMPONENT PARTS + DESIGN DETAILING

- 3.100 *Wrap Style Carriers*
- 3.200 *Basket Style Carriers*
- 3.300 *Tube Style Carriers*
- 3.400 *Cap Style Carriers*

IDEAS AND
INNOVATION
SECOND EDITION



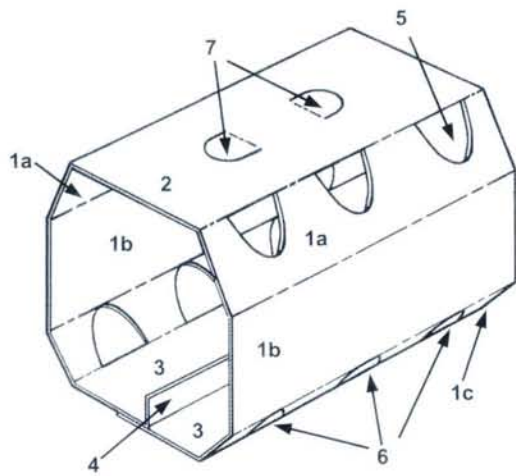
PAPERBOARD PACKAGING COUNCIL



**COMPONENT PARTS
 for BASIC MULTIPLE
 PACKAGING STYLES**

The Multiple Packaging Section is comprised of four sub-sections. Page 3.000 details Wrap Style Carriers and Basket Style Carriers.

3.100 SERIES - WRAP STYLE CARRIERS



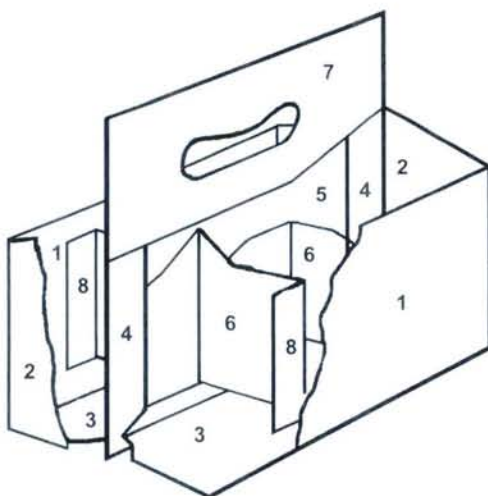
Wrap style carriers bypass the converter's finishing operation. Diecut blanks ship directly to the customer who, in turn, wraps the blank around a grouping of cans, bottles, jars, etc. The wrap is completed by securing either top or bottom panel sections via lock or glue means.

Key components for the majority of carriers in this category are:

- | | |
|--------------------------------------|------------------------------------|
| 1a. Upper Side Panel Sections | 3. Bottom Panel Section(s) |
| 1b. Intermediate Side Panel Sections | 4. Longitudinal Partition Sections |
| 1c. Lower Side Panel Sections | 5. Chime or Cap Apertures |
| 2. Top Panel Section(s) | 6. Chime or Heel Apertures |
| | 7. Finger Holes |

NOTE: Not all styles will include every component.

3.200 SERIES - BASKET STYLE CARRIERS



Basket style carriers are partially assembled by the converter. They are characterized by having side, end and bottom panels, and a central (longitudinal) partition with an integral handle and transverse straps or partition elements. They are erected and top loaded by the customer.

The major components of a basket style carrier are:

- | | |
|--------------------------|---|
| 1. Side Panels | 5. Longitudinal Partition Sections |
| 2. End Panels | 6. Transverse Partition or Strap Sections |
| 3. Bottom Panel Sections | 7. Handle Sections |
| 4. Riser Panels | 8. Glue Flaps and/or Glue Tabs |

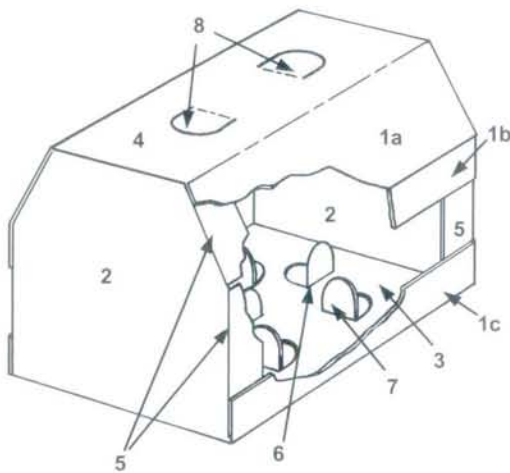
NOTE: Not all styles will include every component.



**COMPONENT PARTS
for BASIC MULTIPLE
PACKAGING STYLES**

The Multiple Packaging Section is comprised of four sub-sections. Page 3.001 details Tube Style Carriers and Cap Style Carriers.

3.300 SERIES - TUBE STYLE CARRIERS



This grouping includes top, side and end loaded variations. The common denominator of Tube Style Carriers is that they are all converter side seamed and shipped to the customer to erect, load and close by means of glue, locks or gussets. The exceptions are auto-erect/open type styles.

Key components for the majority of carriers in this category are:

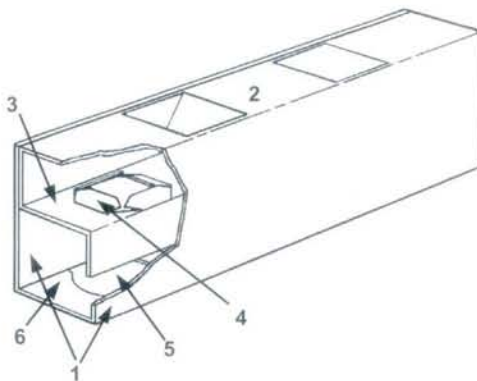
- | | |
|--------------------------------------|--------------------------------|
| 1a. Upper Side Panel Sections | 4. Top Panel Sections |
| 1b. Intermediate Side Panel Sections | 5. Dust Flaps |
| 1c. Lower Side Panel Sections | 6. Longitudinal Partition Tabs |
| 2. End Panel Sections | 7. Transverse Partition Tabs |
| 3. Bottom Panel Sections | 8. Finger Hole Apertures |

NOTE: Not all styles will include every component.

3.400 SERIES - CAP STYLE CARRIERS

Most cap style carriers are partially assembled (folded and glued) by the converter, then shipped flat to the customer who erects and snaps the cap over the top of a grouping of cans or bottles.

The major components of a cap style carrier are:



1. Side Panels
2. Top Panel
3. Partition Panel
4. Cap or Chime Lock Means
5. Cap or Bottle Neck Apertures
6. Bottom Panel

NOTE: Not all styles will include every component.



GLUED SLEEVE
with
TOP and BOTTOM
CHIME LOCKS

The style as shown here is generic. It has been adapted for use on a number of commercially available and proprietary machines.

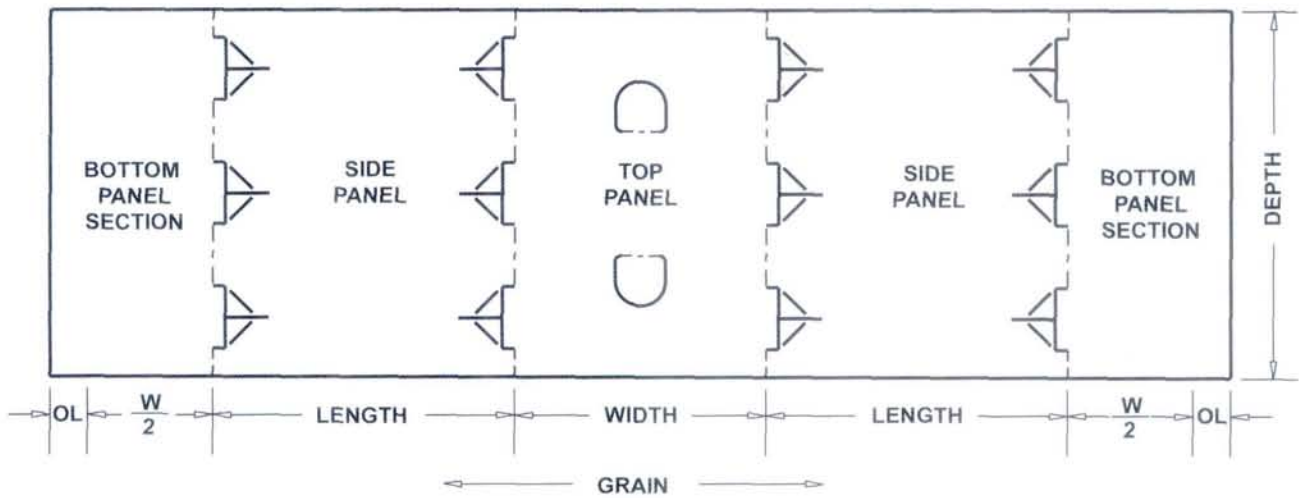


Figure 1

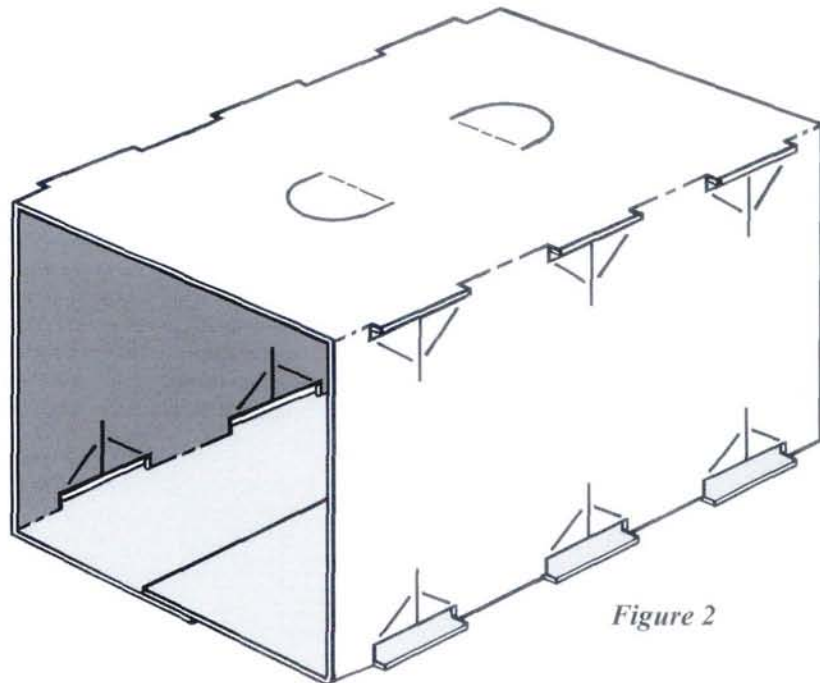


Figure 2



**GLUED SLEEVE
with
TOP and BOTTOM
CORNER GUSSETS**

This corner gusset arrangement may be found as a top-only or bottom-only configuration as well as in the form shown here. It is typically machine formed.

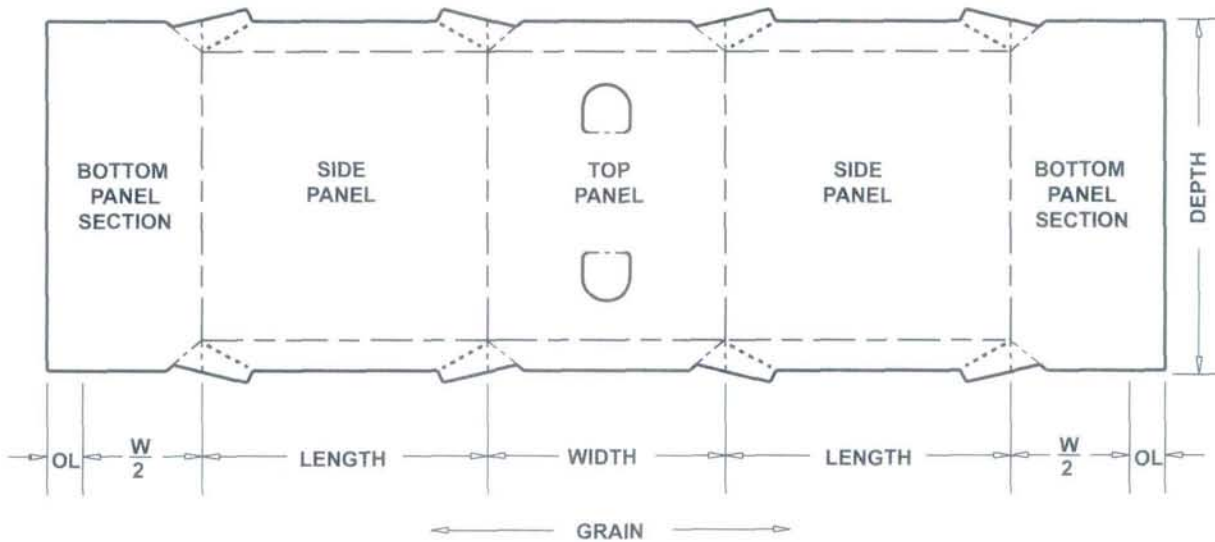


Figure 1

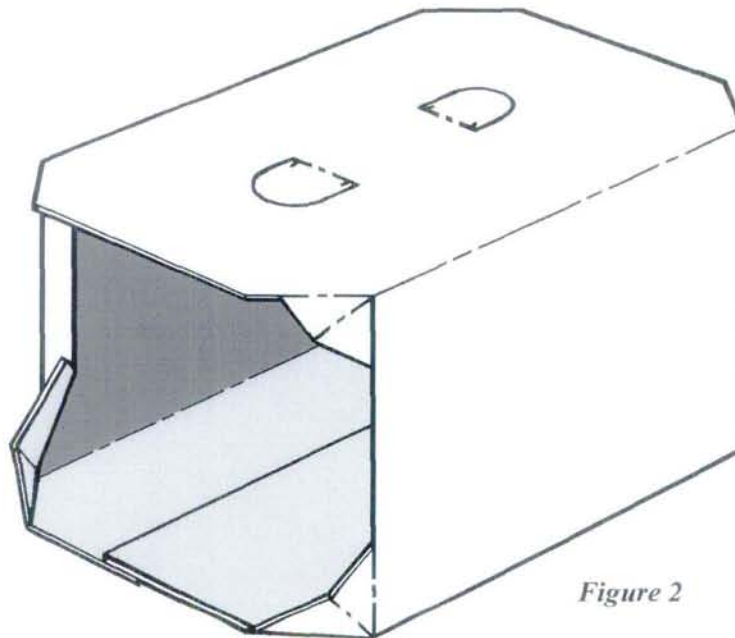


Figure 2



GLUED SLEEVE
with
GUSSETED
TOP END SECTIONS

This style is appropriate for use with rectangular-shaped products as well as with cans. Several adaptations of this style may be found as the retail multiple package for paperboard aseptic cartons. Note: The finger hole carrying means in the top panel is deleted for aseptic cartons. In this illustration it is detailed as a six pack, but the same basic style may be seen in the field as a nine count retail multi-pack used to merchandise paperboard aseptic cartons. See page 3.113 for a three count version.

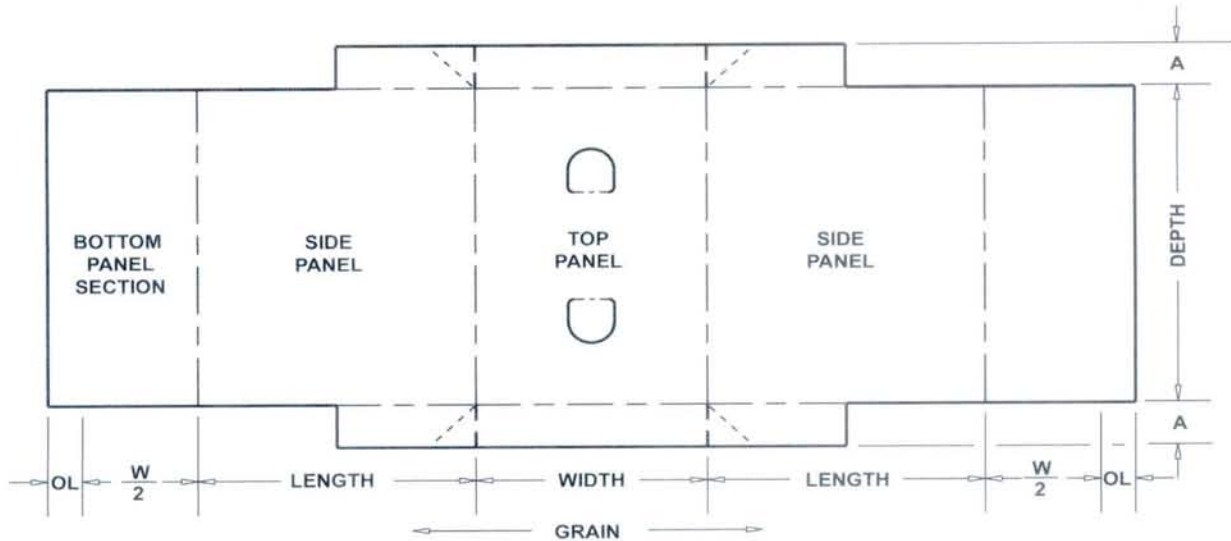


Figure 1

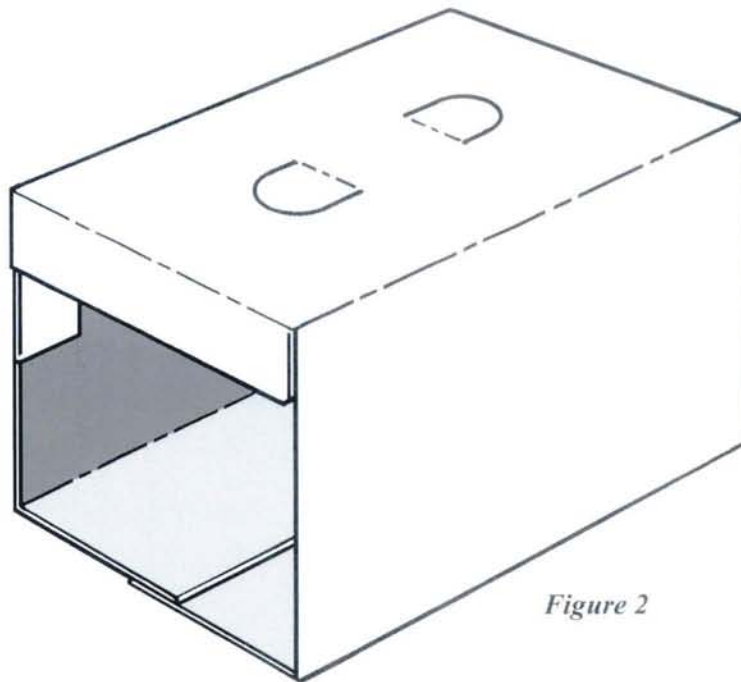


Figure 2



MULTIPLE PACKAGING
Wrap Style Carriers / Customer Glued
For Bottles

GLUED SLEEVE
with NECK & HEEL
APERTURES
(NECK-THROUGH
STYLE)

The style shown here is generic. It has been adapted for use on a number of commercially available and proprietary machines. It may also be seen as a lock bottom wrap. See page 3.112 for lock details.

Note: Length and width on carriers with chamfered sides can only be given in erected form. Refer to Figure 2.

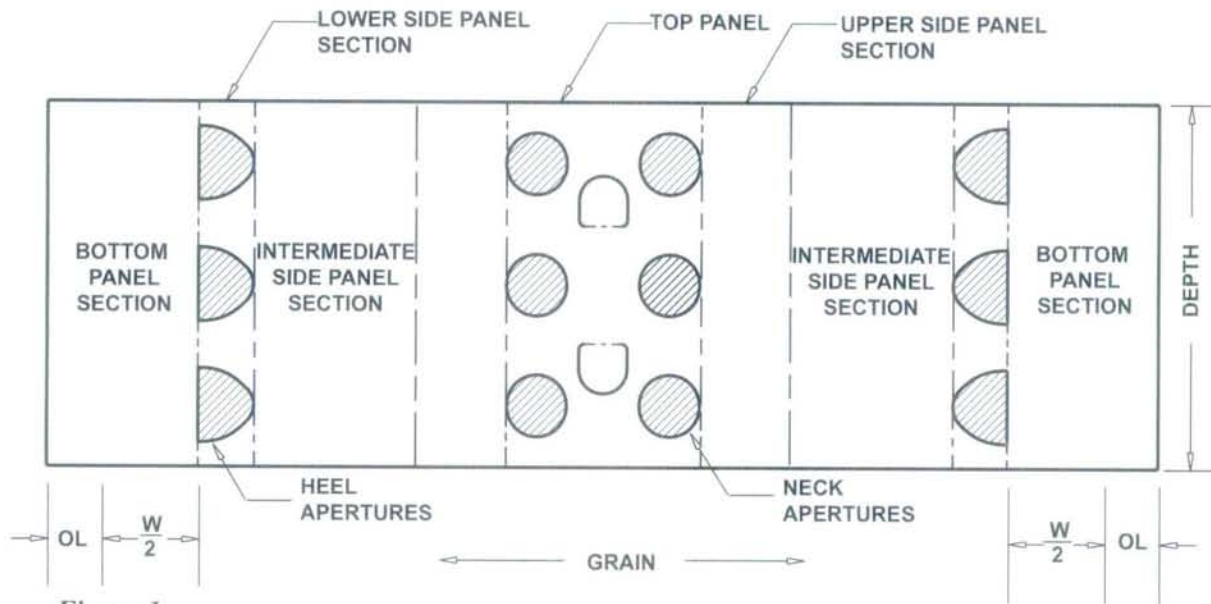


Figure 1

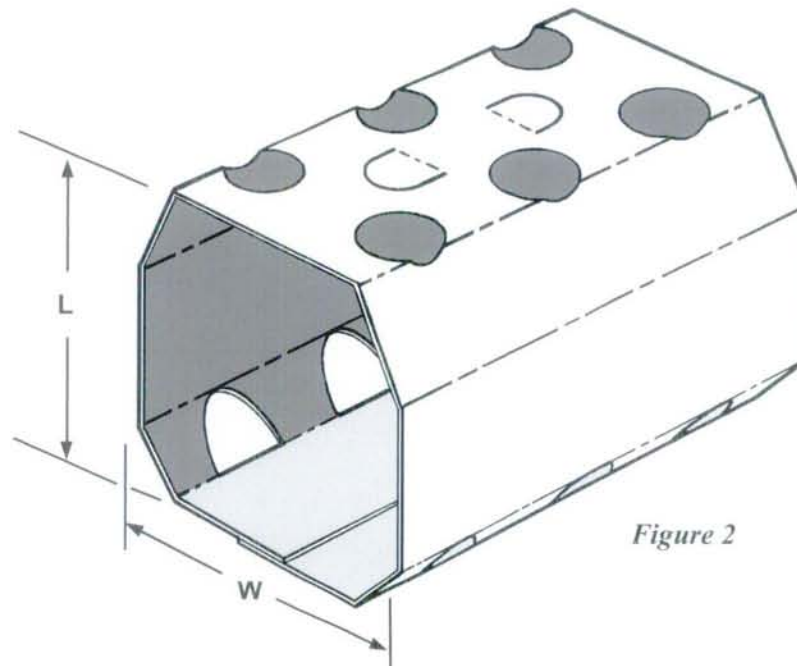


Figure 2



GLUED SLEEVE
with
CAP and HEEL
APERTURES

This page illustrates a six count wrap, but the same style may be seen in the field in counts from two to twelve in a “one-by” arrangement.

Note: The length and width on carriers with chamfered sides can only be given in erected form. Refer to Figure 2.

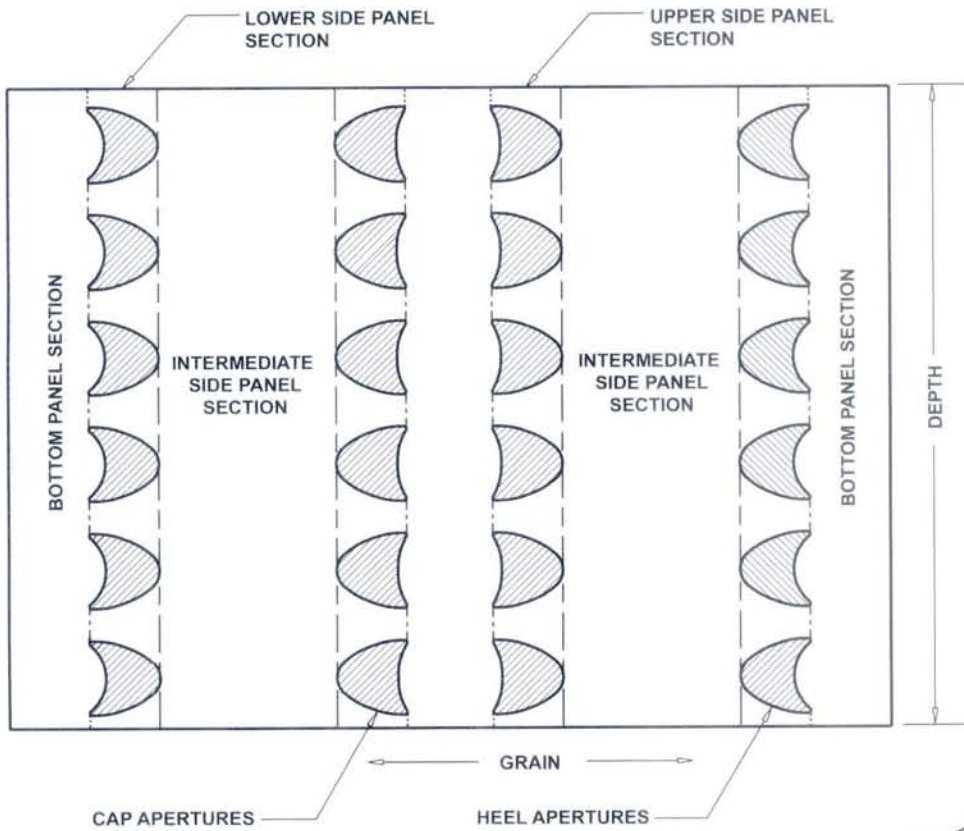


Figure 1

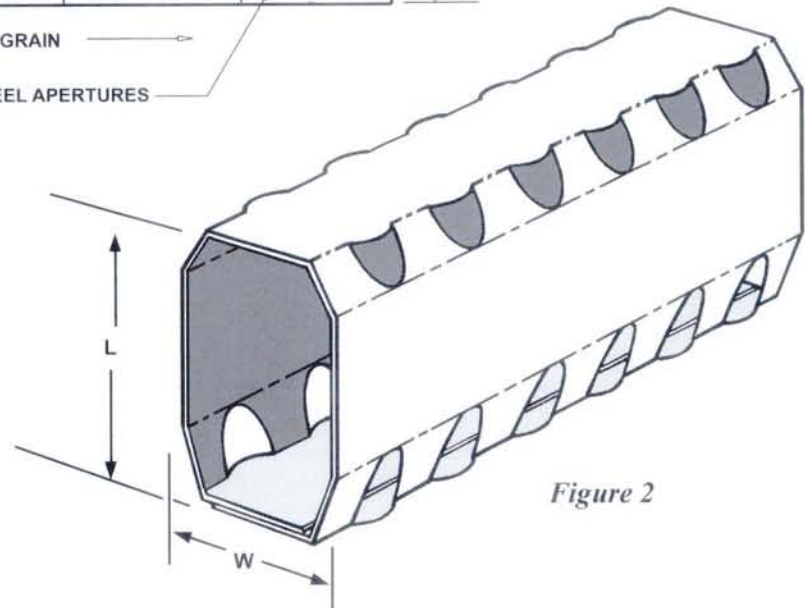


Figure 2



**GLUED SLEEVE with
TOP CAP & SHOULDER
APERTURES and
HEEL CONTOUR CUTS**

This style differs slightly from the other bottle or jar wraps shown in this section. It does not have conventional heel apertures. Instead, it incorporates a series of cuts at the base of the lower sections which permit the side sections to squeeze in and contour around the base of the bottles or jars.

Note: The length and width on carriers with chamfered sides can only be given in erected carton form. Refer to Figure 2.

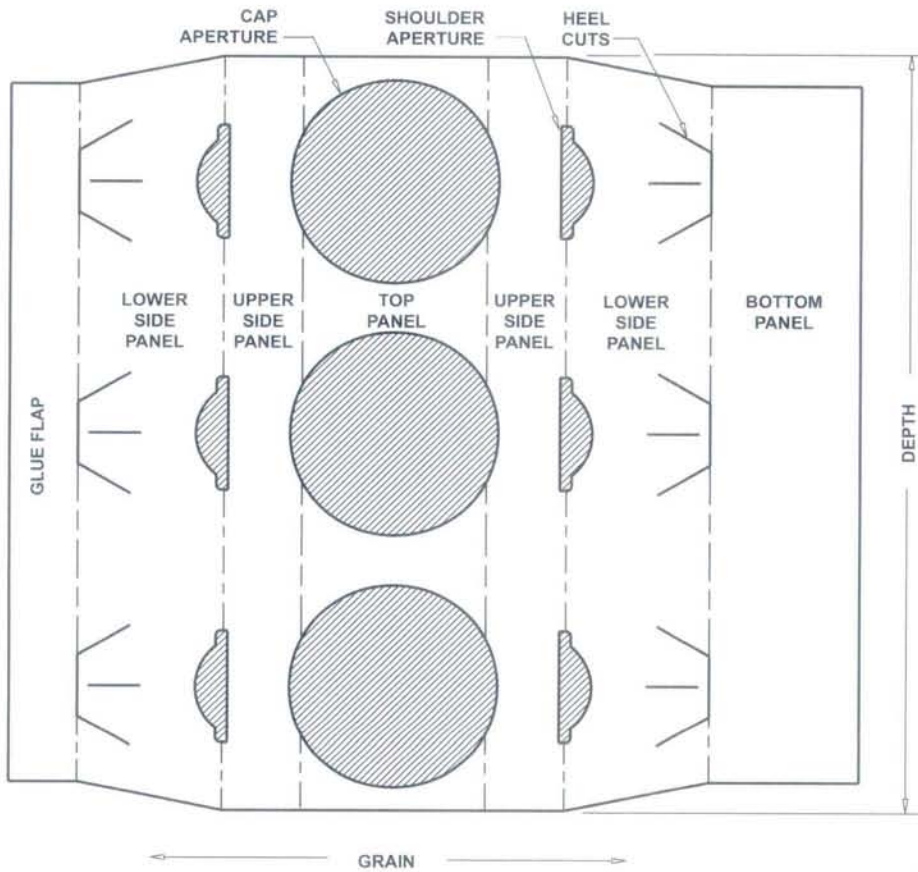


Figure 1

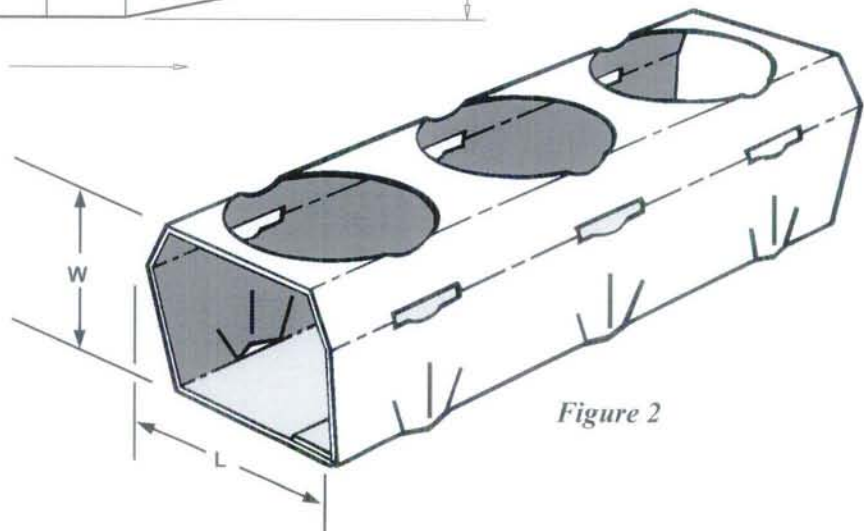


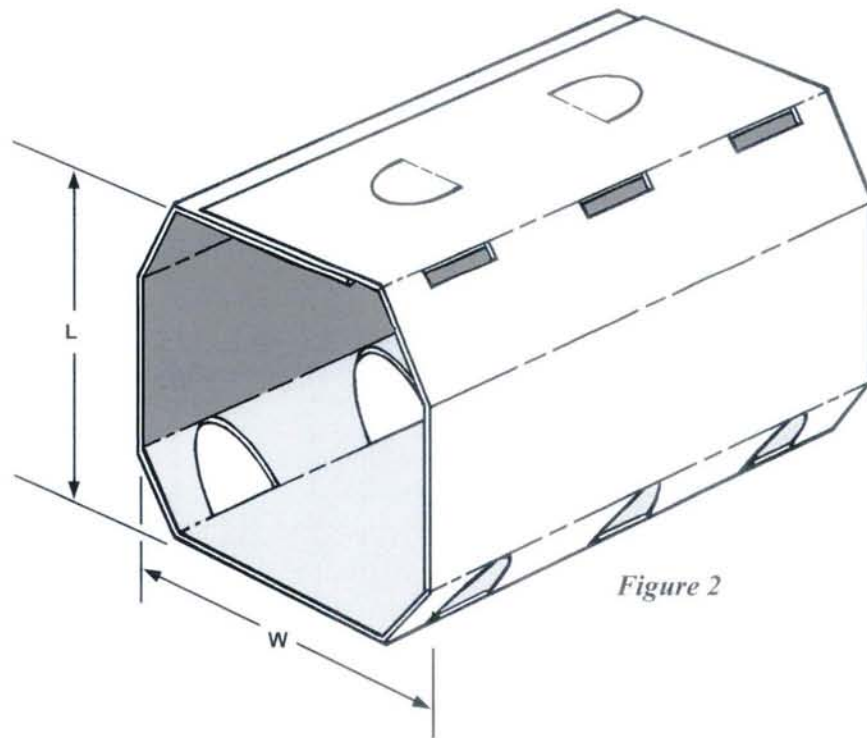
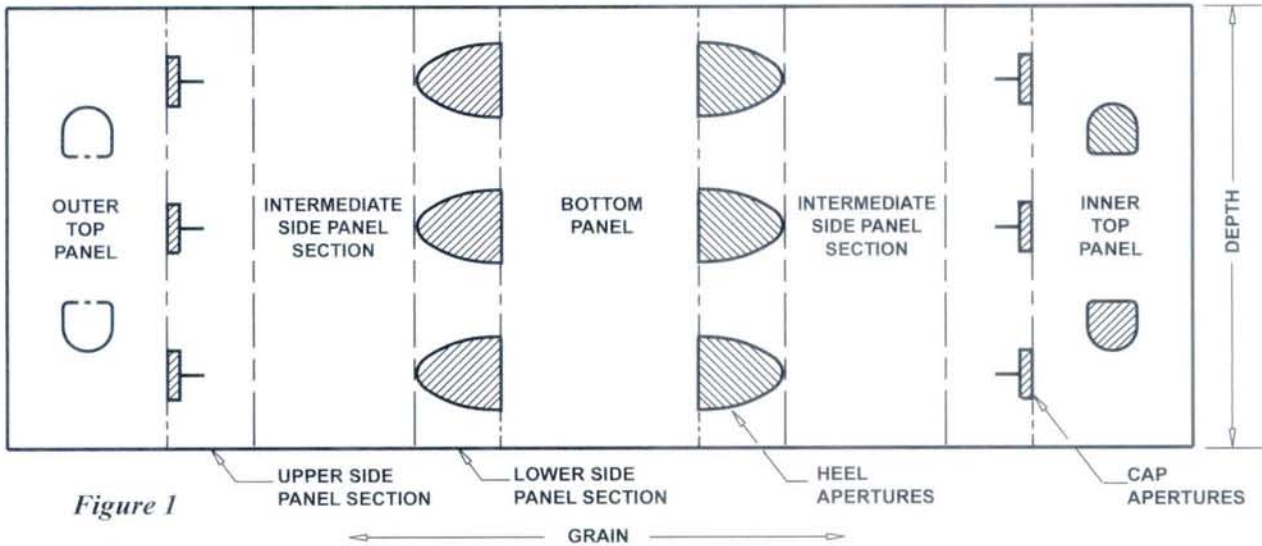
Figure 2



GLUED SLEEVE
with
CAP and HEEL
APERTURES

Most, but not all, wraps are bottom glued or locked. This variation illustrates a multi-pack that wraps from the bottom. The major advantage of a wrap to the top is that it provides double thickness in the finger hole areas.

Note: The length and width on carriers with chamfered sides can only be given in erected carton form. Refer to Figure 2.



GLUED SLEEVE
with SIDE PANEL
APERTURES to
DISPLAY PRODUCT

This style is generally associated with the glass industry where it has been used as a means of transporting and displaying drinking glasses. The large side panel apertures are designed to separate the glasses and show off their shape and design to best advantage.

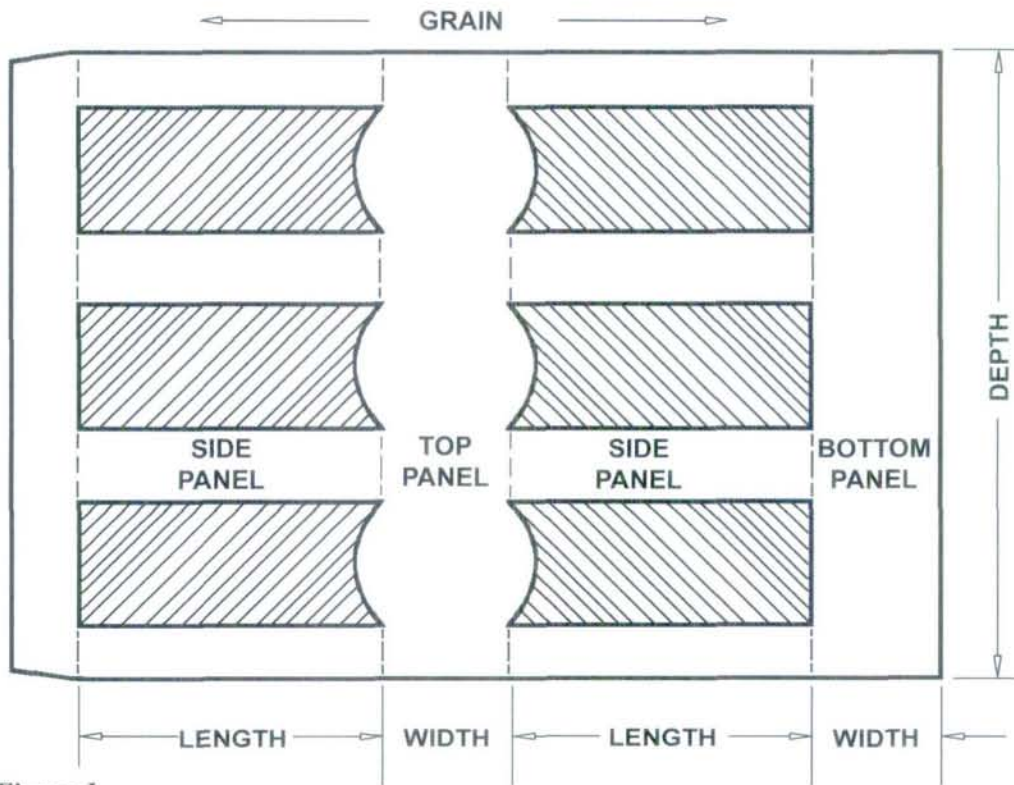


Figure 1

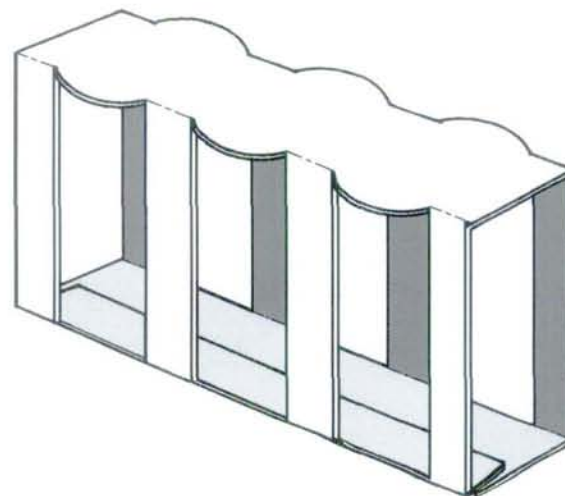


Figure 2



GLUED SLEEVE
with
TOP and BOTTOM
CHIME LOCKS

This style was developed as a wrap for conventional three-piece cans which have outwardly extending top and bottom chimes. While it can be hand assembled and glued, it is typically assembled on automatic packaging equipment.

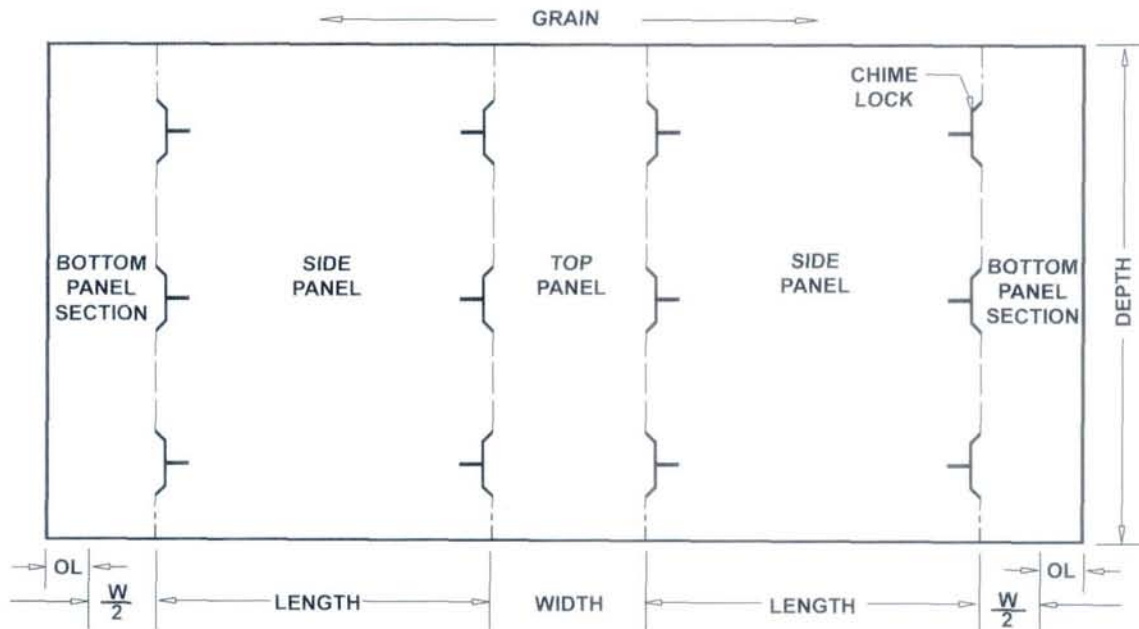


Figure 1

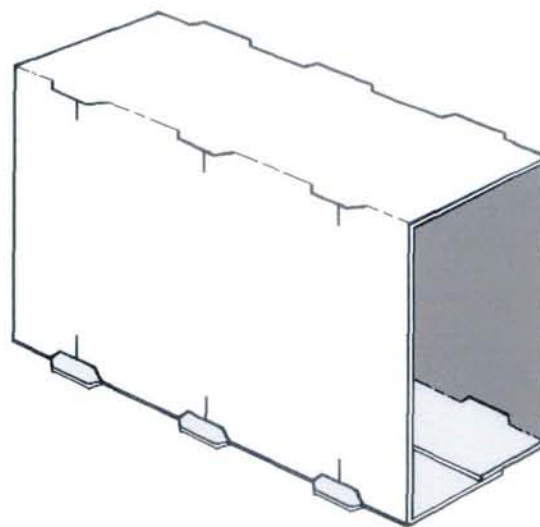


Figure 2



GLUED SLEEVE

This style is generally associated with the packaging of two tubs of margarine, but it has application beyond this product line. It is typically wrapped and glued on high speed, continuous motion packaging equipment. Refer to page 3.114 for locking alternatives.

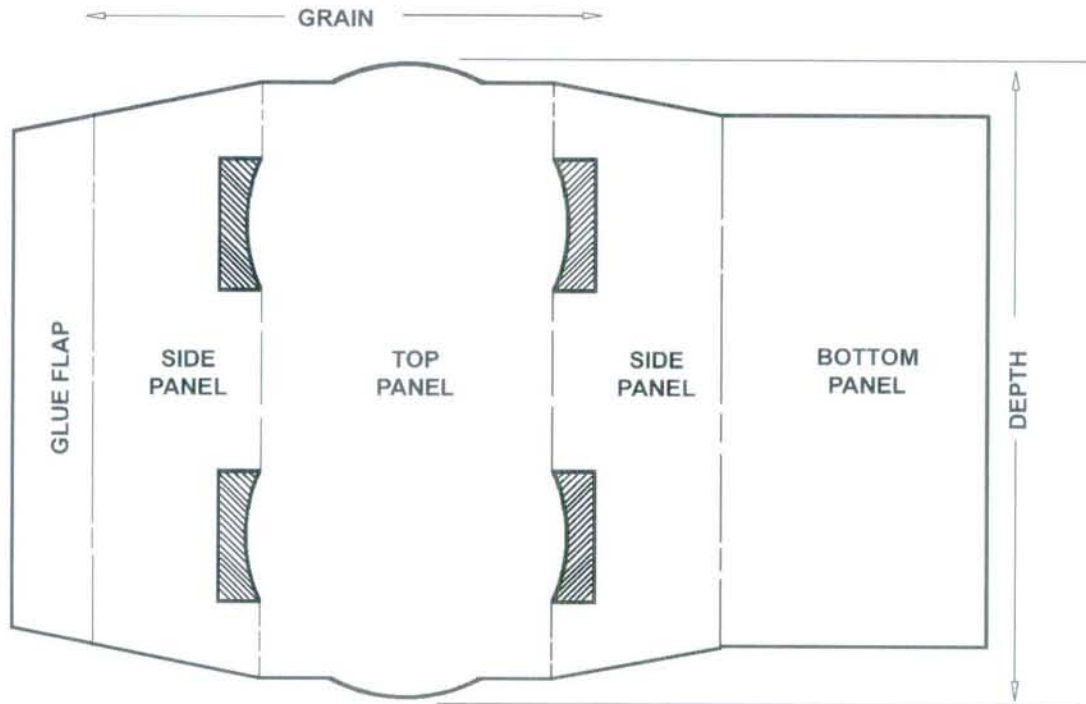


Figure 1

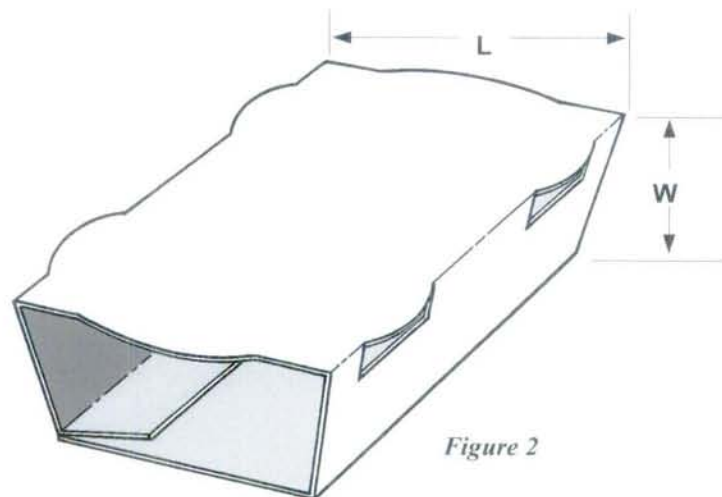


Figure 2

**“BUTTERFLY”
 LOCKED SLEEVE with
 TOP and BOTTOM
 CHIME LOCKS**

The lock style shown here is generic, although a number of proprietary variations exist. The style is adaptable to a number of commercially available or proprietary wrap style machines.

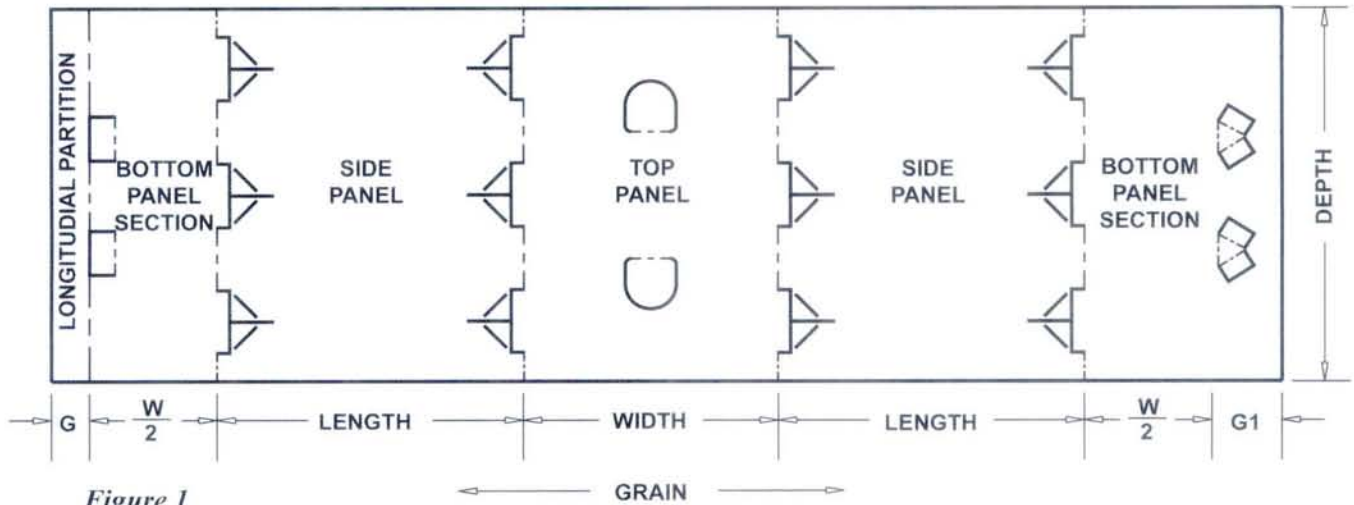


Figure 1

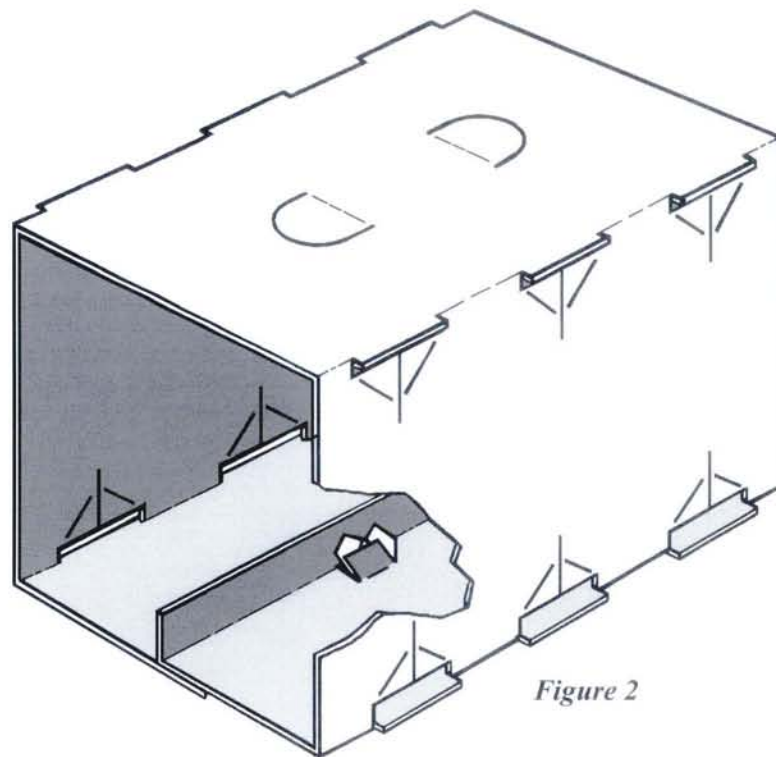


Figure 2



**ACE LOCKED
WRAP with
CAP and HEEL
APERTURES**

As illustrated below, the style is generic. A number of proprietary systems are available which utilize slightly different lock detailing.

Note: The length and width on carriers with chamfered sides can only be given in erected carton form. Refer to Figure 2.

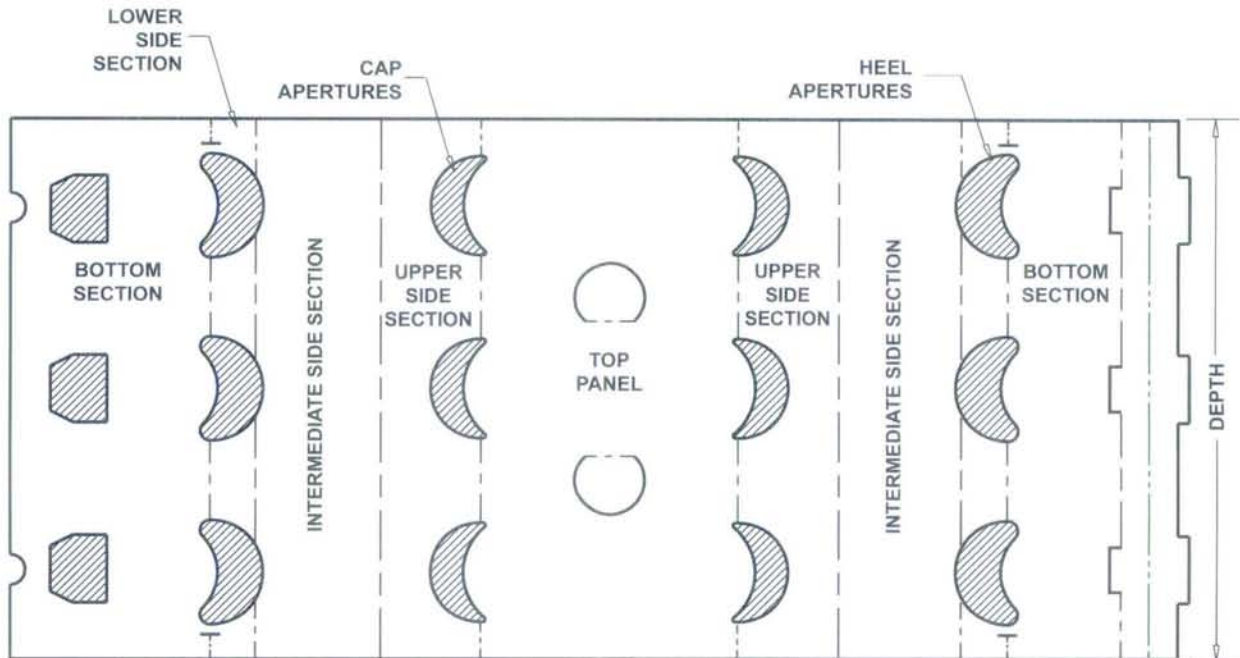


Figure 1

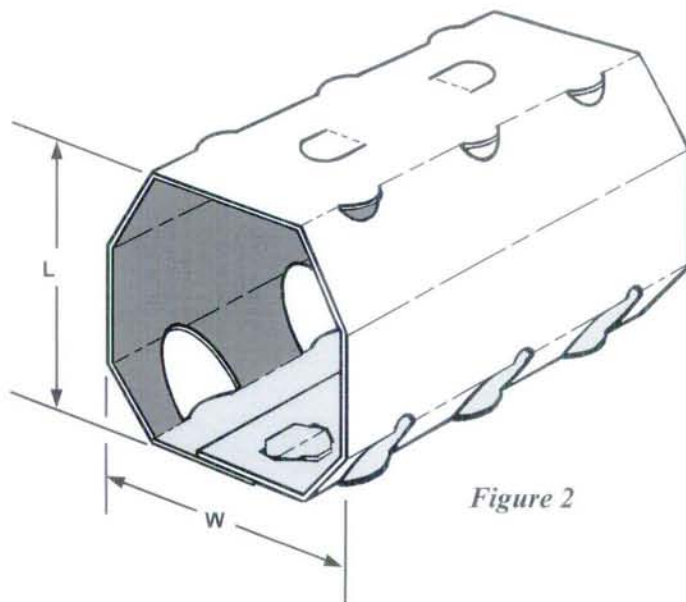


Figure 2



ACE LOCKED SLEEVE
with
GUSSETED
END PANELS

This style is used primarily as a retail multi-pack to merchandise three paperboard aseptic cartons.

The lock style shown here is generic, however several proprietary styles can be found in the field. See page 3.103 for a six count variation of this style.

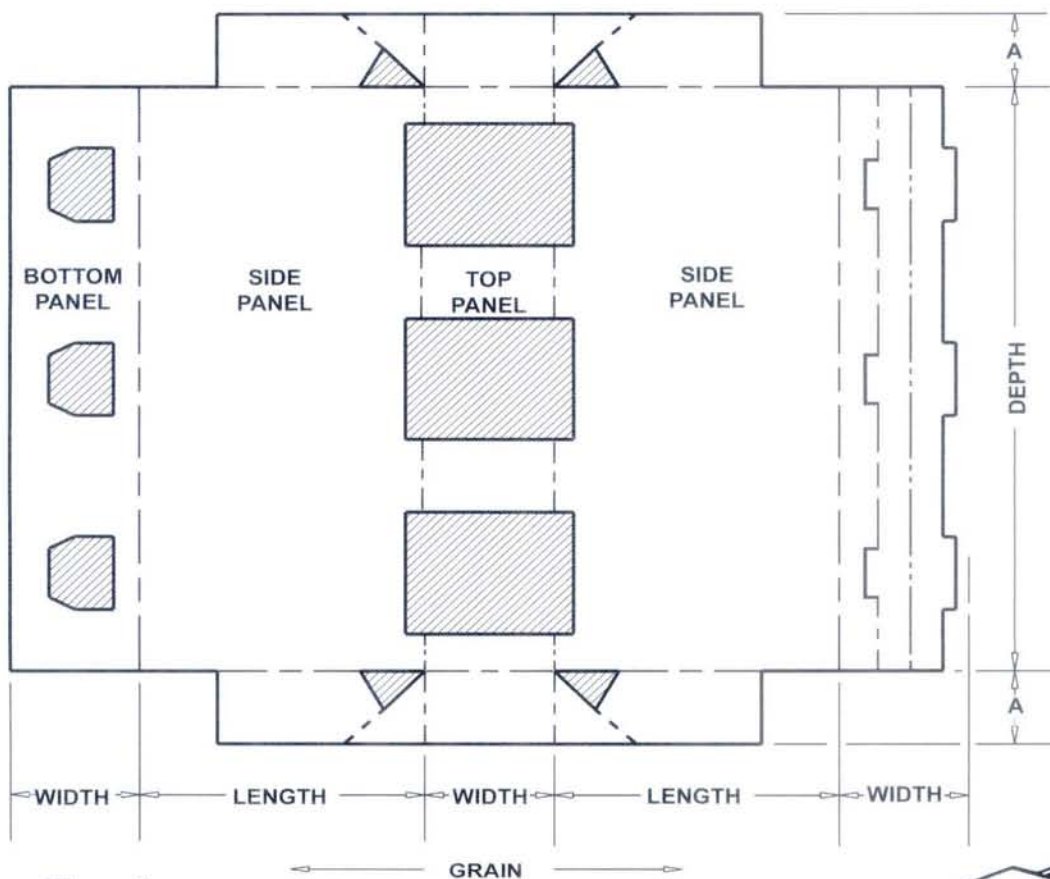


Figure 1

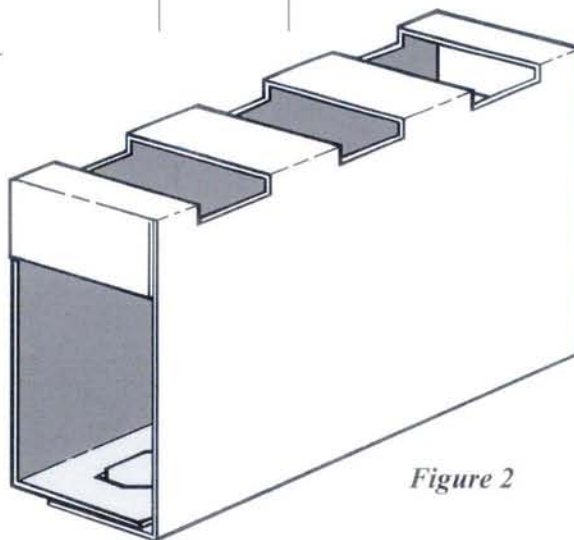


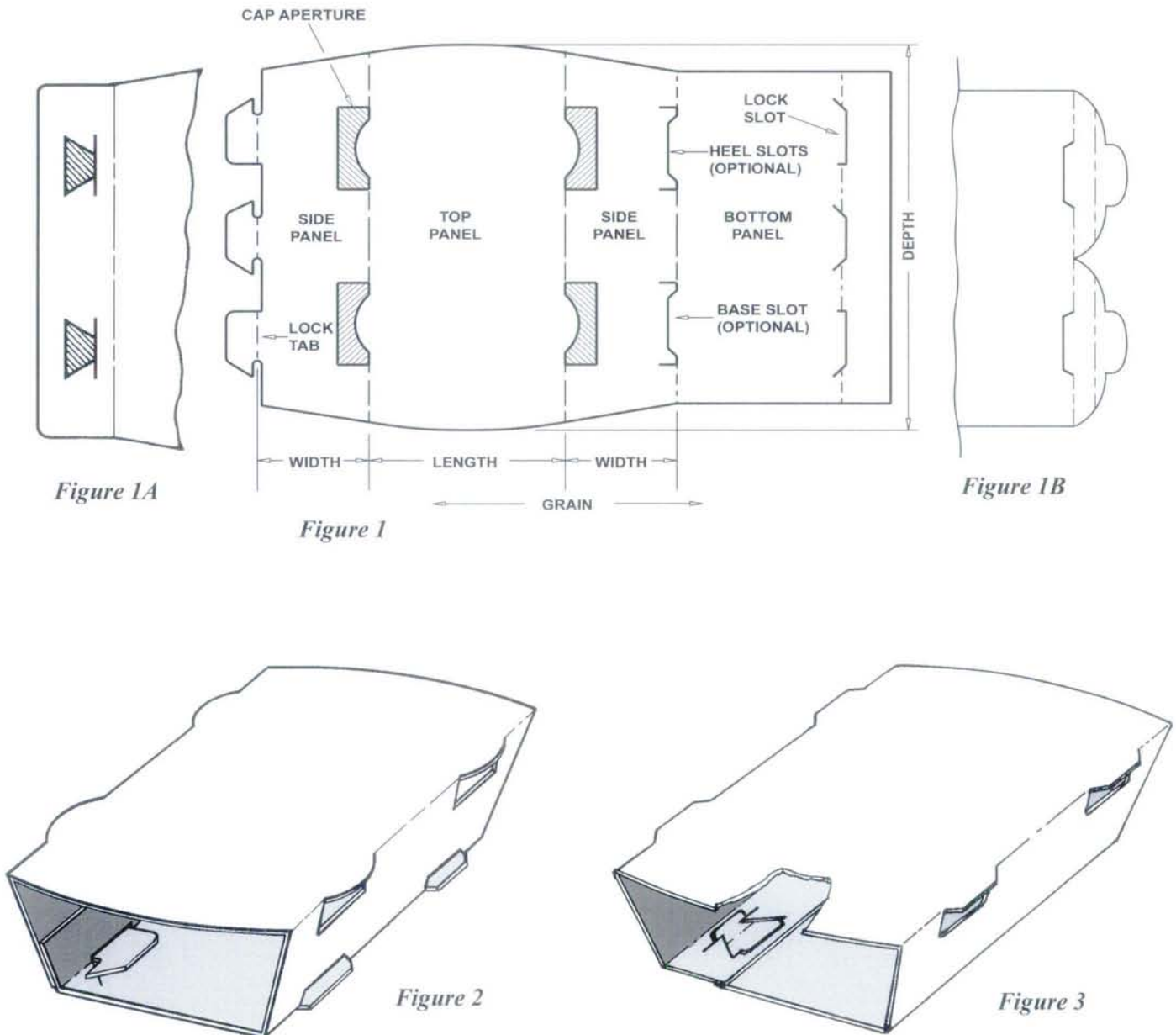
Figure 2



**EDGE LOCKED
SLEEVE**

This style is generally associated with the packaging of two tubs of margarine, but it has application beyond this product line. It can be hand packed, but is typically wrapped and locked on high speed, continuous motion packaging equipment.

Figures 1 and 2 show one locking option (anchor lock). Figures 1A, 1B, and 3 illustrate a second locking option (ace lock). Refer to page 3.110 for a glued alternative.



**ACE LOCKED
SLEEVE with
TOP and BOTTOM
CHIME LOCKS**

As illustrated below, the style is generic. Proprietary systems are available which utilize slightly different lock detailing.

The chime slots as shown work best on conventional three-piece cans with outwardly extended chimes at both the top and bottom.

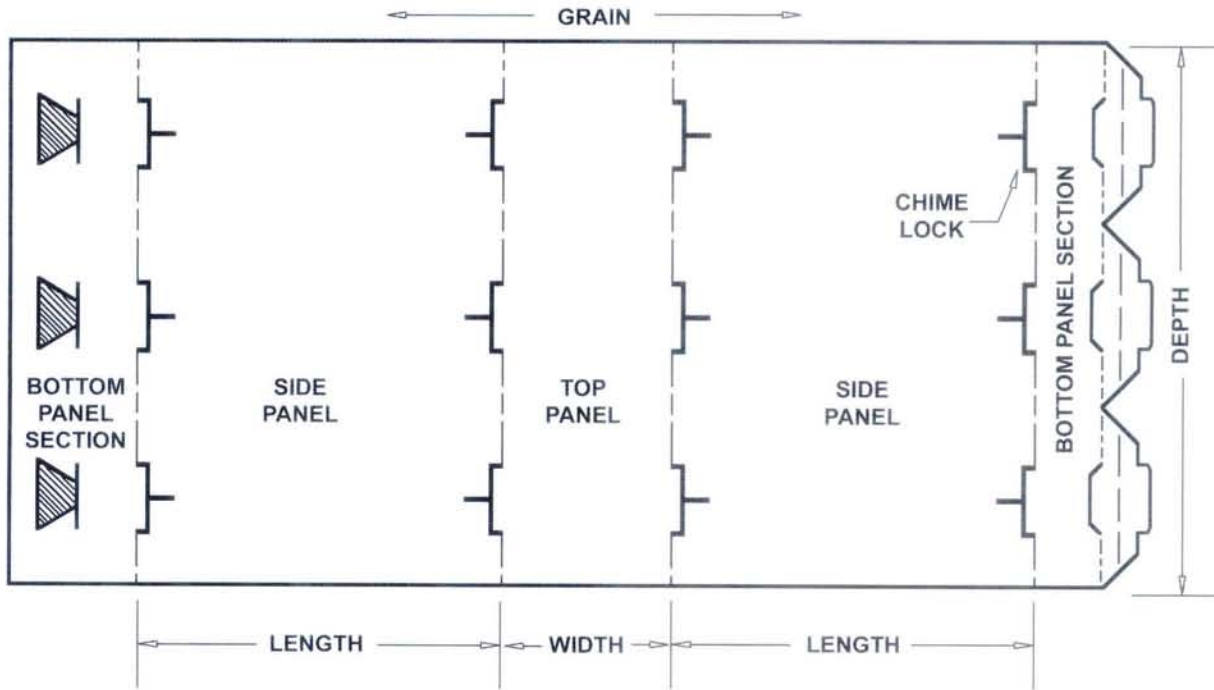


Figure 1

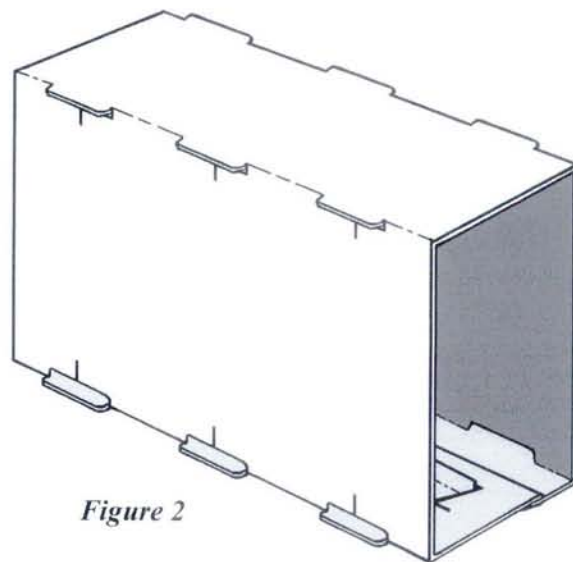


Figure 2



**ACE LOCKED SLEEVE
with INTERNAL
LOCKING TABS**

This is a style best suited for use with shallow depth chime top cans or tubs, and cups having recessed top caps.

Note: Because of the side panel taper, width can only be measured with the wrap in its erected form.

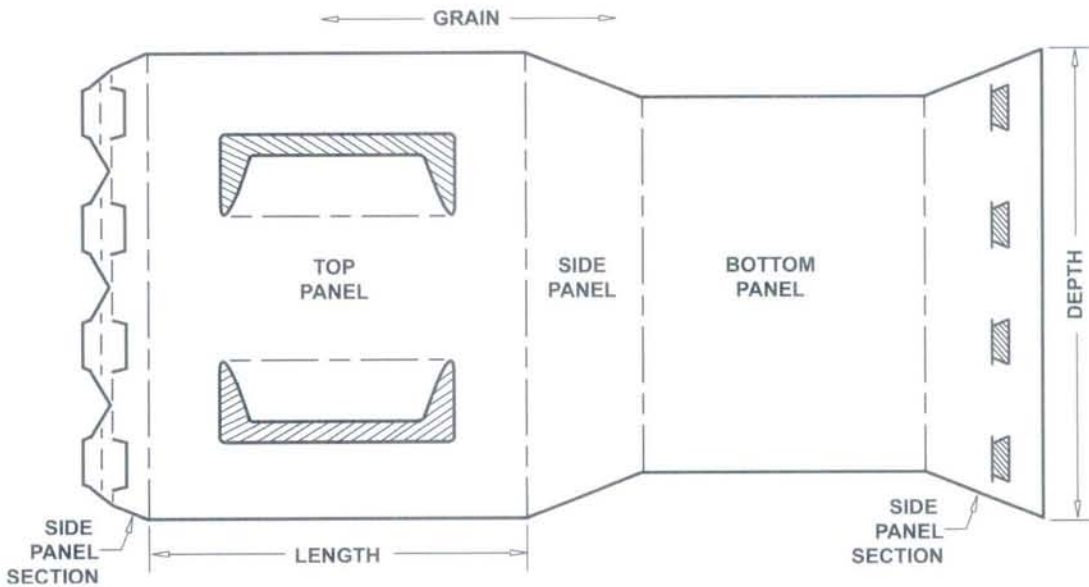


Figure 1

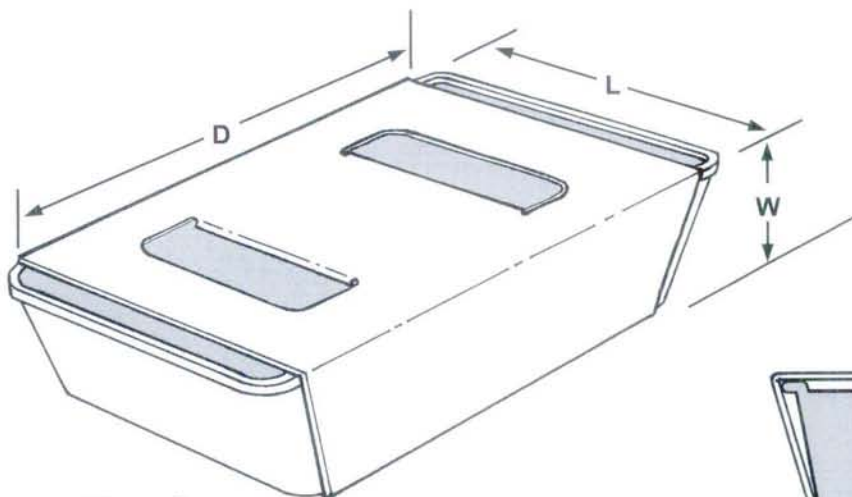


Figure 2

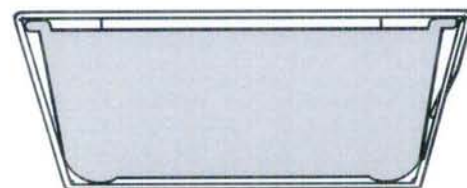


Figure 3



ACE LOCKED SLEEVE
with
RECESSED EXTERNAL
LOCKING TABS

This style was developed for the conventional three-piece can. The chime lock tabs lock into the recess in the ends of the cans. Preglued tube versions of this structure are useful as trial market or promotional multi-packs.

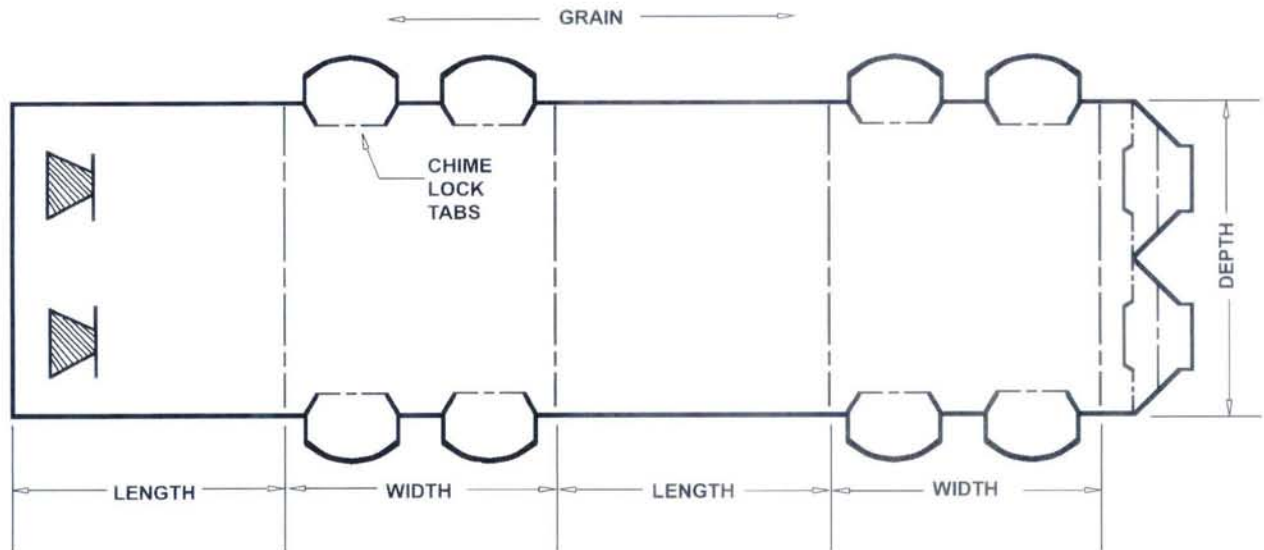


Figure 1

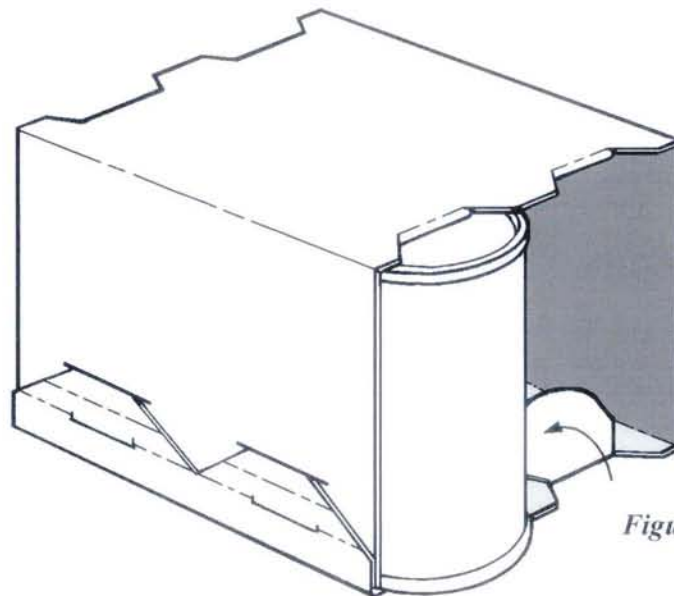


Figure 2



**ONE PIECE,
 NON-STEPPED
 STRAP STYLE
 BASKET CARRIER**

The Strap Style Basket Carrier was developed for the heavyweight returnable soft drink bottle which does not require bottle-to-bottle separation. The variation below shows one of two fundamental methods of developing the transverse straps.

The strap style basket carrier is preglued and shipped flat to the bottler. It can be erected and loaded by hand or on automatic packaging equipment.

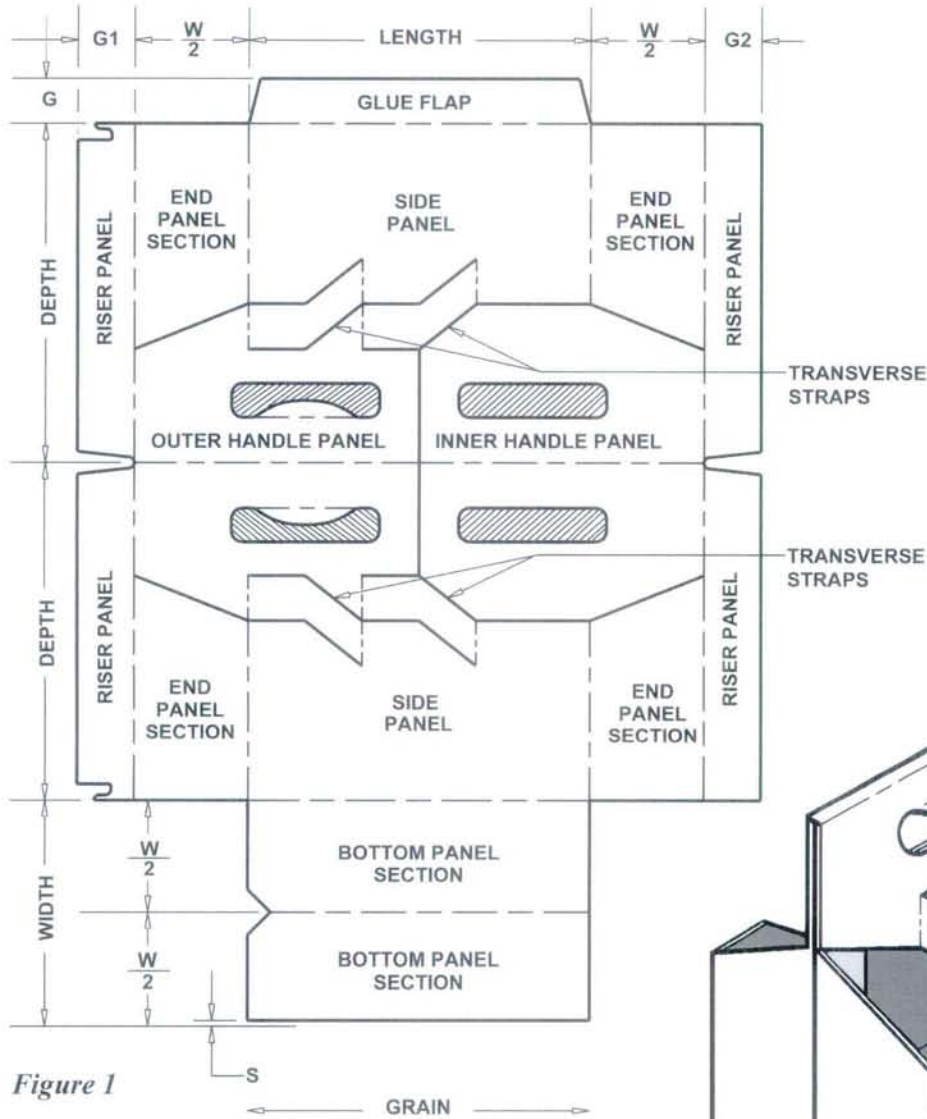


Figure 1

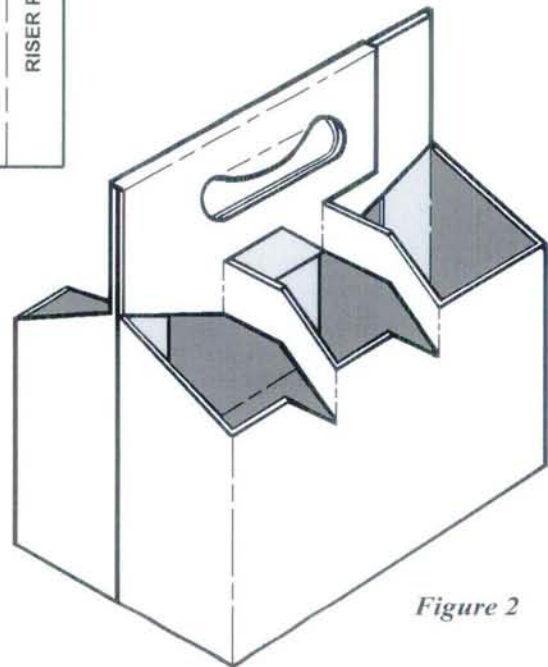


Figure 2



**ONE PIECE
 STEPPED
 STRAP STYLE
 BASKET CARRIER**

The Strap Style Basket Carrier was developed for the heavyweight soft drink bottle which does not require bottle-to-bottle separation. The variation shown below is one of several fundamental methods of developing the transverse straps.

The strap style basket carrier is preglued and shipped flat to the bottler. It can be erected and loaded by hand or on automatic packaging equipment.

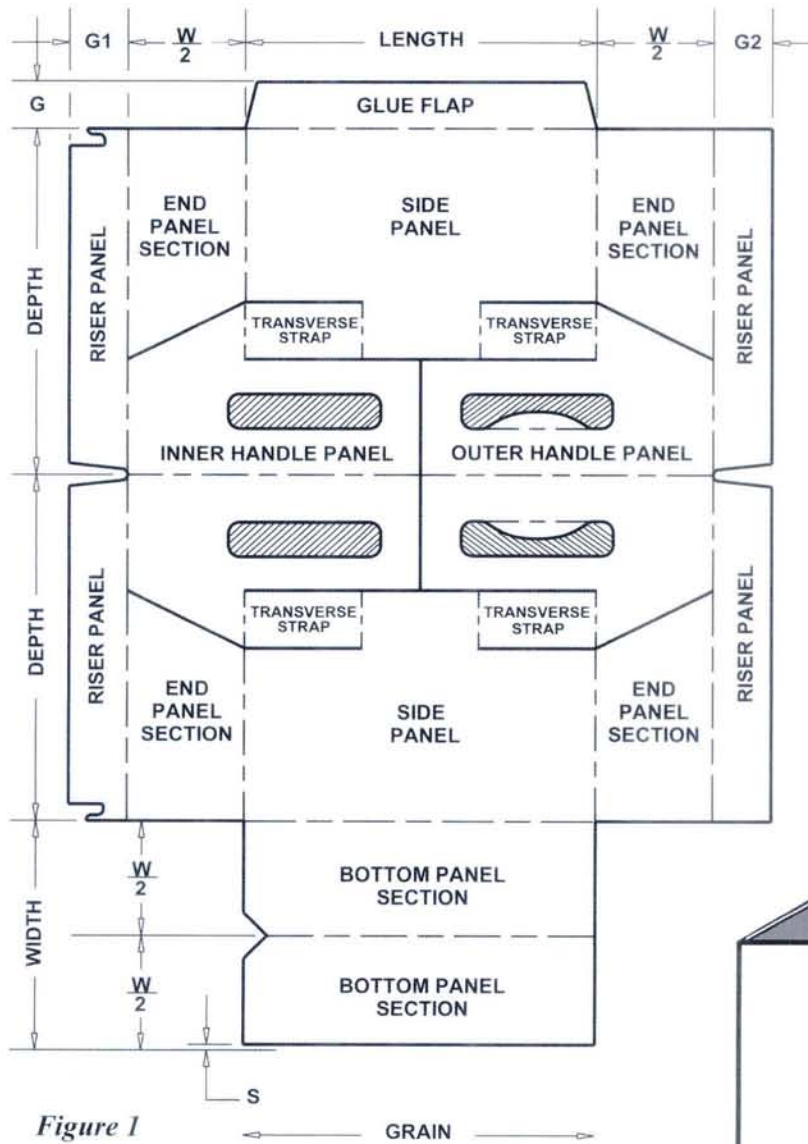


Figure 1

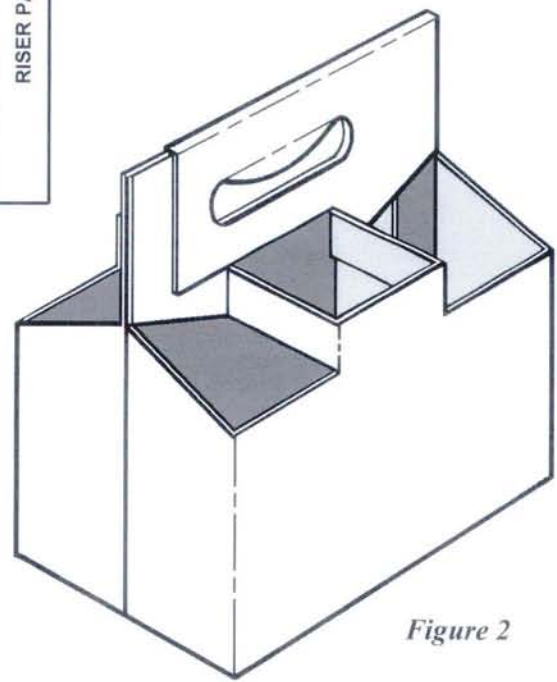


Figure 2



SIX-COUNT CARRIER
with SINGLE PLY
LONGITUDINAL and
TRANSVERSE
PARTITIONS

This is a fundamental style variation for a single ply transverse and longitudinal partition style bottle carrier.

It can be erected and loaded by hand or by machine.

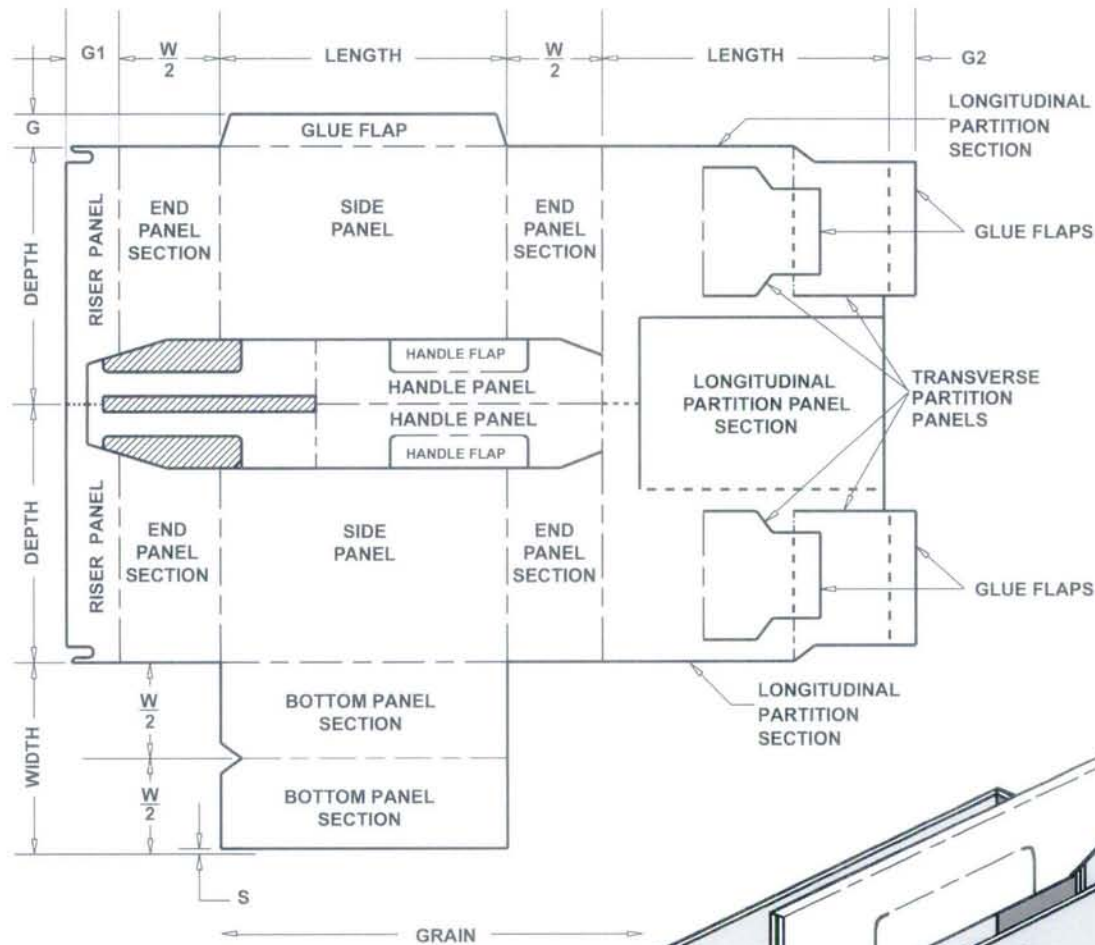


Figure 1

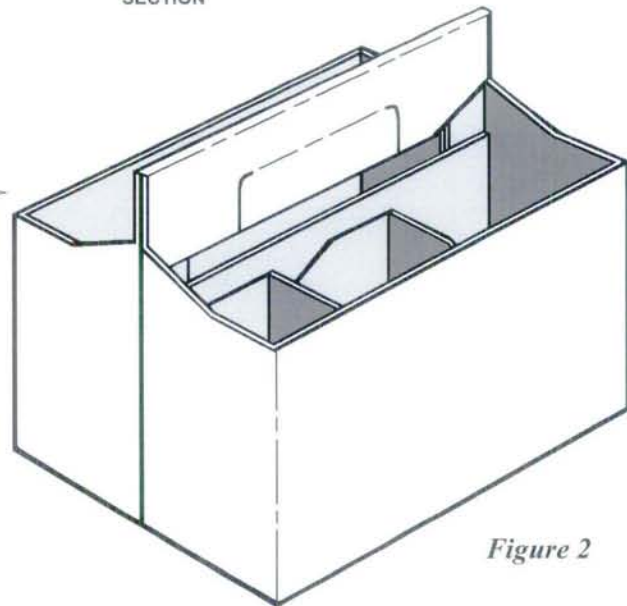


Figure 2



SIX-COUNT CARRIER
with SINGLE PLY
LONGITUDINAL and
TRANSVERSE
PARTITIONS

This is a variation of the style shown on page 3.203. It differs in the method used to develop the four ply handle and the single ply longitudinal partition bottle separation.

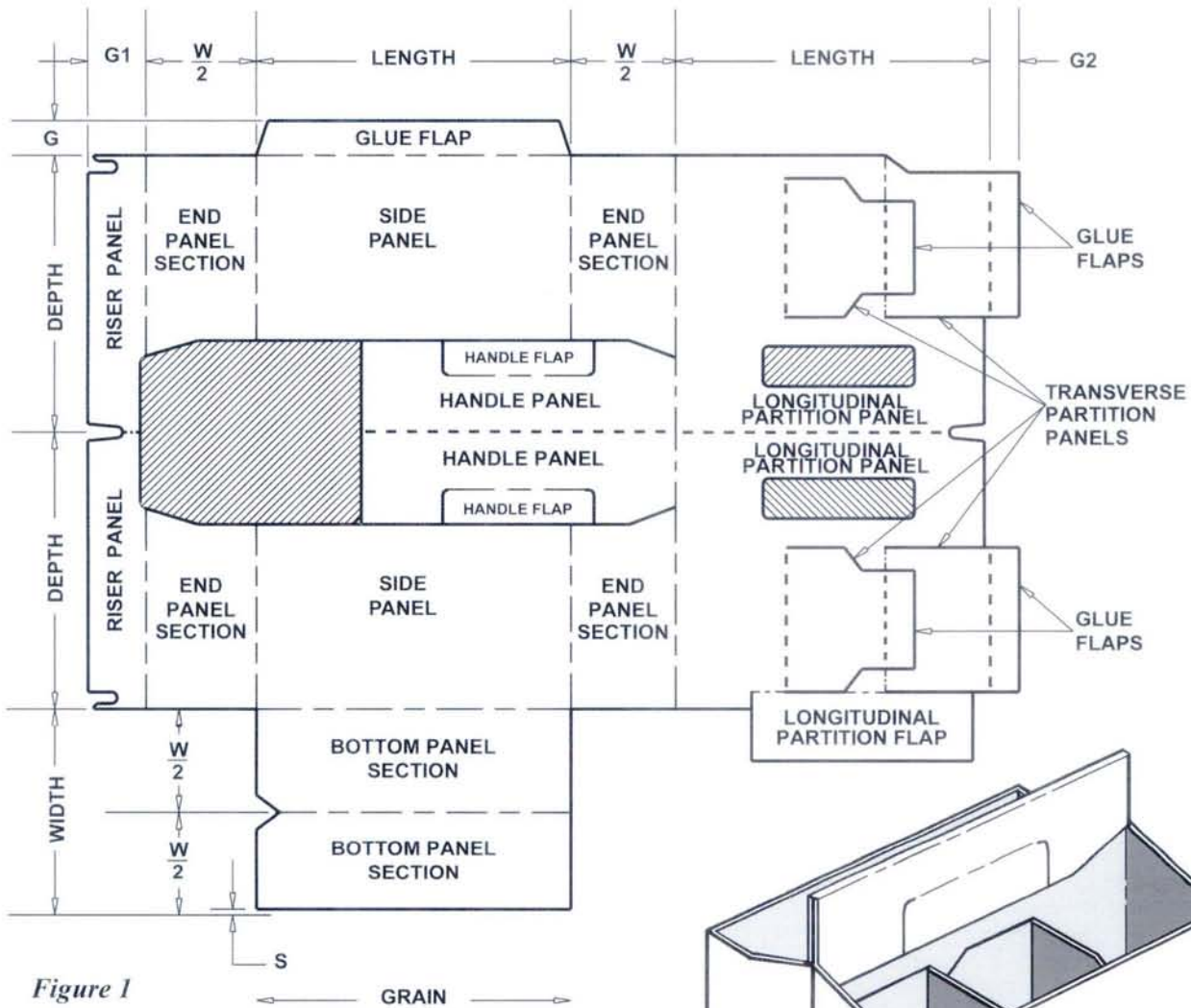


Figure 1

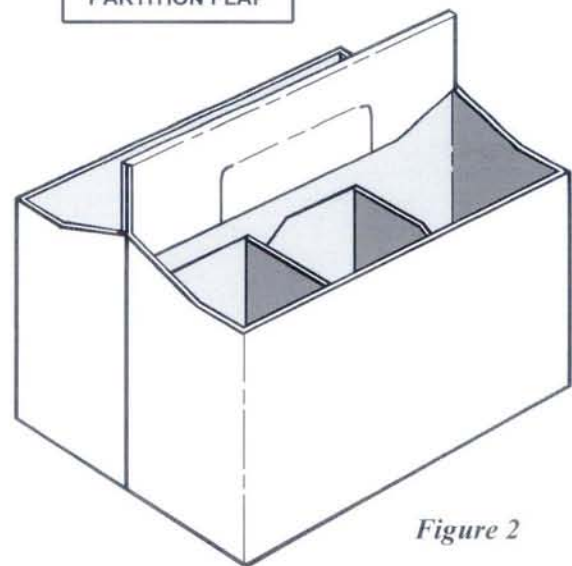


Figure 2



NESTABLE SIX-COUNT
with SINGLE PLY
LONGITUDINAL and
TRANSVERSE
PARTITIONS

This style represents a different panel rotation from that shown on pages 3.203 and 3.204. Note the outboard handle panels and the bottom panel sections toward the inner portion of the carton blank.

It has nesting advantages on certain converting equipment.

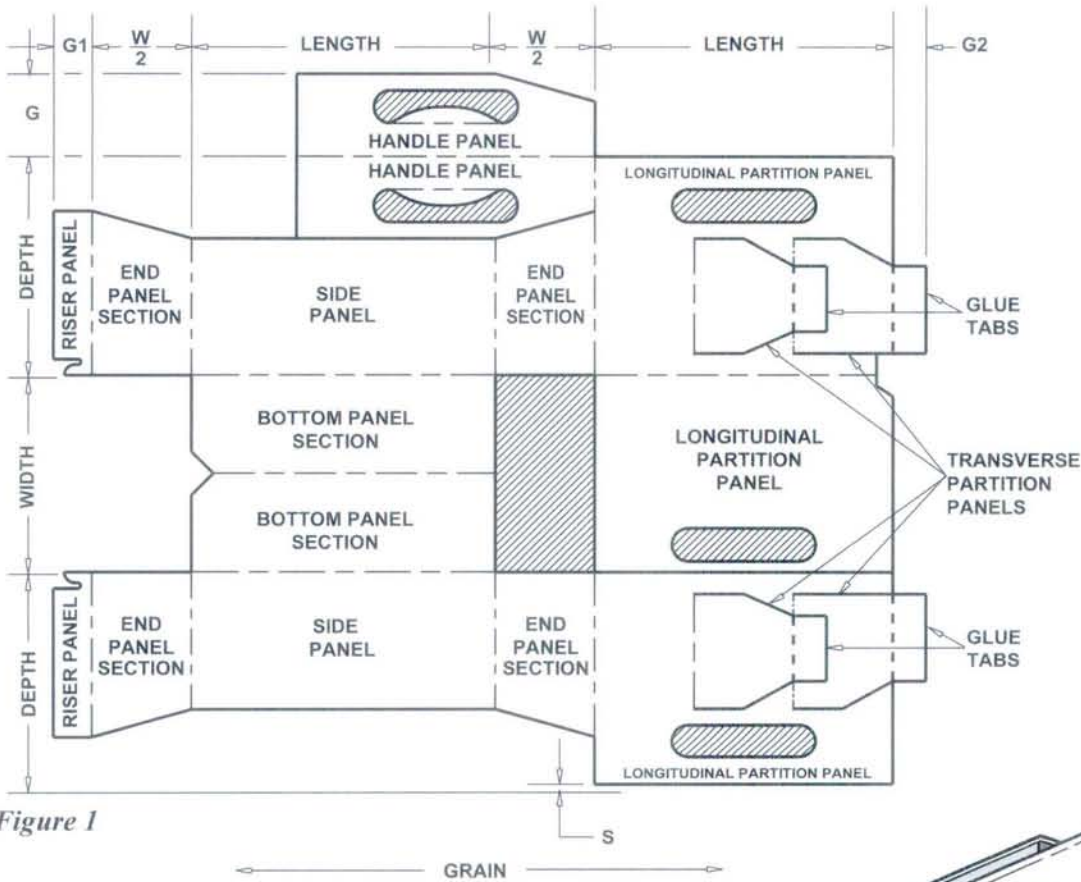


Figure 1

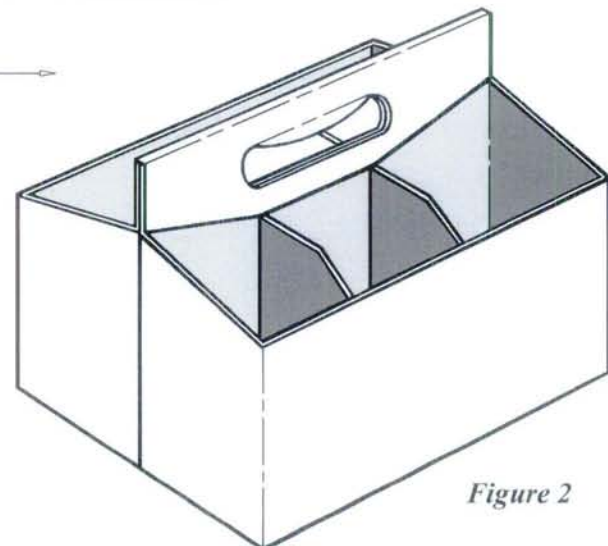


Figure 2



NESTABLE 4-COUNT
with SINGLE PLY
LONGITUDIAL and
TRANSVERSE
PARTITIONS

This style, and variations thereof, are widely used as the carrier of choice for wine coolers.

It offers both longitudinal and transverse bottle separation.

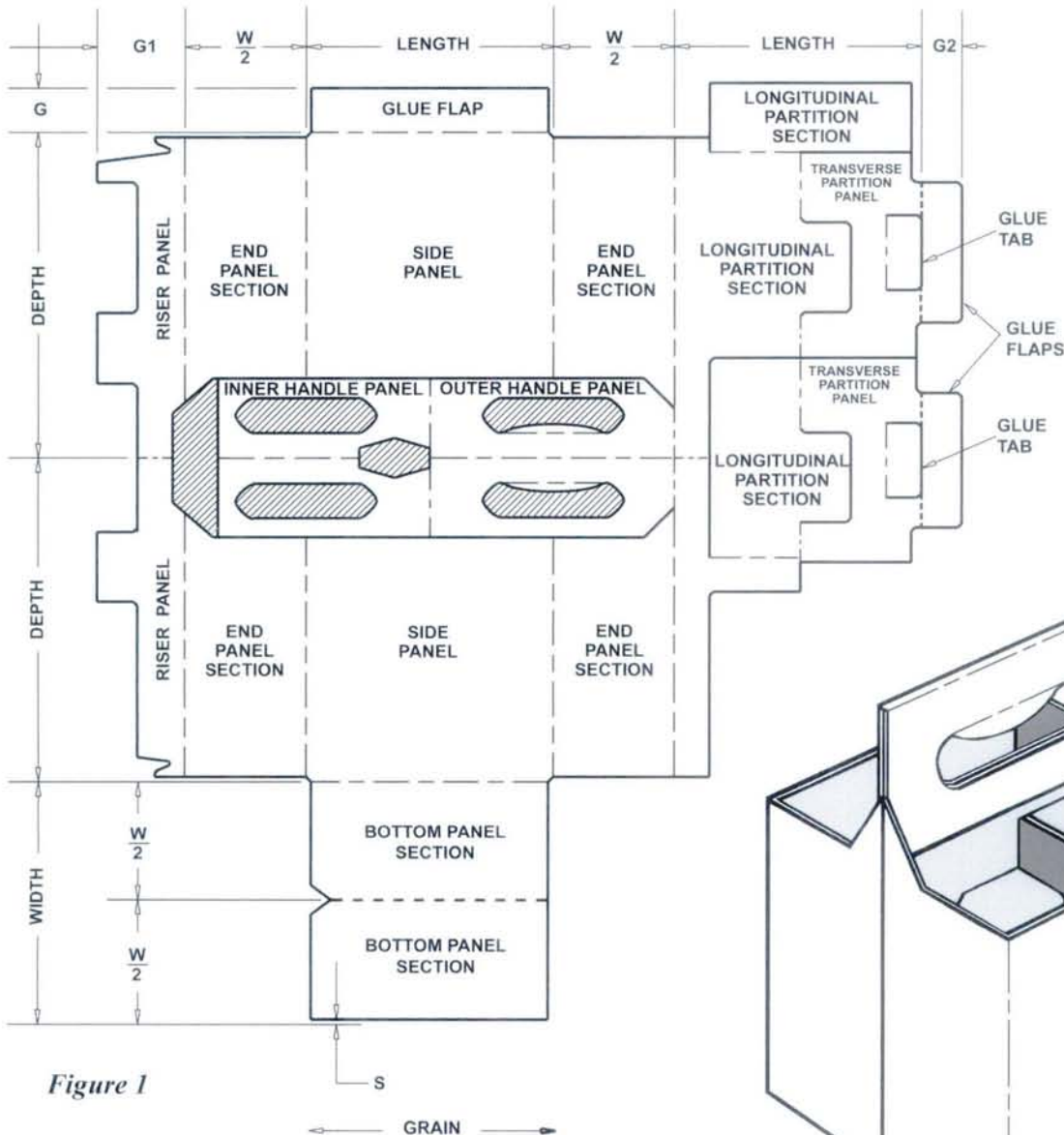


Figure 1

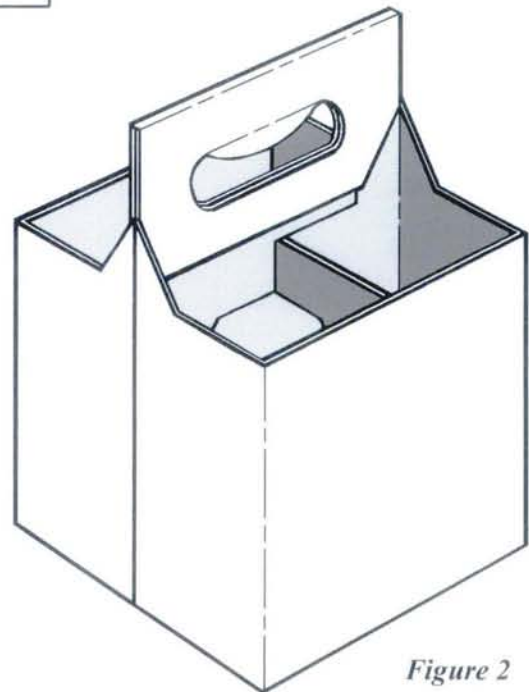


Figure 2



END LOAD TUBE
with
REINFORCED HANDLE

This carrier is delivered to the customer as a preglued tube. The customer erects, loads and glue seals the end panel sections. As shown here, it has a two ply handle. A third ply can be provided by adding another flap hinged off the free edge of the inner top panel section. (See Figure 1.)

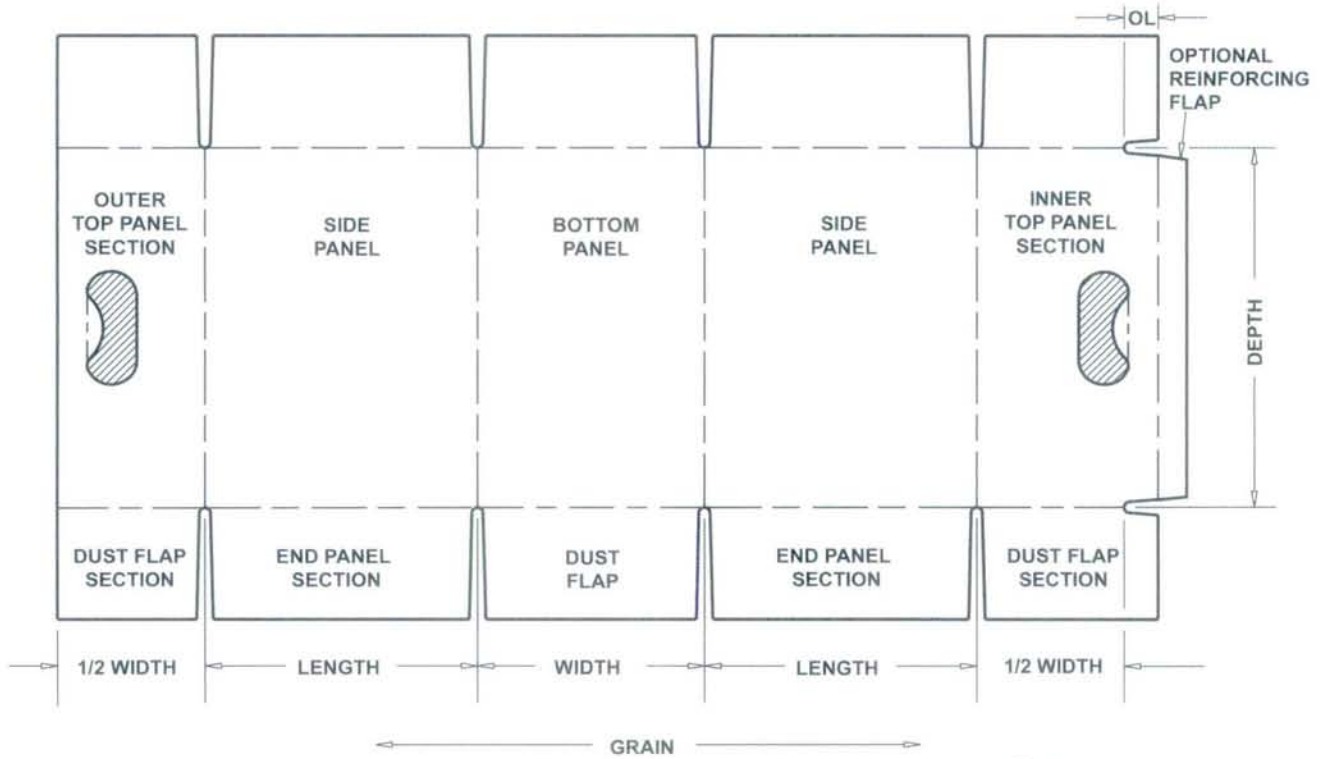


Figure 1

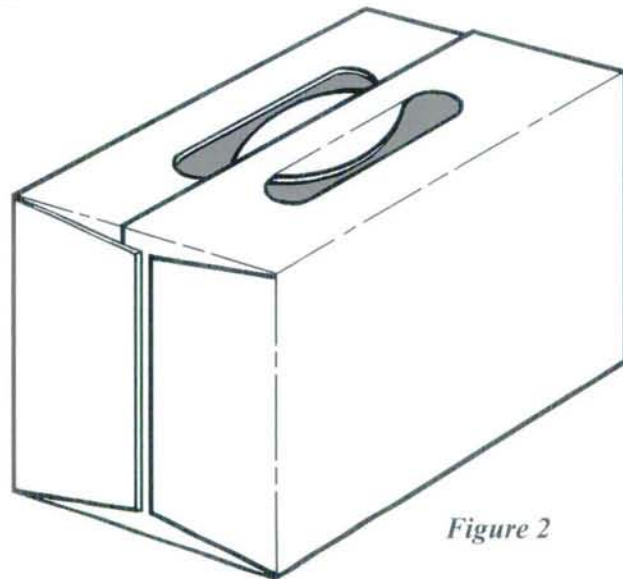


Figure 2



**SIDE LOADED
 GABLED TOP TUBE
 with INTEGRAL
 PARTITION TABS**

This carrier is delivered to the customer as a preglued tube. The customer erects, loads and glue seals the side panel sections. As shown here, it is a generic style; however, there may be some proprietary variations in the field.

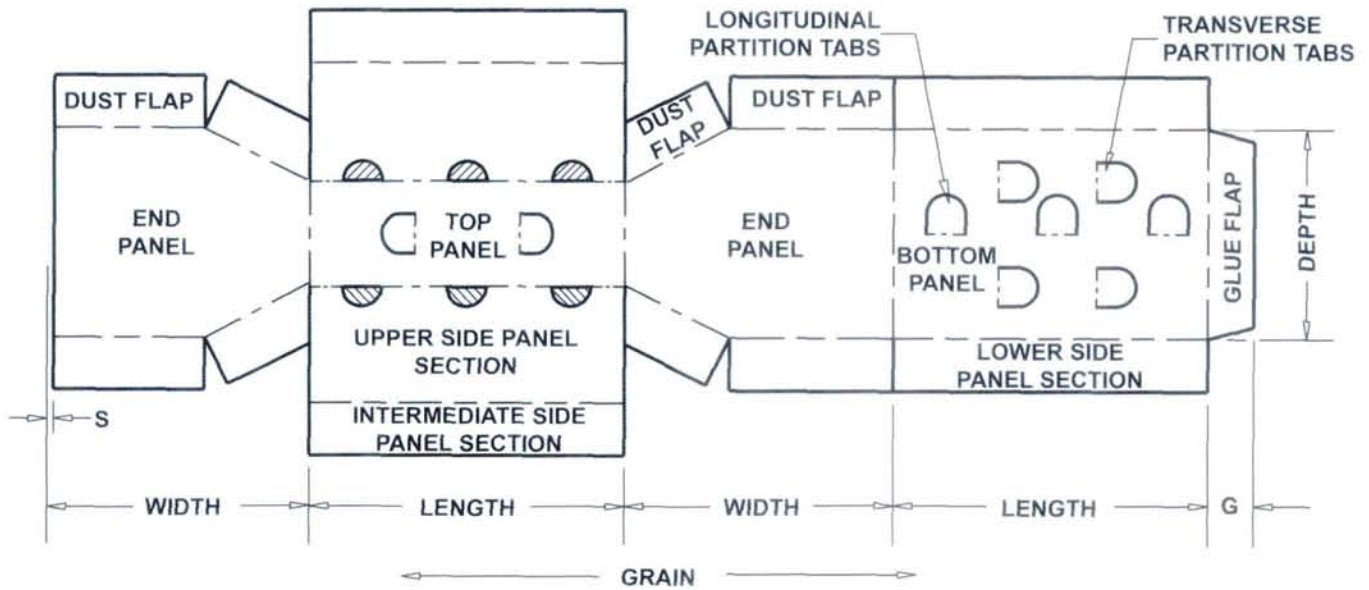


Figure 1

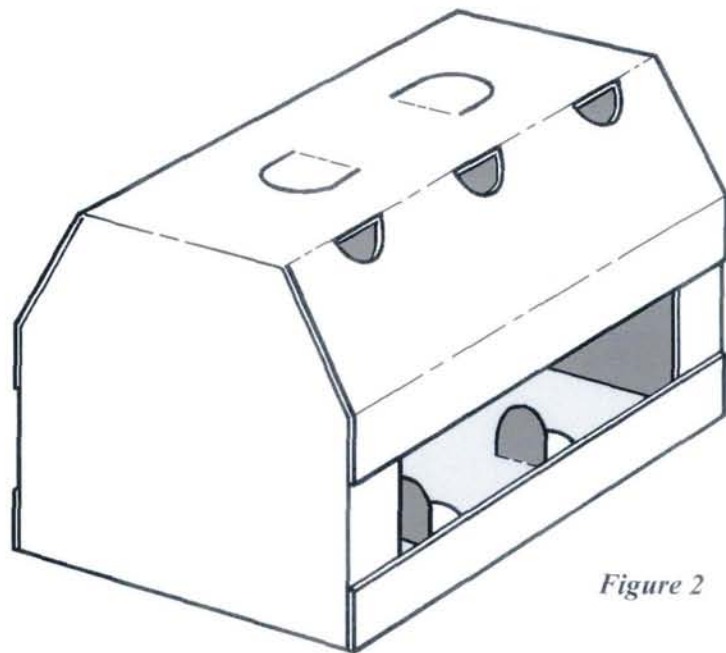


Figure 2



TOP LOAD
AUTO-ERECT BOTTOM
TWIN PACK with
INTEGRAL HANDLE

In its erected form, this may look more like a basket style, but it is fabricated as a glued tube with an auto-erect bottom. This style is primarily used for low volume applications or as a promotional piece.

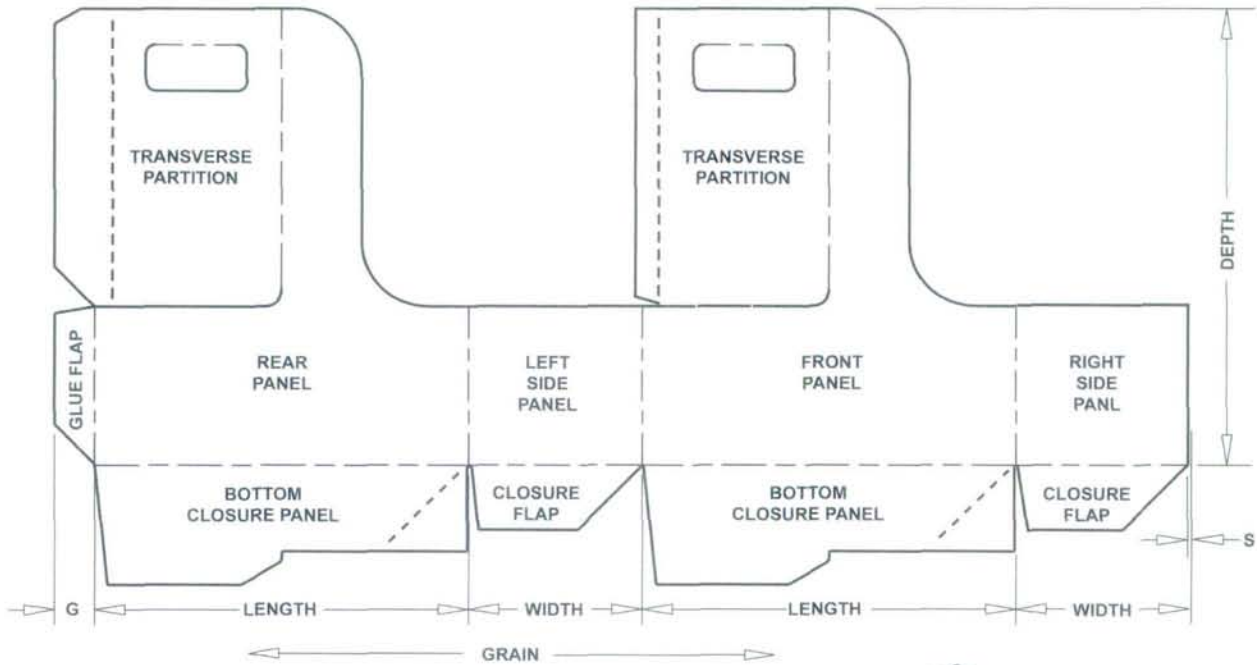


Figure 1

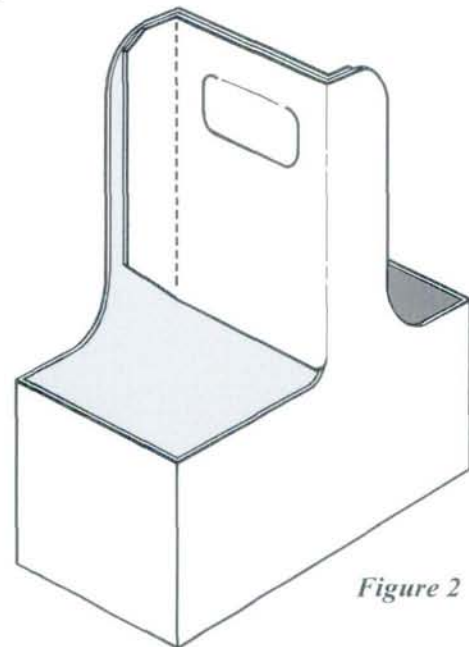


Figure 2



END LOADED TUBE
with RECESSED,
EXTERNAL TABS
a.k.a. "CAN BAND"

This once patented proprietary package is now public domain. It has been produced as an automatic erect and load multi-pack for two rows of cans (4, 6 or 8 count) and as a preglued tube for a single row of cans. While no longer a factor as a wrap, the preglued tube version is a valid structure as a hand erect or semi-automatic erect and load multi-pack for short run promotional items. Figure 3 shows the structure partially erected with the bottom tabs folded in ready to receive the can. The top tabs have not yet been folded in.

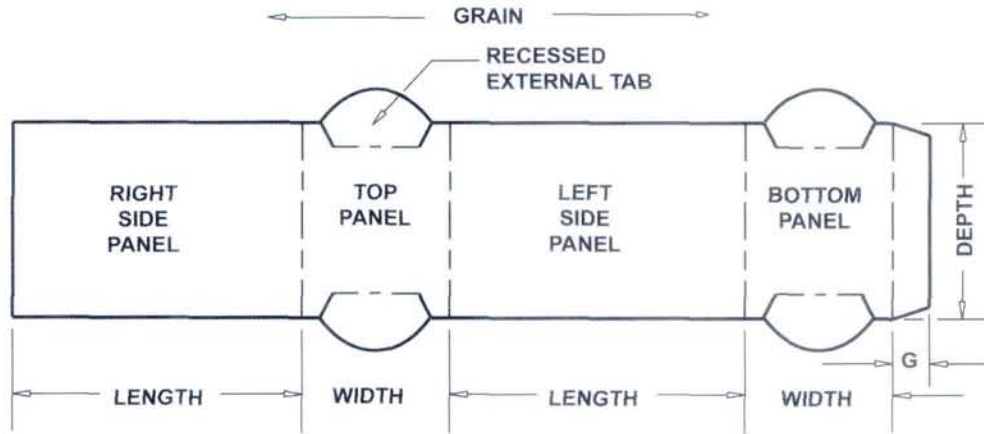


Figure 1

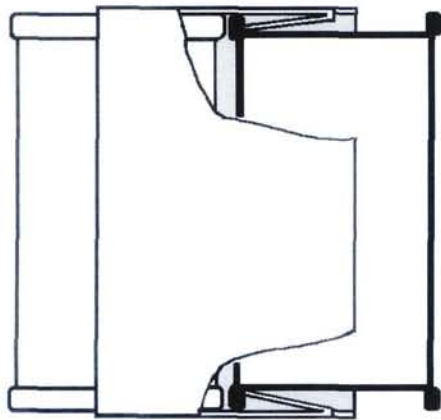


Figure 2:
Side Elevation: Cut-away view

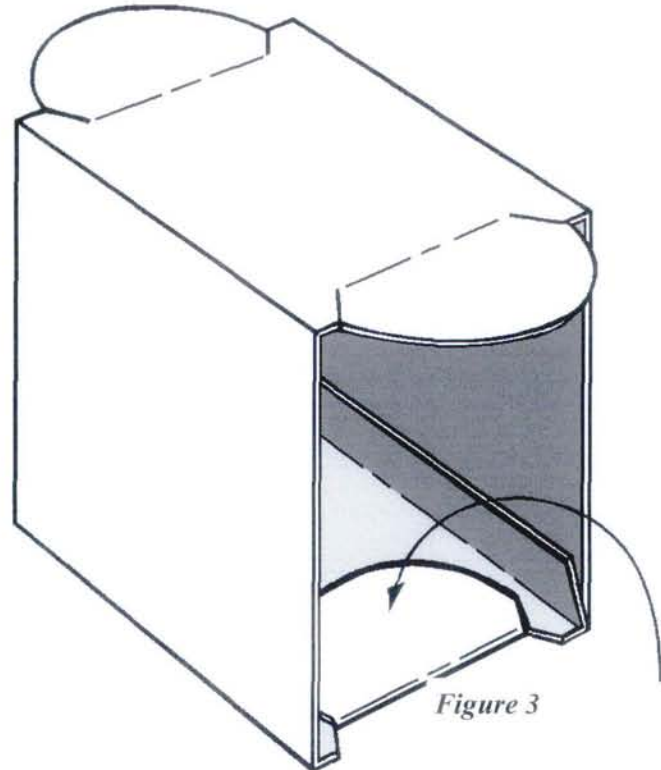


Figure 3



**CHIME LOCK CAP
 (RIGIDWALL)**

This chime lock cap is developed from the classic Rigidwall tray. (Refer to page 2.405.) It is only appropriate for cans with top chimes which extend beyond the basic body diameter of the can.

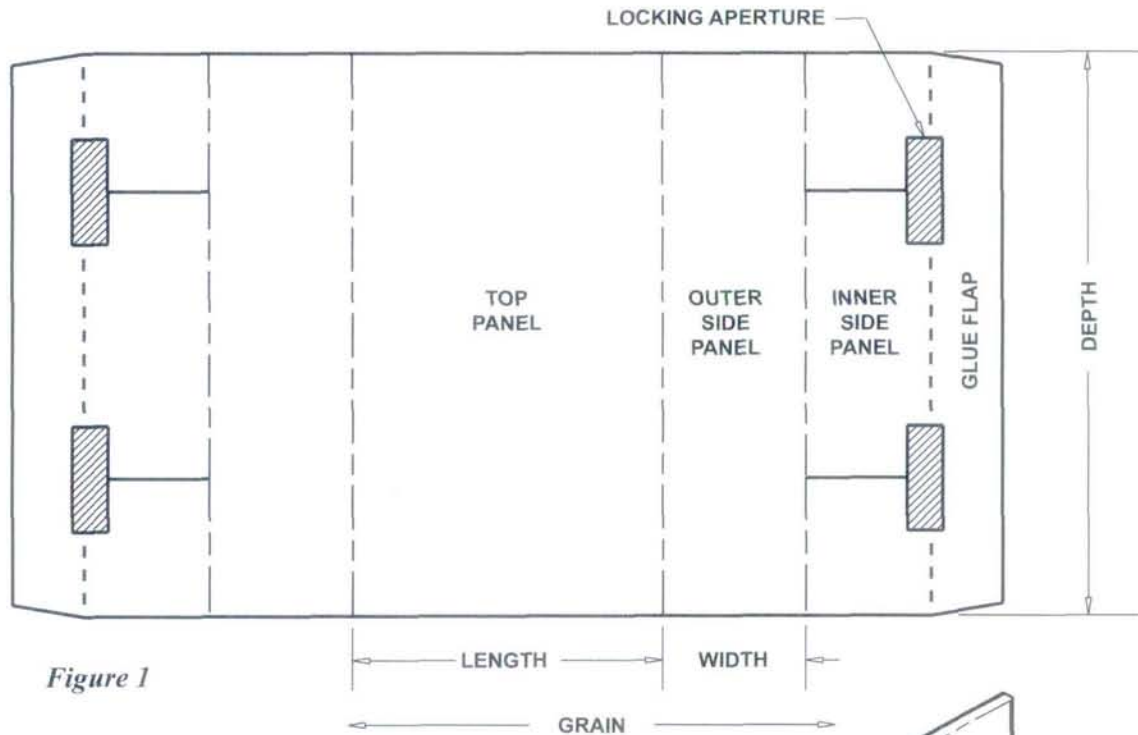
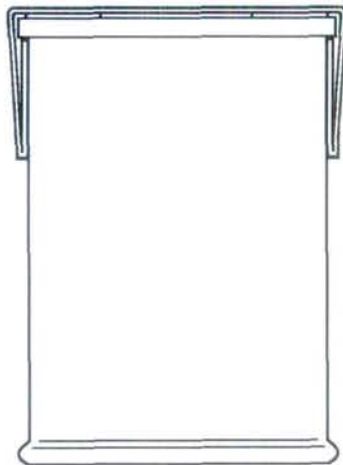
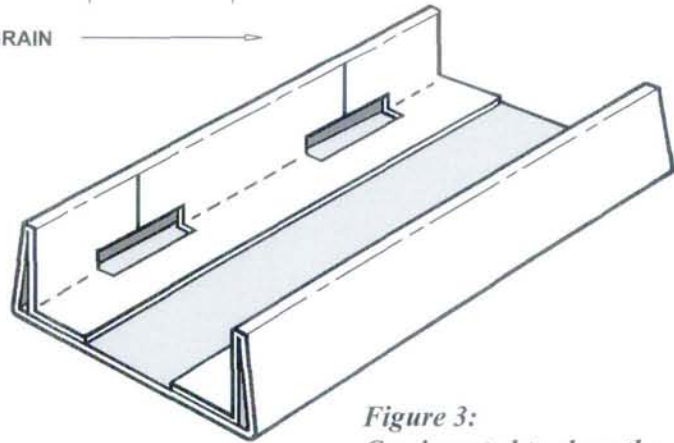


Figure 1



*Figure 2:
 End elevation showing the
 interlock between the can
 chime and the inner side
 panels.*



*Figure 3:
 Cap inverted to show the
 chime lock slots.*



GLUED SLEEVE
with INTEGRAL
TRANSVERSE
PARTITION and
CAP LOCKS

This style can be applied by hand or automatically. It is more likely to be used for promotional items or for products such as condiments, as opposed to high volume beer or soft drink bottles.

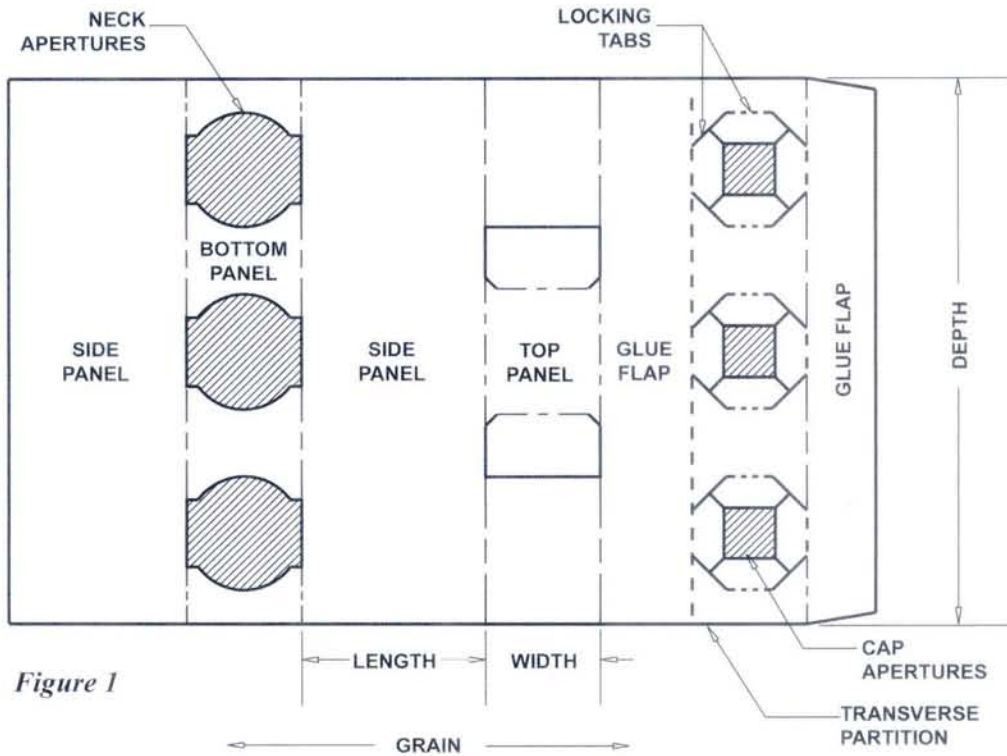


Figure 1

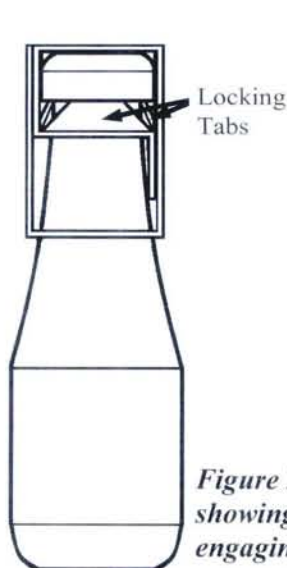


Figure 2: End elevation showing locking tabs engaging bottle cap.

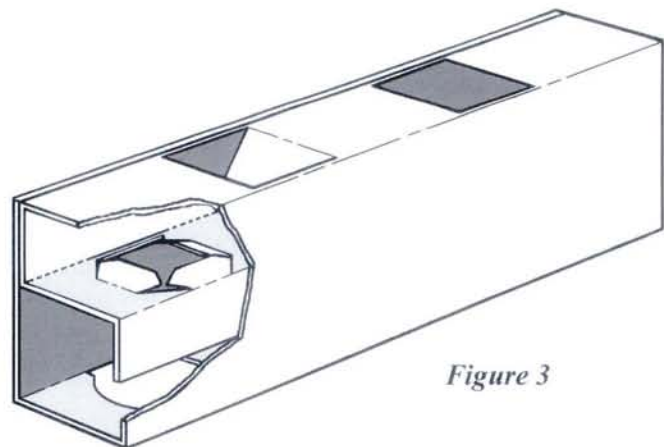


Figure 3



**TRAPEZOIDAL
GLUED SLEEVE**

This preglued "stick" type multi-pack is typically hand loaded. It is primarily a promotional package or a start-up package, used until volume builds to a point that automated packaging equipment can be justified.

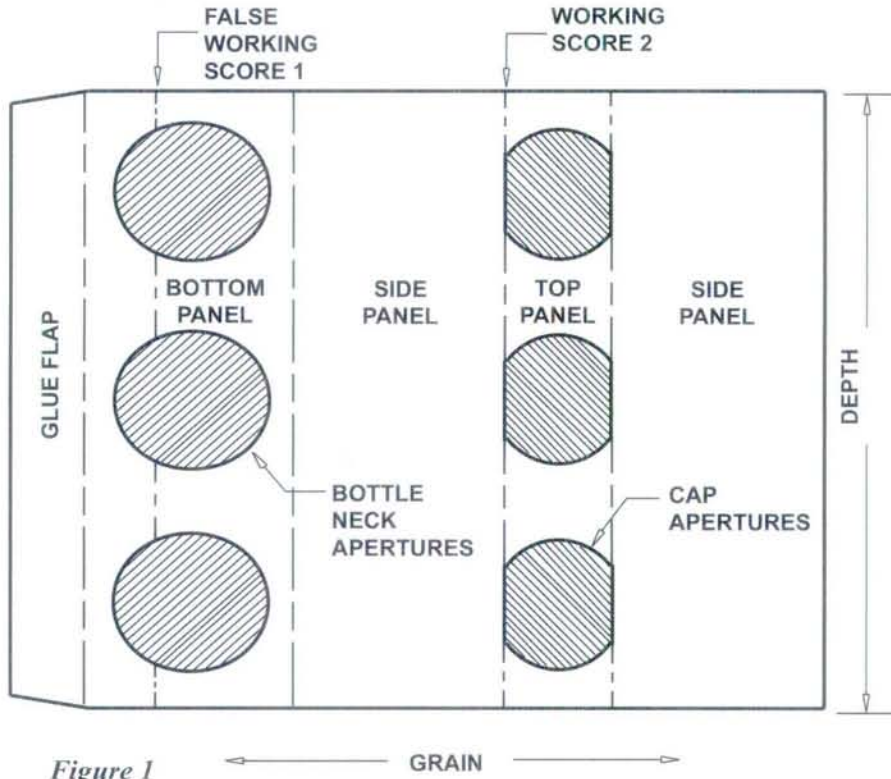


Figure 1

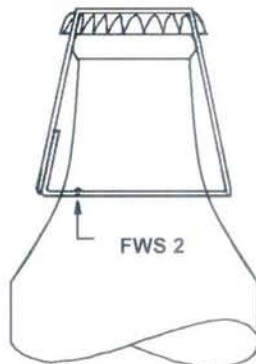


Figure 2

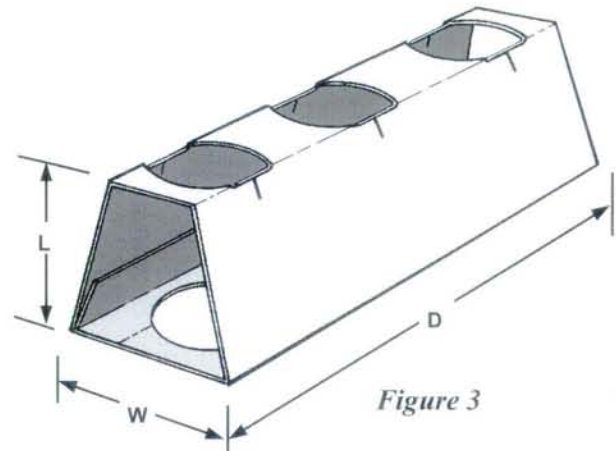


Figure 3



4.000

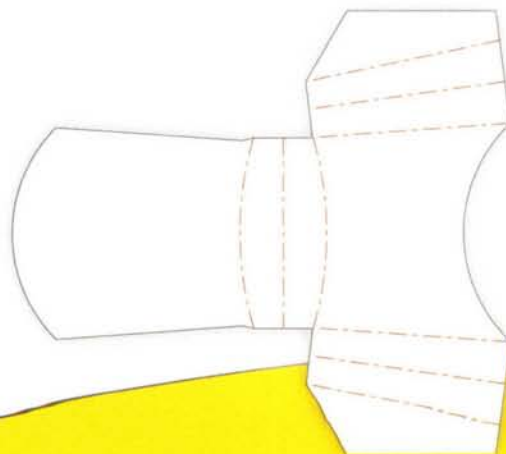
PAPERBOARD PACKAGING:
SPECIALTY PKG.

4.000

OVERVIEW : SPECIALTY PACKAGING

- 4.100 *Folders and Envelopes*
- 4.200 *Counter Display Shippers and Dispensers*
- 4.300 *Tapered Trays, Scoops and Clam Shells*
- 4.400 *Shadow Boxes*
- 4.500 *Unique Machine Formed Structures*

**IDEAS AND
INNOVATION**
SECOND EDITION



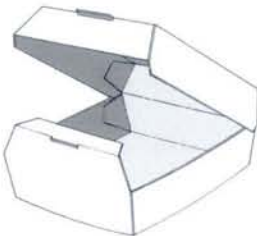
The Specialty Packaging Section consolidates a variety of items which do not fit conveniently or logically into the Tube, Tray, or Multiple Packaging classifications. More specifically, Specialty Packaging includes structures that fit into one of the groupings listed below.



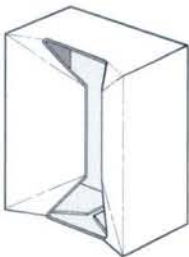
4.100 FOLDERS and ENVELOPES



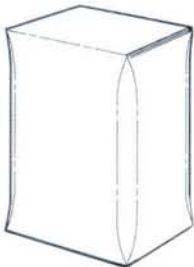
4.200 COUNTER DISPLAY SHIPPERS and DISPENSERS



4.300 TAPERED TRAYS, SCOOPS and CLAM SHELLS



4.400 SHADOW BOXES



4.500 UNIQUE MACHINE FORMED STRUCTURES



**DOUBLE
ANCHOR LOCK
NO DEPTH FOLDER**

This is typically a hand loaded and closed carton. It may be used as illustrated below or with a film window added to the bottom panel.

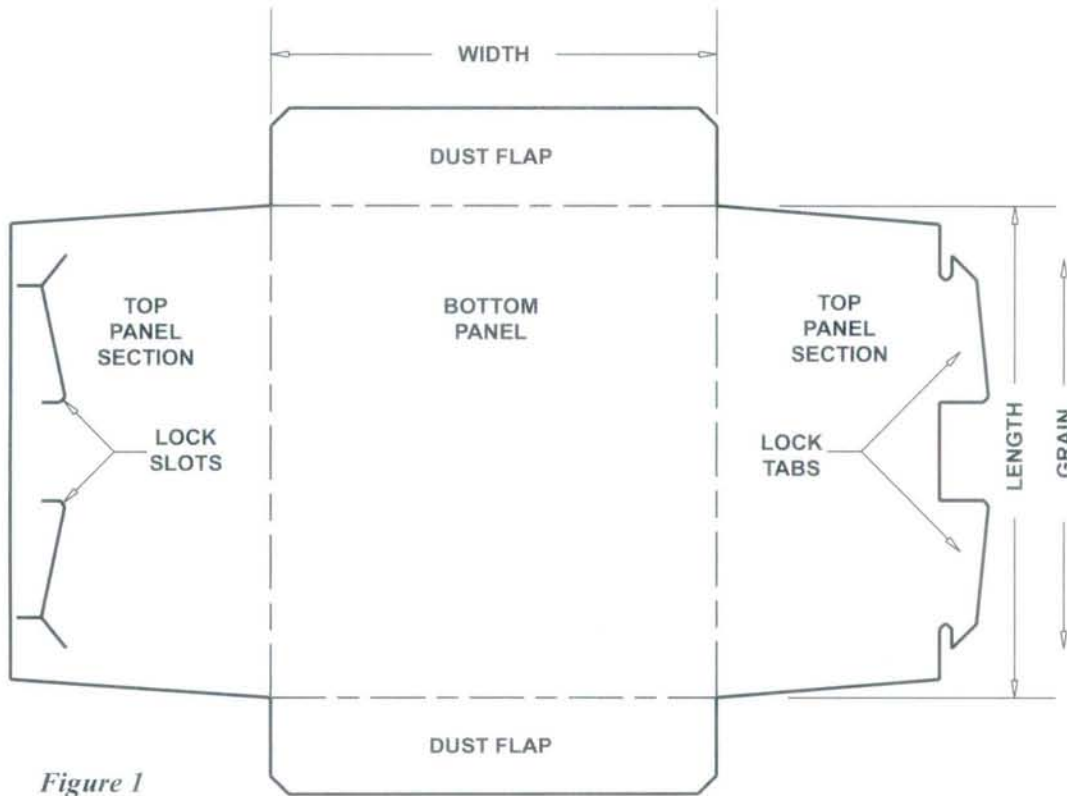


Figure 1

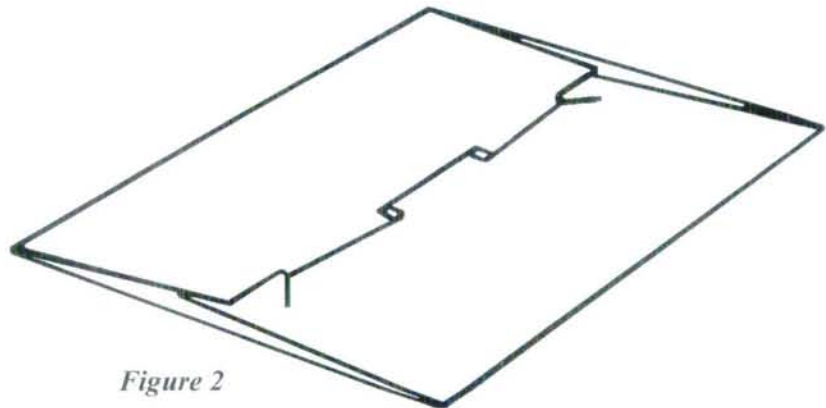


Figure 2



**DOUBLE
ANCHOR LOCK
SHALLOW DEPTH
FOLDER**

The locking detail here is the same as page 4.101; however, this folder provides some product depth.

This is typically a hand erected, loaded and closed style but it may also be automated.

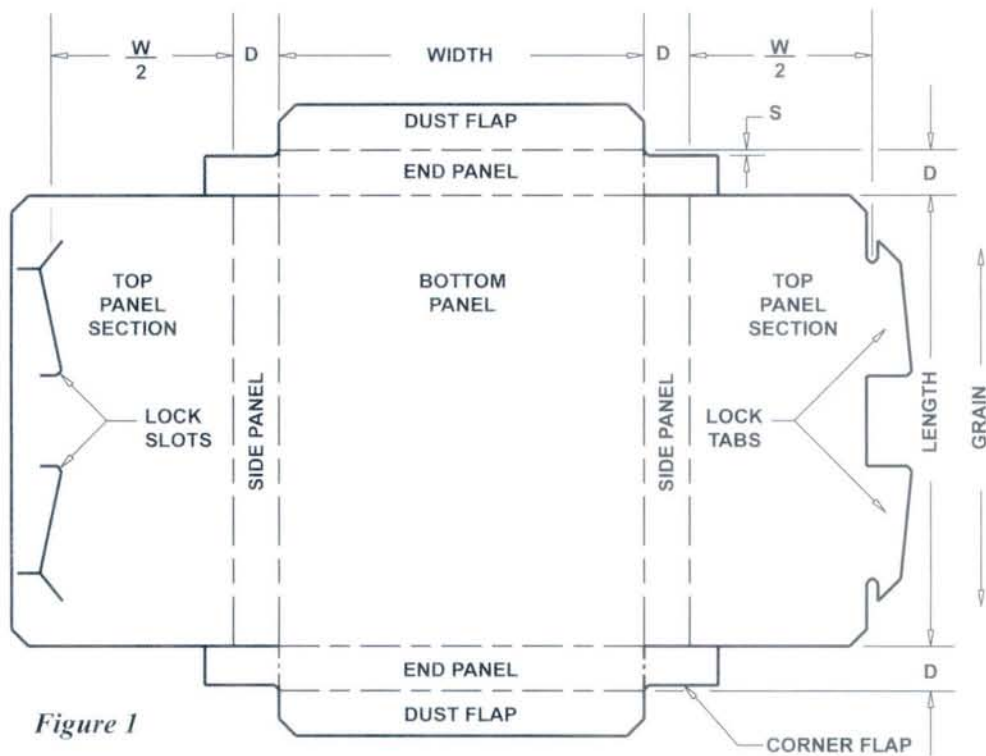


Figure 1

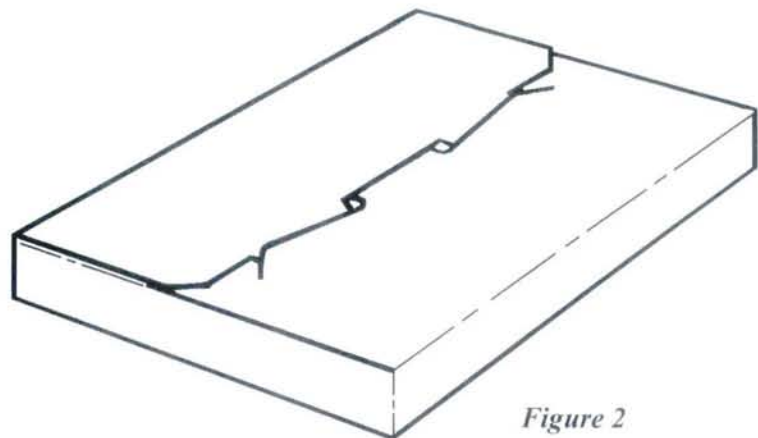


Figure 2



**LOCKED SLEEVE with
INTEGRAL HEADER
and HANGER FLAP**

This is a hand assembled folder primarily associated with the packaging and display of textiles (socks, towels, neckties, etc.). It offers superior merchandising potential compared with the typical all-plastic hanger unit. It is equally effective with faceted scores (Figure 1), curved scores (Figure 2), or conventional parallel straight scores (Figure 3).

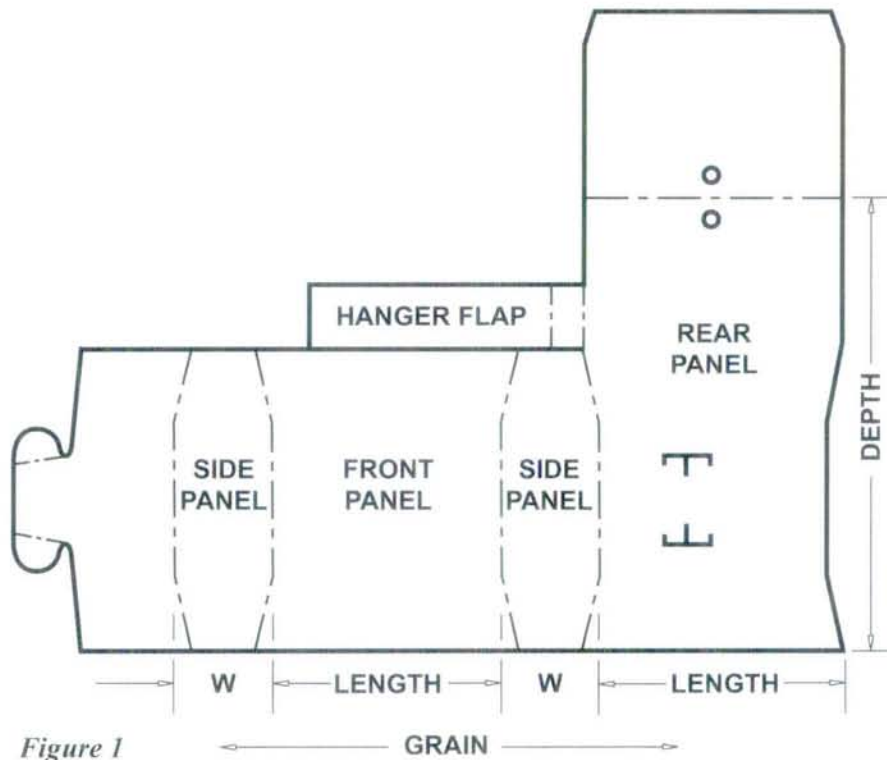


Figure 1

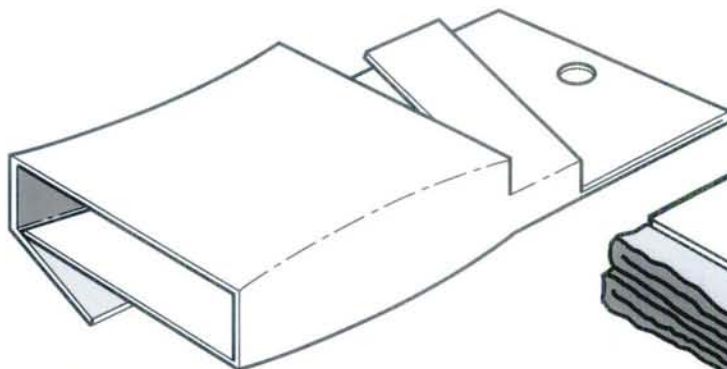


Figure 2

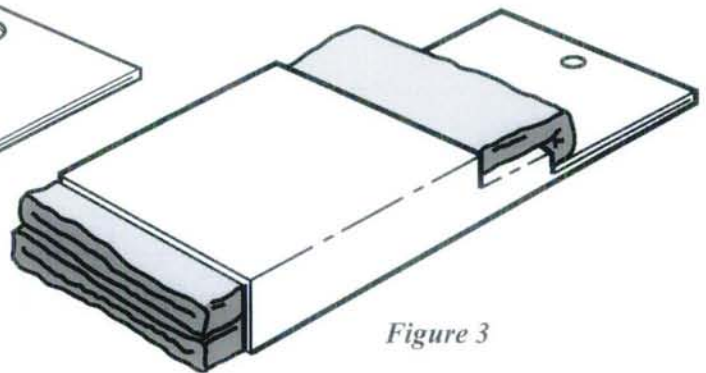


Figure 3



PILLOW-PAK (PACK)
(a.k.a.)
P.D.Q. FOLDER or
ARCUATE FOLDER

This style has found broad use as a mailing envelope and as a retail box for shallow products (gloves, ties, etc.).

The most common form, as seen in Figures 1 and 3, has curved score end closure panels. Figure 2 shows a straight score alternative and an alternative manufacturer's joint location.

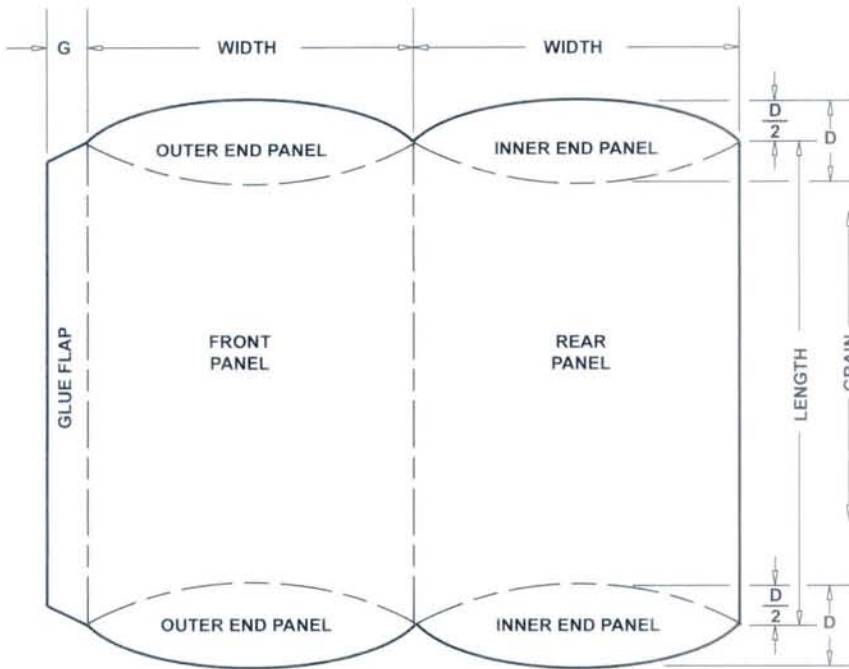


Figure 1

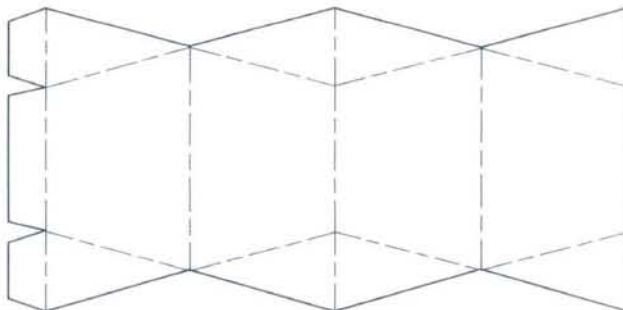


Figure 2

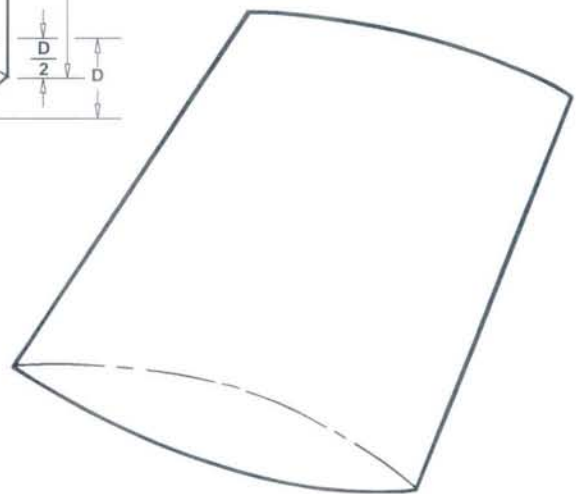


Figure 3



**PILLOW-PAK (PACK)
with ANCHOR LOCK
CLOSURE or
GLUED COVER PANEL**

The locking version as seen in the Pillow-Pak Figures 1 and 2 is primarily used as a retail carton. It is typically shipped flat to the retail outlet to be set up, loaded and locked on demand by a sales associate.

The alternative shown in Figures 3 and 4 would be filled and sealed on the customer's packaging line. Refer to page 4.104 for a preglued version of the Pillow-Pak.

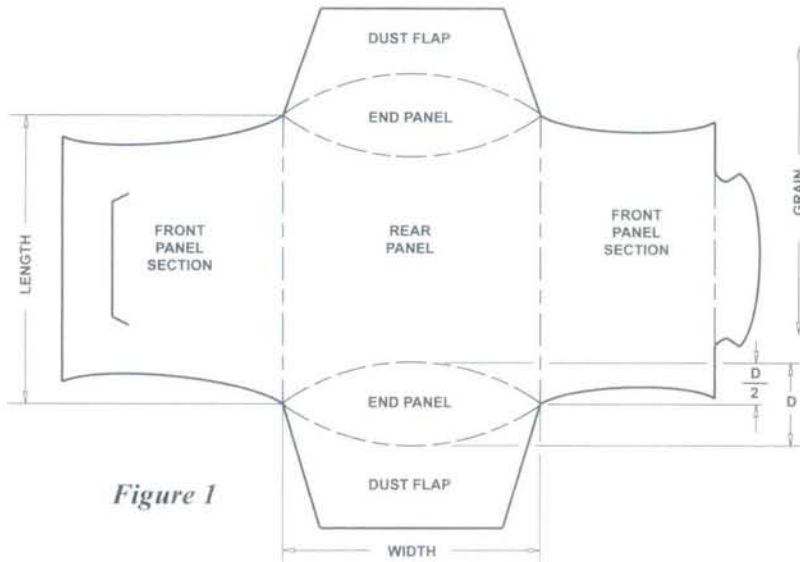


Figure 1

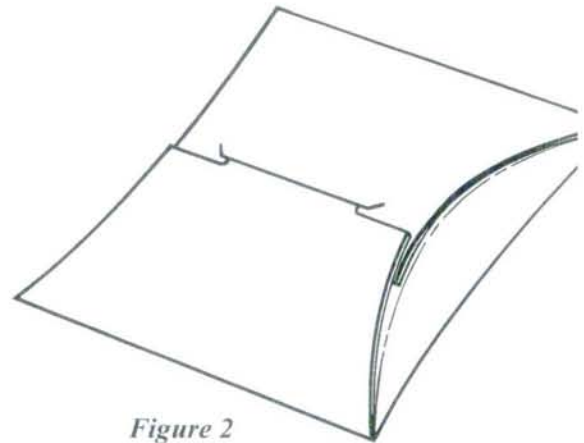


Figure 2

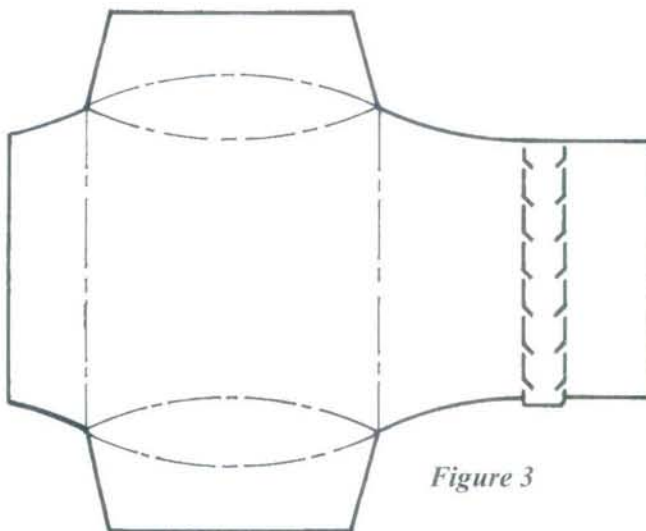


Figure 3

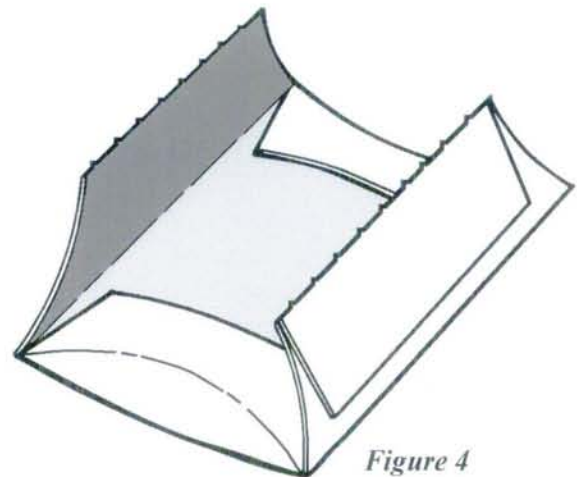


Figure 4



**NO DEPTH
HOSIERY FOLDER**

This folder style may be used for other products, but it is generally associated with the hosiery trade.

It is typically hand loaded and machine closed, and will frequently be seen with a film window in the front (display) panel.

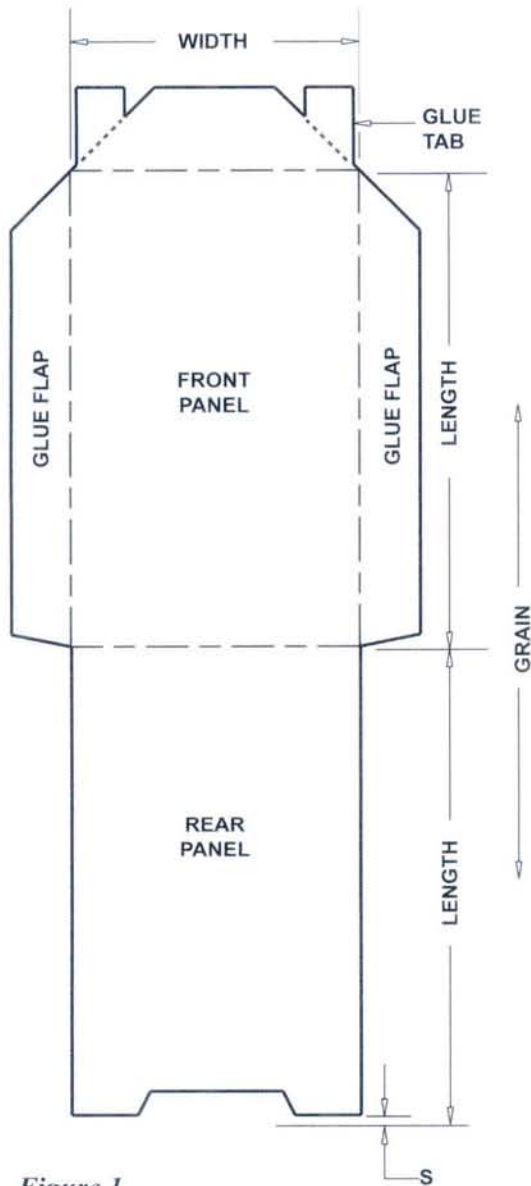


Figure 1

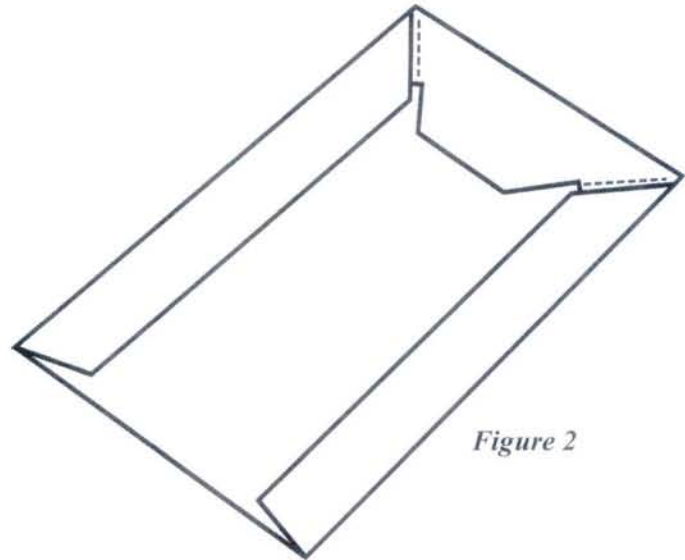


Figure 2

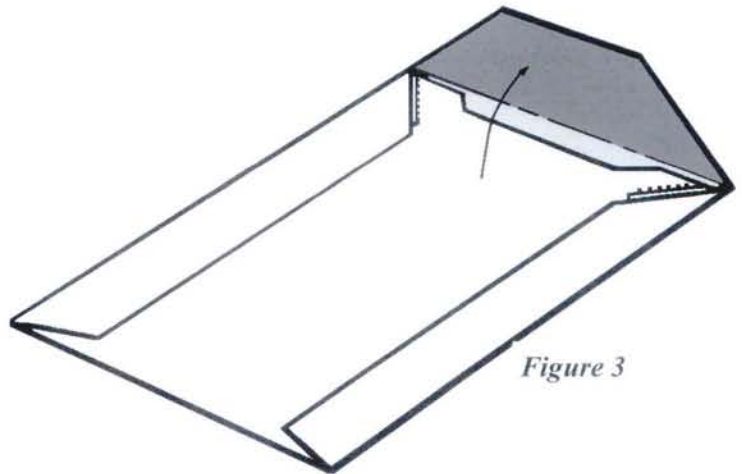


Figure 3



**GLUED
NO DEPTH
ENVELOPE**

This is a glued alternative to the anchor lock no-depth folder identified on page 4.101.

The design is the same as many commercial envelopes, except that it is fabricated from paperboard, not paper.

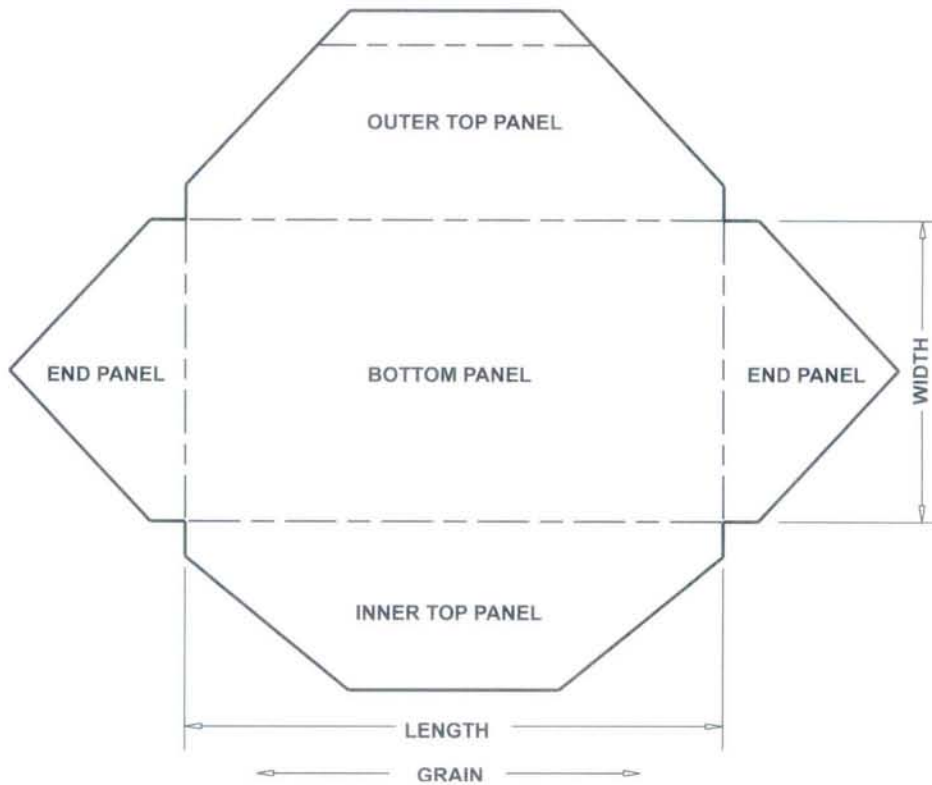


Figure 1

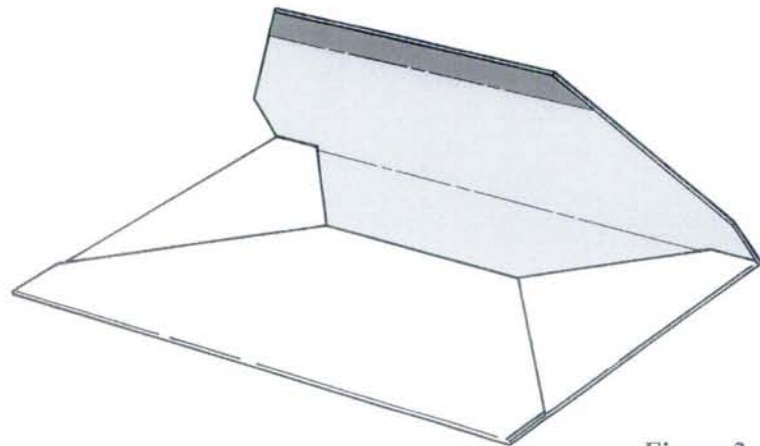


Figure 2



**HOOK LOCK and
 WALKER LOCK
 COMBINATION
 COUNTER DISPLAY
 PACKER**

Two variations of the hook lock are shown. Other variations are possible. A guset (bellows) flap may be substituted for the front corner flap illustrated below.

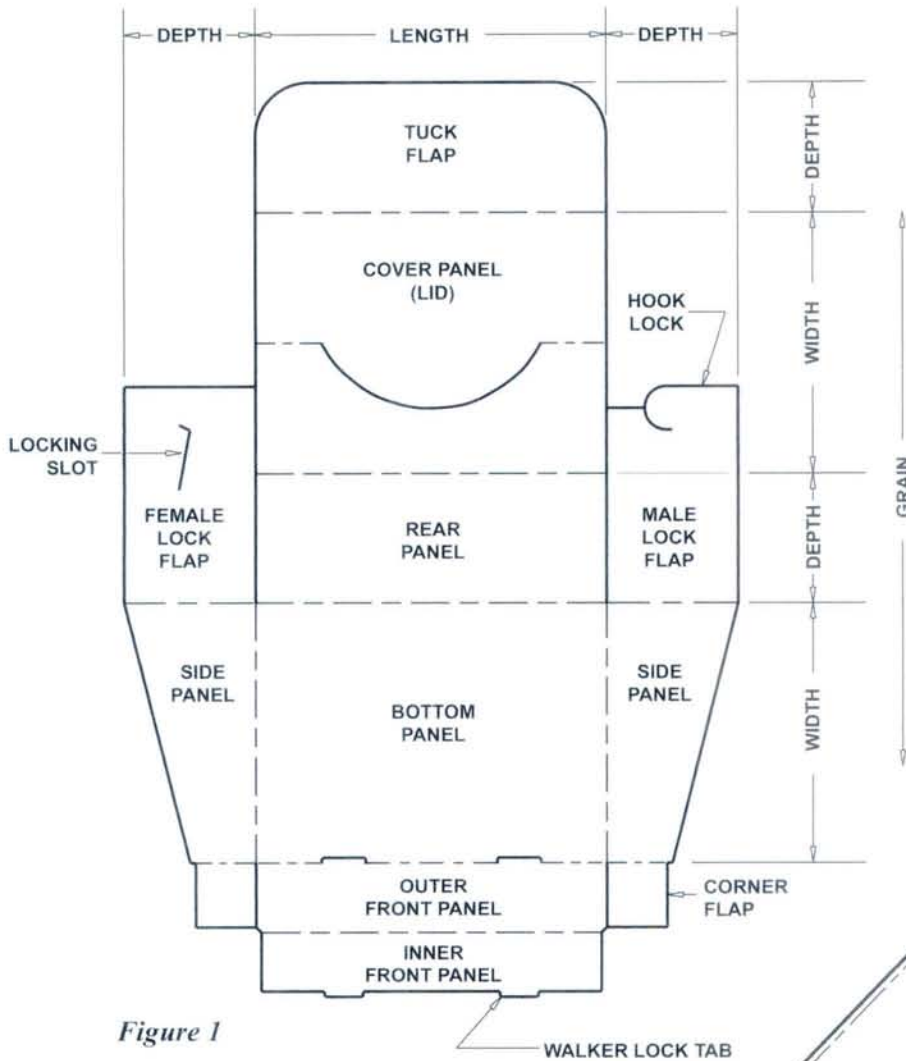


Figure 1

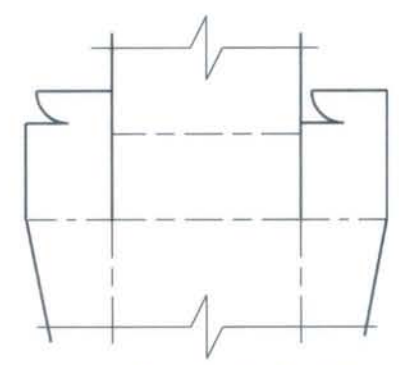


Figure 2: Rear Lock Variation

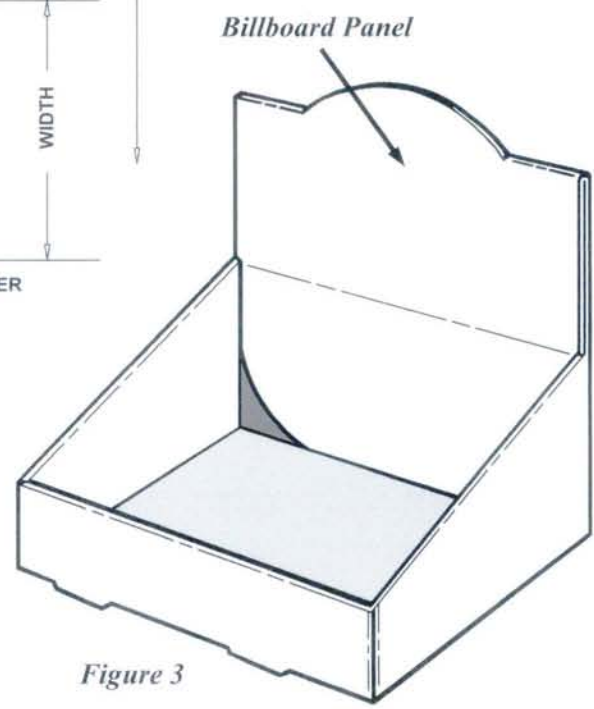


Figure 3



**DOUBLE SIDE and
FRONT WALL
PINCH LOCK BOTTOM
COUNTER DISPLAY
PACKER**

This is a hand set-up style. The clean, finished appearance is the result of using double wall front and side panels.

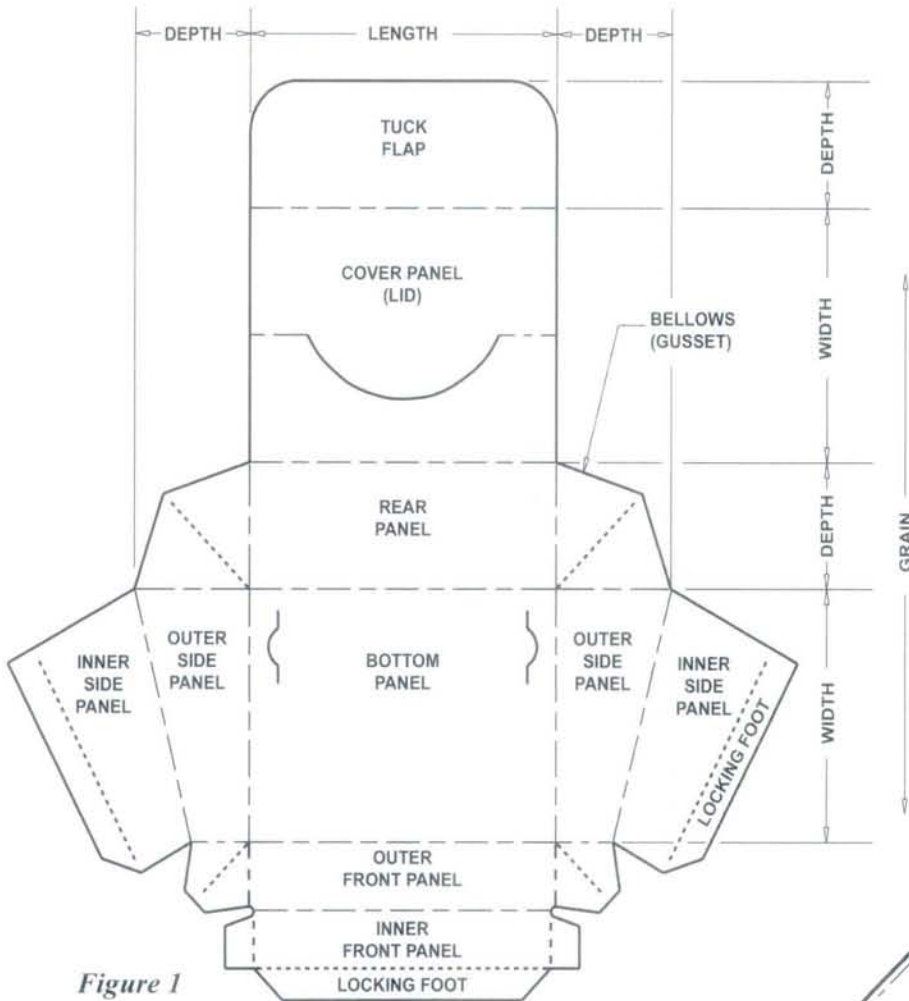


Figure 1

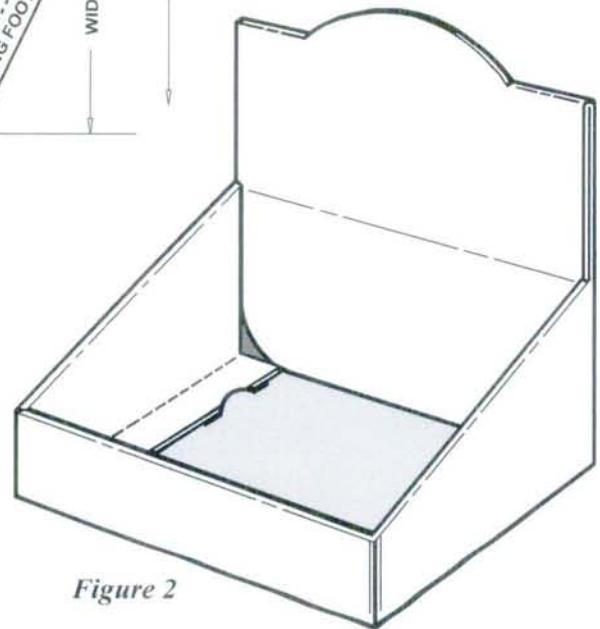
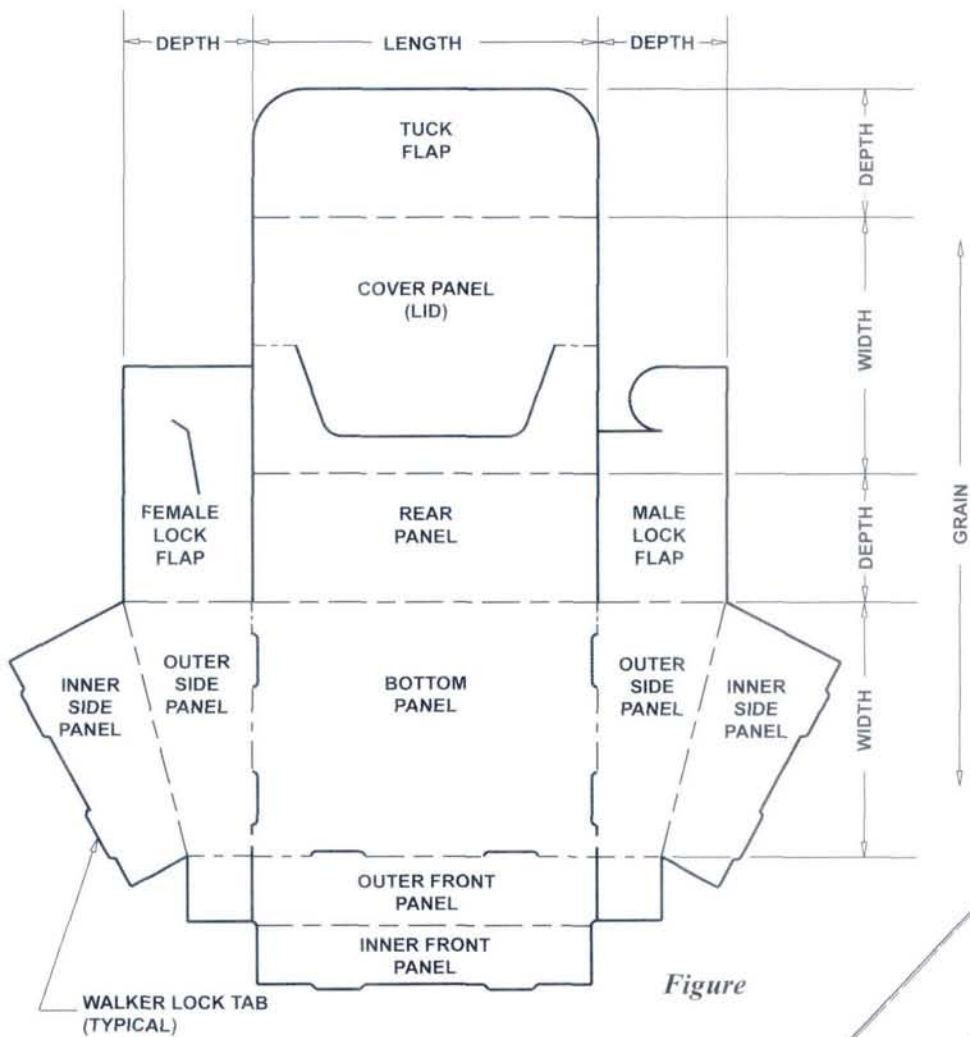


Figure 2



**DOUBLE SIDE and
 FRONT WALL
 WALKER LOCK -
 HOOK LOCK
 COMBINATION**

This is a finished edge version of the style illustrated on page 4.201. Here, Walker locks are used to secure the inner side panels as well as the inner front panel. The rear panel hook lock is the same for both styles.



Figure

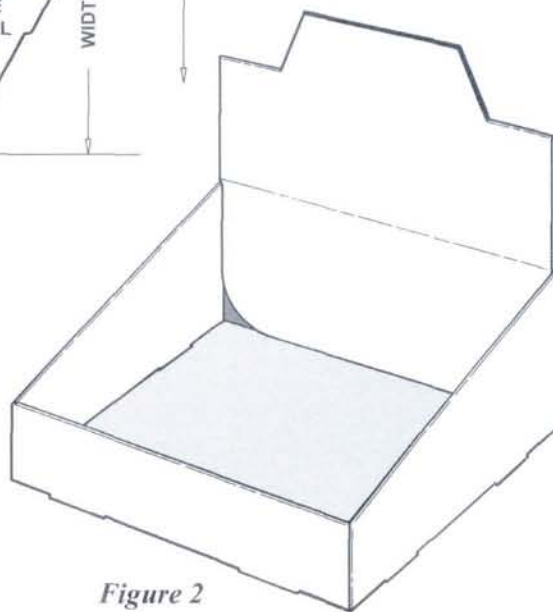


Figure 2



**TWO PIECE
 COMBINATION:
 INNER TRAY and
 OUTER CONVERTIBLE
 SLEEVE**

In this two piece display/shipper, the outer unit serves two purposes. First, it is the protective shipping sleeve. Second, it is a tilt back easel.

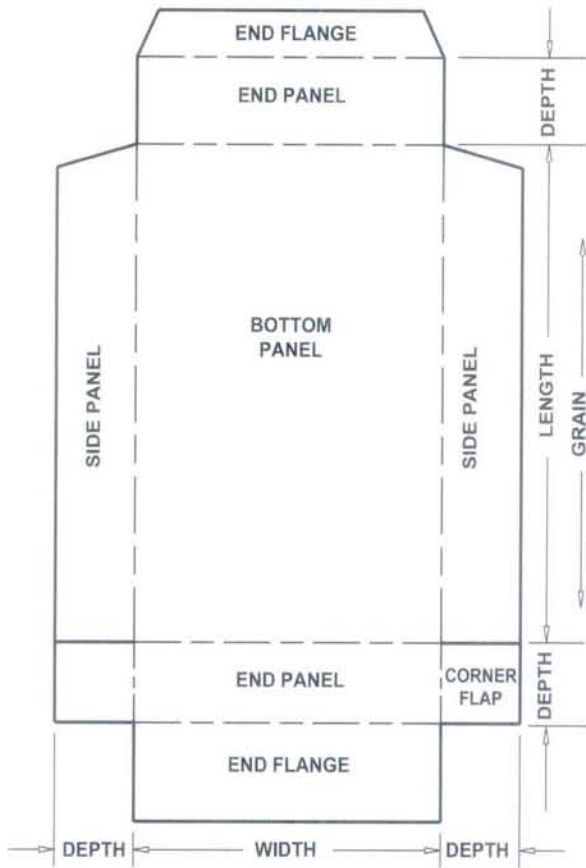


Figure 1

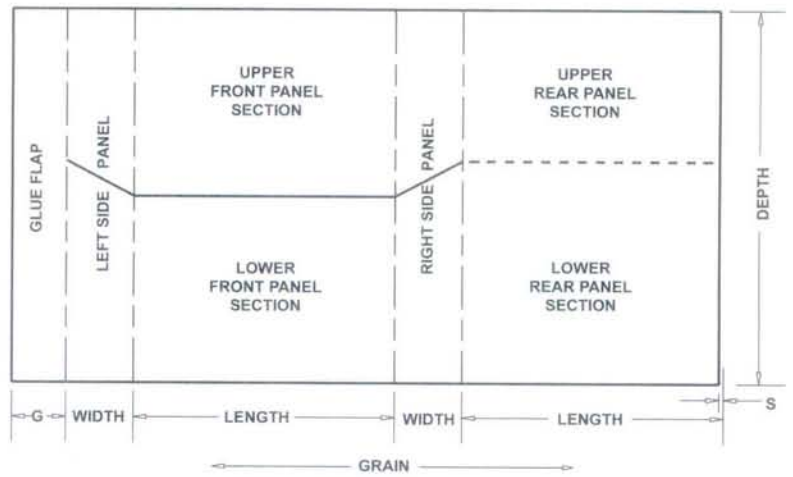


Figure 2

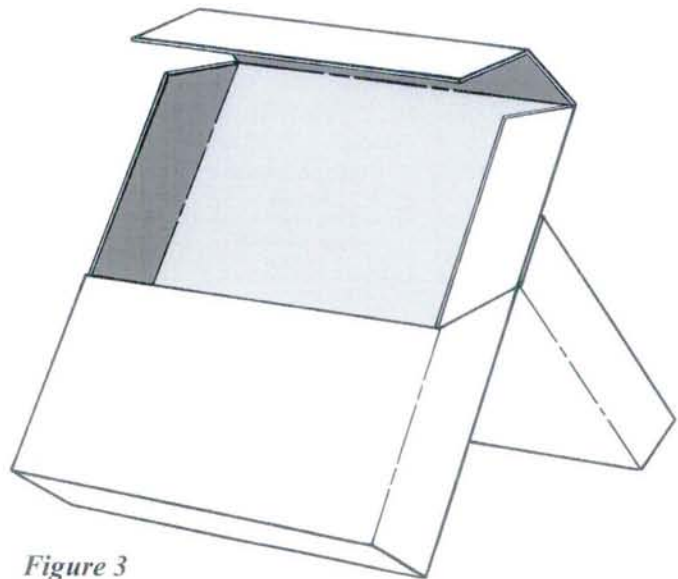


Figure 3



**DOUBLE WALL
JONES LOCK
SLANT FRONT TRAY**

This is a very basic, coverless display/packer utilizing simple friction to keep the inner side and front panels locked in place

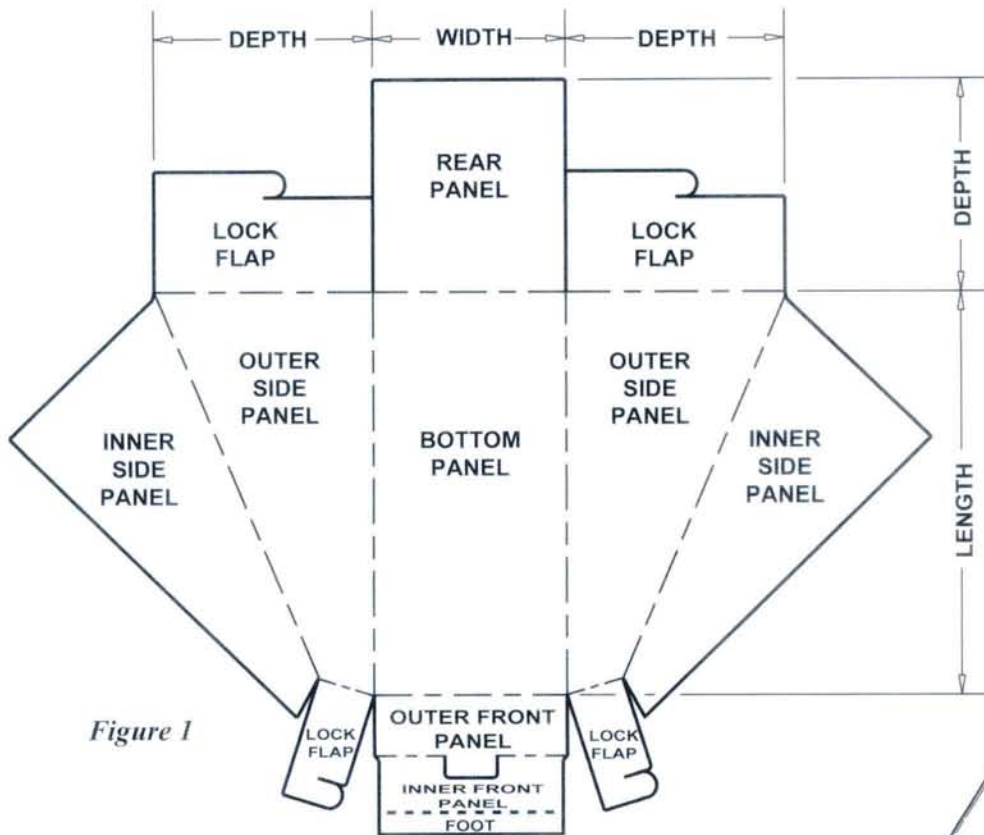


Figure 1

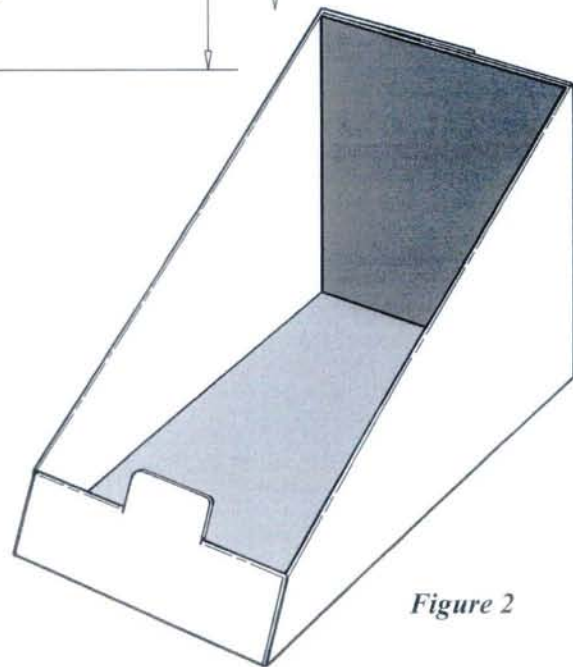


Figure 2



**BIN DISPENSER with
JONES LOCK BOTTOM
and
BEVELED TUCK TOP**

This hand assembled shipper/dispenser is typically placed at the retail checkout counter or near the cash register to stimulate impulse sales.

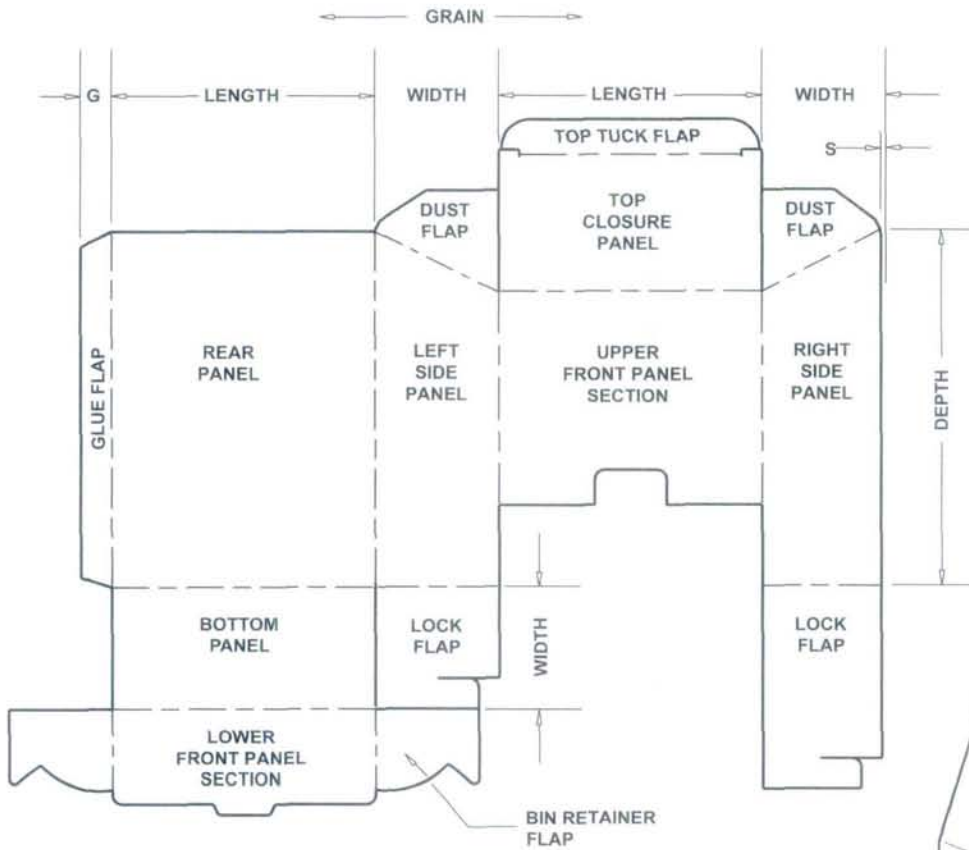


Figure 1

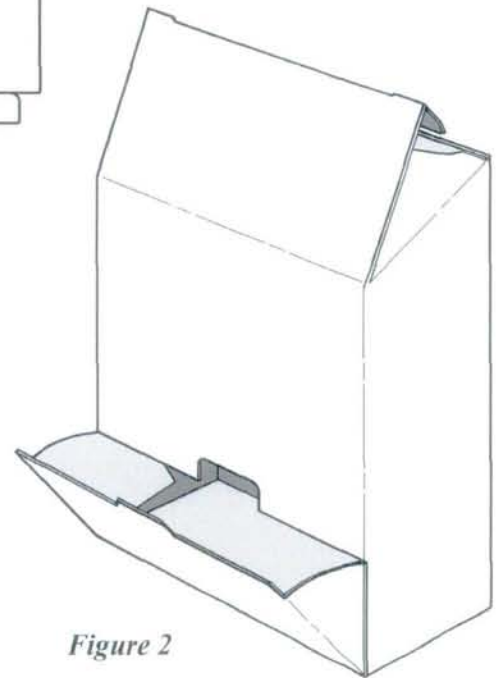


Figure 2



**MODIFIED TUCK TOP/
 1-2-3 BOTTOM
 TUBE STYLE PACKER**

This is an easy to assemble, hand-erected display packer. It is illustrated here with a 1-2-3 (Houghland) bottom, however a Himes (crash-lock) or full flap auto-bottom (page 1.504) are equally applicable.

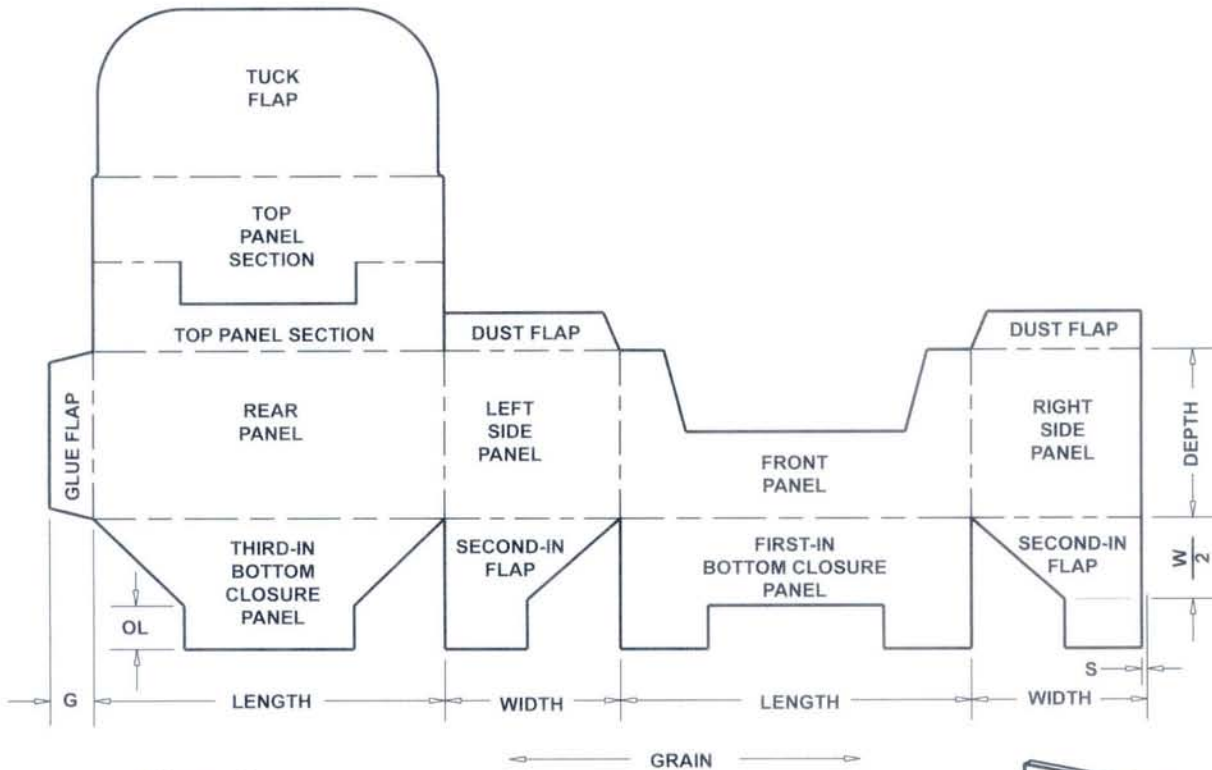


Figure 1

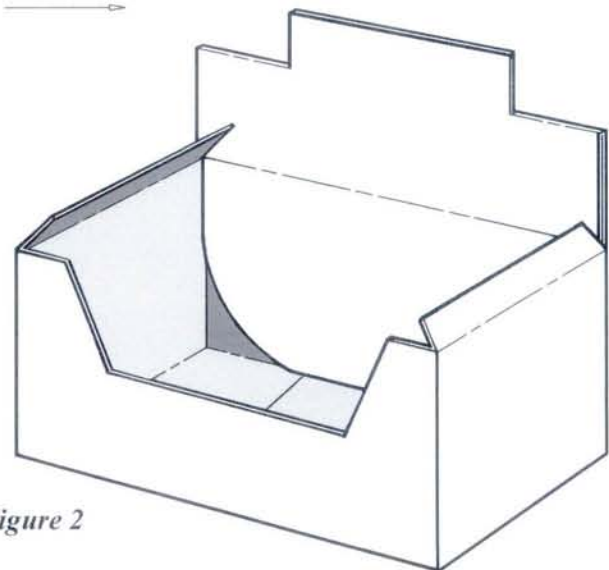


Figure 2



**MODIFIED TUCK TOP
HIMES (crash lock)
AUTO-BOTTOM
TUBE STYLE PACKER**

This is an easy to assemble, hand-erected display packer. It is shown here with a Himes (crash lock) auto-bottom, however, a 1-2-3 (Houghland) bottom or a full flap auto-bottom (page 1.504) are equally applicable.

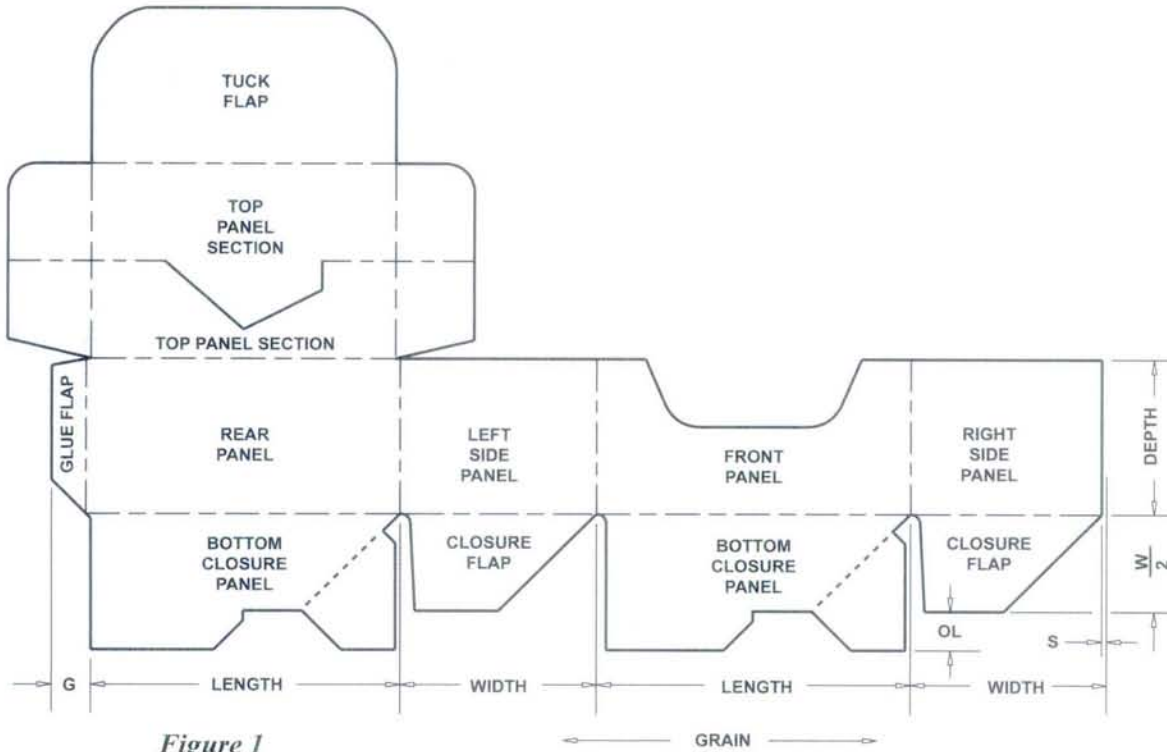


Figure 1

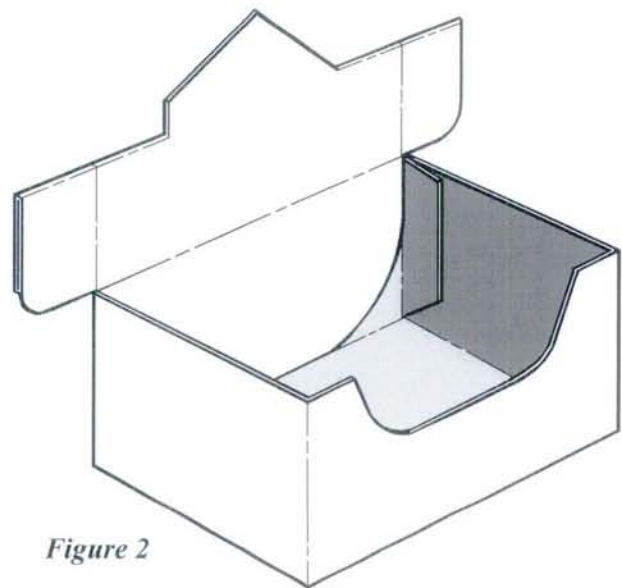


Figure 2



**FOUR CORNER
BRIGHTWOOD TRAY
with HINGED COVER
and TUCK**

This is one of the most fundamental counter display concepts. It is similar to the hinged cover Brightwood tray shown on page 2.203, except it substitutes a cover with integral pop-up features and a front tuck for the glued corner lid.

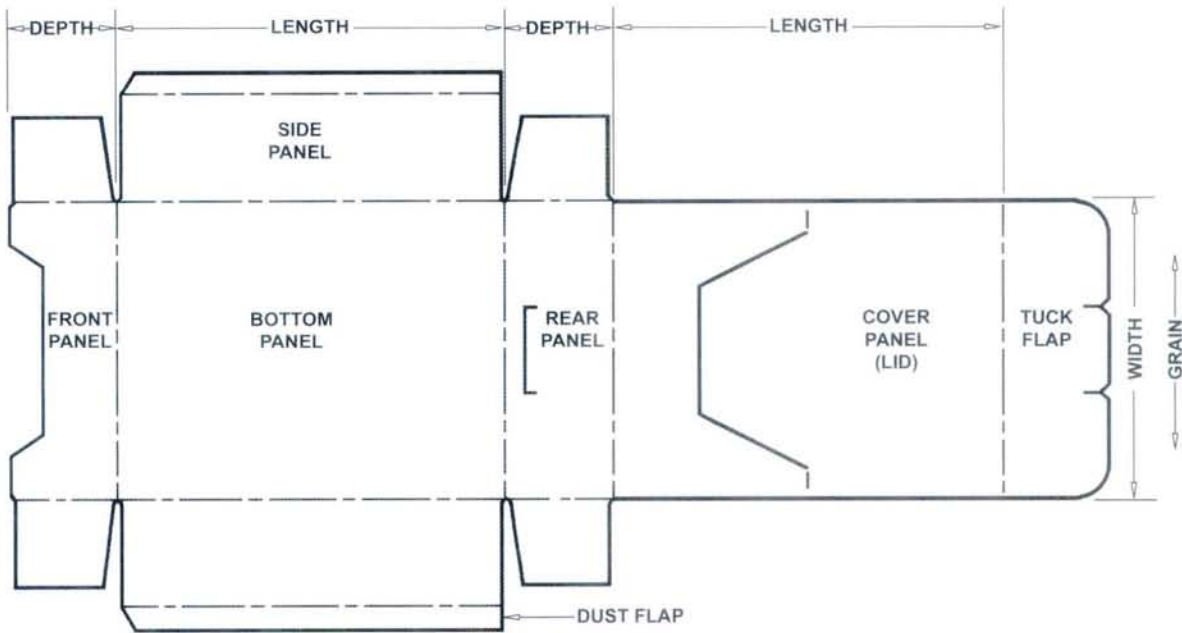


Figure 1

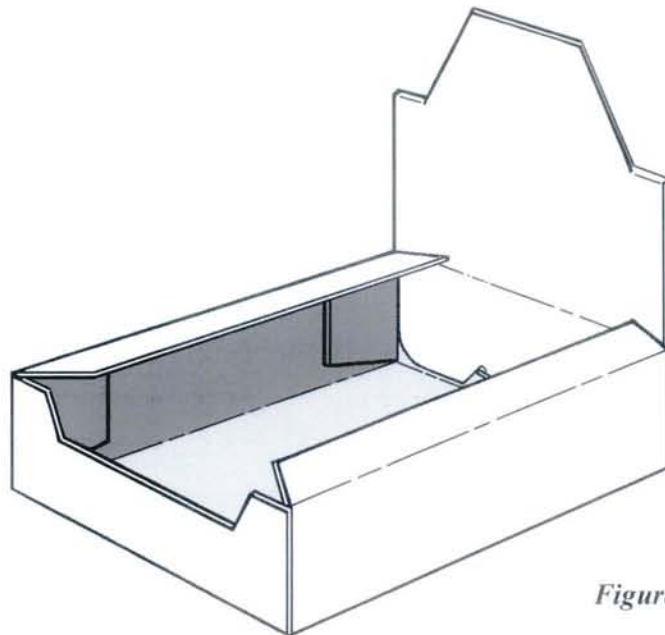


Figure 2



**GLUED CORNER
SINGLE SIDE and
ENDWALL TRAY**

With a simple coating and heat sealed or resin adhesive secured corners, this style is applicable for many conventional products. With a high temperature resistant lamination and a thermosetting adhesive, it becomes an ovenable tray.

Note: The depth of a tapered tray can only be given in erected carton form. Refer to Figure 2.

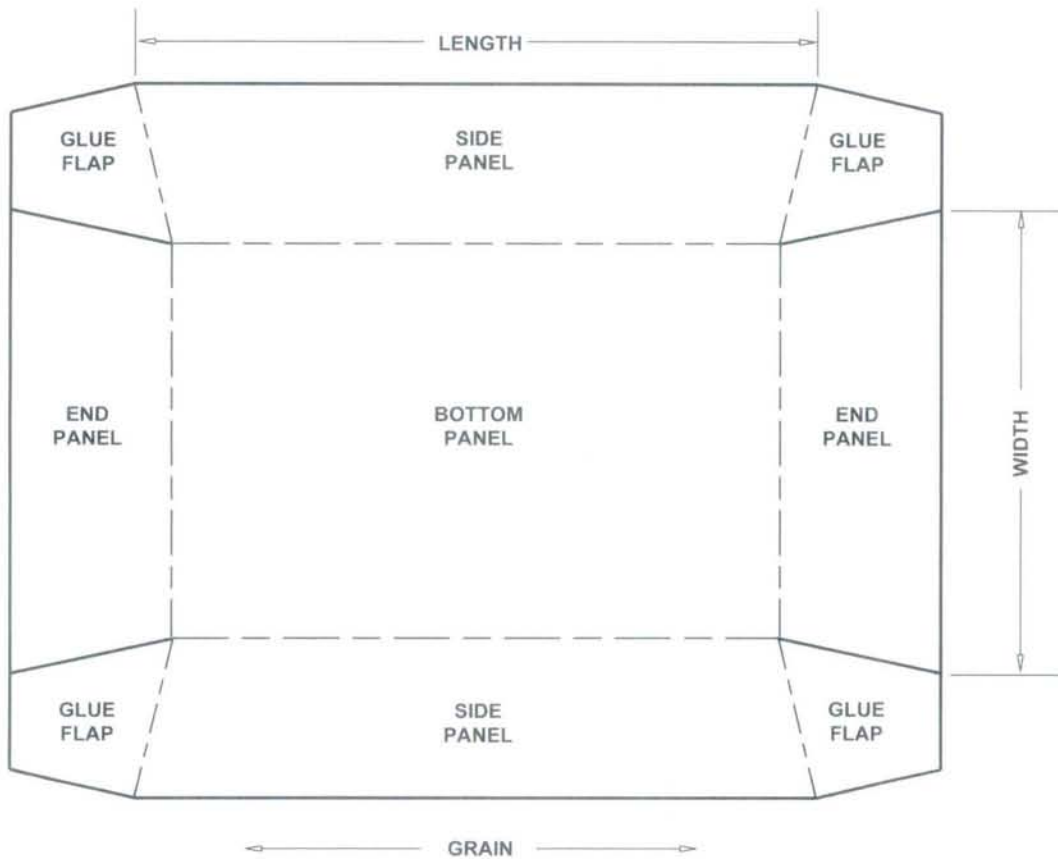


Figure 1

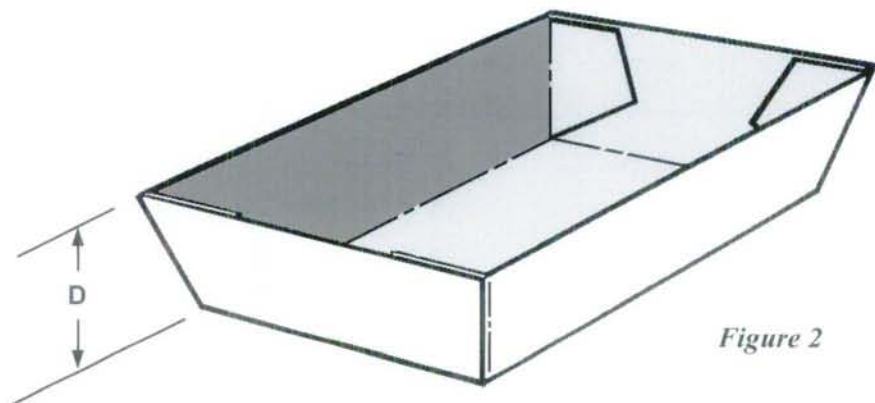


Figure 2



**GLUED or
 HEAT SEALED
 TAPERED TRAY
 with FLANGES**

The style as illustrated is typically closed with a sealed film or paperboard cover (membrane). A variation of this style has a lid extension off one side panel which can be heat sealed to the existing flanges off the end panels and the opposed side panel. With the proper combination of materials and machine forming and closing techniques, this can become an ovenable tray. There are proprietary packaging systems on the market using a variation of this structure. Note: The depth of a tapered tray can only be given in erected carton form. Refer to Figure 2.

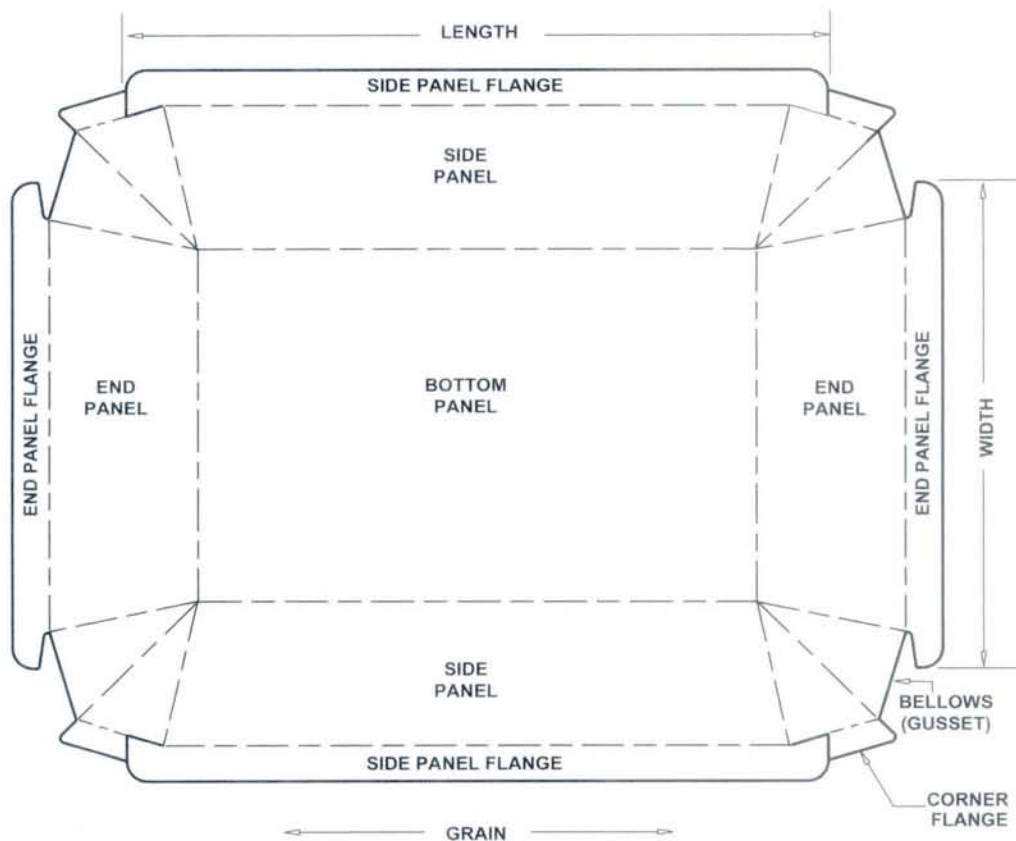


Figure 1

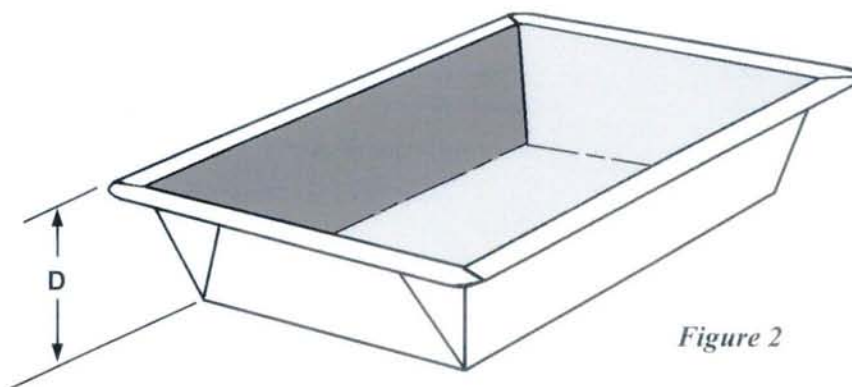


Figure 2



**HEAT SEALED CORNER
SINGLE SIDE and
ENDWALL TRAY
(a.k.a.) BOAT**

The gusset sections adjacent to the end walls are cut away to permit the opposite gusset sections to heat seal directly to the inside surface of the end wall. There are proprietary packaging systems on the market using a variation of this structure.

Note: The depth of a tapered tray can only be given in erected carton form. Refer to Figure 2.

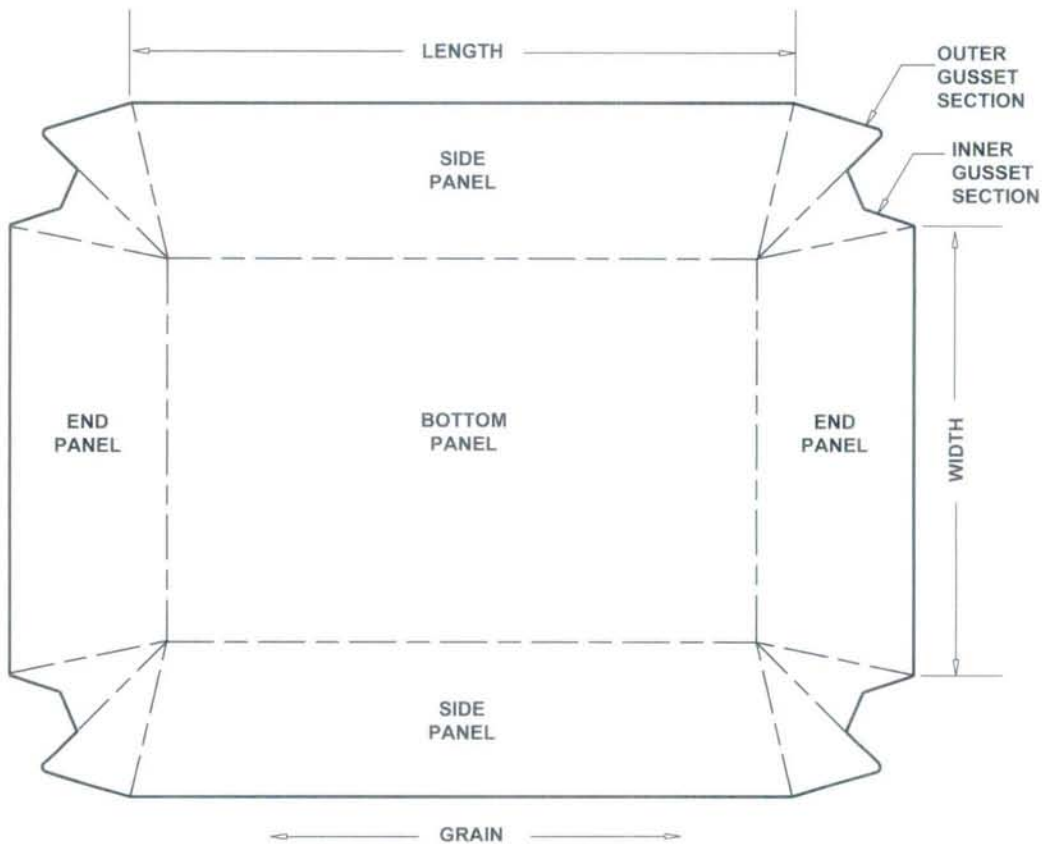


Figure 1

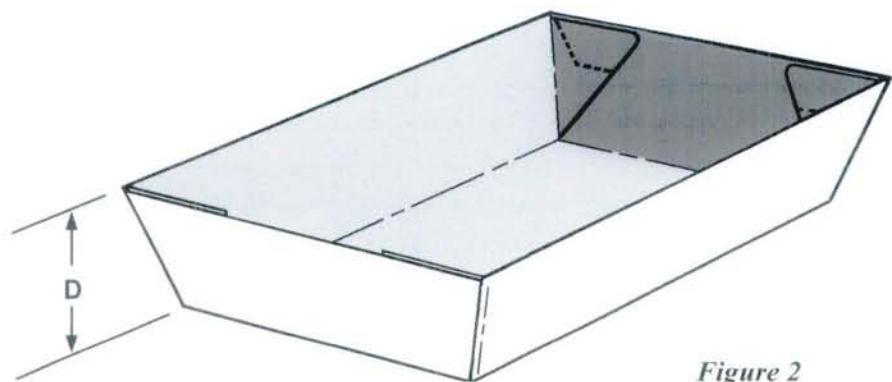


Figure 2



**TAPERED and NESTED
ARCUATE BOTTOM
GLUED SCOOP**

This item is used almost exclusively by the fast food industry. The scoop is formed, glued and nested for delivery to the individual franchise. Generally the forming/nesting operation is performed by the customer, but in some instances it may be done by the converter who then ships nested scoops to the customer.

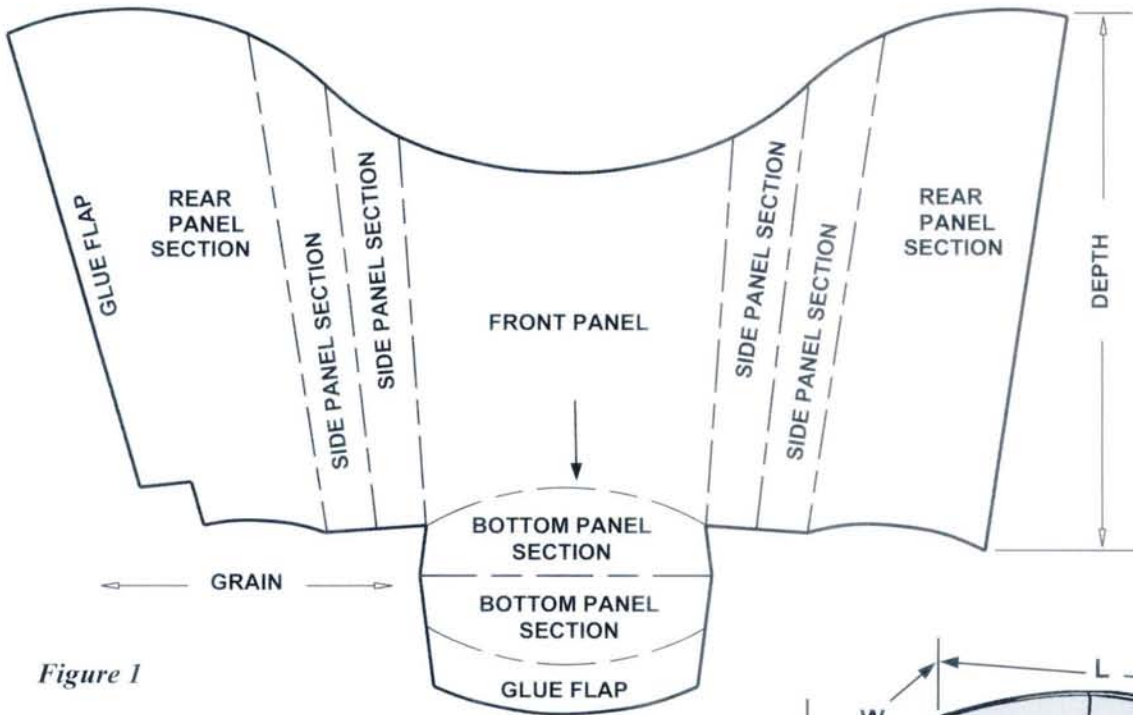


Figure 1

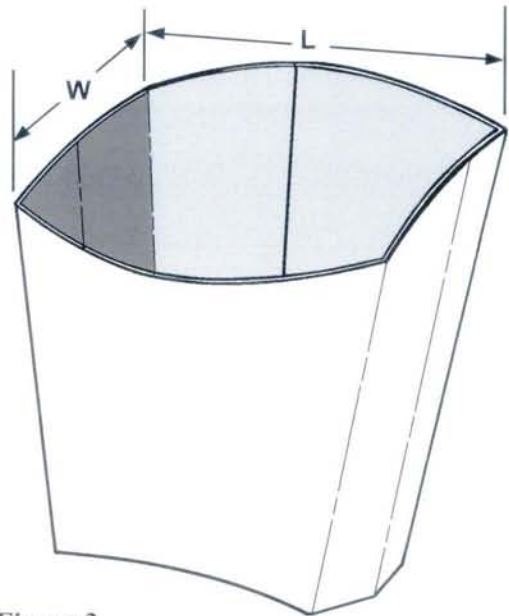


Figure 2



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ARCUATE BOTTOM
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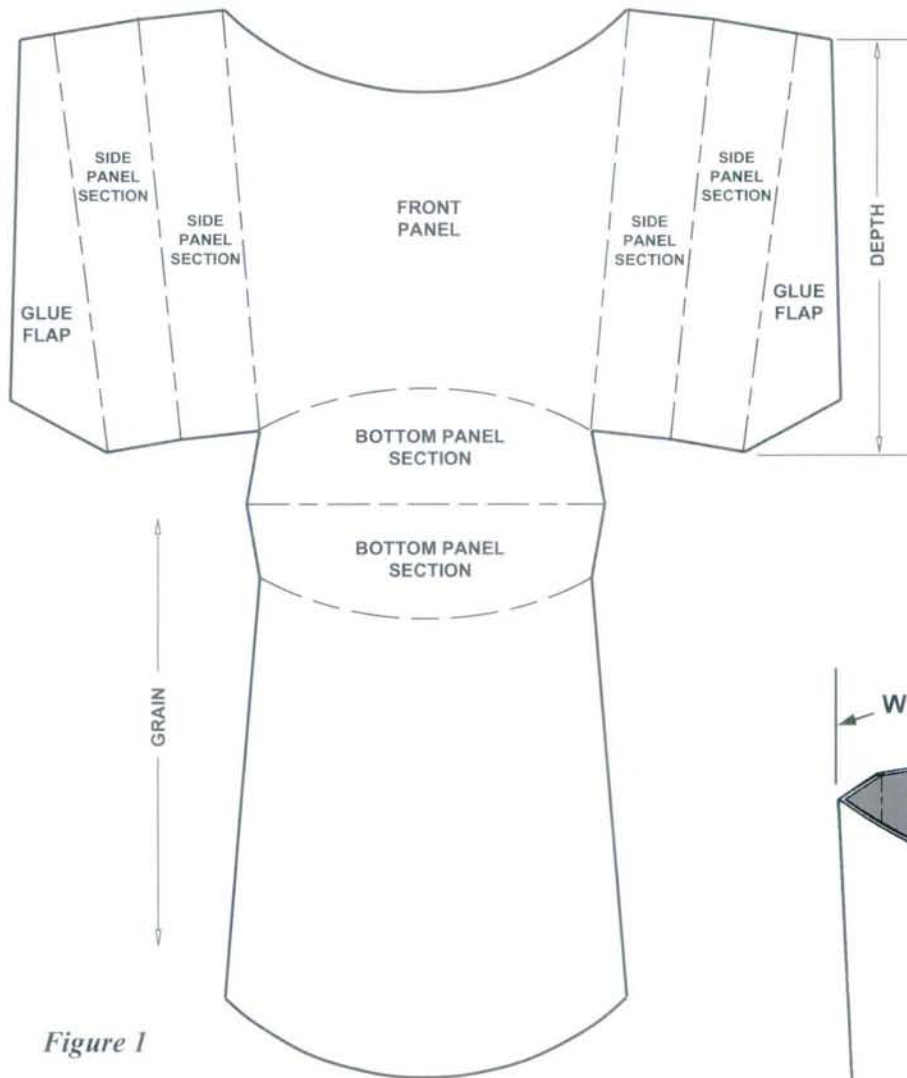


Figure 1

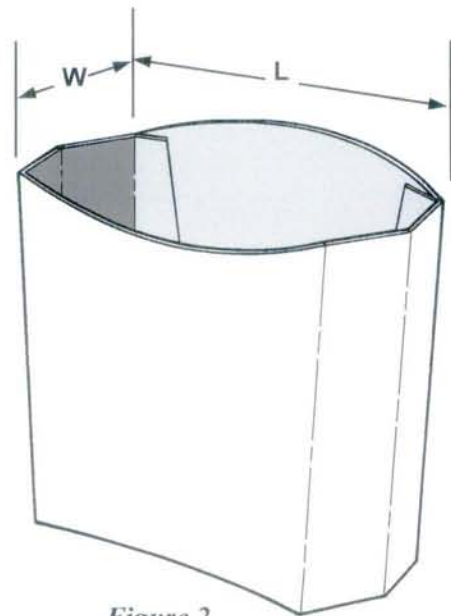


Figure 2



**TAPERED, NESTED
 ARCUATE BOTTOM
 GLUED CORNER
 HINGED COVER
 "CLAM SHELL"**

This tapered and nested "clam shell" tray, like the scoops detailed on pages 4.304 and 4.305, is used almost exclusively by the fast food industry. Also, like the scoops, the clam shell is usually machine formed and nested by the customer, although in some cases these functions are performed by the converter.

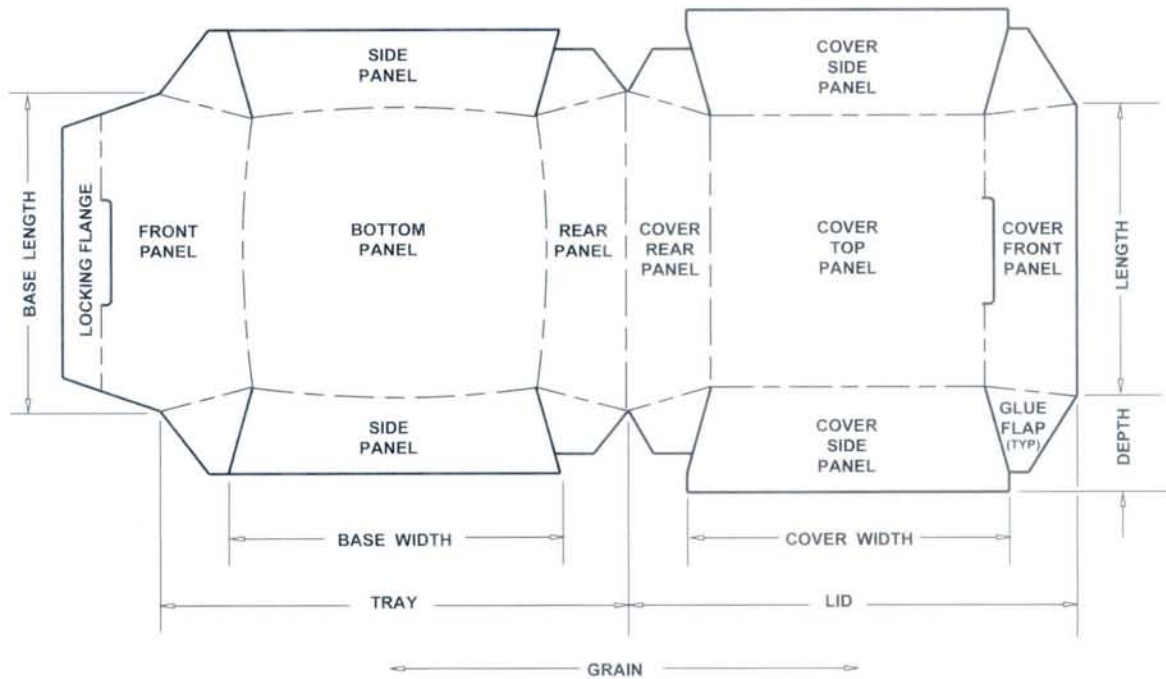


Figure 1

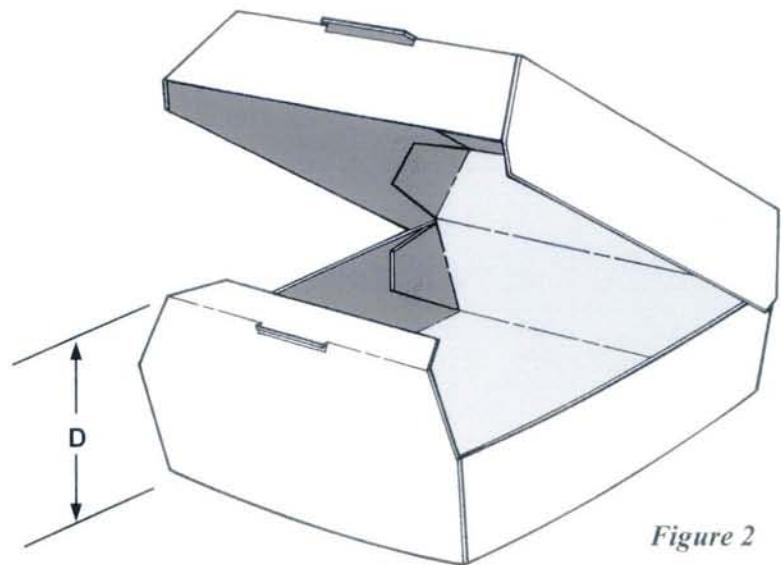


Figure 2



**TAPERED TRAY
with
GUSSET CORNERS &
LOCKING
COVER PANELS**

A paperboard classic, this gusset corner tray (or pail) has been in use for decades and remains virtually the same as when it was created more than fifty years ago. It is typically assembled at a distribution point and shipped nested to retail outlets. The wire handle is a both a convenience feature and the means for securing the gussets. This pail is strongly associated with Chinese take-out, but is by no means limited to this product line.

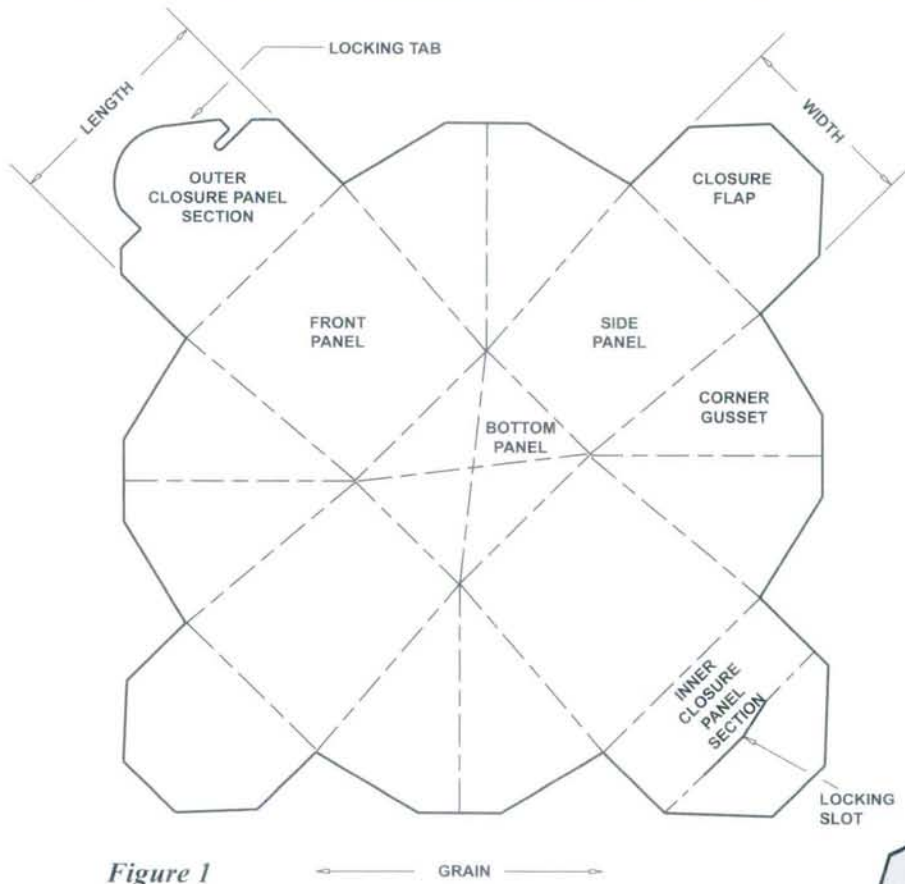


Figure 1

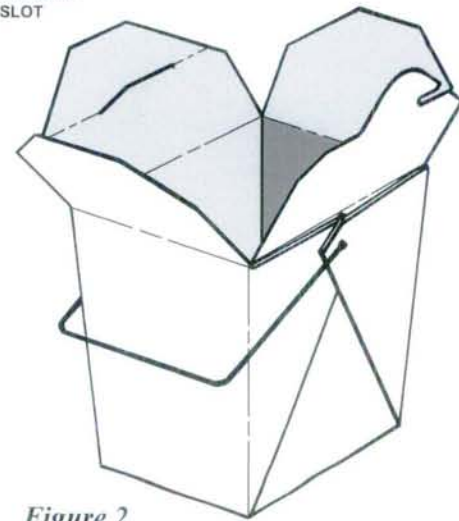


Figure 2



**FRICTION LOCK
CORNER TRAY with
HOLLOW SIDE and
END PANEL**

This is a non-glued, machine formed, top loaded carton style shipped flat from the converter to the customer.

The hollow wall tray creates extra display area and also makes the retail unit large enough to discourage shoplifting.

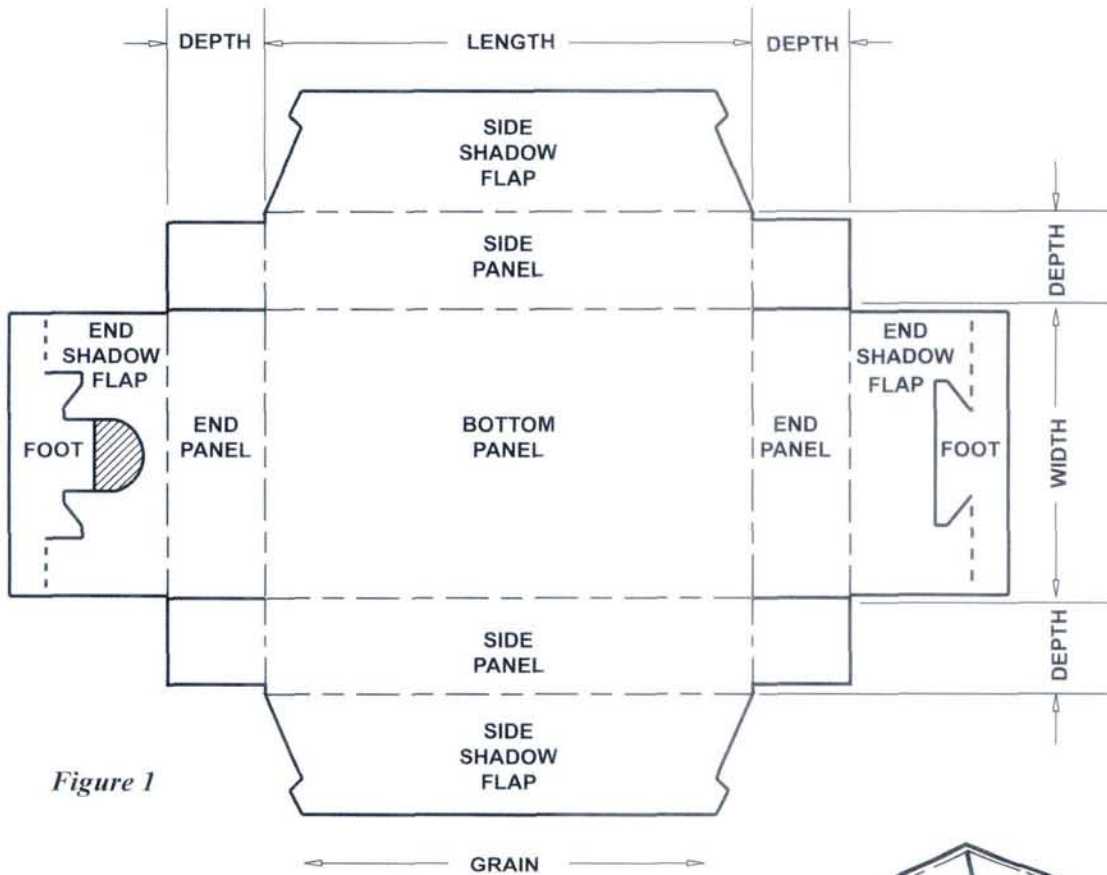


Figure 1

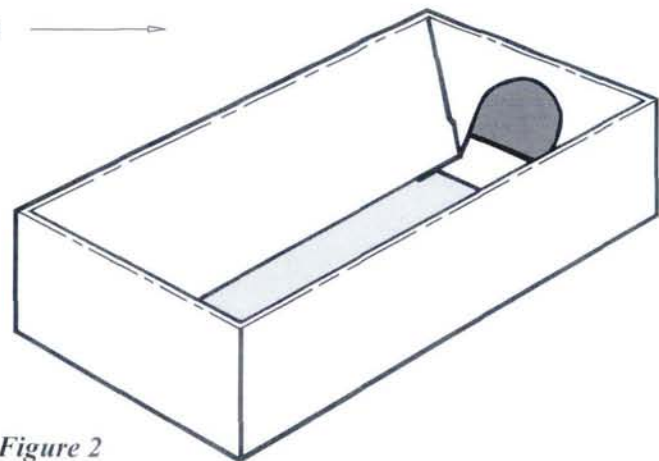


Figure 2



**REVERSE TUCK with
 INNER CELL and
 FRONT PANEL
 WINDOW**

As configured here, this three celled tube represents one of the most commonly used shadow box styles. It is sometimes produced as a seal end structure which offers better protection against product pilfering.

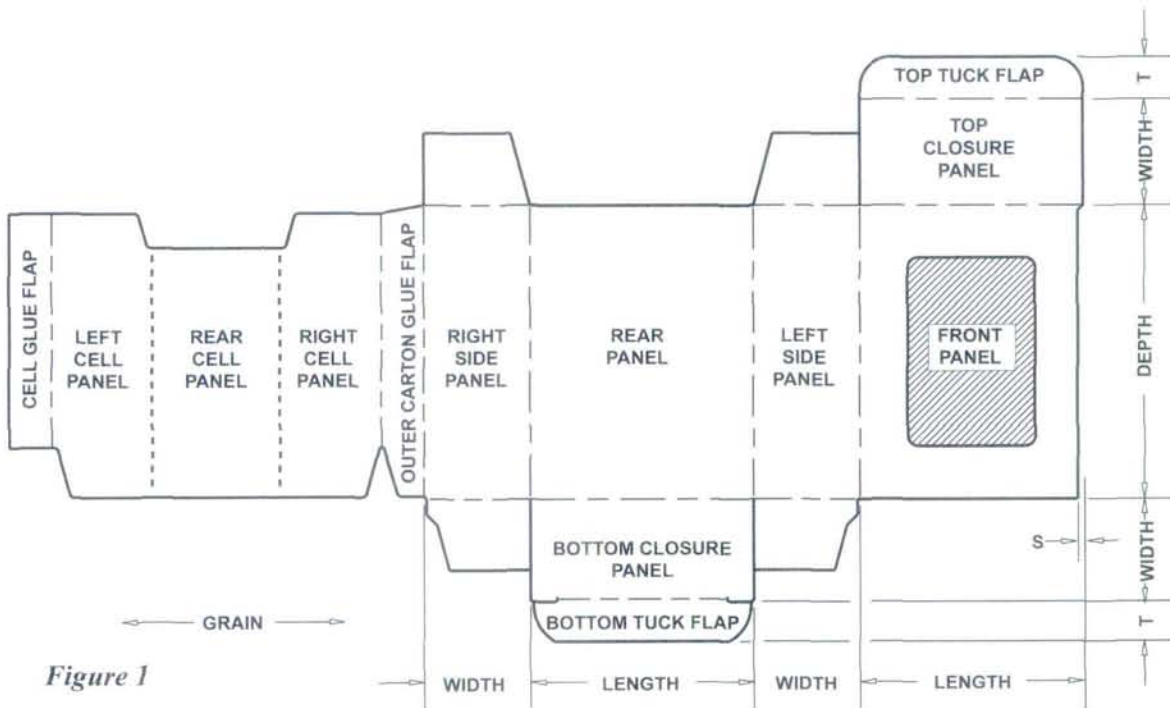


Figure 1

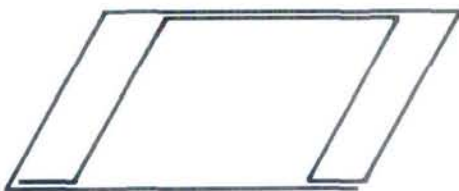


Figure 2: Folding Sequence - Top View

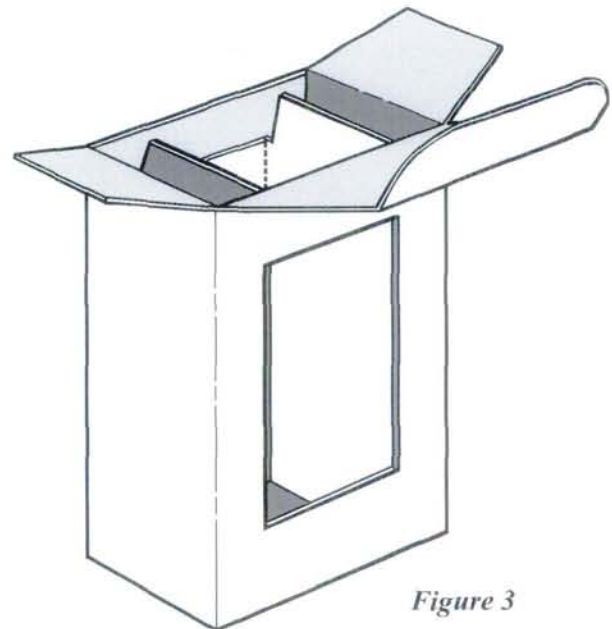


Figure 3



**REVERSE TUCK with
 TOP and BOTTOM
 PLATFORMS and
 FRONT
 SHADOW FLAPS**

This is a simple form of shadow box which is typically erected and loaded by hand. Shadow flaps fold inward from the front panel to frame the product. Apertures in the upper and lower platforms position the product for proper display.

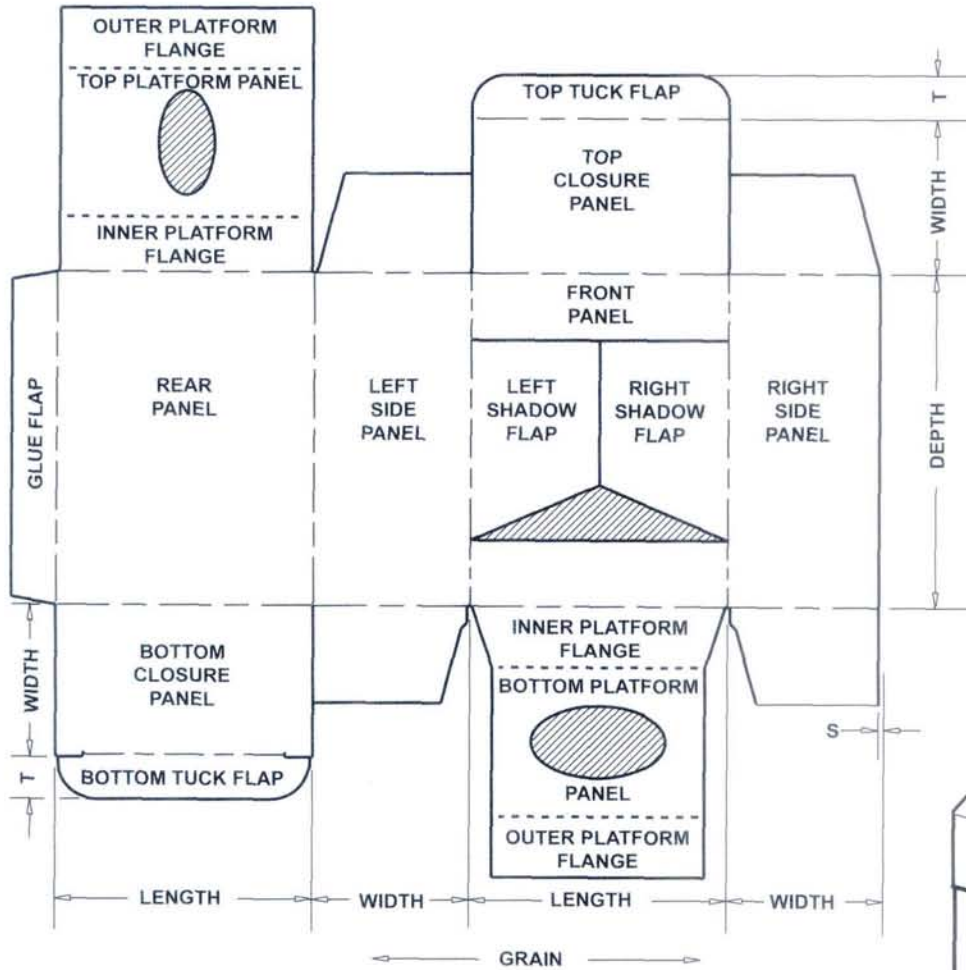


Figure 1

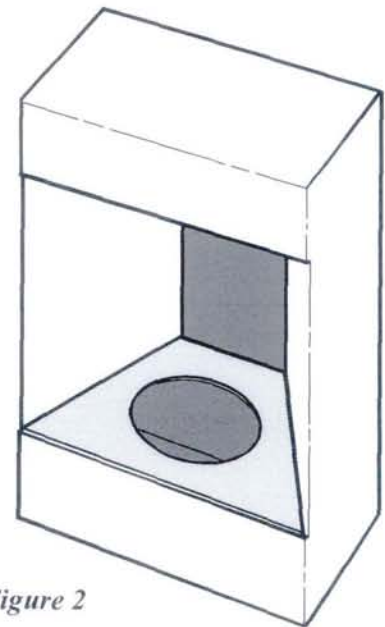


Figure 2



STRAIGHT TUCK
with GUSSETED
FRONT PANEL
SHADOW FLAPS

Once a patented proprietary style, this concept is now in the public domain. Typically, this shadow box is erected and closed first, then the product is inserted by pressing it inward against the shadow flaps until it locks in place.

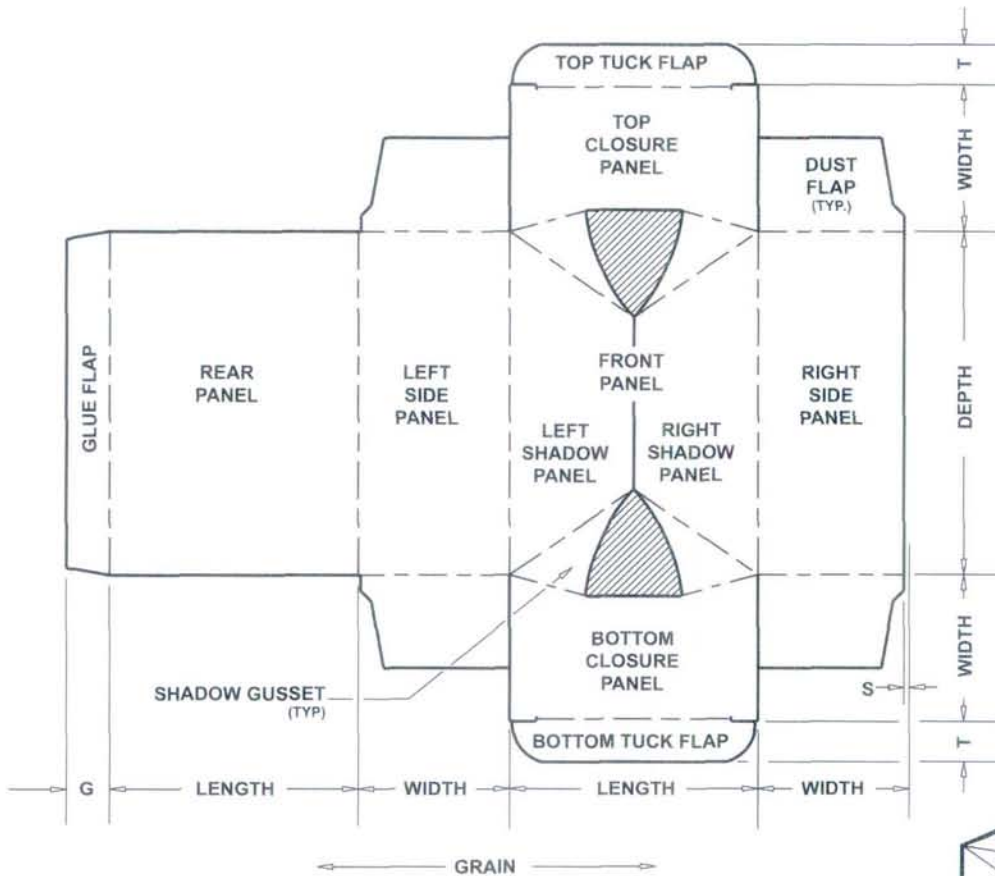


Figure 1

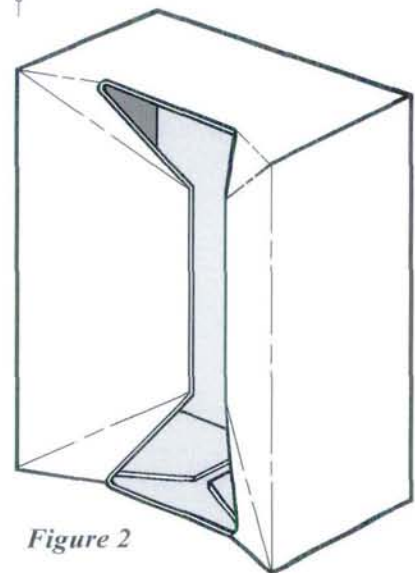
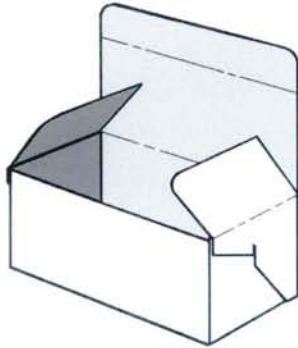


Figure 2



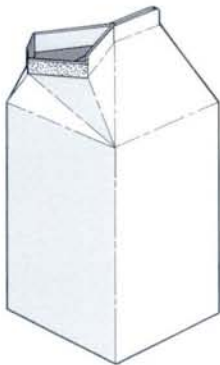
Many of the styles illustrated in the three major categories of Tubes, Trays, and Multiple Packaging can be machine formed, but the common denominator of the structures featured in Section 4.500 is their unique association with a particular piece of cartoning equipment, a particular industry or a highly specialized method of form, fill and close equipment. This group has been divided into the following sub-sections:



4.510

EQUIPMENT SPECIFIC STYLES

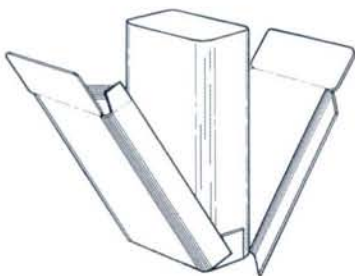
Structures that are almost exclusively associated with a specific piece of cartoning equipment.



4.520

CATEGORY SPECIFIC STYLES

Structures that are almost exclusively associated with a specific product and/or general product category; i.e., milk, juice, liquid or semi-liquid products.



4.530

CUSTOMER MANDREL FORMED STYLES

Unique mandrel formed shapes.

This sub-section of cartons focuses on the use of mandrels to form sculpted shapes or cartons with unusual proportions.



STANDARD LINERLESS
(a.k.a.)
ANDERSON STYLE

This style is strongly associated with ice cream. It is machine formed, filled and closed on equipment used primarily by the dairy industry. This is a tube style carton but the panel and flap nomenclature is unique unto this style and end use. It has traditionally been available in standard pint, quart, half gallon and gallon sizes; but has recently been adapted for the reduced weight sizes now being marketed in the ice cream industry.

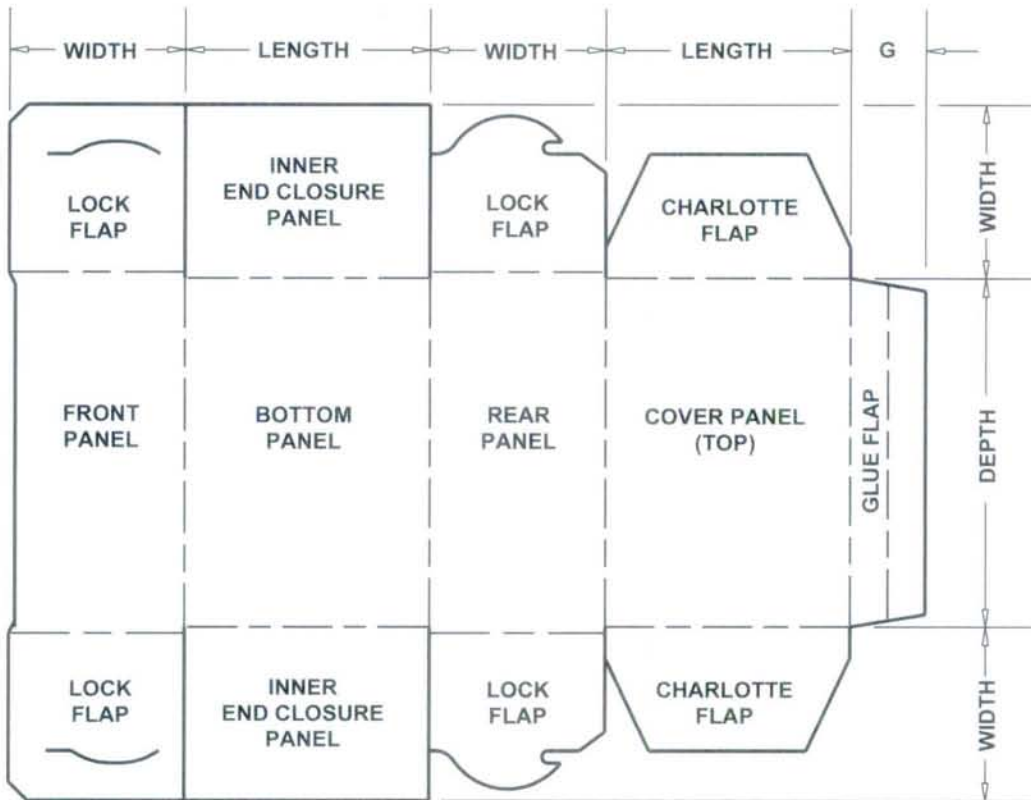


Figure 1

← GRAIN →

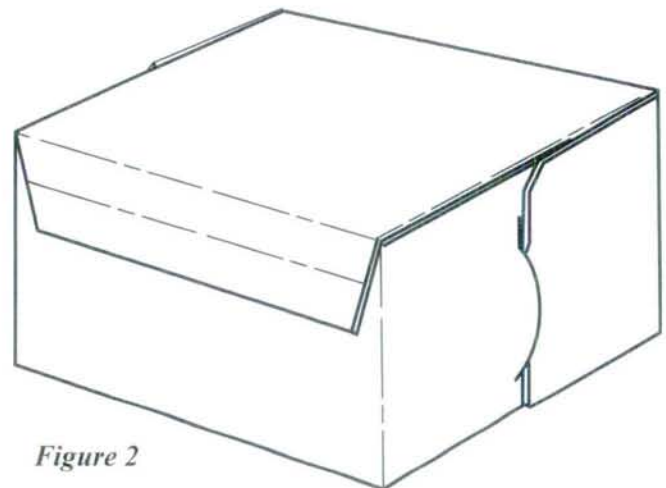


Figure 2



**PETERS
LOCK STYLE**

This style takes its name from the equipment manufacturer who built the first forming equipment. The term has become generic as associated with this specific style.

It is typically produced as a non-printed shell, then overwrapped.

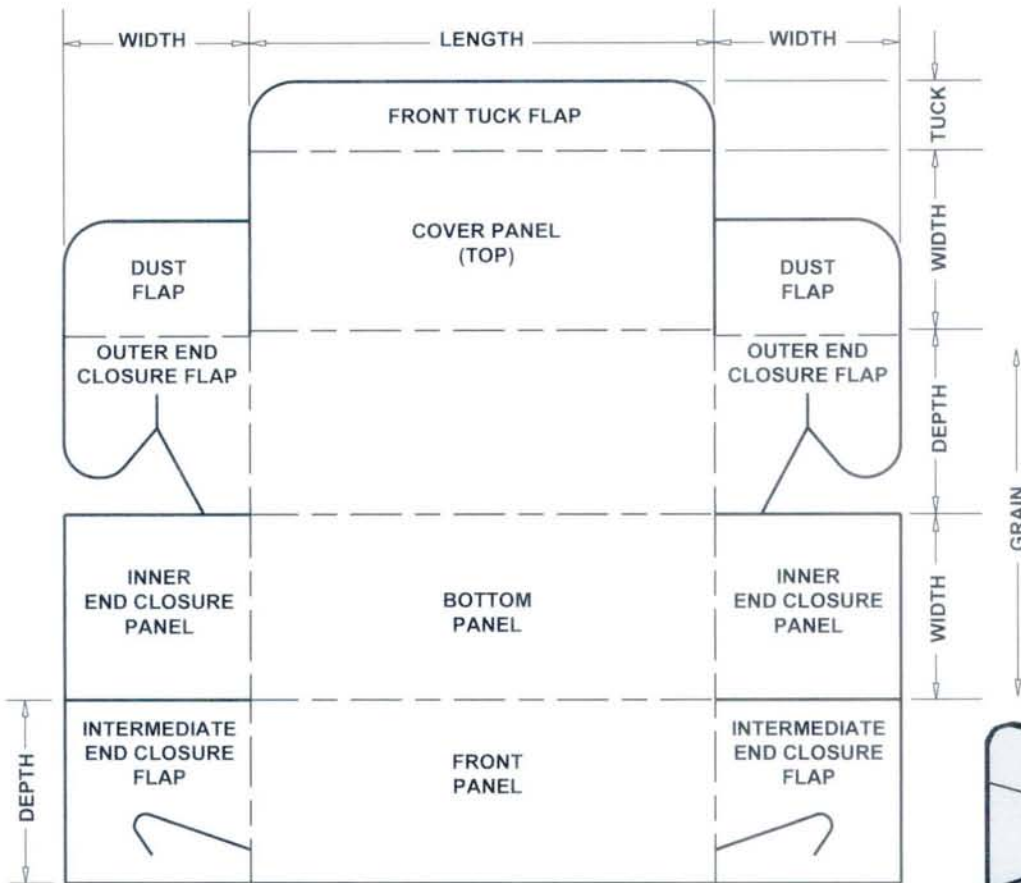


Figure 1

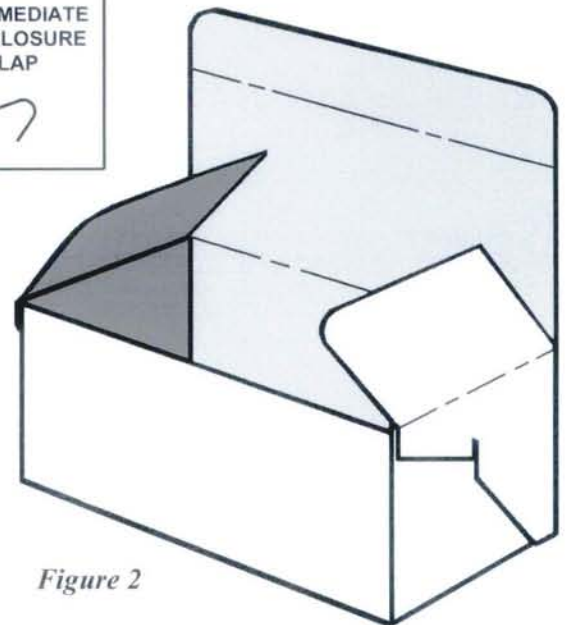


Figure 2



ELGIN STYLE

This is a non-glued sleeve which is wrapped and tucked around the product. The Elgin style is associated almost exclusively with the packaging of butter.

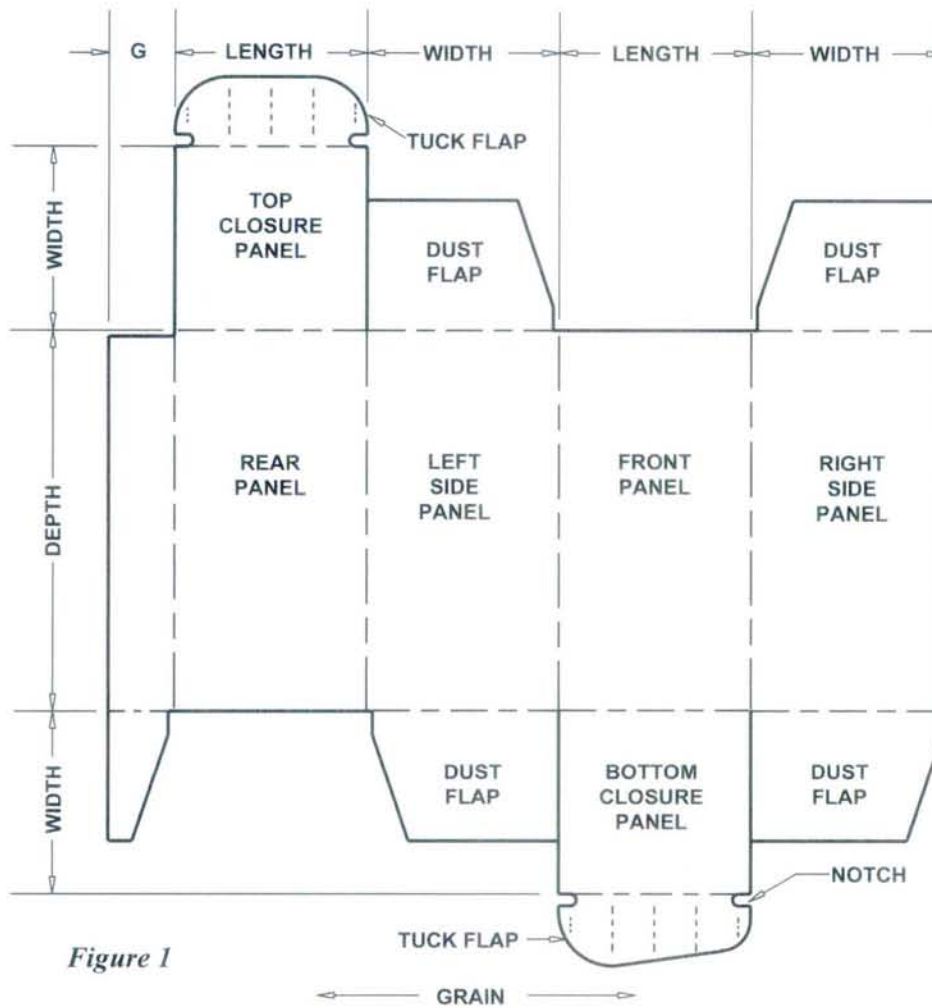


Figure 1

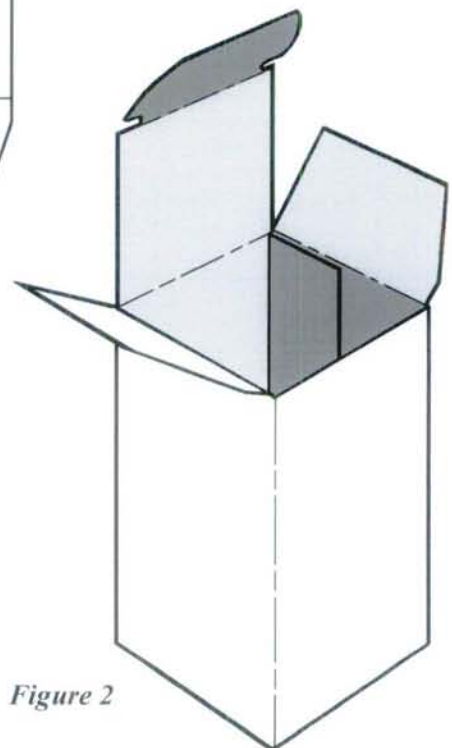


Figure 2



**SINGLE UNIT SLEEVE
(a.k.a)
ACE LOCK SLEEVE**

While this style can be hand wrapped and locked (or glued), it is generally automatically assembled on one of many types of commercially available or proprietary high speed wrapping machines.

The primary purpose of the wrap is to provide the billboard space needed for the product (usually a jar or tub) to compete on the store shelf. The lock style shown here is generic; however, a number of proprietary designs may be seen in the field.

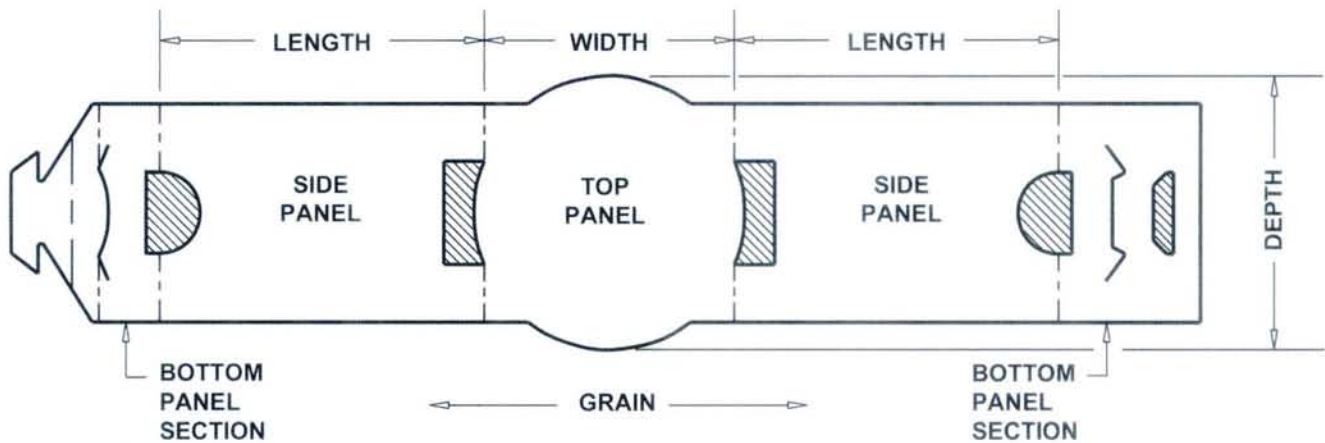


Figure 1

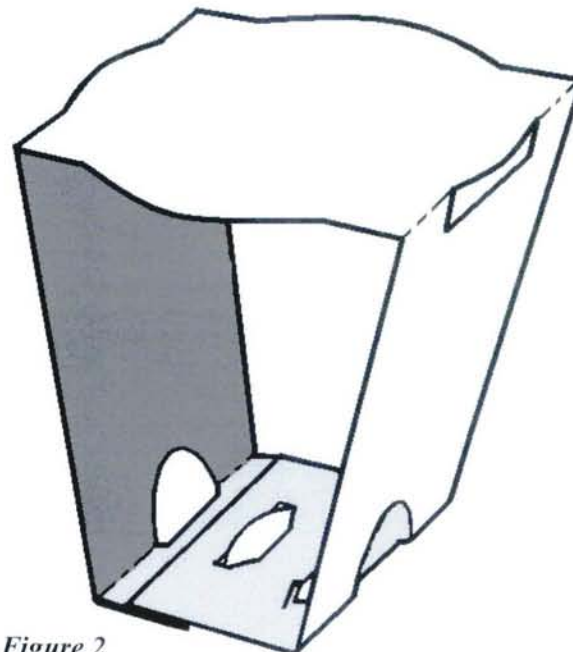


Figure 2



**GUSSET CORNER
 HEAT SEALED
 PARTIAL OVERLAP
 SEAL END
 (ASEPTIC PACKAGE)**

This simple yet sophisticated carton is a rectangle with gusseted top and bottom closures. However, the substrate is a complex barrier laminate, the manufacturer's joint unique, and the end closure sealing and securing (gussets folded to the sides at the top and to the bottom for the bottom closure) is different from any other carton in the field and requires highly specialized equipment. A number of proprietary opening and dispensing features not illustrated here are available.

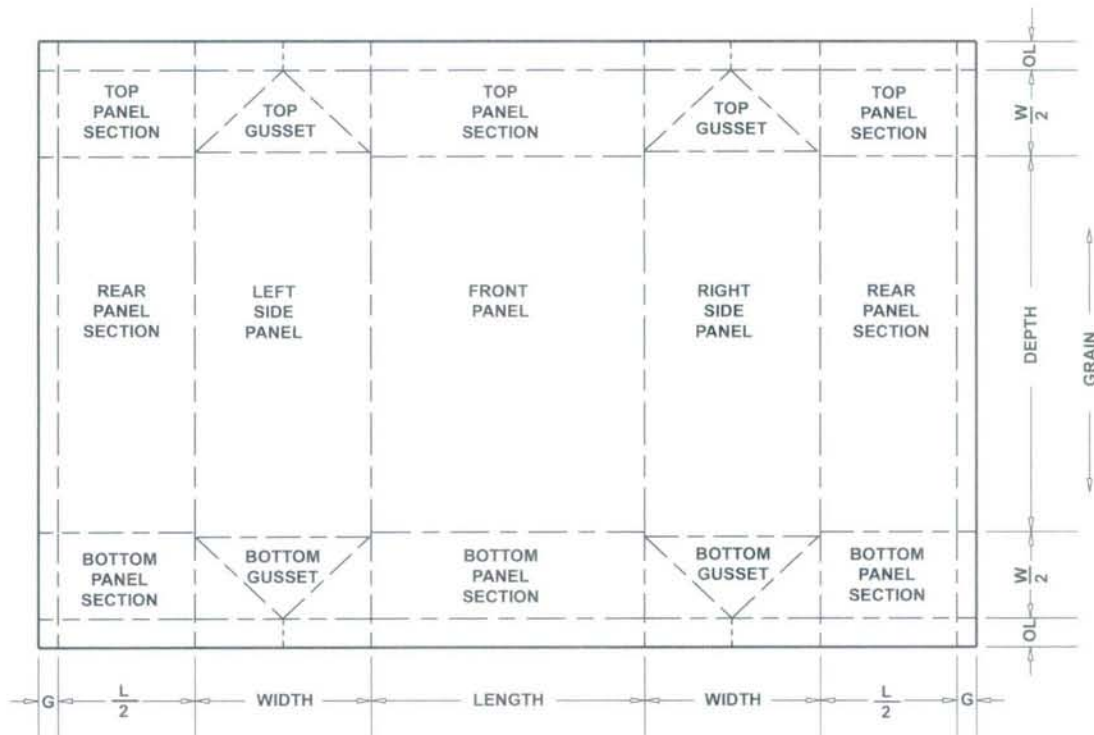


Figure 1

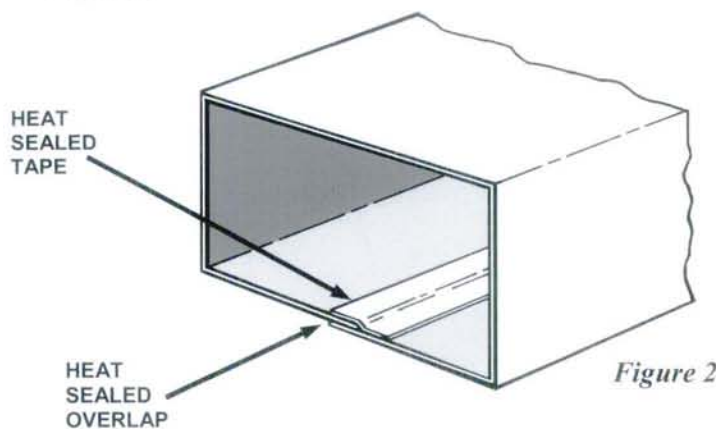


Figure 2

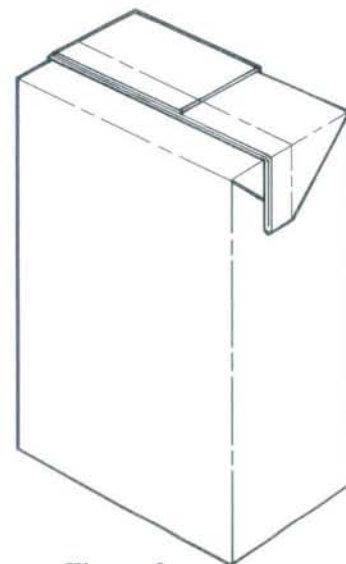


Figure 3

NOTE: These drawings illustrate the fundamental structure. They do not detail the means, some of which may be proprietary, by which the integrity of the aseptic field is maintained in the erected carton.



**GABLED TOP
GUSSET BOTTOM
LIQUID TIGHT
TUBE**

This basic liquid tight, gusset bottom gabled top paperboard carton is used for milk, juice and other liquid or semi-liquid products. Figure 2 shows the classic integral paperboard pour spout. Milk and fresh juices are the primary markets for this structure, but it is also used as a wholesale distribution container for wet or semi-liquid products such as prepared salads.

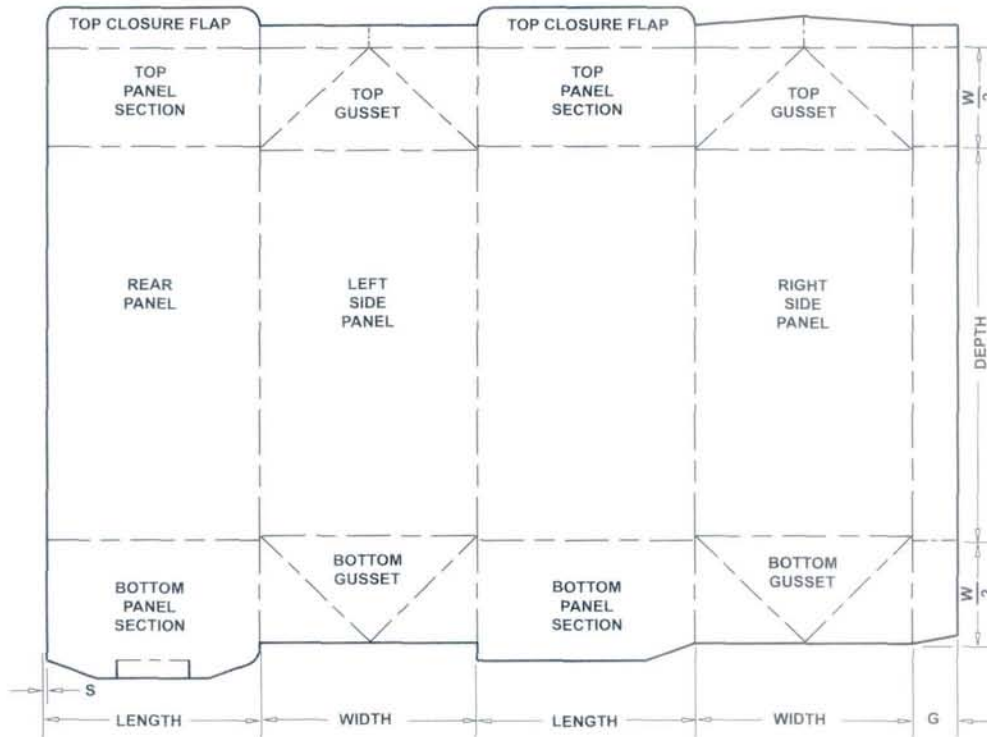


Figure 1

NOTE 1: These illustrations show the basic structure only. There are additional features to assure the liquid tight integrity of the carton, which are unique to specific commercially available or proprietary packaging equipment that are deliberately not shown here.

NOTE 2: The glue flap is typically skived. Refer to page 1.006 for two possible skiving options.

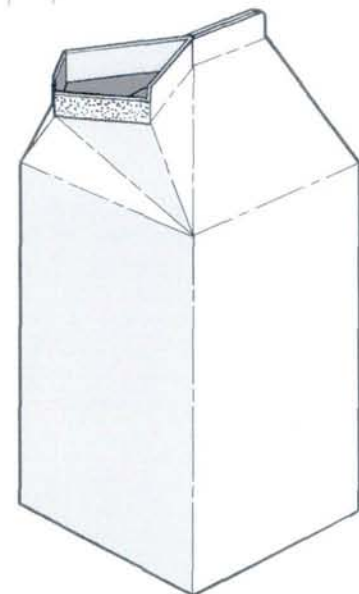


Figure 2



**MANDREL FORMED
TRAY - DEEP WALL
with GLUED or
HEAT SEALED
SIDE SEAM**

Figures 1B and 2B show an economy overlap side seam in combination with a partial overlap seal end top closure. Figures 1A and 2A show the same side seam with a friction lock top closure. Full overlap or partial overlap side seams are also viable style options.

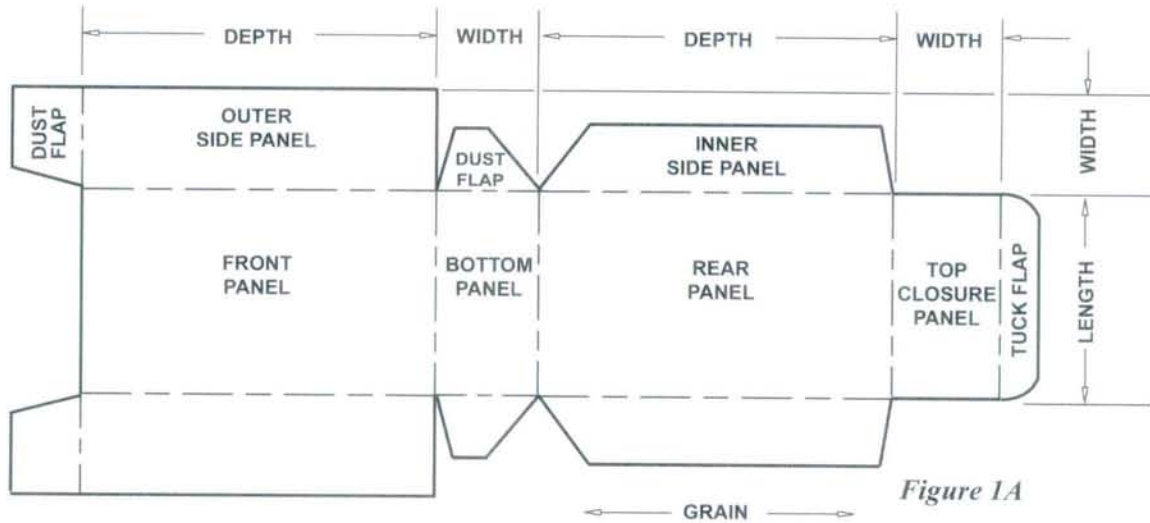


Figure 1A

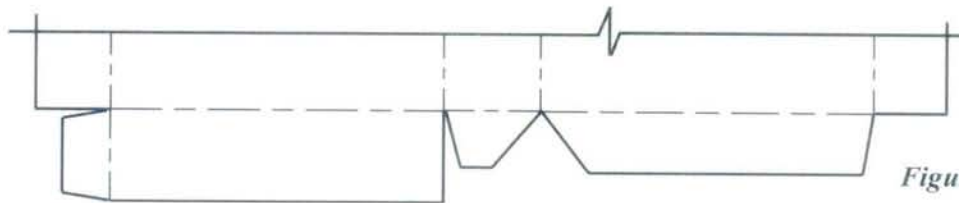


Figure 1B

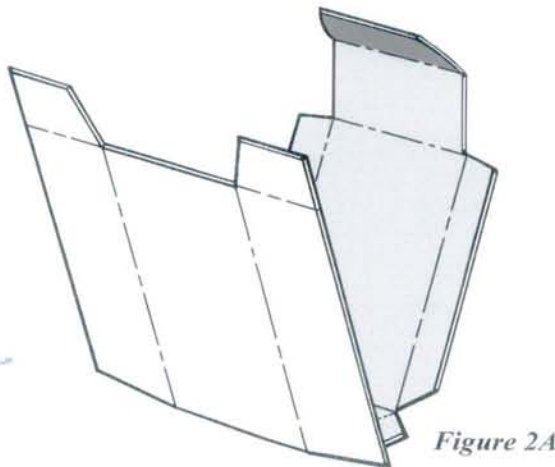


Figure 2A

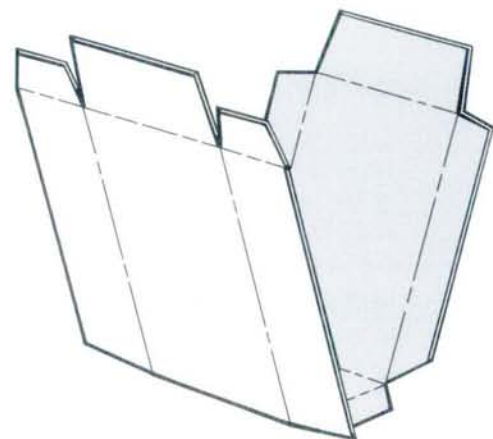


Figure 2B: Seal End Closure



**SCULPTED CORNER
MANDREL FORMED
SPECIAL TRAY STYLE**

This style looks like a tube but is formed as a very deep tray. It illustrates the design potential of customer packaging line, mandrel formed cartons. It is shipped by the converter as a printed non-glued blank. It is then formed vertically or horizontally around a mandrel, stripped off the mandrel and then top/end closed.

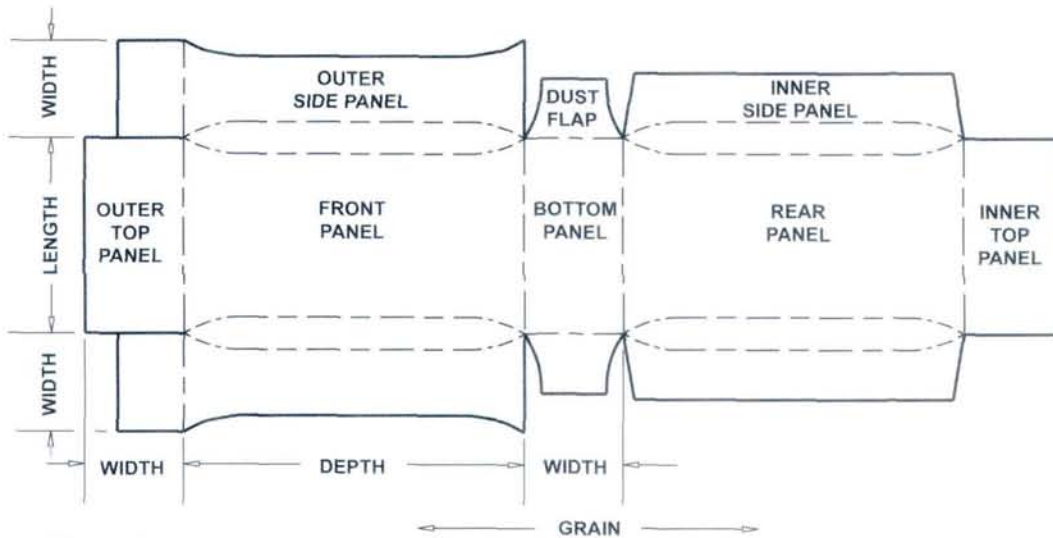


Figure 1

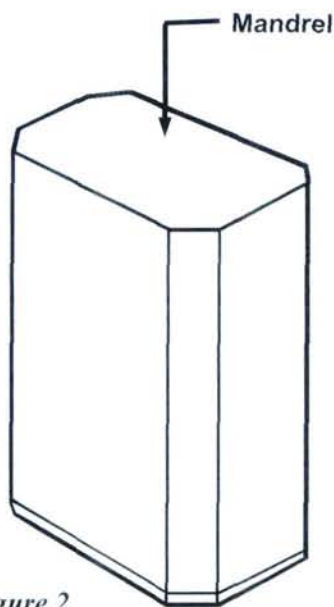


Figure 2

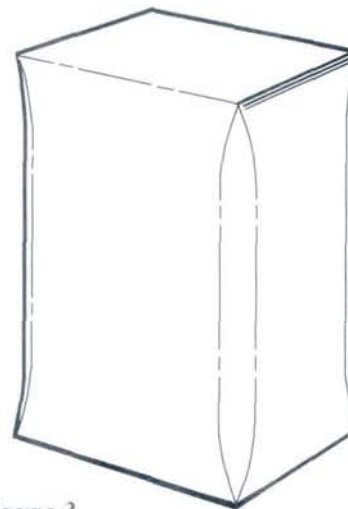


Figure 3



**SCULPTED CORNER
 MANDREL FORMED
 SPECIAL TRAY STYLE**

This style looks like a tube but is formed as a very deep tray. It illustrates the design potential of customer packaging line, mandrel formed cartons. It is shipped by the converter as a printed non-glued blank. It is then formed vertically or horizontally around a mandrel, stripped off the mandrel and then top/end closed.

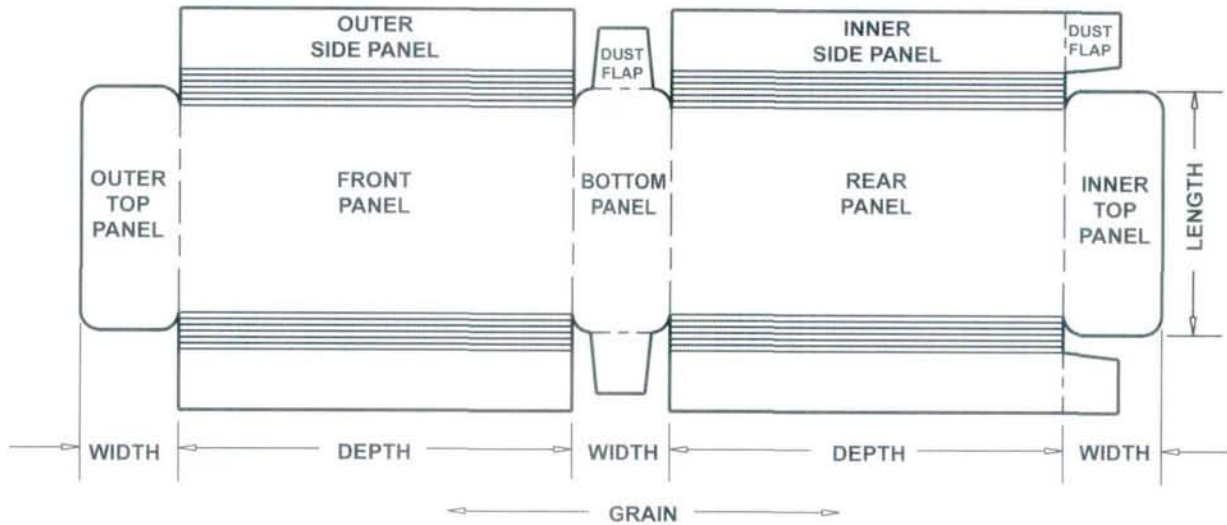


Figure 1

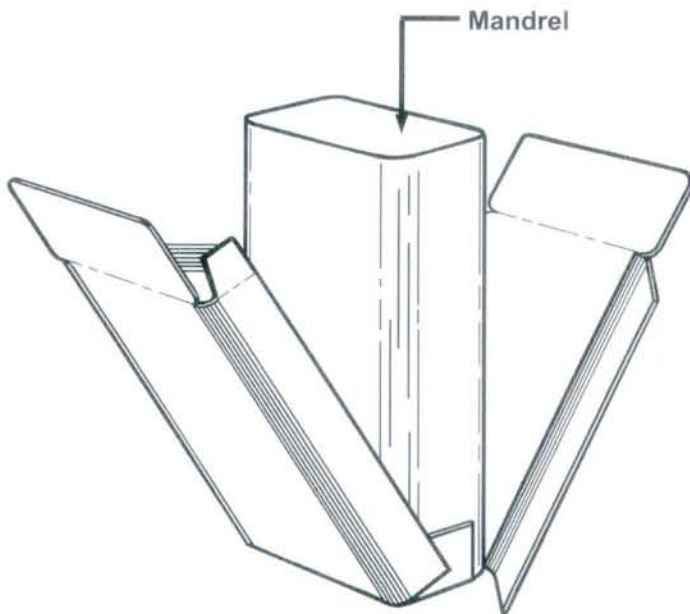


Figure 2

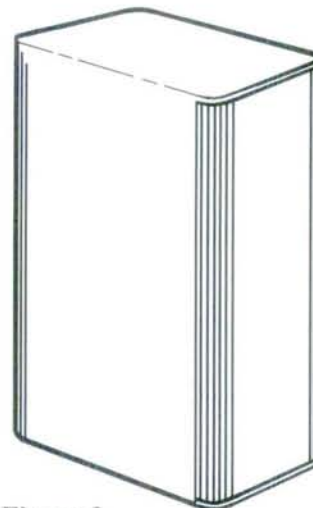


Figure 3



**ROLLED CORNER
BOTTOM LOCKED
TRUNCATED
PYRAMID**

This structure is assembled and erected on highly specialized equipment and identified almost exclusively with Italian special occasion cakes. It is included here to illustrate what can be accomplished with paperboard. Superb design and engineering skills combine to create this international packaging classic, produced in Italy and shipped around the world.

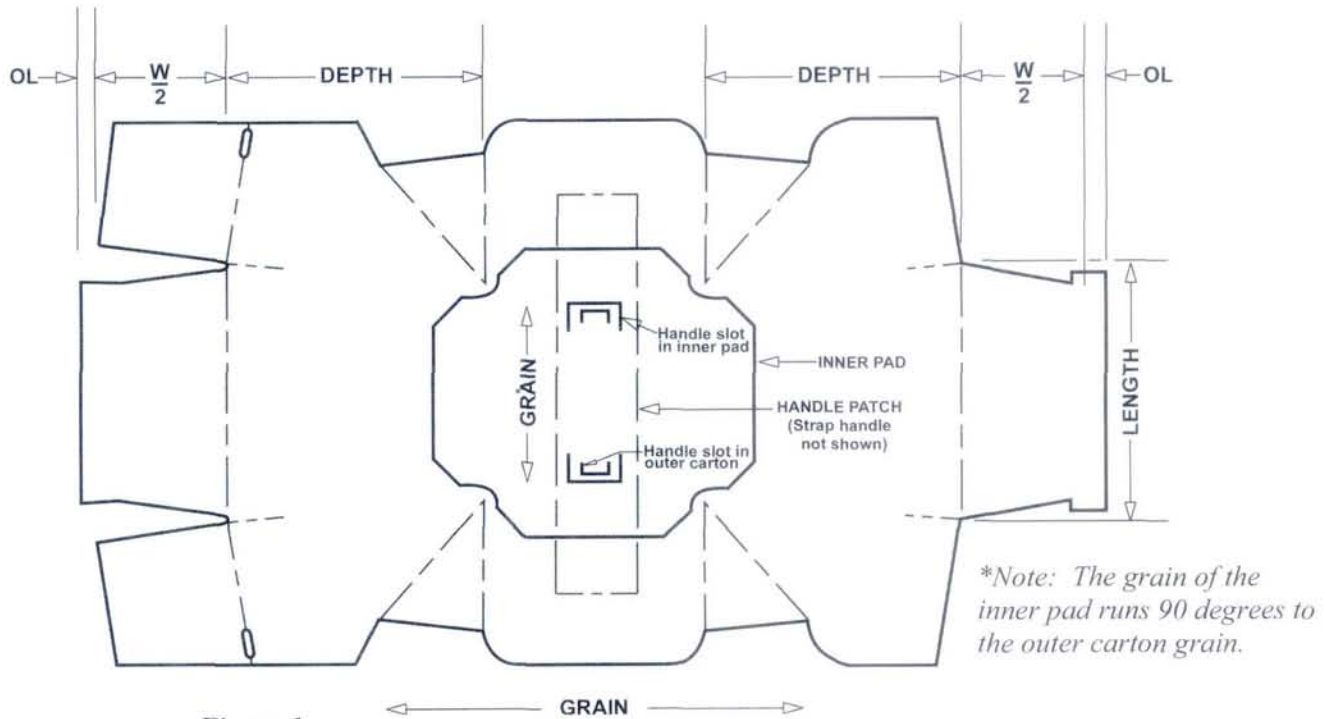


Figure 1

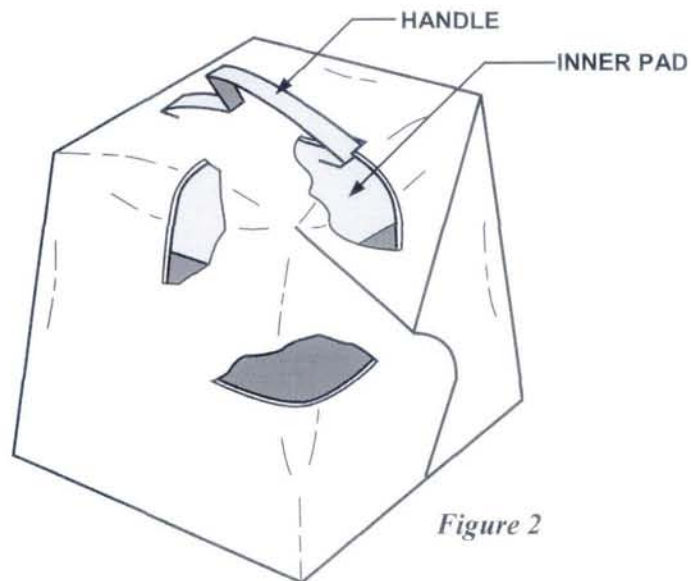


Figure 2



**ROUND TOP
SQUARE BOTTOM
DOUBLE SIDE LAP
CAN**

Several converters developed variations on this square bottom, round top carton in the 1960's and 1970's. Some were glue flap styles as shown here. Others were gusseted for improved leak resistance. All were auto-formed on proprietary or commercially available paper can making equipment. All of the basic patents pertaining to this structure are now public domain.

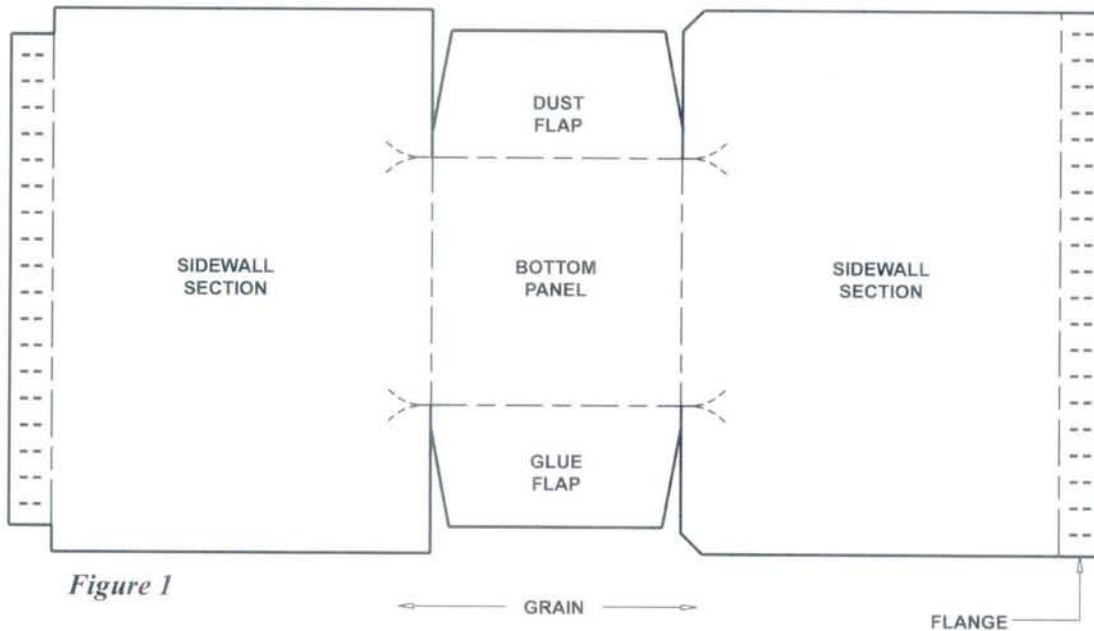


Figure 1

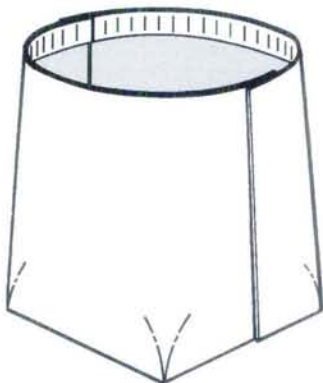


Figure 2

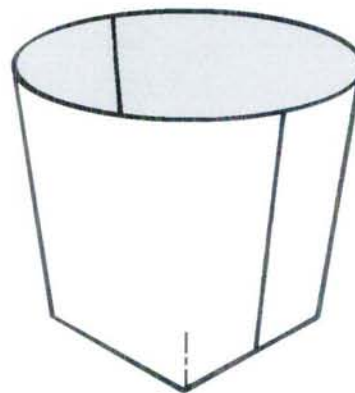


Figure 3: Shape Alternative

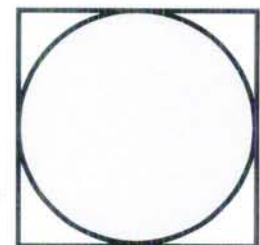


Figure 4: Plan View



**TUBULAR
TRIANGLE CARTON**

Mandrel forming triangular tubes eliminates the need for the false working score incorporated into the standard preglued triangular carton (see page 1.601). Typically unglued blanks would be delivered to the customer to form, load, and close the carton on custom packaging equipment.

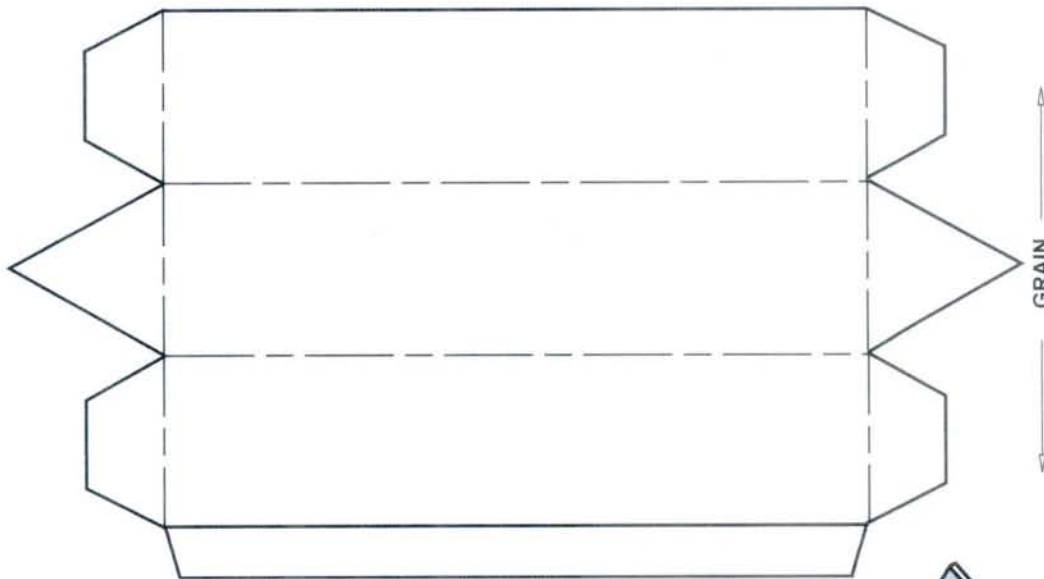


Figure 1

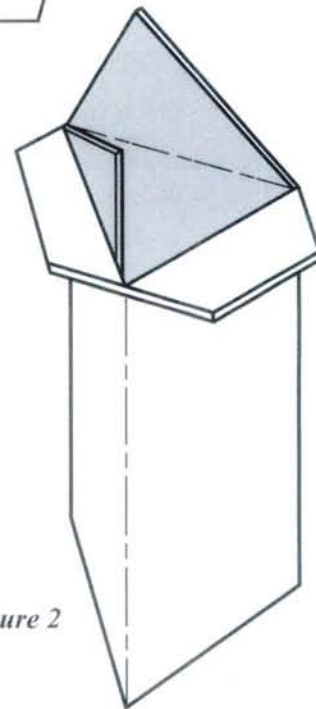
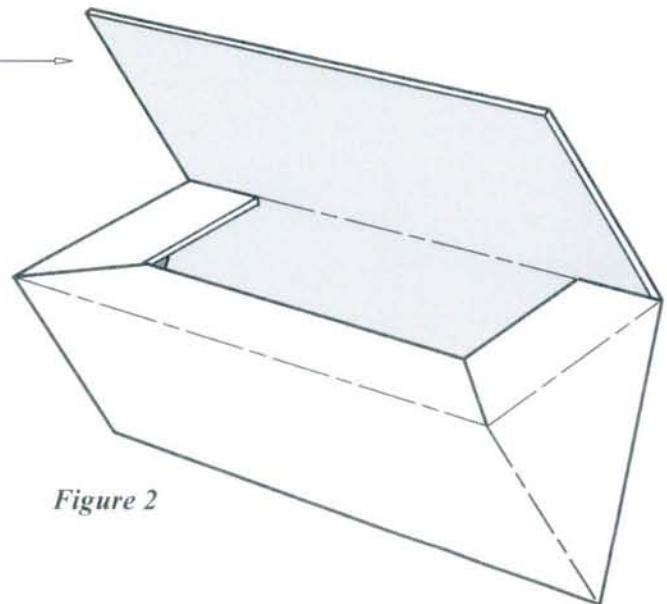
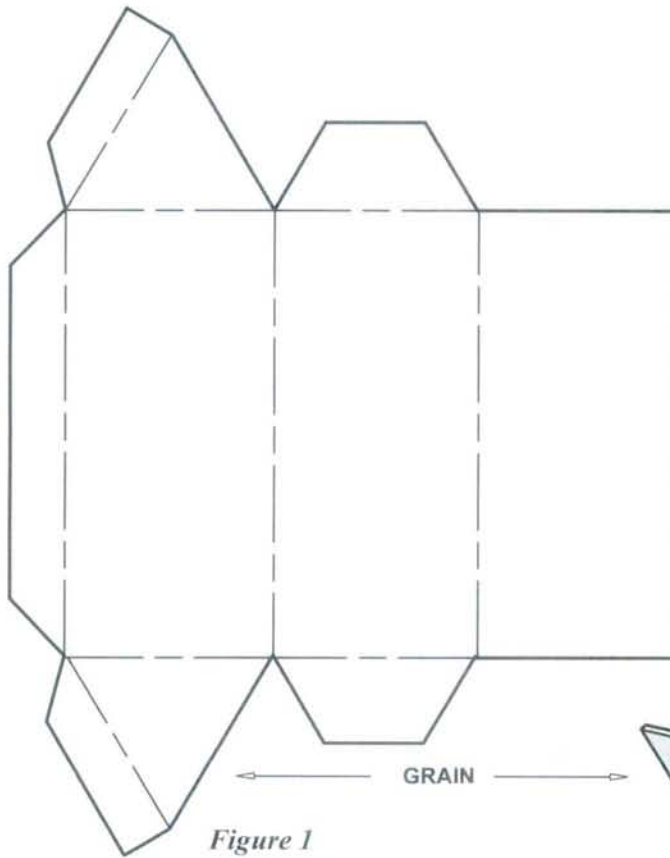


Figure 2



**MANDREL FORMED
TRIANGULAR
TRAY**

This is an alternative to the triangular tube illustrated on page 4.536. This style is frequently top loaded as a horizontally-oriented tray; but displayed vertically, its finished appearance is virtually identical to the tube style.



5.000

PAPERBOARD PACKAGING:
ALTERNATIVE PKG.



5.000

OVERVIEW : ALTERNATIVE PAPERBOARD PACKAGING

- 5.100 *Cans, Tubs, Cups and Buckets*
- 5.200 *Set-Up Boxes*
- 5.300 *Combination Packaging*
- 5.400 *Small Flute Paperboard*
- 5.500 *Pressure Formed Containers*



IDEAS AND
INNOVATION
SECOND EDITION

5.000
ALTERNATIVES



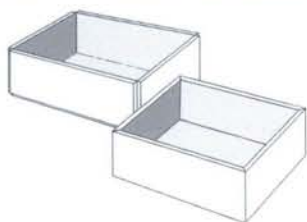
Paperboard packaging is not associated exclusively with folding cartons. Paperboard cans, tubs and buckets; packaging which combines paperboard with materials such as plastic and film; and the old standard set up box have been part of the packaging genre for decades.

This section highlights paperboard containers which fall outside the basic tube, tray and multiple packaging carton categories. It includes non-carton containers made of 100% paperboard, and also features sub-categories which include paperboard as a major component used with other media such as metal and flexible, semi-rigid, or rigid plastics.



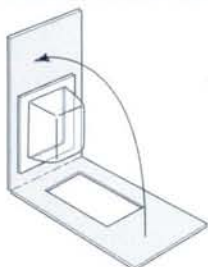
5.100 CANS, TUBS, CUPS and BUCKETS

Single lap, paper, and spiral wound paperboard body units are combined with metal, thermoformed or injection molded plastic bottom and top end caps. Integral pour spouts or dispensing features may also be included.



5.200 SET UP BOXES

Paperboard packaging generally associated with high end gift packaging for jewelry, cosmetics, deluxe confections and the like.



5.300 COMBINATION PACKAGING

Packages which combine a basic paperboard component with flexible or semi-rigid film, molded plastic components, metal components, or a second paperboard element comprise this sub-category. The common denominator is that each component part contributes its own unique quality or function to the composite package.



5.400 SMALL FLUTE PAPERBOARD

Carton styles for small flute paperboard are generally the same as for conventional paperboard cartons. This sub-category focuses on the unique detailing requirements for converting small flute paperboard in order for it to function properly for the customer and the consumer.



5.500 PRESSURE FORMED CONTAINERS

Flanged, round corner, tapered trays thermoformed from special high moisture content paperboard into a variety of shapes which can be closed using various forms of film, paperboard, foil, or plastic lids.

The **SINGLE LAP CONTAINER** (including cans, tubs, cups and buckets) is the most versatile category of round or modified round, open-end paperboard tubes. The single lap container can be produced in a number of cross-section configurations and may have either straight or tapered walls.

The top and bottom edges may be finished in several different ways. There are also a number of side seam sealing options and methods for accomplishing the end closure; including elements made of paperboard, metal, thermoformed or injection molded plastic, or combinations thereof. A number of these design options are illustrated on pages 5.100 through 5.102.

NOTE: Size, proportion, side seam type or edge configuration will impact on the viability of certain shape or end closure combinations.

BODY TUBE CROSS-SECTION OPTIONS

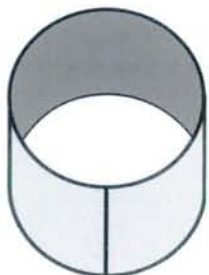


Figure 1A
 Round

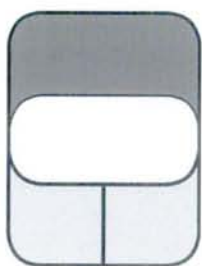


Figure 1B
 Square or Rectangular

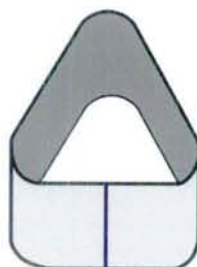


Figure 1C
 Triangular

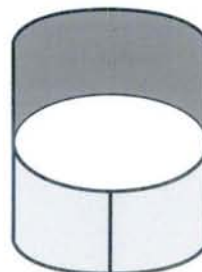


Figure 1D
 Modified Rectangular

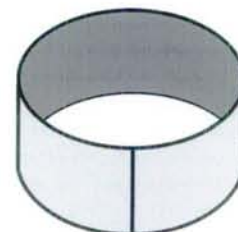


Figure 1E
 Elliptical

TOP END OPTIONS



Figure 2A
 Outward Rolled Edge - Round

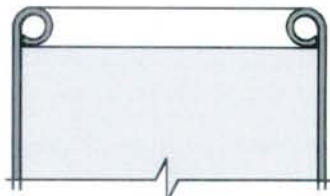


Figure 2B
 Inward Rolled Edge - Round

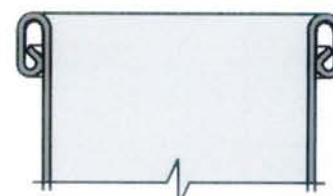


Figure 2C
 Outward Roll - Modified Round



Figure 2D
 Straight Edge

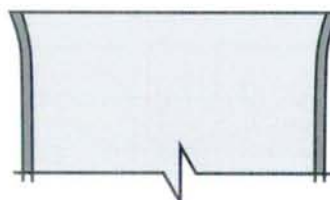


Figure 2E
 Slightly Flared Edge

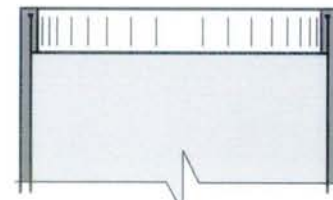


Figure 2F
 Folded Edge



Cans, Tubs, Cups and Buckets
 Single Lap Containers

**SIDE SEAM
 OPTIONS**

If no barrier is required, the heat sealed or adhesive secured single lap joint, shown in Figure 1A is sufficient. Figures 2A through 5A illustrate some of the barrier joint possibilities for the single lap container.

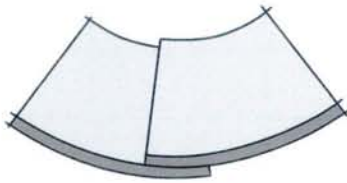


Figure 1A:
 Single Lap Joint

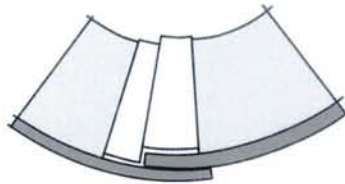


Figure 2A:
 Lap Joint with Inner Tape

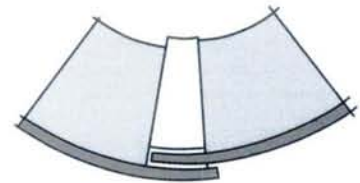


Figure 3A:
 Lap Joint with "U" Fold Tape

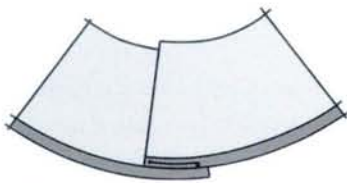


Figure 4A:
 Lap Joint with Scived Inner Ply

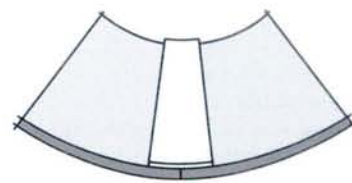


Figure 5A:
 Butt Joint with Inner Tape*

* The addition of an outer tape over the butt joint is also possible.

**BOTTOM CLOSURE
 OPTIONS**

Paperboard, metal and injection molded or thermoformed plastics are all used as bottom closure materials. Representative commercial bottom closure designs are illustrated below.

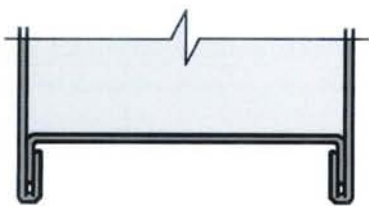


Figure 1B: Flanged Recessed Paperboard Disk

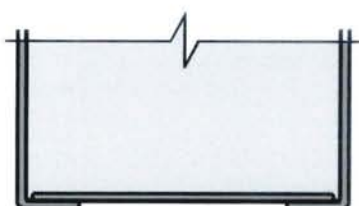


Figure 2B: Flush Paperboard Disk

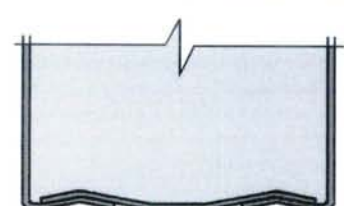


Figure 3B: Modified Flush Paperboard Disk

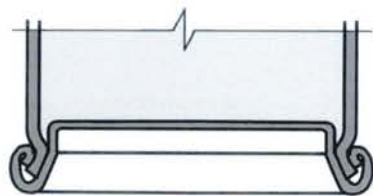


Figure 4B: Crimped Metal End

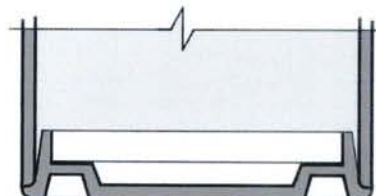


Figure 5B: Flush Injection Molded Plastic End

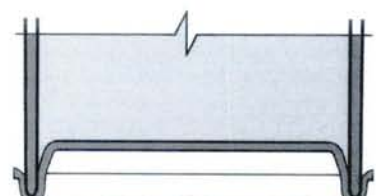


Figure 6B: Recessed, Thermoformed Plastic End



Cans, Tubs, Cups and Buckets
Single Lap Containers

TOP CLOSURE
OPTIONS

While material combinations are essentially the same as those used for bottom closures, the design configurations differ. The base, or bottom, closures are usually permanently affixed to the paperboard body; top closures are designed to be removed and replaced. Some current commercial options are illustrated below.

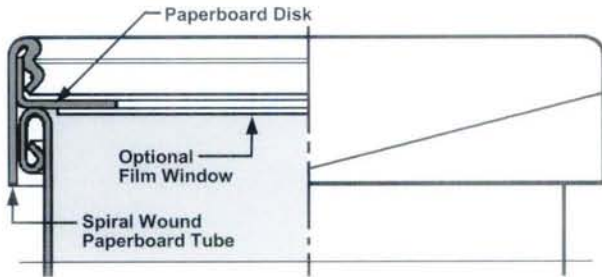


Figure 1:
Two piece spiral wound tube and flanged paperboard disk lid in combination with a modified outward rolled body wall top edge.

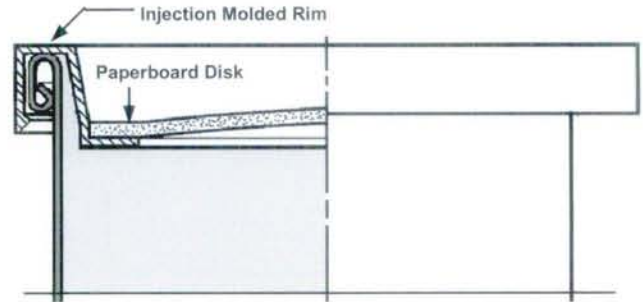


Figure 2:
Two piece insert injection molded paperboard/plastic lid in combination with a modified outward rolled body wall edge top.

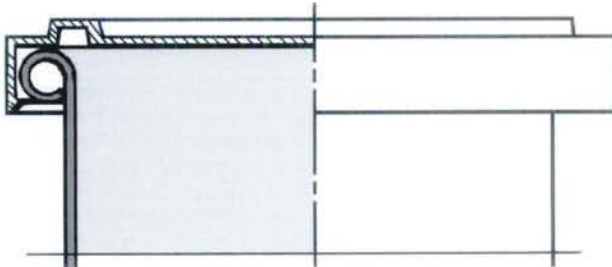


Figure 3:
One piece injection molded plastic lid in combination with an outward rolled body wall top edge.

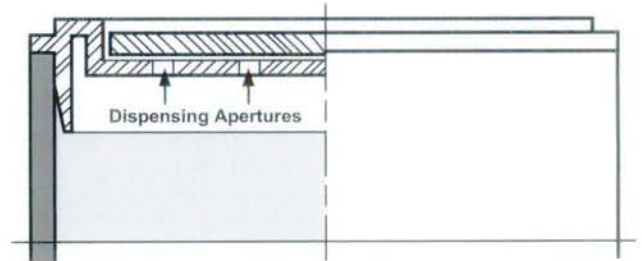


Figure 4:
Two piece plug type injection molded plastic lid with an integral dispensing means, in combination with a straight body wall top edge.

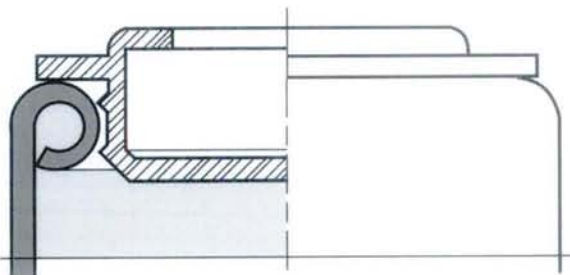


Figure 5:
Recessed plug type injection molded plastic lid in combination with an inward rolled body wall top edge.

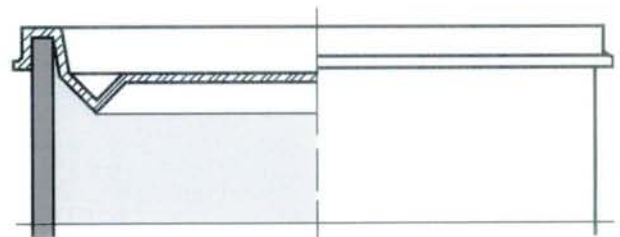
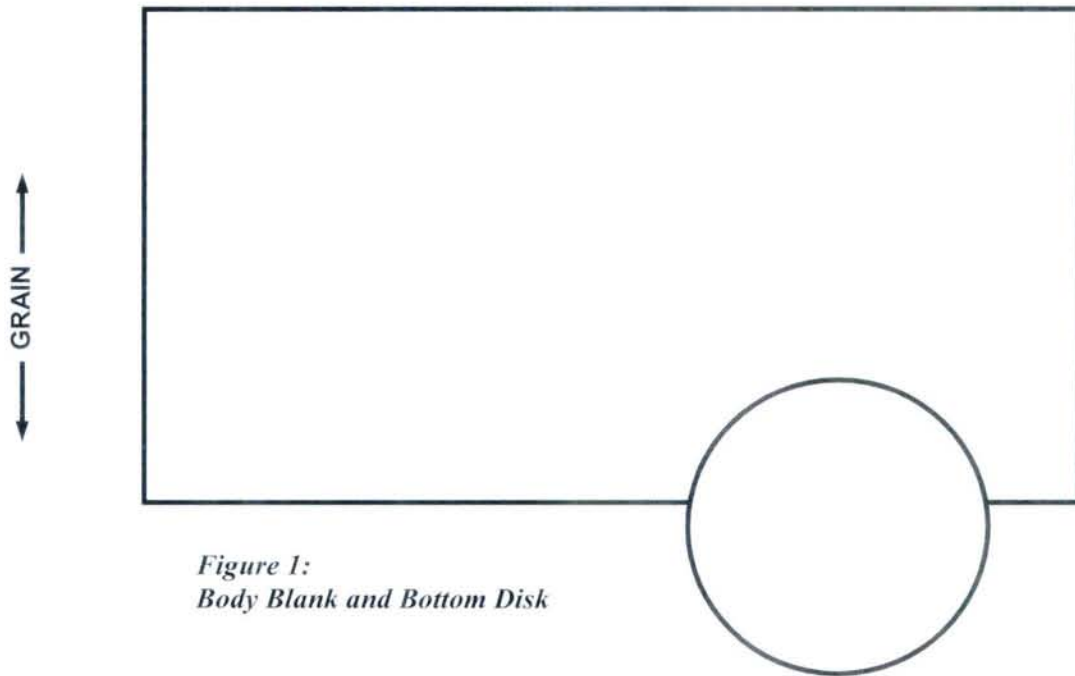


Figure 6:
One piece thermoformed plastic lid in combination with a straight body panel top edge.

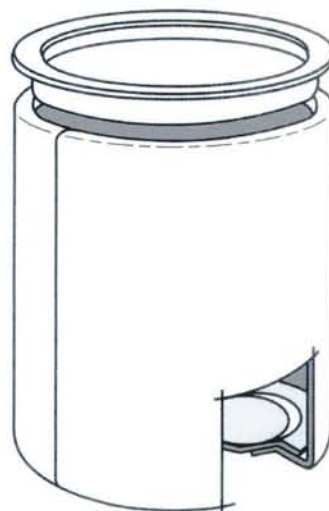


**TWO PIECE
STRAIGHT WALL
PAPERBOARD
CONTAINER**

Improved barrier sealing and forming technology has expanded markets for single lap cans and tubs. Many design options are possible by combining side seam, bottom closure and lid options illustrated on pages 5.100, 5.101 and 5.102.



*Figure 1:
Body Blank and Bottom Disk*



*Figure 2:
Example shown has an inward
rolled top edge and a modified
flush bottom. It is closed with
a recessed, plug-type injection
molded lid.*



**TWO PIECE,
TAPERED WALL
PAPERBOARD
TUB or BUCKET**

Many of the design options illustrated on the previous pages are applicable to the tapered tub or bucket as well as to the straight wall can.

The most significant differences between the categories are the shape of the body blank and the ability for formed tubs, cups or buckets to be nested. Nesting allows more containers to be packed per case than for a like sized straight wall can.

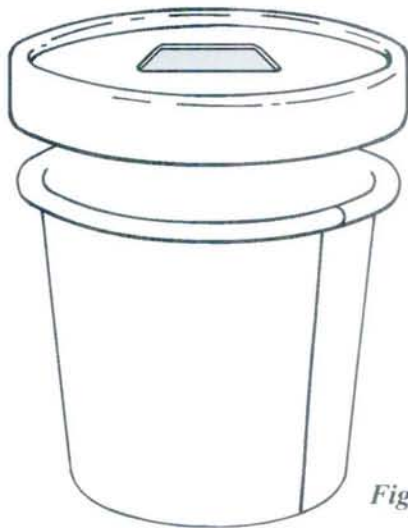


Figure 1

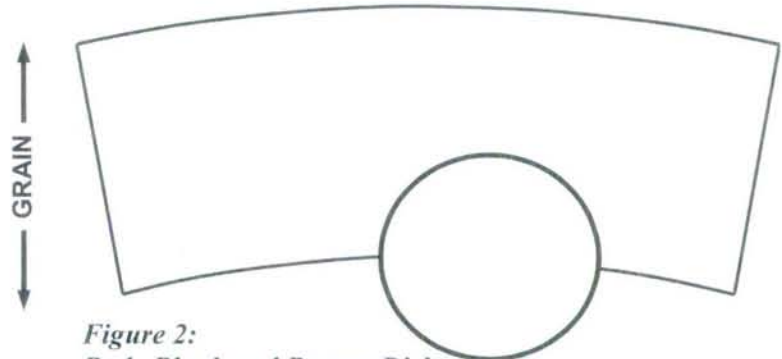


Figure 2:
Body Blank and Bottom Disk

Shown here are the two component parts of the typical tapered tub. Figure 1 illustrates a familiar use of the single lap tapered tub. This is the classic paperboard tub and lid which has been a container of choice for premium ice cream.

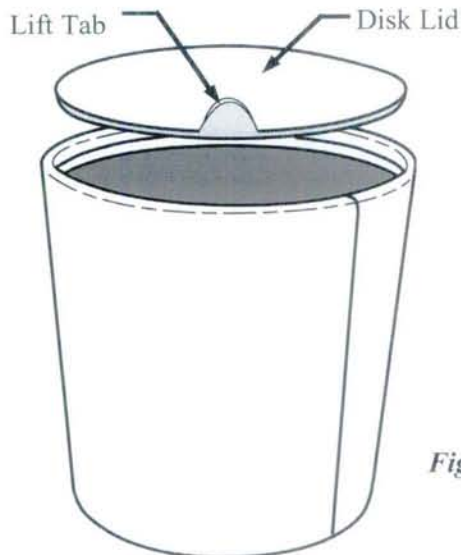


Figure 3

Figures 3 and 4 illustrate another all paperboard tapered tub design configuration.

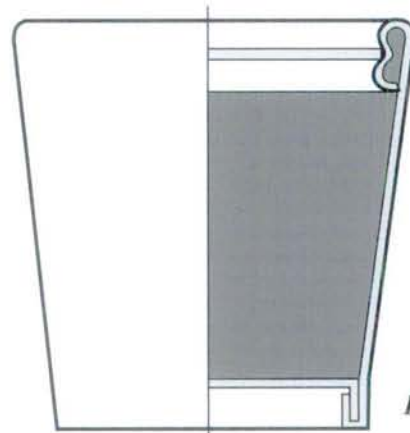


Figure 4



Cans, Tubs, Cups and Buckets
Convolute Containers

**CONVOLUTE
PAPERBOARD
CONTAINERS**

The convolute container is essentially a multiple ply version of a single lap can. A single web of paperboard is fed onto and wrapped around a mandrel to form a master tube. The tube is cut into individual body lengths and then removed from the mandrel.

This is an intermediate motion process and is capable of making straight wall container bodies only. While a viable process, it lacks the design flexibility of the single lap container and the speed potential of the spiral wound tube process, limiting its commercial success. Most, if not all, of the top and bottom end closure configurations shown on pages 5.101 and 5.102 are applicable to the convolute container.

The convolute container is typically finished with a printed single lap paper label which is applied after the end capping process.

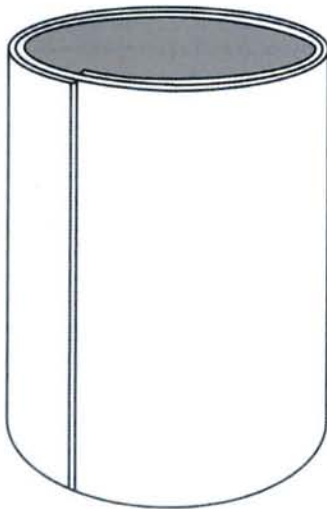


Figure 1

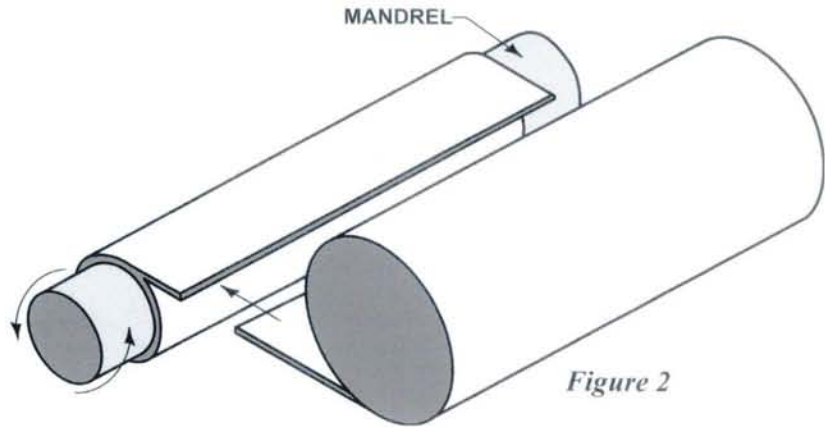


Figure 2

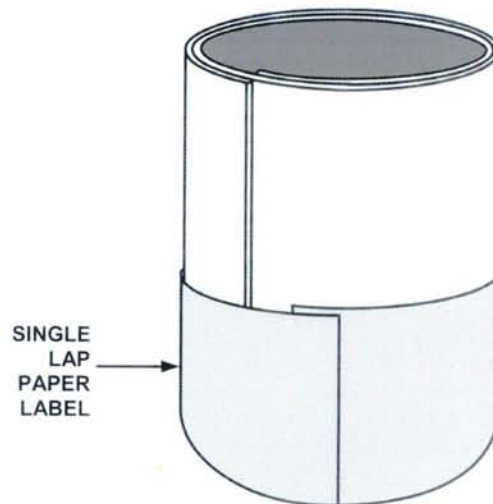


Figure 3

Cans, Tubs, Cups and Buckets

Spiral Wound Containers

SPIRAL WOUND
CONTAINERS

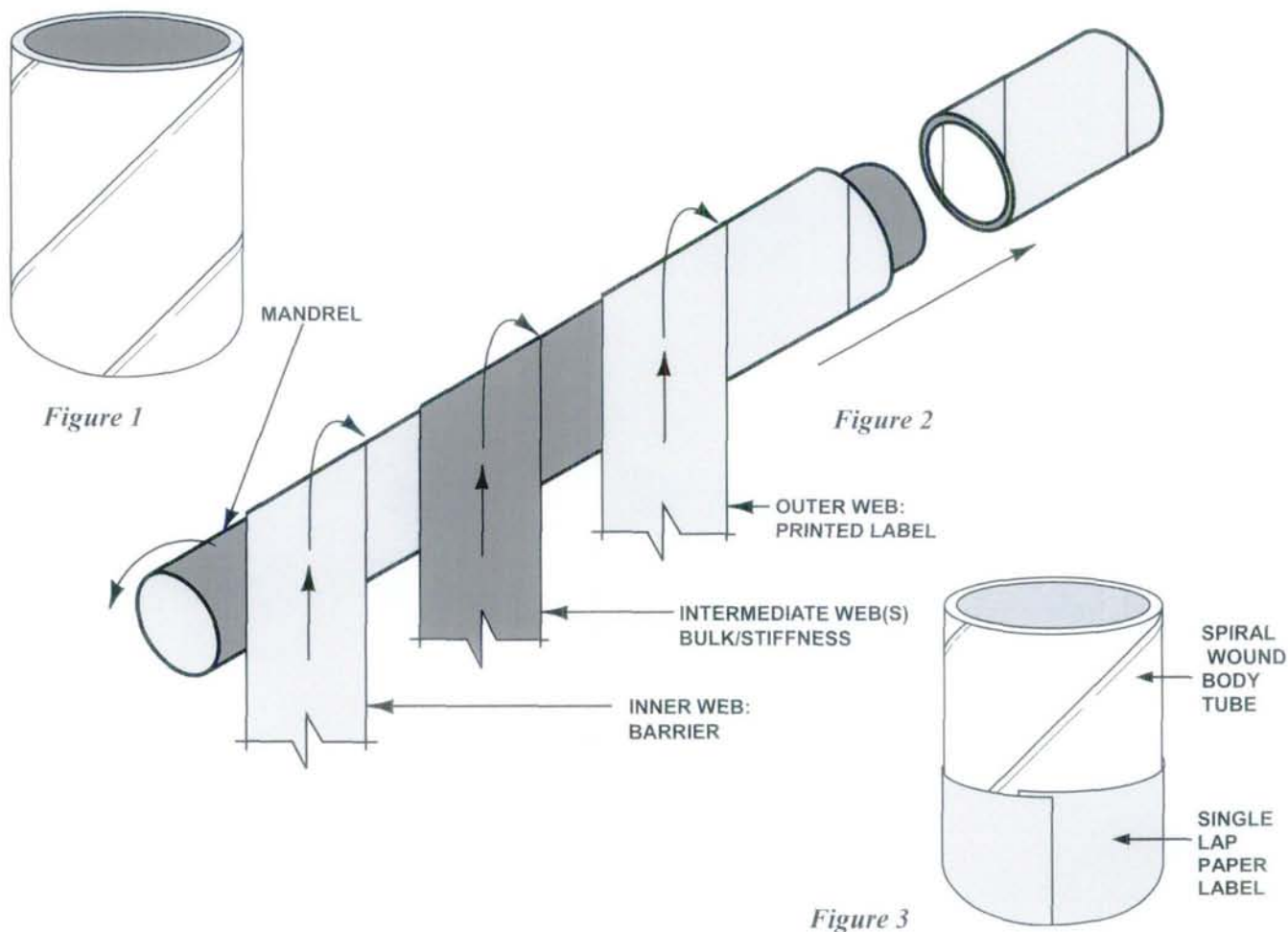
One or more webs of paper, paper/foil or paperboard are fed at an angle and continuously wrapped around a fixed mandrel. These webs may be butted or slightly overlapped, depending on the function of each web.

The configuration may be as simple as a single, non-barrier overlapped web as used for paper towels or gift wrap tubes. For packaging uses it is typically made from two or more layers which may impart barrier, bulk, stiffness or graphic qualities to the finished tube.

Figure 2 illustrates how a multi-ply spiral wound can body might be formed. As shown here, the printed label is spiral wound. Another option is to apply a single lap label to a spiral wound body (Figure 3).

The spiral wound can does not have the side seam bulk of a single lap container, making it easier to achieve end cap barrier seal integrity. Its major limitation is that it is available only as a straight wall container. Tapered tubs and buckets are not possible with this process.

Most of the top and bottom closure configurations shown on pages 5.101 and 5.102 are also applicable to the spiral wound container body.



COMPONENT PARTS

Since its inception in the 1830's the set up box has been associated with high end gift packaging. The materials and method of assembly are relatively unchanged. The mainstay of the set up box industry is the square or rectangular tray with corner stays and a paper wrap. The basic components of the set up box are discussed below.

FUNDAMENTAL BUILDING BLOCKS OF A SET UP BOX

- **PAPERBOARD BLANK:**
Heavy caliper non-bending chip paperboard (chip board) typically ranging from .033 to .060. The chip board may be plain, stained, or have a white liner.
 - **CORNER STAYS:**
Plain or reinforced tape to secure the corners in the erected position.
 - **PAPER WRAP:**
Typically 70 pound pre-printed litho paper, coated one side.
-

BASIC METHOD OF CONVERTING AND ASSEMBLY

A typical production operation might include tandem lines; one creating bottoms and a second forming lids.

- Non-bending chip blanks are cut scored, corner cut and punched (formed) into trays.
 - Corner stays are applied on a *quad stayer*.
 - The paper wrap is applied. This wrap may be a simple rectangular blank or diecut to yield a more tailored finished corner. It may be applied as a tight wrap, where the paper is 100% adhered to the underlying chipboard, or as a loose wrap with only the perimeter edges secured.
-

ADDITIONAL FINISHING STEPS

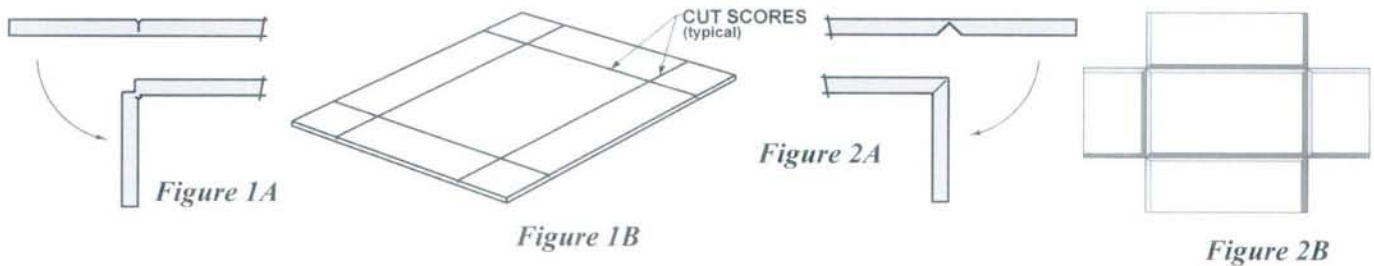
- After wrapping, the lids and/or bottoms may be further decorated by hot stamping or silk screening.
 - A common alternative to a set up box lid is a clear vinyl plastic, full or partial depth lid. The vinyl is diecut, formed and solvent-sealed in the corners. These clear plastic lids may also be decorated using hot stamping or silk screening.
 - Custom set-up boxes could include hinges or locks, or applied embossed labels.
-



SET UP BOX CONVERSION

STEP 1: SCORING

Typically accomplished by cut scoring the paperboard to create the fold lines. Refer to Figures 1A and 1B. A less common alternative, but appropriate to heavier caliper board would be to skive the blank as illustrated in Figures 2A and 2B.

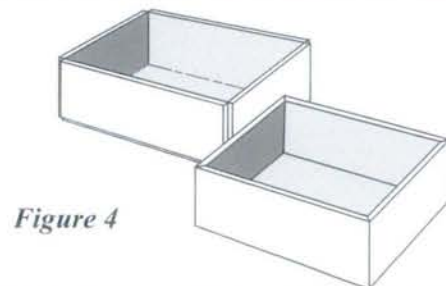
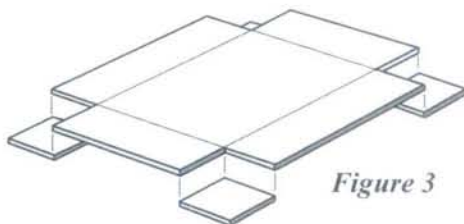


STEP 2: CORNER NOTCHING

In a separate step, corners are removed to create a base with hinged side and end walls. (Figure 3)

STEP 3: PUNCHING (forming)

The corner notched blank is plunged into a form to create the basic set up box tray. (Figure 4)

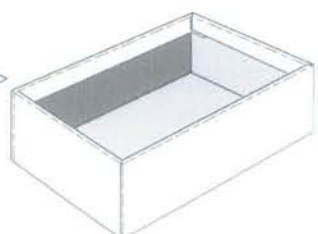
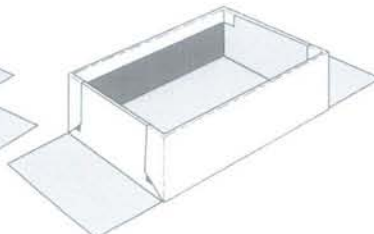
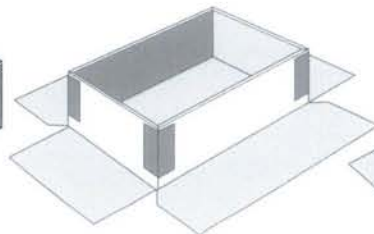


STEP 4: CORNER STAYING (taping)

A plain or reinforced paper tape is applied to secure the corners. (Figure 5)

STEP 5: WRAPPING

A paper wrap is affixed to the base, then wrapped around the side and end walls to complete the set up box. (Figures 6A, 6B & 6C)



**TWO PIECE
EXTENDED EDGE
TRAY**

While the majority of commercial set up boxes are classic rectangular or square four-wall trays, the process allows for a good deal of latitude in shape if the product, cost or marketing requirements can justify the expense of custom assembly equipment.

The package illustrated here has been associated with high end confections for decades. It is based on the same tray detailed on page 5.201 but adds a second paperboard component and more complex paper wrapping sequence.

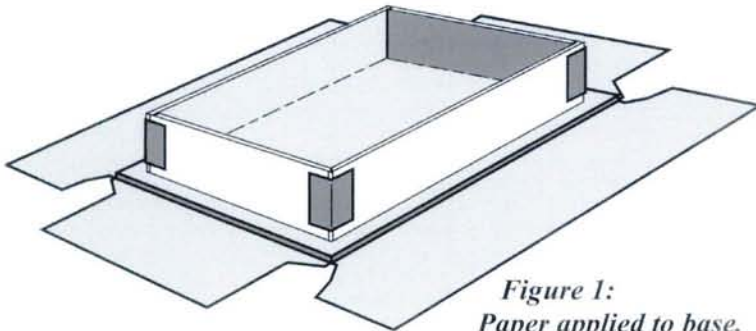


Figure 1: Paper applied to base.

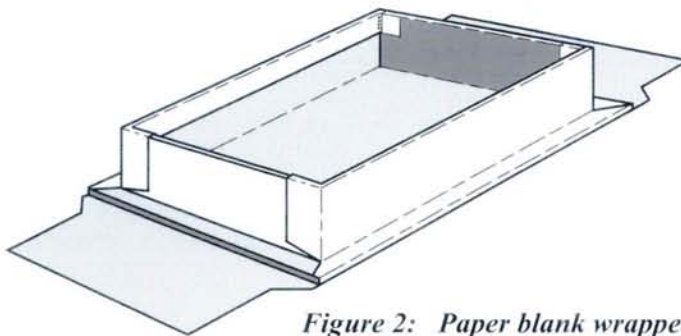


Figure 2: Paper blank wrapped around extended edge and side panels.

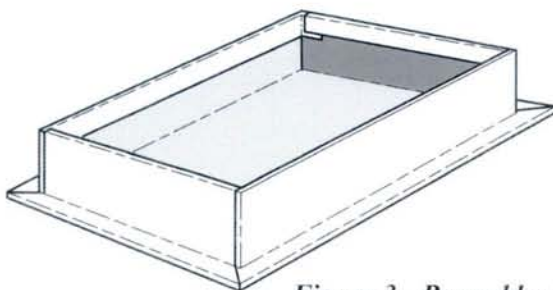


Figure 3: Paper blank wrapped around extended edge and panels to complete the tray.

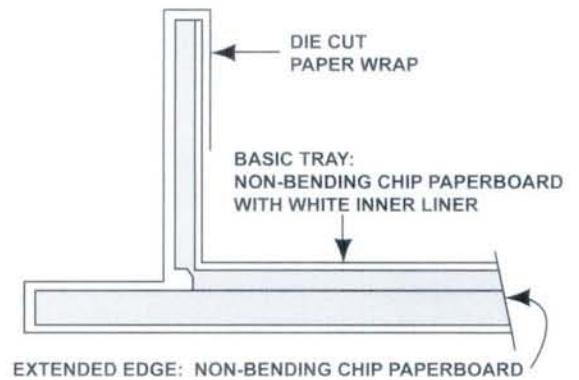


Figure 4: This best illustrates how the paper is wrapped around the extended edge, up the outer surface of the side or end panel, then secured to the inner surface of the side or end panel.



Set Up Boxes
Shape Options

**MULTI-PIECE
TELESCOPING
OCTAGONAL
BASE and LID**

This highly specialized structure illustrates the creative potential of the set up box.

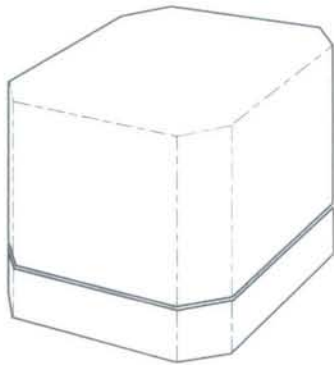


Figure 1A

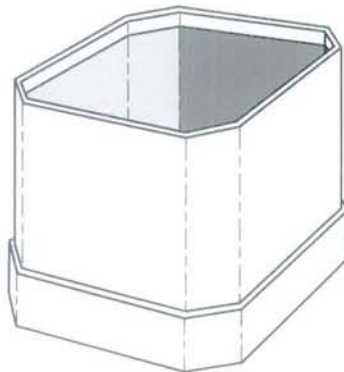


Figure 2A

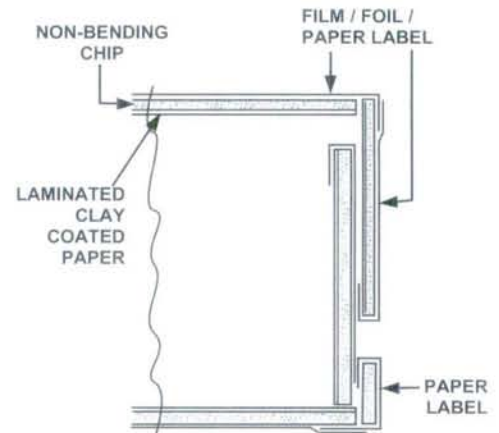


Figure 3A

**LID or COVER
OPTION**

A full or partial depth telescoping lid is the more common form of cover for the set up tray, but a widely used alternative is the semi-rigid clear plastic lid illustrated below. It is telescoped either inside or outside a set up tray base.

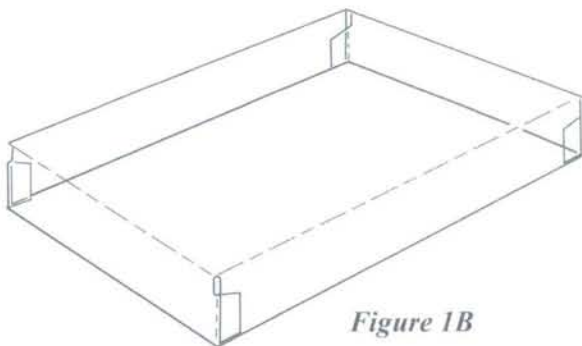


Figure 1B

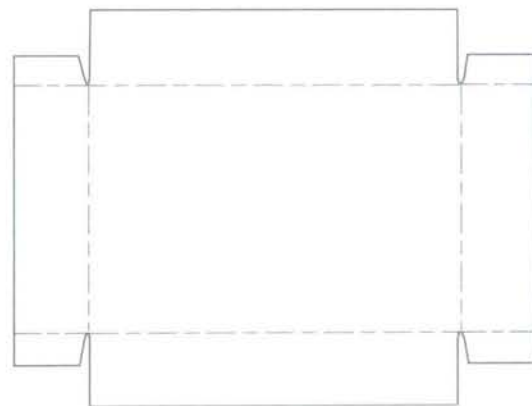
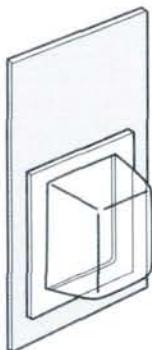


Figure 2B



The basic thrust of this portion of Alternative Paperboard Packaging is to spotlight structures that combine a basic paperboard component with one or more other packaging materials (film, rigid plastics, metal; or a second type, caliper or grade of paperboard) to yield a package that maximizes the virtues of each material - where "the whole is greater than the sum of the parts."



PAPERBOARD and FLEXIBLE or SEMI-RIGID PLASTIC

Paperboard combined with extruded, draped or laminated film; laminated foil, adhesively secured flexible film (window); laminated decorative paper; heat sealed or mechanically combined semi-rigid thermoformed plastic materials, inner bags, or applied film or paper patches.

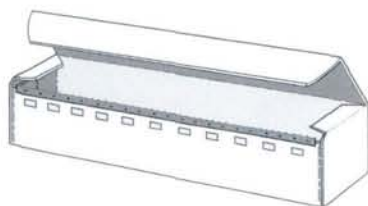
Examples: Skin packs, blister cards, embossed film laminations, bag-in-box.



PAPERBOARD and RIGID PLASTIC COMPONENTS

Paperboard structures enhanced with special purpose molded plastic components.

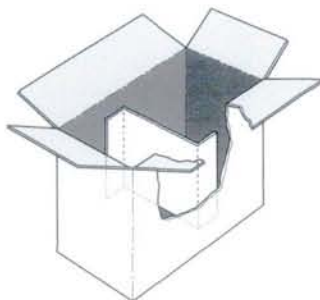
Examples: Pour spouts, closures with integral dispensing features.



PAPERBOARD and METAL

Paperboard structures enhanced with special purpose metal components.

Examples: End closures, tear strips, pour spouts, applied hinges and latching means.



DISSIMILAR PAPERBOARD GRADES and/or CALIPER

Combinations of two or more paperboard components, each contributing a unique quality to the composite.

Examples: Strength, economy, merchandising potential.



Combination Packaging
Paperboard / Flexible or Semi-Rigid Plastic

**SINGLE CARD
BLISTER PACK**

This is the most fundamental type of visual carded packaging (VCP) blister card. The thermoformed blister is sealed directly to the face panel of a paperboard card. Typically, the card is printed both sides, and may include a product access means, as illustrated in Figure 2.

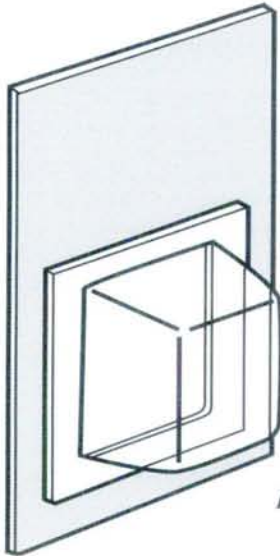


Figure 1

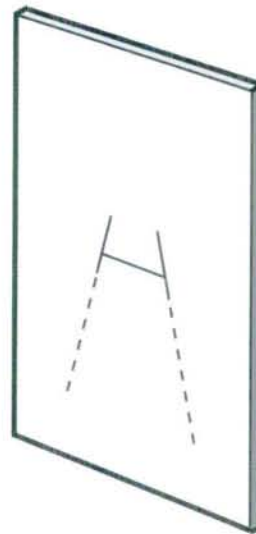


Figure 2

**HINGED
SINGLE POCKET
BLISTER PACK**

The thermoformed visual carded packaging blister is mechanically trapped between two plies of paperboard. This type of blister is typically secured by heat sealing; however, other means such as stapling or taping are also applicable. This type of VCP frequently includes a diecut product access means in the rear panel as illustrated in Figure 2.

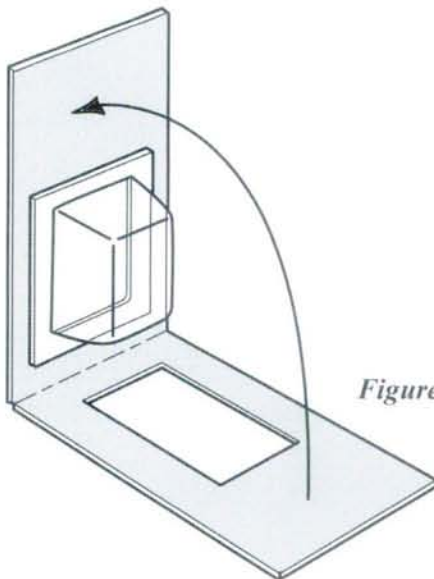


Figure 1

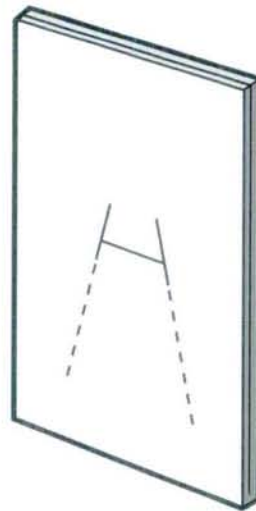
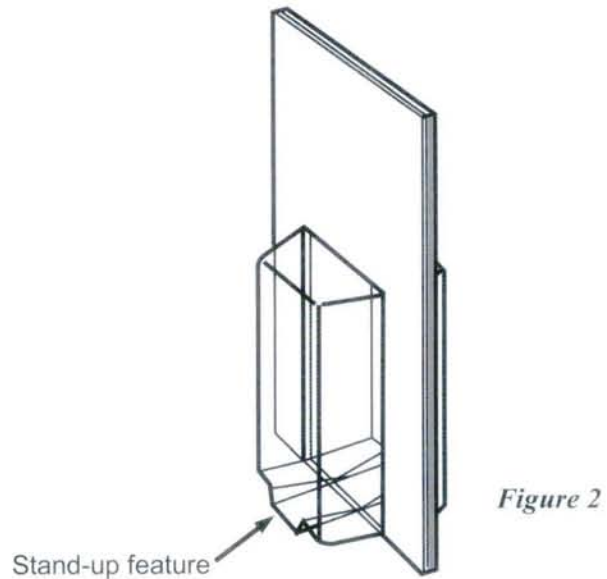
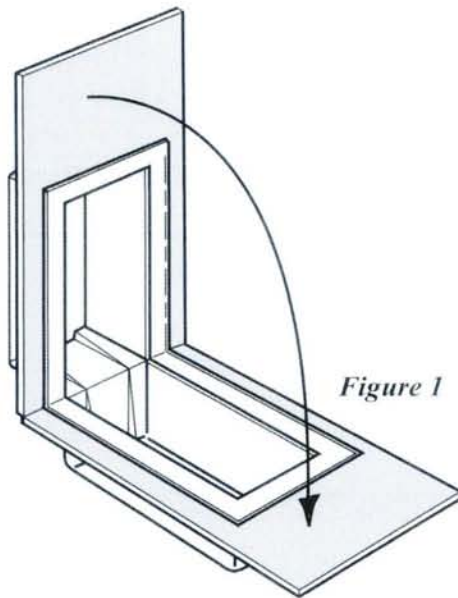


Figure 2



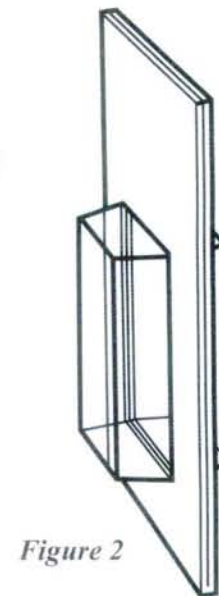
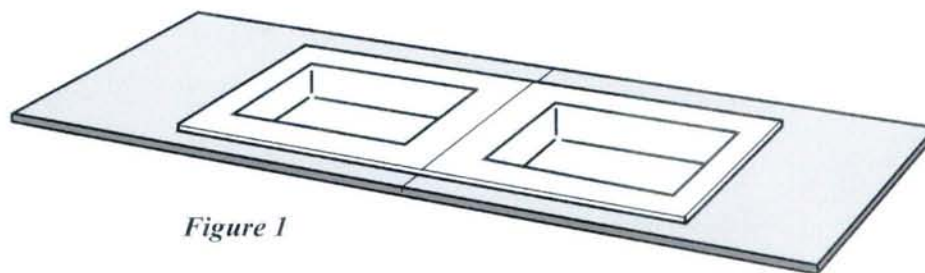
**HINGED
DOUBLE POCKET
BLISTER PACK**

This hinged VCP card with apertures in both the front and rear panels accepts a twin pocket, semi-rigid thermoformed blister resulting in a blister pack with product visibility from both the front and rear. As shown here, the blister also incorporates a stand-up feature.



**FLEXIBLE FILM
BLISTER PACK**

This paperboard/flexible film visual carded package is windowed and thermoformed in the converting plant, then shipped nested to the customer where it is loaded, closed and sealed.



Sheet film skin packaging, (a.k.a. "Skin Pack") is formed by positioning heated film over a product, then by means of a vacuum, drawing the film down onto and securing it to a porous paperboard substrate which has a sealable surface coating. Low density, non-clay coated boards work best.

Controlled areas of film to board adhesion and non-adhesion are derived by adding a block-out coating

and/or eliminating perforations in the areas where no adhesion is desired; usually directly under the product (refer to Figures 3 and 4).

The sheet film skin pack is illustrated in Figures 1 and 2 while Figure 5 shows the extrusion type skin pack. The skin pack is used both as a retail package and as a means of protecting small industrial product components within a larger shipping container.

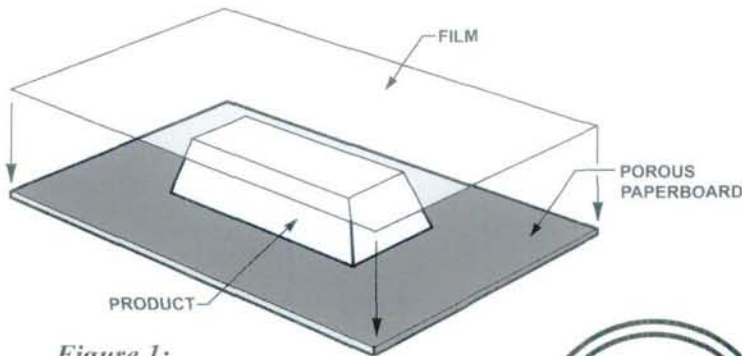


Figure 1:
 Sheet Film Skin Pack

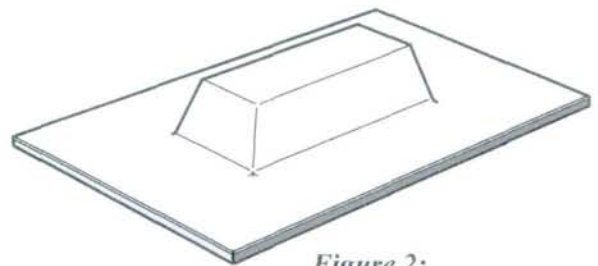


Figure 2:
 Sheet Film Skin Pack

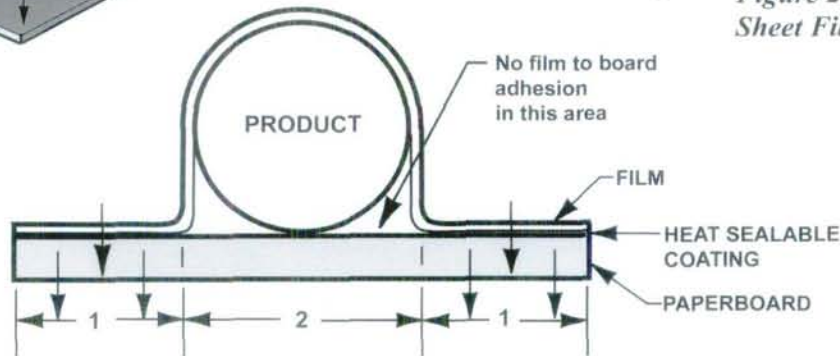


Figure 3:
 Adhesion control

1. Porous Areas
 2. Non-Porous Areas

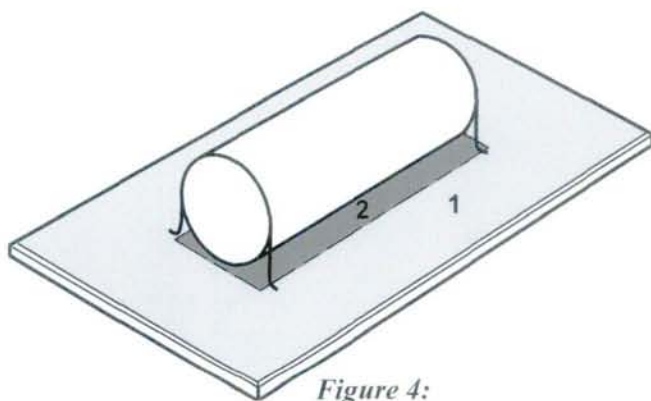


Figure 4:
 Adhesion control

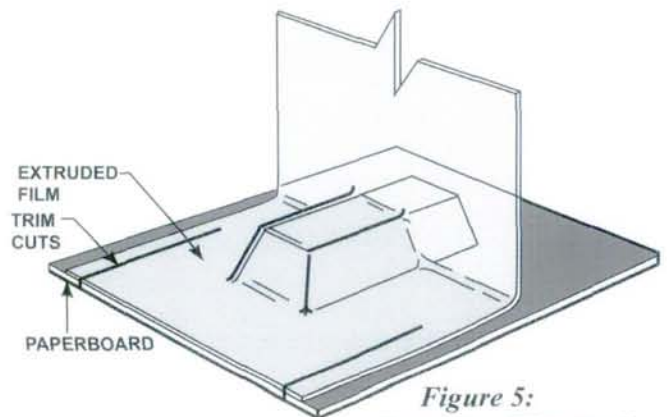


Figure 5:
 Extrusion Film Pack



Combination Packaging
Paperboard / Flexible or Semi-Rigid Plastic

**COMBINED BLANK of
PAPERBOARD and
SCORED & DIECUT
SEMI-RIGID SHEET**

While clear plastic scored, diecut and glued cartons exist, once graphics, informational and mandatory copy are added, their "see through" quality is greatly compromised. This interesting alternative combines the advantages of both materials. The carton blank consists of a scored and diecut plastic element secured in tight register to a paperboard element. The combination paperboard/plastic blank is erected, loaded and closed in the same manner as an all-paperboard carton.

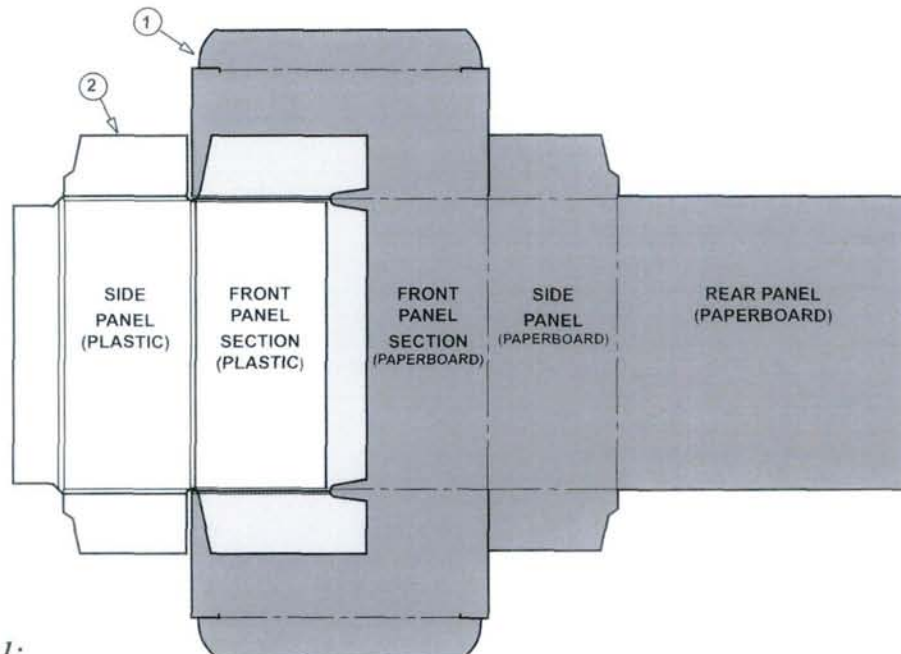


Figure 1:
For clarity, this illustration shows the combination blank print side down.

1. Printed paperboard blank.
2. Scored and diecut semi-rigid film secured in register to inside of paperboard blank

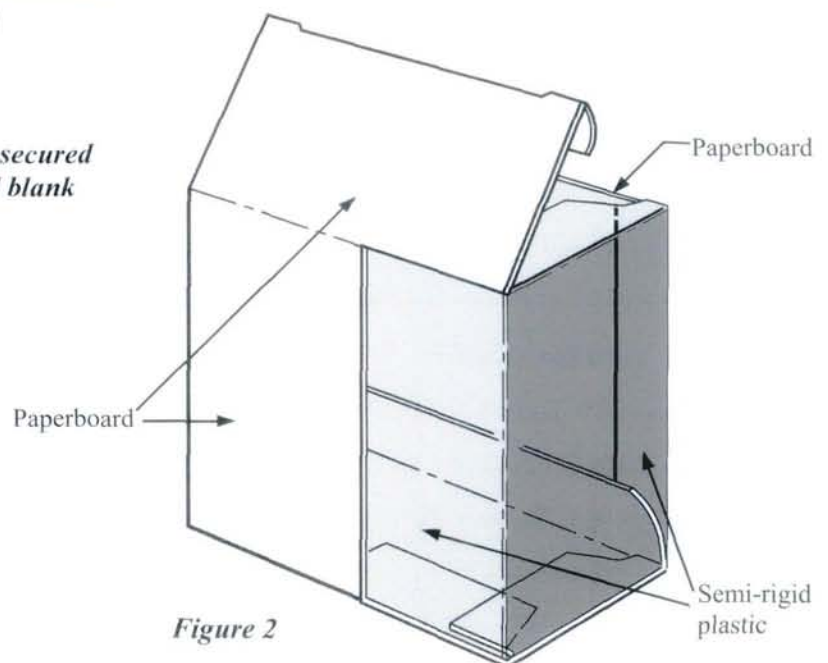


Figure 2



Combination Packaging

Paperboard / Metal

PAPERBOARD with METAL POUR SPOUT

This classic pour spout has been part of the paperboard packaging landscape for decades. Typically, a peelable patch over the spout is removed before use. Here, the pour spout is used in conjunction with a sift resistant end closure. Refer to page 7.302 for additional data on this feature.

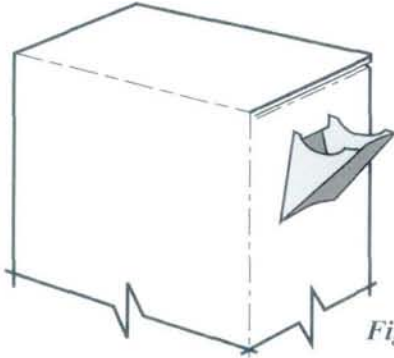


Figure 1

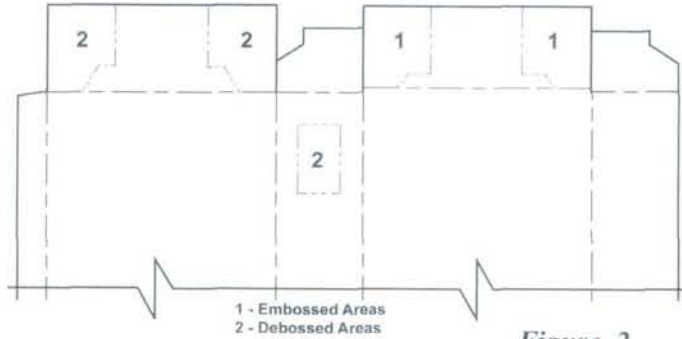


Figure 2

PAPERBOARD CARTON with METAL TEAR STRIP

Like the metal pour spout carton, the hood cover paperboard tray with an applied metal edge is another long-time industry standard. It is the style most commonly used for dispensing aluminum foil and plastic film.

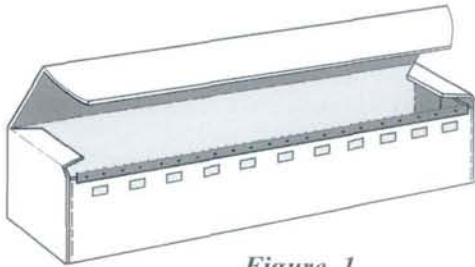


Figure 1

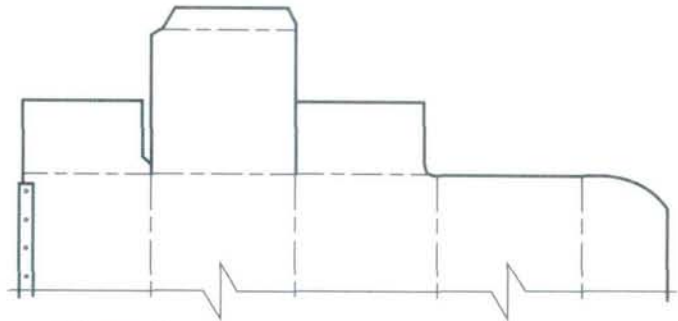


Figure 2

PAPERBOARD CAN with CRIMPED-ON METAL ENDS

Liquids, semi-liquids and powdered or granulated products are likely candidates for this material combination in the form of either a single lap or spiral wound can body.



Figure 1

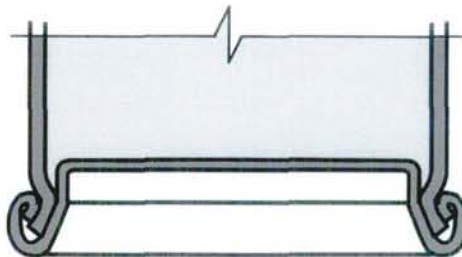
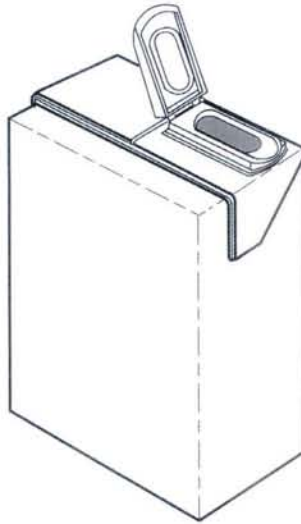


Figure 2

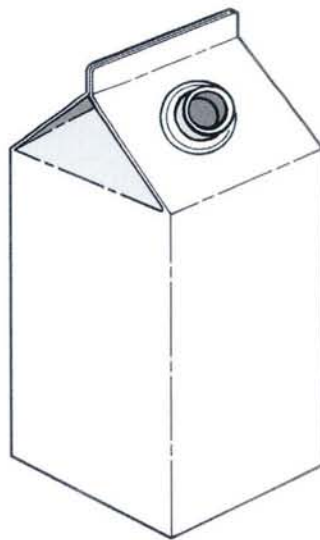
**PAPERBOARD BASE
FILM/FOIL COMPOSITE
INJECTION MOLDED
POUR SPOUT**

The fundamental aseptic package is illustrated on page 4.521 as part of the Unique Machine Formed Structures category. As shown here, the basic structure has been enhanced with the addition of an injection molded pour spout with an integral reclosing feature. This expands the package's use beyond its initial single service function.



**COATED PAPERBOARD
CARTON with
APPLIED INJECTION
MOLDED POUR SPOUT**

The classic gable top carton for liquids such as milk or juice utilized an integral paperboard pour spout (page 4.522). The same base carton with an applied injection molded pour spout has largely replaced the earlier version. The newer unit merges the economy and marketing superiority of paperboard with the reclosure convenience of the plastic pour spout feature.



**Combination Packaging
Paperboard / Paperboard**

**APPLIED
BULGE RESISTANT
STRAP**

This is an older example of combined paperboard. Product weight and outer carton board caliper dictate how substantial the strap material should be, ranging from paper to heavy caliper chip board. The strap is applied as a tip-on in the finishing operation. It functions as a bulge resistant feature and is an economical alternative to strap made from blank extensions of the more expensive printing grade carton stock.

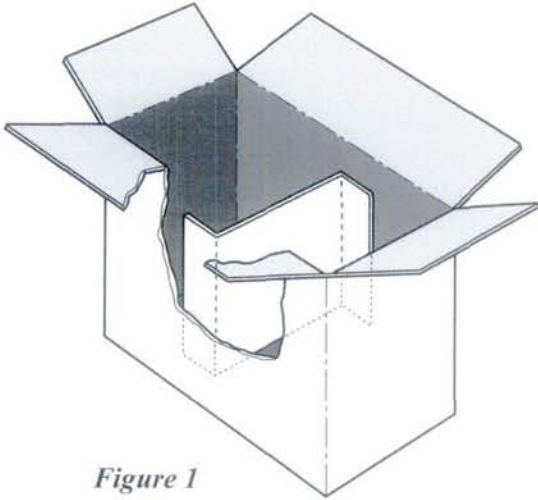


Figure 1

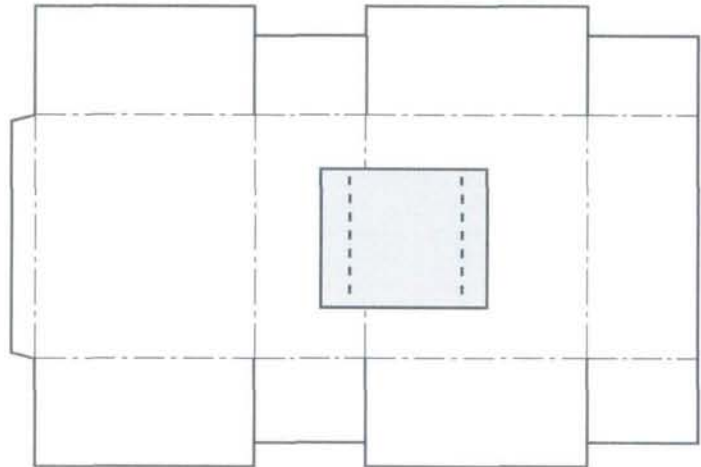


Figure 2: For clarity, this illustration shows the blank printed side down.

**APPLIED
BULGE RESISTANT
SLEEVE**

This combination offers both bulge resistance and overall stacking and handling strength. Here a full inner liner of inexpensive, heavy gauge chip board is fabricated into a sleeve, placed in tight register and spot glued to a printing grade outer carton blank.

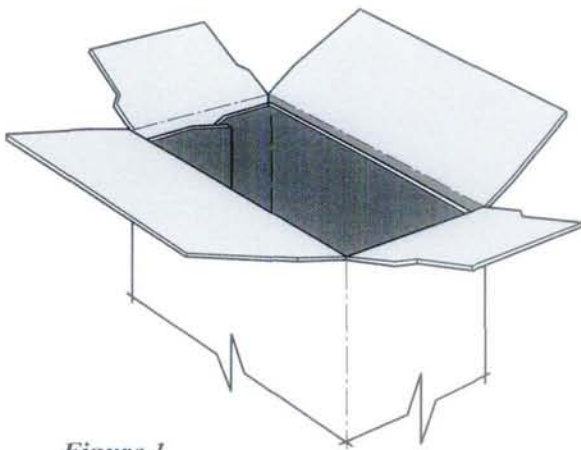


Figure 1

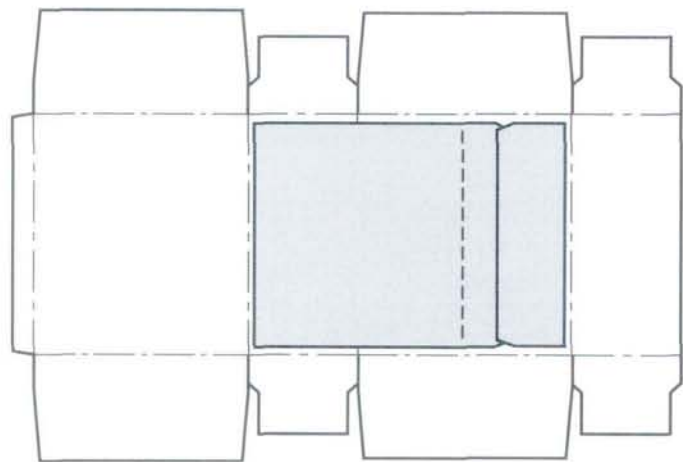


Figure 2: For clarity, this illustration shows the blank printed side down.



Combination Packaging
Paperboard / Paperboard

**FLIP TOP BOX with
APPLIED
“U” BOARD**

The rationale for combining separate components in this classic flip top cigarette box is economy of layout. One-piece flip tops that look and function the same are available but do not layout as effectively. For large volume production, as in the case of cigarette packaging, material savings justified the development of custom combining equipment.

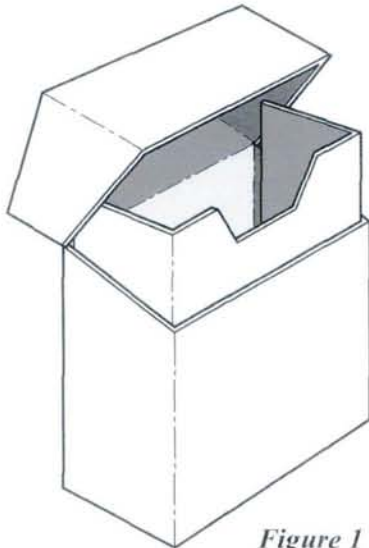


Figure 1

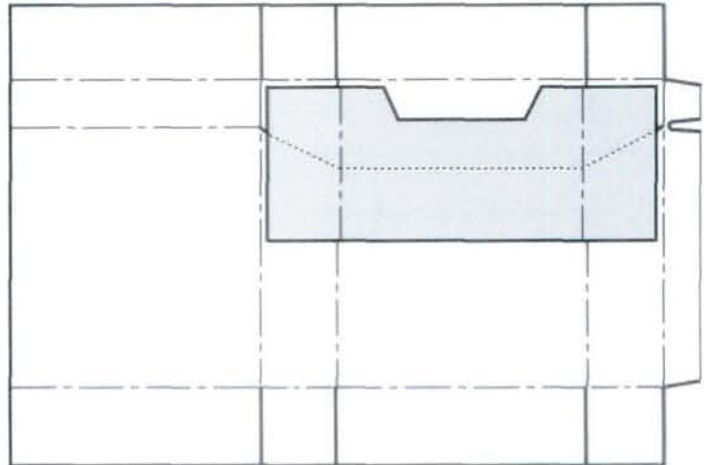


Figure 2: For clarity, this illustration shows the blank printed side down.

**TWO PIECE
BOTTLE
MULTI-PACK**

This hypothetical design is created to illustrate another example of combined paperboard. Finger holes and cap apertures dictate the use of a printable high tear resistant grade of paperboard for the top and side panel elements. Tear resistance is less critical for the bottom and end panel elements, allowing for a possible reduction of board grade and/or caliper.

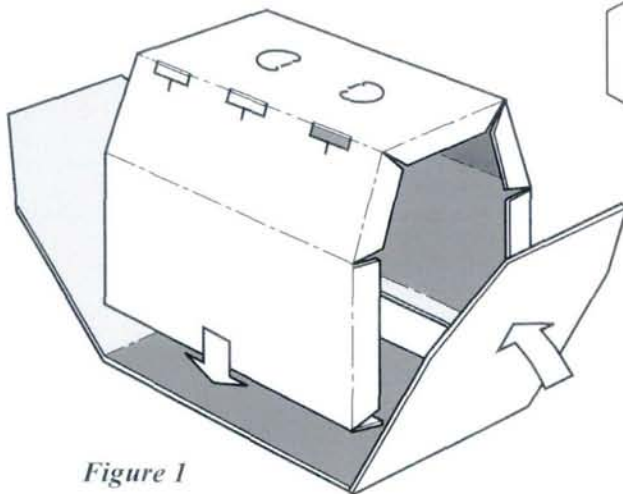


Figure 1



Figure 2

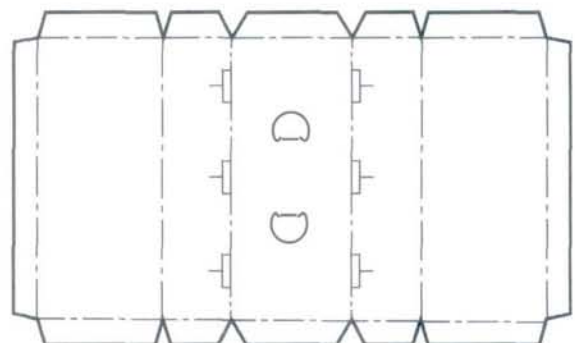


Figure 3



Combination Packaging
Paperboard / Paperboard

**TWO PIECE
HAND ASSEMBLED
STRAIGHT TUCK**

Not all paperboard/paperboard combinations need to be utilitarian, driven primarily by economics, or auto-assembled in the converter's finishing operation or on custom combining equipment. Here is an example of a hand assembled paperboard/paperboard combination created simply for its aesthetic appeal.

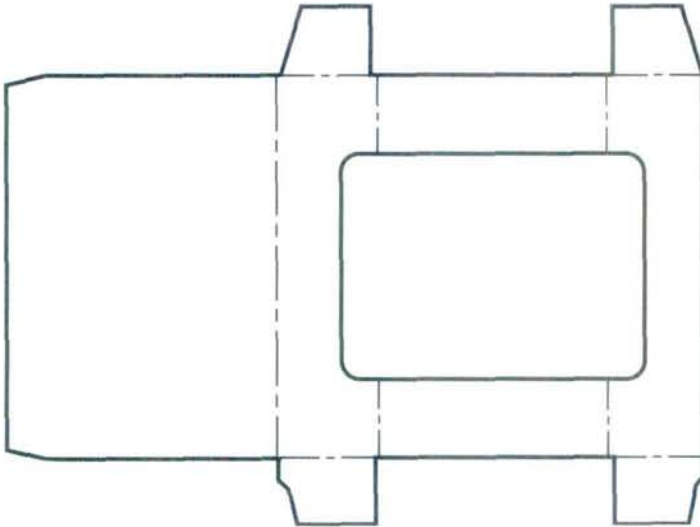


Figure 1
Outer Unit: Printed Paperboard

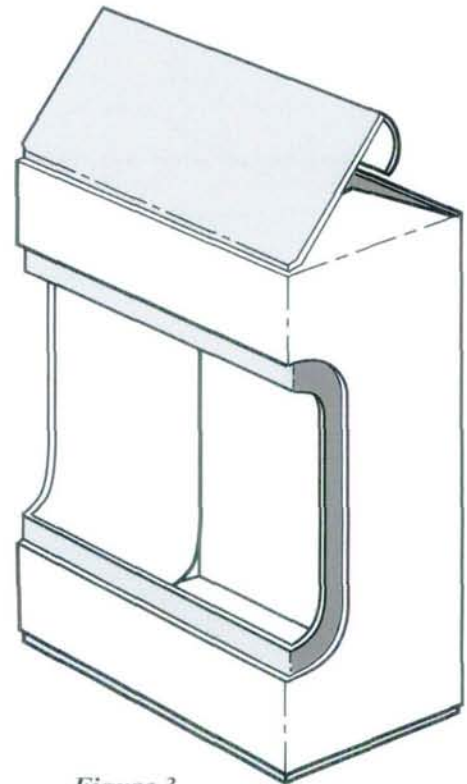


Figure 3
Assembled Carton

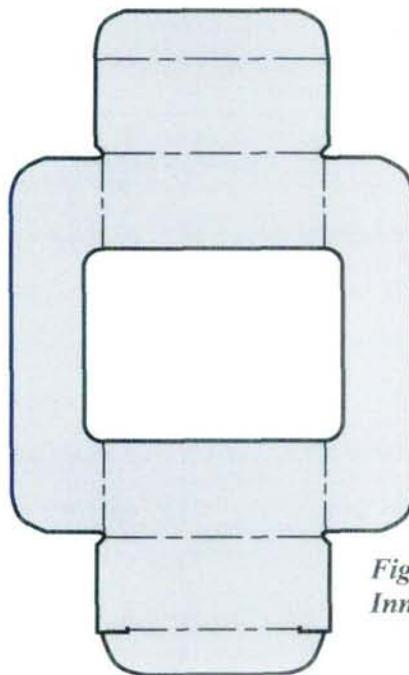


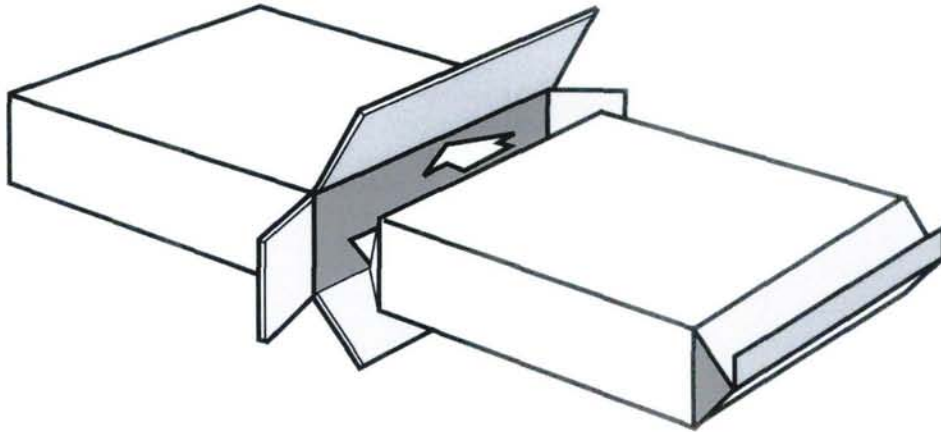
Figure 2
Inner Unit: Foil or metalized polyester laminated to paperboard



Combination Packaging
Paperboard / Paperboard

BAG IN BOX

This is a very attractive, low cost combination of barrier or sift resistance of a separate inner bag of paper, film, foil, or a combination thereof, and the product protection and marketing impact of a printed outer folding carton. Cereals are merchandised in this type package. The bag is first formed, filled and sealed, then inserted horizontally or vertically into the carton.



**SIFT RESISTANT
PATCH**

A simple paper or light weight film patch, pattern glued across the end closure panels and a portion of the adjacent carton body panels is an effective sift resistant feature for products that do not have high moisture or gas barrier requirements and do not need overall package barrier properties.

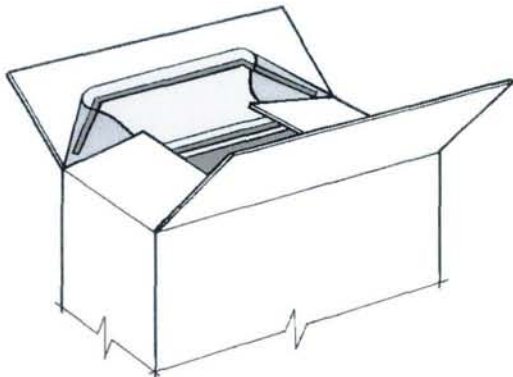


Figure 1

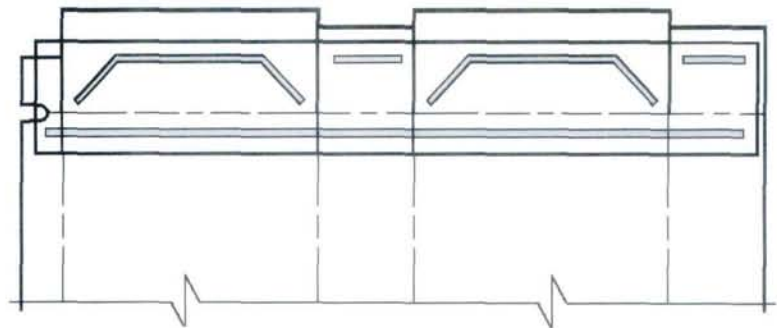


Figure 2





Small flute paperboard has been utilized by the folding carton industry more and more since the early 1990's. Pages 0.115 and 0.116 describe small flute paperboard and the two fundamental methods of fabrication and printing: a pre-printed paperboard sheet laminated to a single face corrugated base sheet, or direct printing on a fully assembled small flute paperboard sheet (a corrugated medium faced with a top and bottom liner).

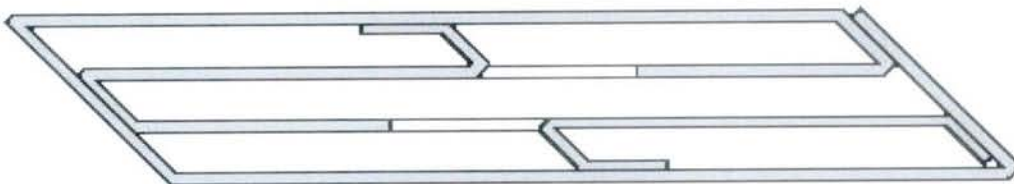
MATERIAL CHARACTERISTICS

Small flute paperboard offers excellent stiffness, stacking strength, tear and puncture resistance, cushioning and thermo-insulation qualities.

DESIGNING WITH SMALL FLUTE PAPERBOARD

Design detailing for E, F and N flute paperboard is essentially the same as for heavy caliper paperboard; although offsets, setbacks and fit tolerances are generally greater to accommodate the extra thickness of the substrate.

Many of the basic paperboard structures described and illustrated throughout this publication can be manufactured from small flute paperboard. However, structures with complex folds and layers such as illustrated below may not be suitable for small flute paperboard. The bulk of multiple layers of material could make gluing difficult or result in unsightly compression belt marks.



CONVERTING SMALL FLUTE PAPERBOARD

Direct print, usually offset lithography, is one technique in common use. However, printed liner stock which is laminated to a single face corrugated base will generally net the best print result.

Diecutting techniques are much like those used for heavy caliper paperboard. Windowing, side seam gluing and automatic bottoms are within the scope of conventional finishing equipment, but the shear bulk of the cross-section shown above would probably take it beyond the capabilities of most carton plant gluers.



**Small Flute Paperboard
 Tuck End Closure Options**

Because of the thickness of the fluted material it is common practice to offset dust flaps as illustrated in Figures 1 and 2 below. Slit lock tucks are commonly used, the tolerances increased to compensate for the extra material, but the slotted tuck as shown in Figure 1 is also a commonly used option. In the case of friction lock tucks, it is typical practice to have side edge setbacks on the tuck flap to prevent bulging or split scores in the corners. (Refer to Figure 2 - number 2). Refer to pages 1.002 and 1.003 for additional tuck end closure details.

**SLOT LOCK
 TUCK**

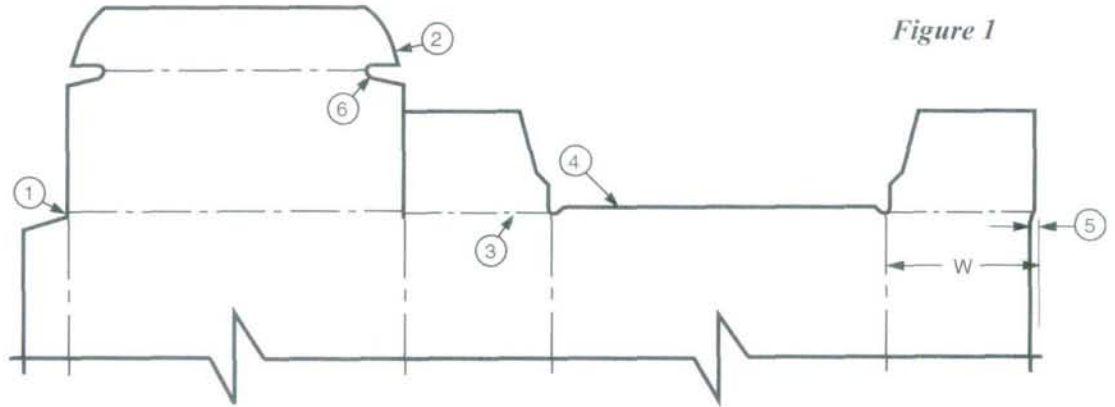


Figure 1

- | | |
|---|---|
| 1. Glue flap setback edge for dust flap clearance | 4. Raised edge (optional) |
| 2. Tuck flap edge setback | 5. Increased manufacturer's joint setback |
| 3. Dust flaps offset | 6. Slotted lock |

**FRICTION LOCK
 TUCK**

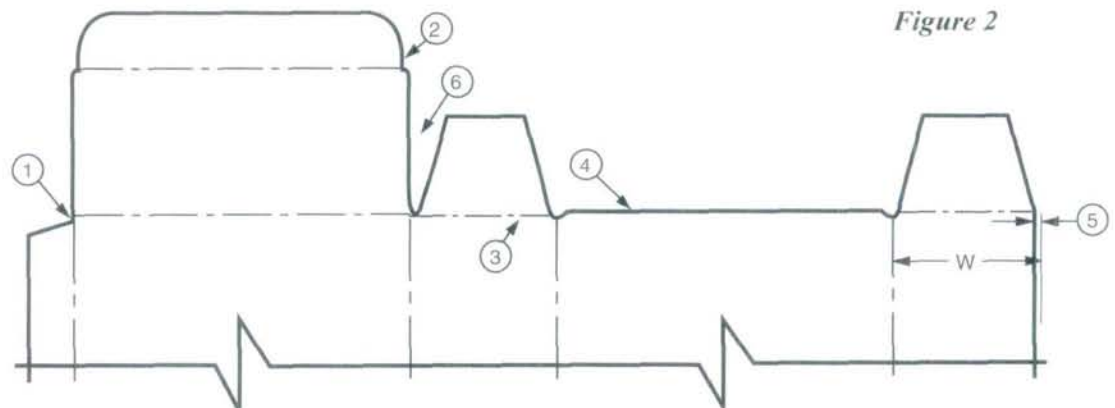


Figure 2

- | | |
|---|--|
| 1. Glue flap setback edge for dust flap clearance | 4. Raised edge (optional) |
| 2. Tuck flap edge setback | 5. Increased manufacturer's joint setback |
| 3. Offset dust flaps | 6. Strip-out at rear edge of dust flaps (optional) |



Small Flute Paperboard

Seal End, Auto-Bottom and 1-2-3 Lock Bottom Closures

As in the case of tuck end closures, the basic styles are typically the same as for heavy caliper paperboard; however, the tolerances and setbacks may be greater to compensate for the thicker material. The illustrations below show the areas of concern on three of the major types of tube style end closures.

SEAL END CLOSURE

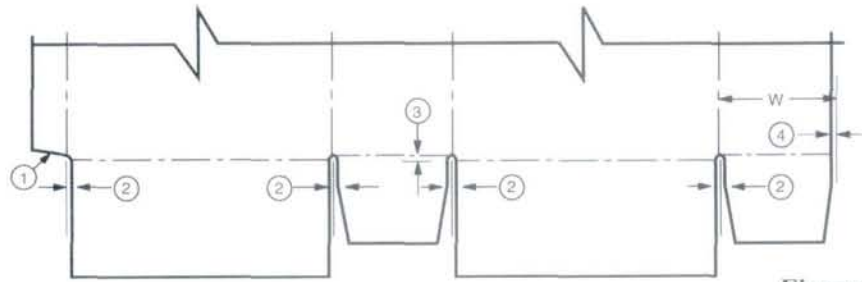


Figure 1

- | | |
|---|---------------------------------|
| 1. Glue flap setback edge for dust flap clearance | 3. Offset dust flaps |
| 2. Closure panel and dust flap edge setbacks | 4. Manufacturer's joint setback |

AUTO-BOTTOM CLOSURE

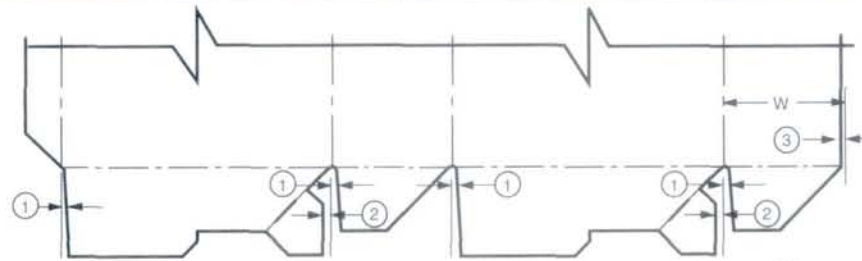


Figure 2

- | | |
|---|---------------------------------|
| 1. Closure panel and closure flap edge setbacks | 3. Manufacturer's joint setback |
| 2. Glue tab edge setback | |

HOUGHLAND or 1-2-3 BOTTOM LOCK CLOSURE

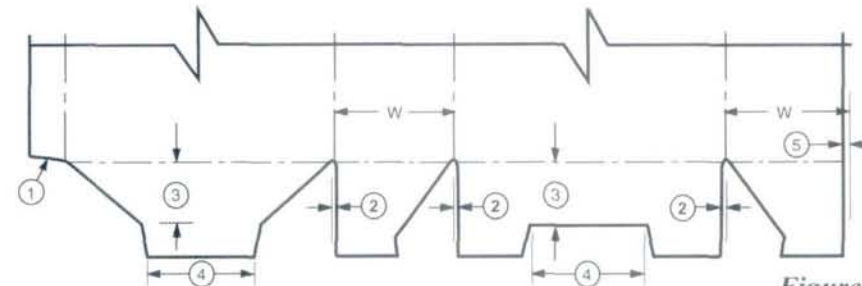


Figure 3

- | | |
|--|--|
| 1. Glue flap edge setback | 4. Male and female lock width tolerances |
| 2. Closure panel and flap edge setback | 5. Manufacturer's joint setback |
| 3. Male & female interlock tolerances | |



**CRIMPED CORNER,
FLANGED TOP
TAPERED TRAY**

Below are two examples of thermoformed paperboard trays, and examples of shape options and compartmentalization. Options range from plain, uncoated trays for industrial or institutional use to high graphic impact, barrier board containers suitable for dual ovenable or other retail uses. The pressure formed paperboard is an attractive alternative to C-PET, foil, molded pulp or foam trays.

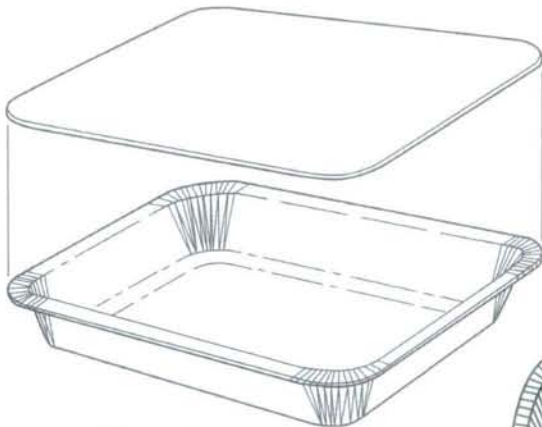


Figure 1



Figure 3

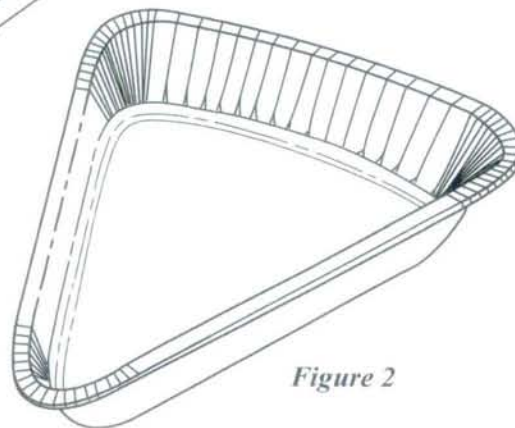


Figure 2

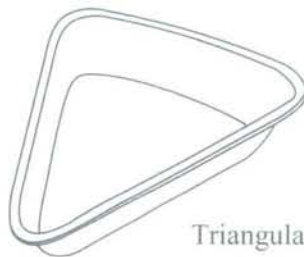
TYPICAL SHAPE OPTIONS



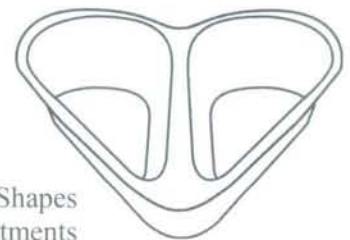
Square or Rectangular



Round, Oval or Elliptical



Triangular



Special Shapes
Compartments



**LID OPTIONS for
THERMOFORMED
PAPERBOARD TRAYS**

A number of closure options are available ranging from a simple shrink film overwrap to peelable sealed film or paperboard covers, crimped foil covers, or formed plastic or paperboard lids or domes.

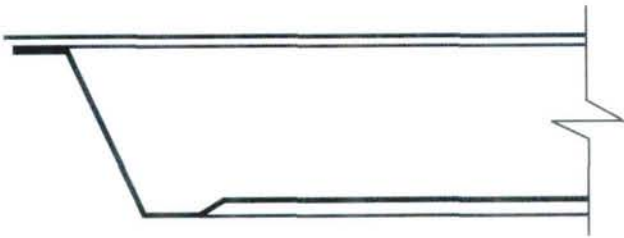


Figure 1: Heat sealed, peelable film

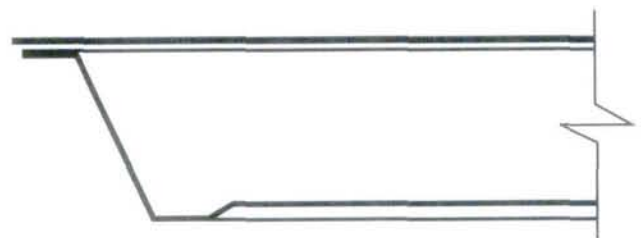


Figure 2: Heat sealed, peelable paperboard

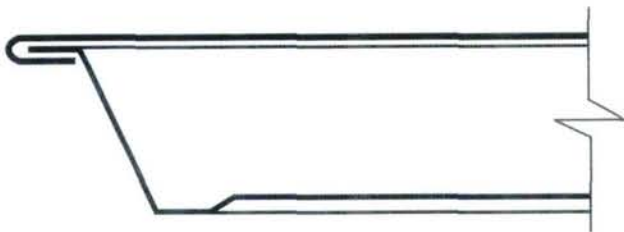


Figure 3: Crimped foil

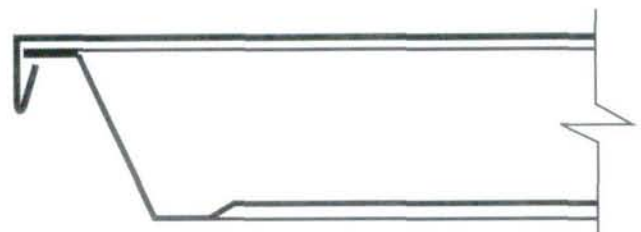


Figure 4: Formed, clip-on paperboard lid

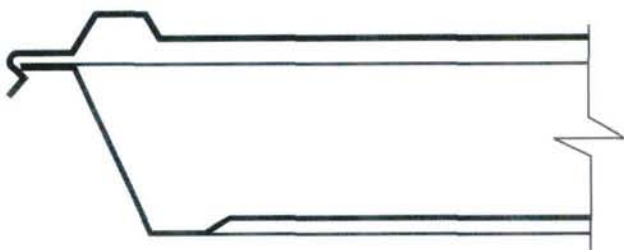


Figure 5: Thermoformed, clip-on plastic lid





6.000

PAPERBOARD PACKAGING:
PROMOTIONS

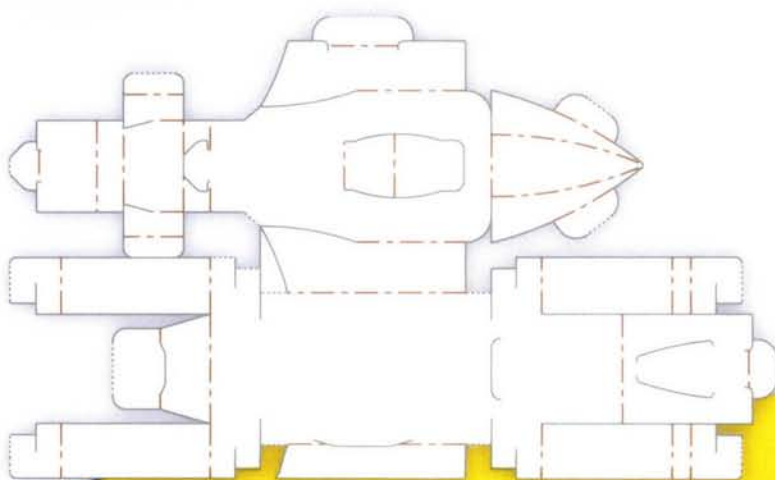
NON-CARTON STRUCTURES



6.000

OVERVIEW : PROMOTIONS + NON-CARTON STRUCTURES

- 6.100 *Promotional Packaging Combinations*
- 6.200 *Header Panels and Hanger Tabs*
- 6.300 *Partitions*
- 6.400 *Easel Features*
- 6.500 *Novelty Structures*

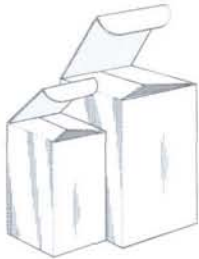


IDEAS AND
INNOVATION
SECOND EDITION

6.000
PROMOTIONS

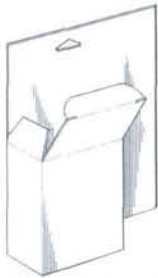


Most of the structures in this section cannot be classified as tubes or trays. In fact, it is not even appropriate to call many of them carton styles. Some may incorporate carton design elements (tucks, anchor locks, etc.), but essentially they are highly specialized structures aimed at very specific end uses.



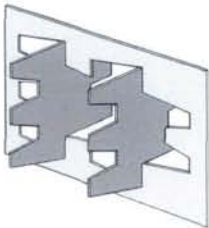
6.100 MULTI-CARTON STYLES

Structures that allow for the combination of two or more like or related products into a “package deal” combination. (Book style cartons, hinge-connected cartons, etc.)



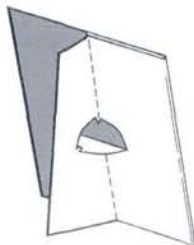
6.200 CARTONS with HEADER PANELS and/or HANGER TABS

Cartons with integral header cards and/or hanger tabs. Typically variations on a basic tube style carton.



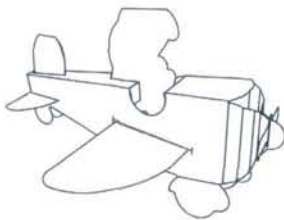
6.300 PARTITIONS

Separate partition units typically applicable to many types of basic tube, tray or wrap style structures.



6.400 COUNTER TOP EASEL DISPLAYS

Stand-alone displays or easel components that can be attached to a base carton.



6.500 NOVELTY STRUCTURES

Structures loosely based on tube or tray styles which may or may not contain product, but are generally intended for entertainment purposes.



**INTEGRALLY
 CONNECTED
 STRAIGHT TUCK &
 REVERSE TUCK
 TUBES**

The blank in Figure 1 corresponds to the structure shown in Figure 2 where the structure has different cell heights. Figure 3 illustrates the same basic structure where both cells are the same height. Figure 4 demonstrates the folding sequence which is applicable to both versions.

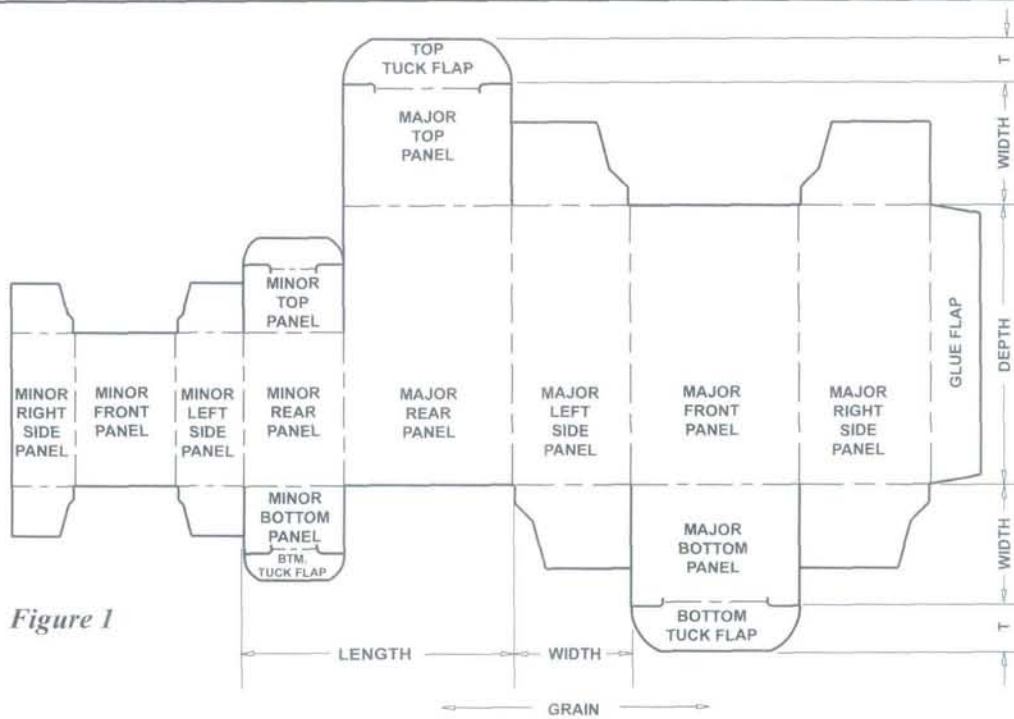


Figure 1

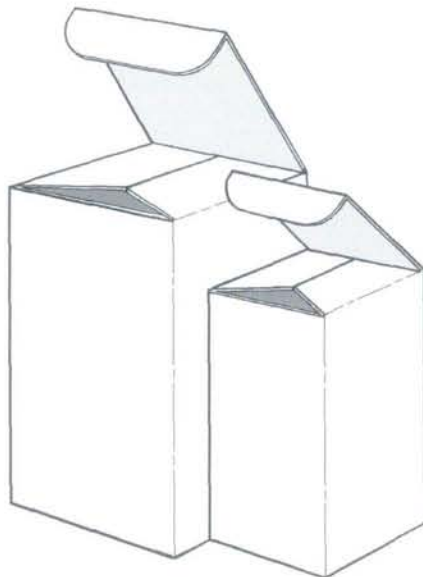


Figure 2: Cells of different length, width and height

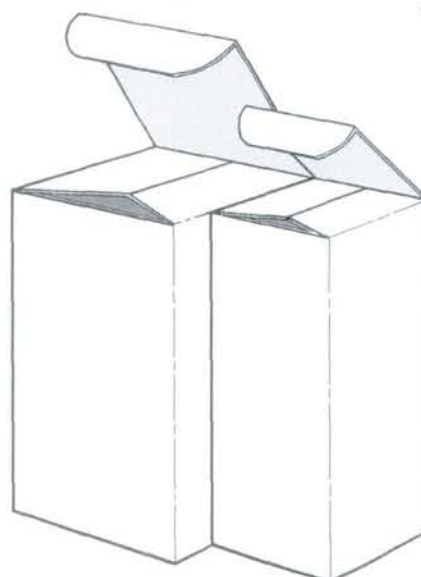


Figure 3: Cells of different length and width; common height

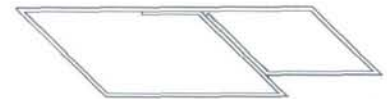


Figure 4: Folding Sequence Common to both versions (Top View)



**STRAIGHT TUCK
BASE with HINGED
TWO PLY COVER**

The book style illustrated here has a two ply cover for full graphic potential. A more simple single ply version is possible but, even with reverse printing, does not have the same graphic impact of the two ply cover.

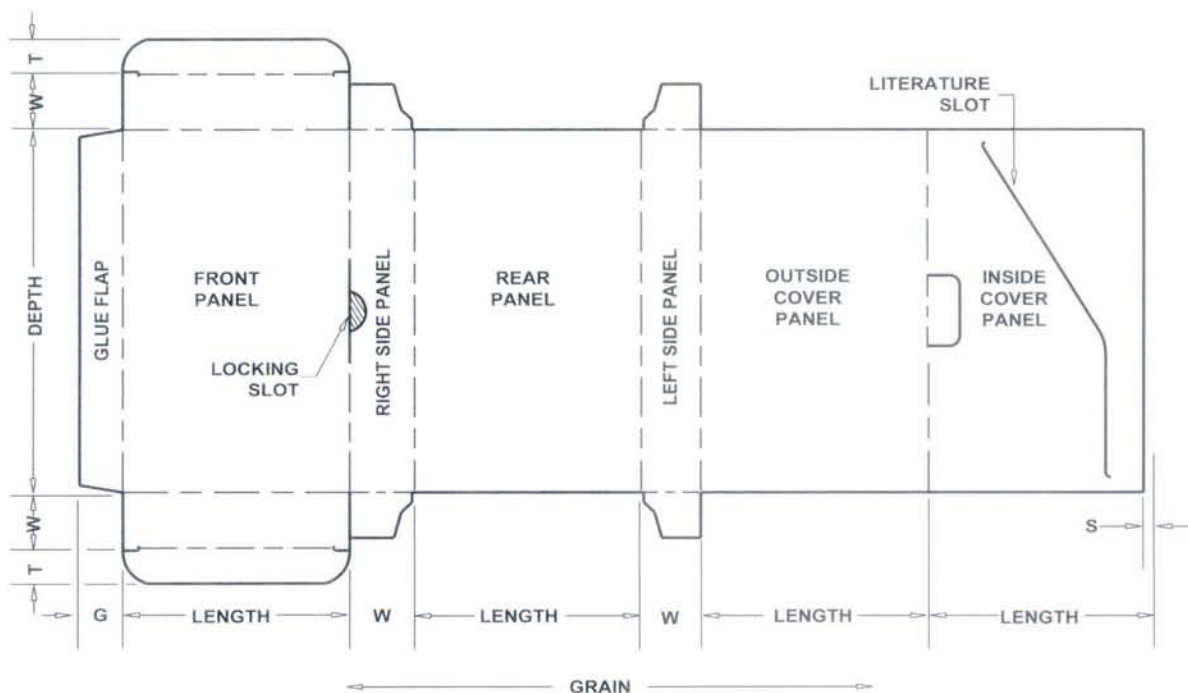


Figure 1

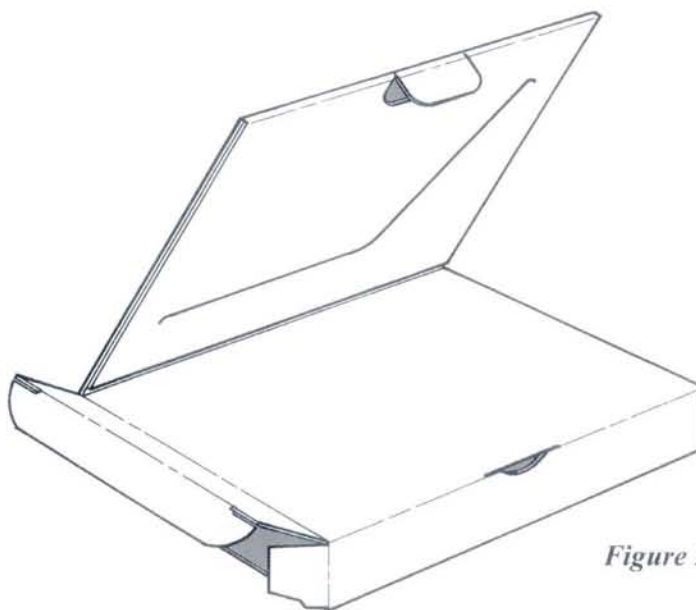


Figure 2



**TWIN HINGED
 STRAIGHT TUCK**

This variation of the book style is designed to hold product in both halves of the "book." Also illustrated (Figure 3) is a separate "U" board used to lock the book closed. A shipping sleeve is another possible closure means.

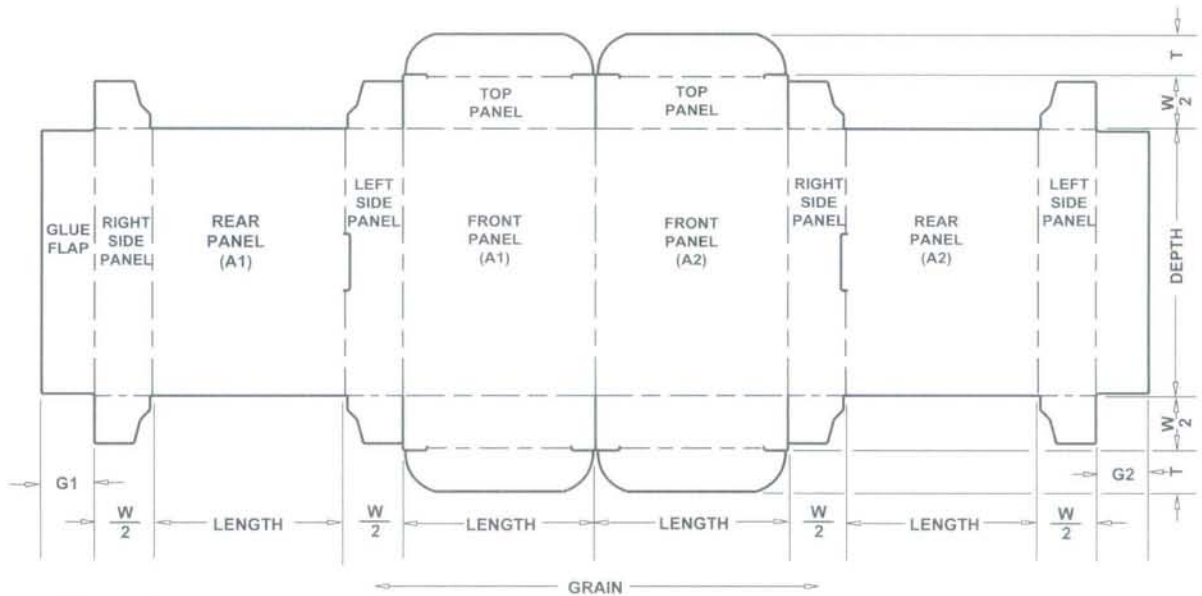


Figure 1



Figure 4: Folding Sequence - Top View

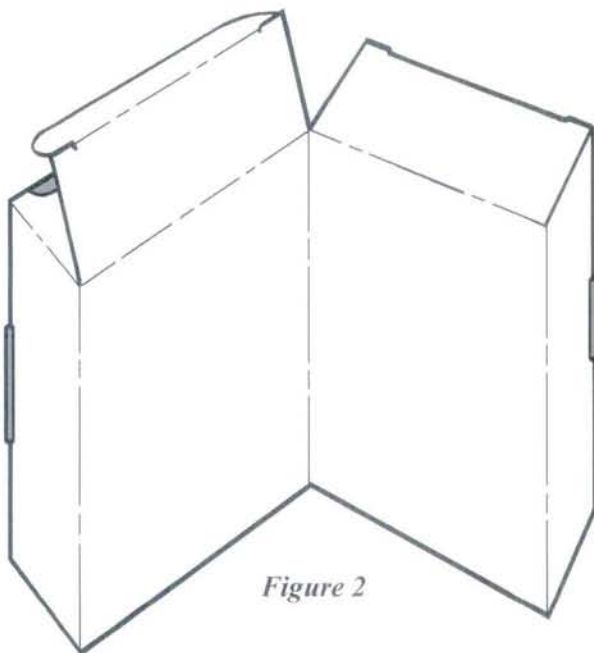


Figure 2

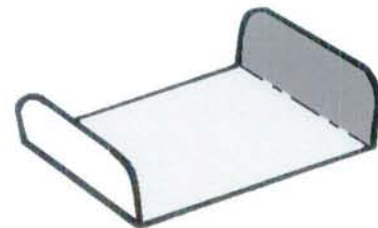


Figure 3: Separate friction lock "U" board (Optional)

Slots to accept friction lock "U" board



**STRAIGHT TUCK
 with TWO PLY
 HANGER TAB
 EXTENDING OFF
 REAR PANEL**

This style can be produced with the header card folded and glued in place by the converter. It may also be shipped unglued to be folded by the customer as part of the closing operation. Figures 1A and 3 show a variation where the header card is attached to the rear panel along a line of weakness, which allows it to be readily removed. In this form it can be used as a seasonal or special occasion promotion, then removed following the promotion leaving a conventional tuck carton.

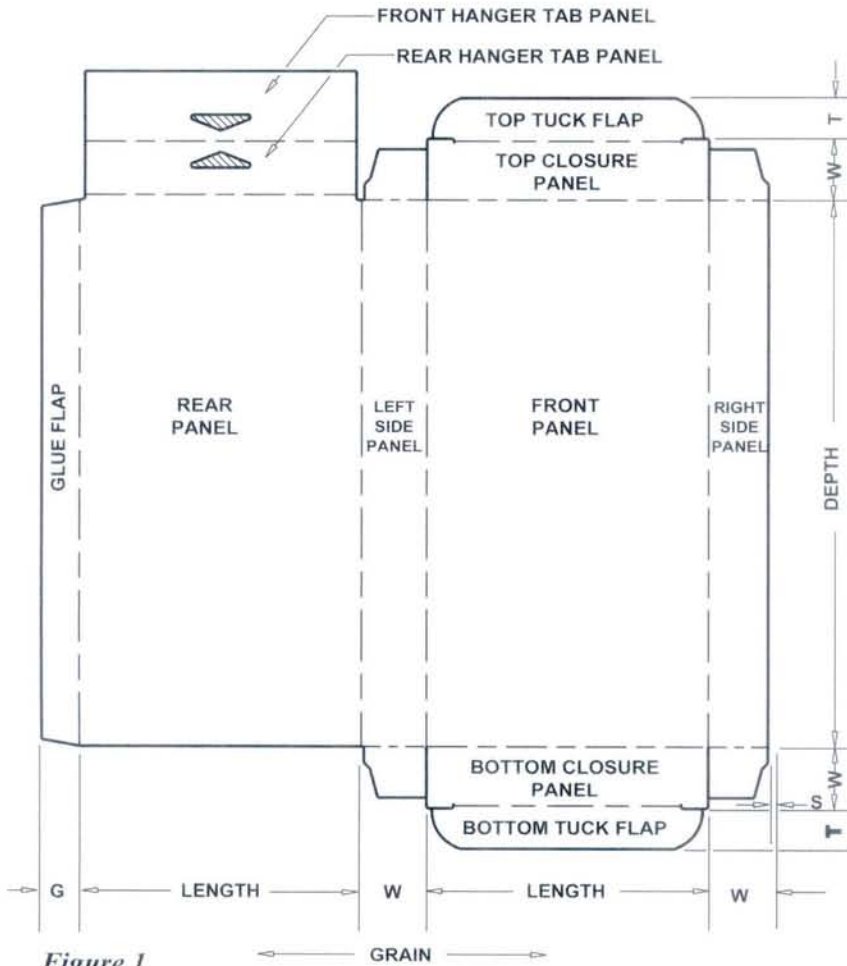


Figure 1

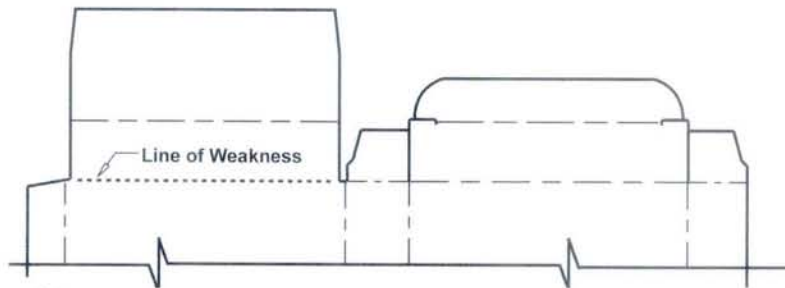


Figure 1A

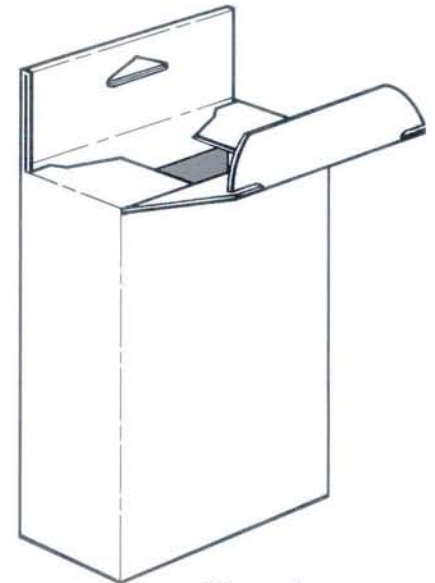


Figure 2

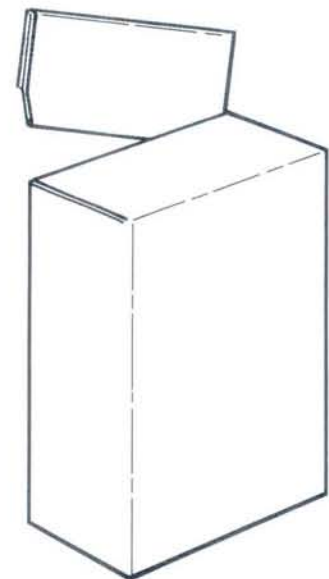


Figure 3



**REVERSE TUCK with
 SINGLE PLY
 HANGER TAB
 STRUCK FROM
 REAR PANEL**

This is the most elementary form of hanger tab. It is a simple diecut tab folded out of the rear panel of a tuck or seal end top carton (shown here as a reverse tuck).

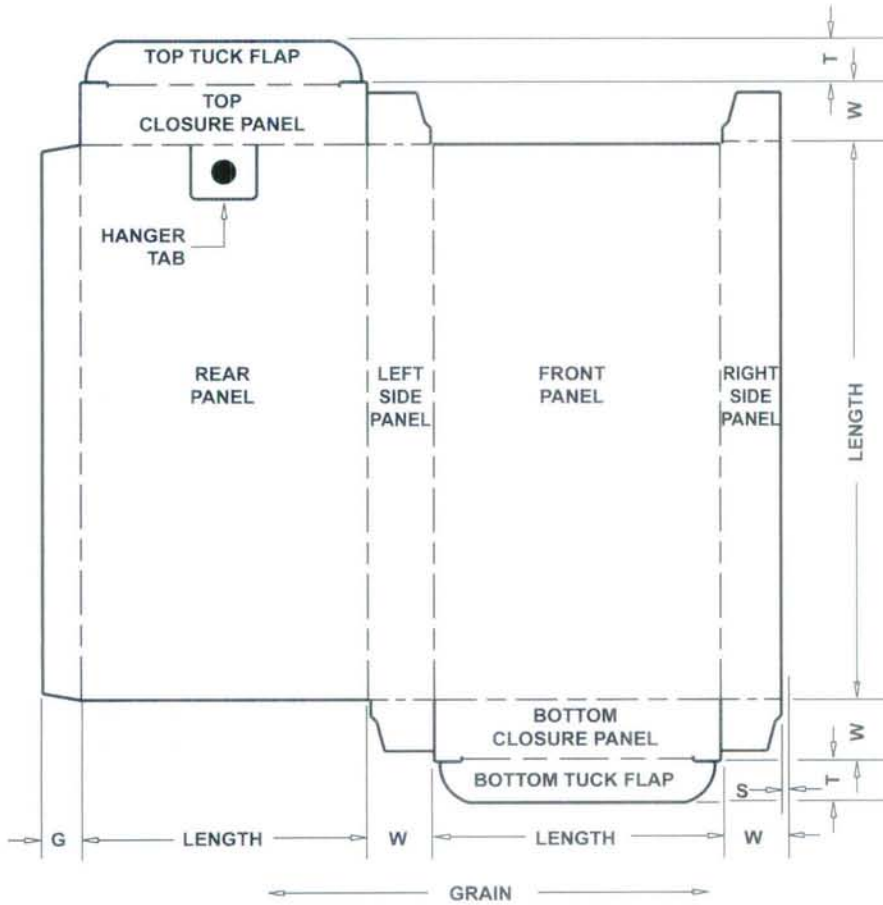


Figure 1

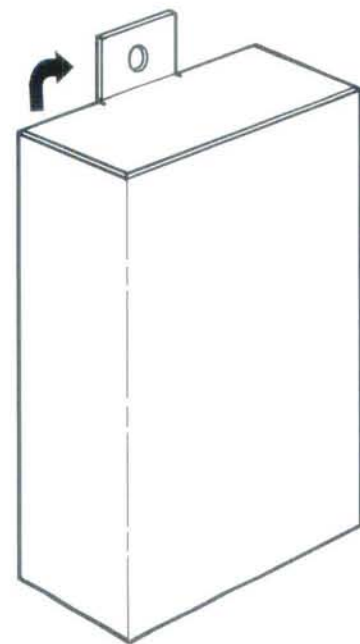


Figure 2



**STRAIGHT TUCK with
 SINGLE PLY
 HEADER CARD
 EXTENSION OFF
 REAR PANEL**

As shown here, this style requires reverse printing. If reverse printing is a viable option, this is a simple and direct way to develop a header card display. If reverse printing is not a practical option, the two ply header card style shown on Page 6.204 may be a good alternative.

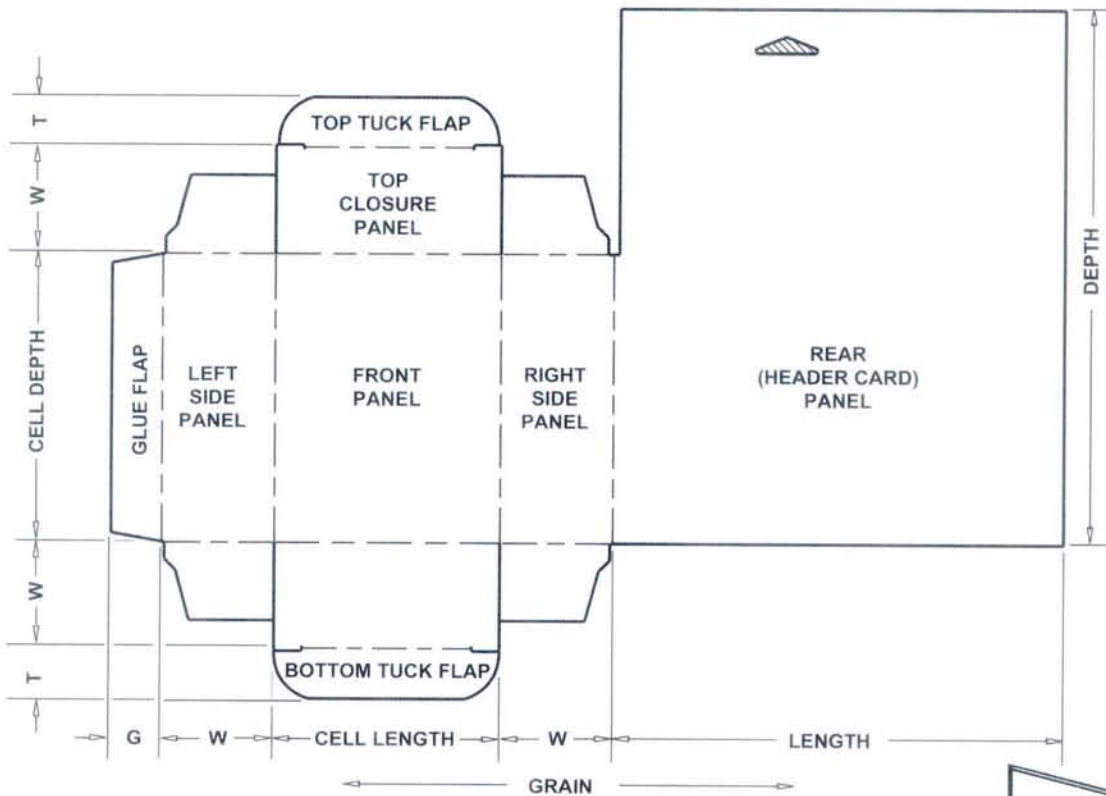


Figure 1

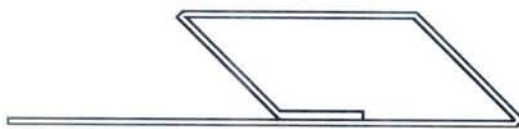


Figure 2: Folding Sequence - Top View

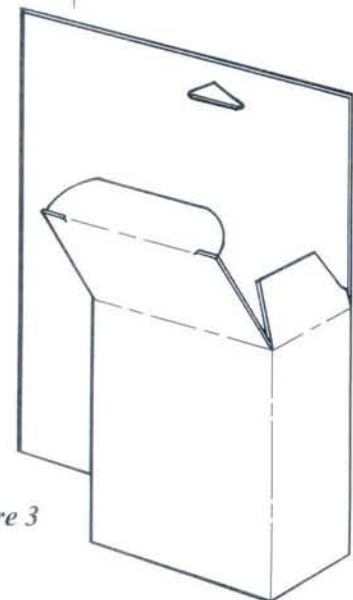


Figure 3



**STRAIGHT TUCK with
 TWO PLY HEADER
 CARD EXTENSION
 OFF REAR PANEL**

The finished appearance of this style is similar to that illustrated on page 6.203. It differs in that it has a two ply header which uses more board, but does not require reverse printing.

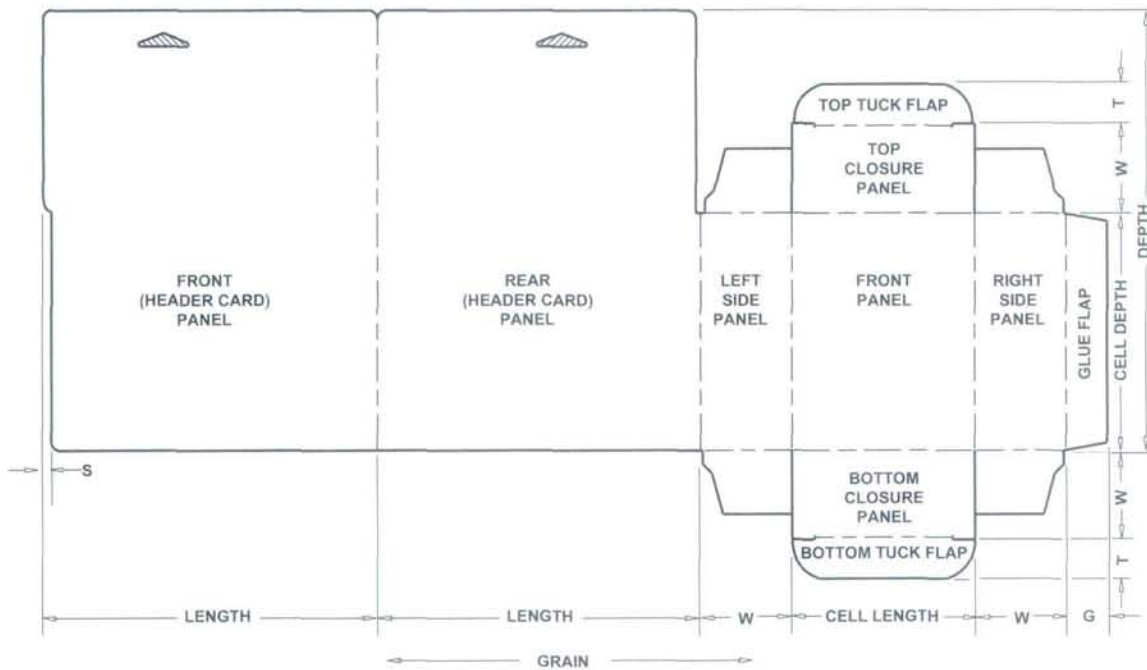


Figure 1

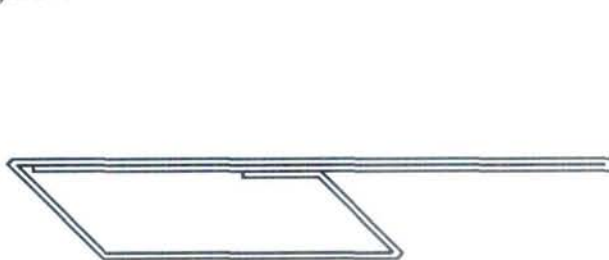


Figure 2: Folding Sequence - Top View

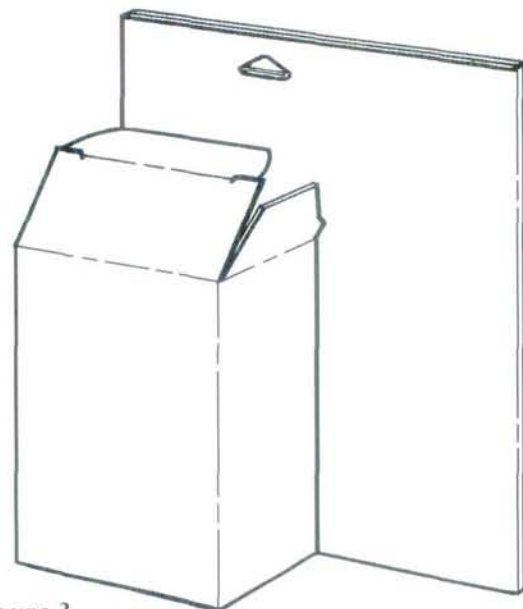


Figure 3



HORIZONTAL STRAIGHT TUCK with HEADER CARD OFF MANUFACTURER'S JOINT

This is one of the two most common ways of developing a header panel or hanger card. In this case, extensions of the two panels which normally define the manufacturer's joint, create the two ply header panel. It can be oriented with the header card up (Figure 3) or to the side (Figure 4). It may have a full two ply header card as shown in Figures 1 and 2A, or be an economy version as illustrated in Figure 2B. A.k.a. fifth panel straight tuck.

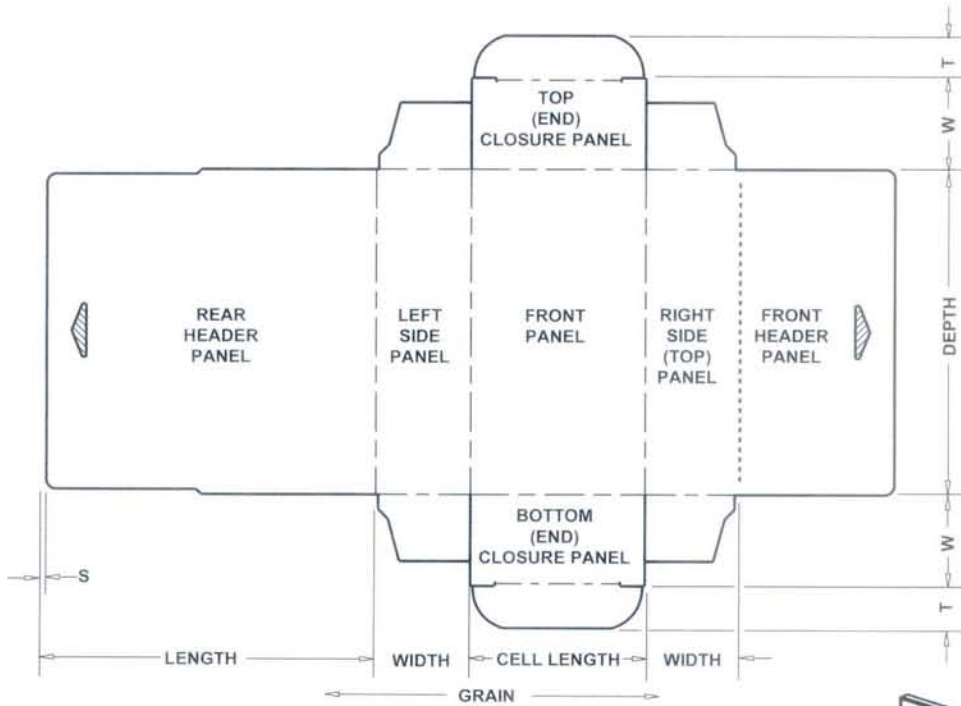


Figure 1



Figure 2A: Full Two Ply Header Card



Figure 2B: Economy Version

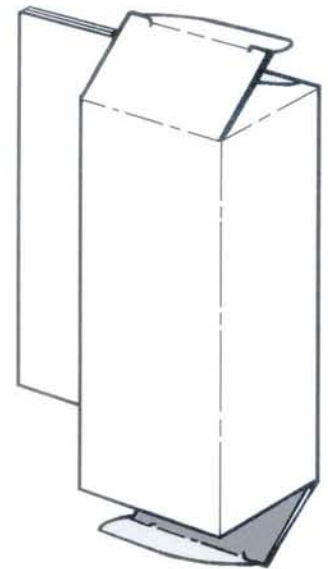


Figure 4

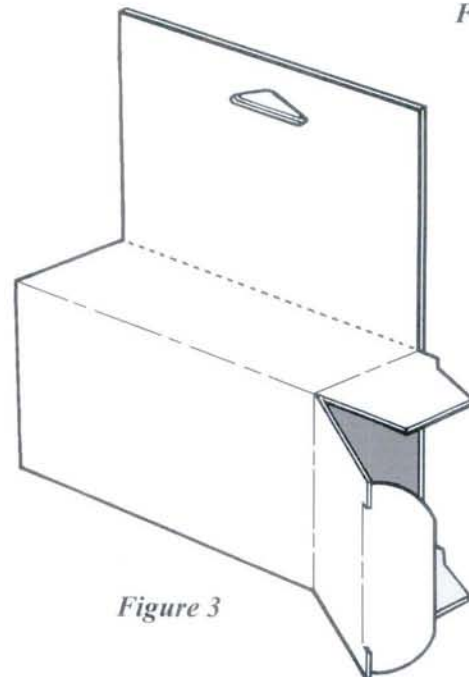


Figure 3



Promotional Packaging Styles
 Header Cards and Hanger Tabs

**STRAIGHT TUCK
 with GUSSETED
 FRONT PANEL
 SHADOW FLAPS &
 INTEGRAL HEADER**

This is a hybrid style being both a shadow box and a header card style. It is typically a hand erected and loaded carton.

Page 4.404 details the pure shadow box version of this concept.

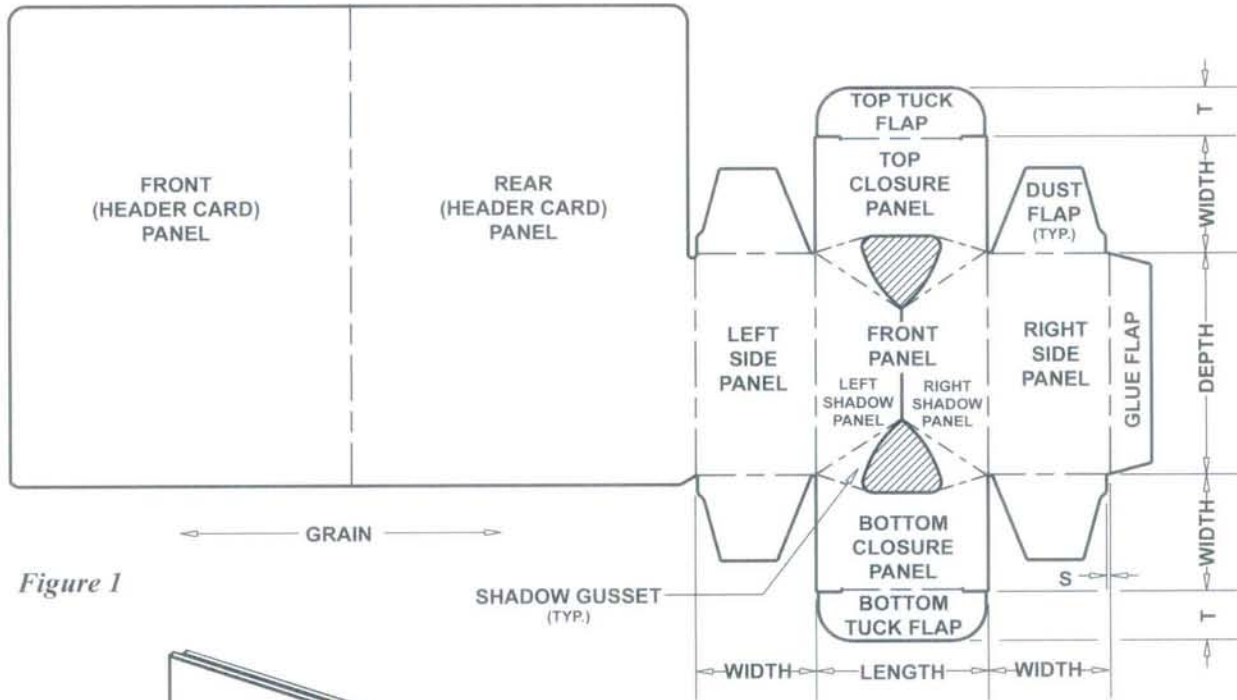


Figure 1

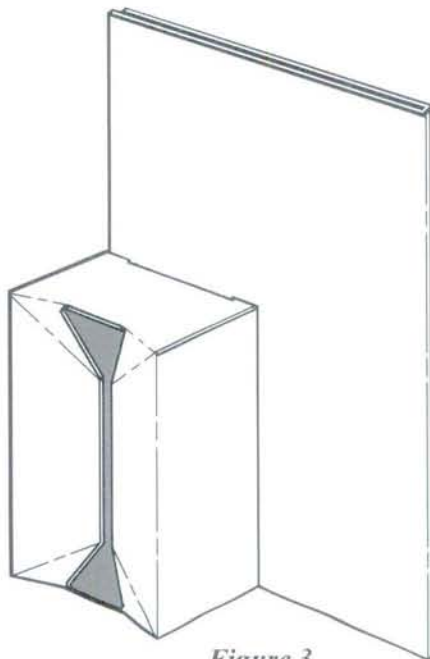


Figure 3

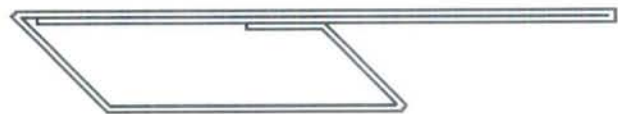


Figure 2: Folding Sequence – Top View



**REVERSE TUCK with
 SINGLE or TWO-PLY
 HEADER CARD
 EXTENSION OFF
 REAR PANEL**

This is a more simple side loaded version of the styles shown on pages 6.203 and 6.204. Figures 1A and 2A show a single ply header card option which requires two sided printing. The two ply header card option is illustrated in Figures 1B and 2B.

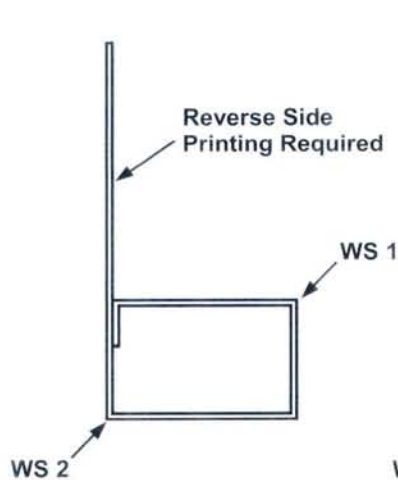
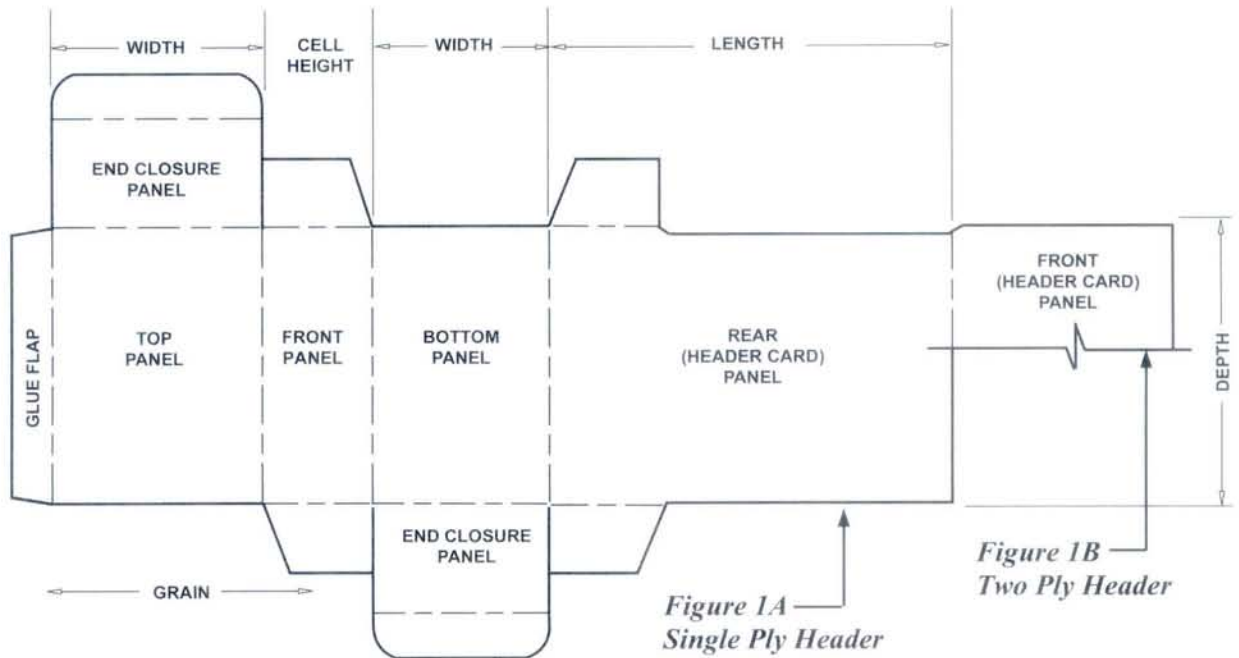


Figure 2A
 Single Ply Header

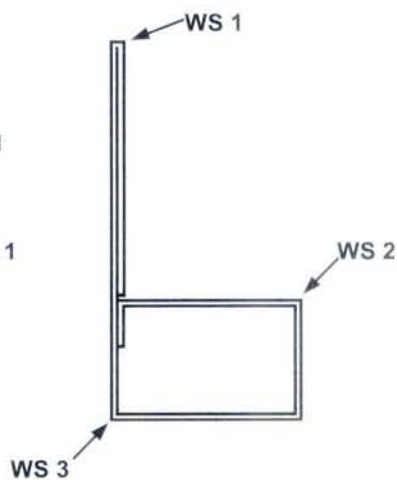


Figure 2B
 Two Ply Header

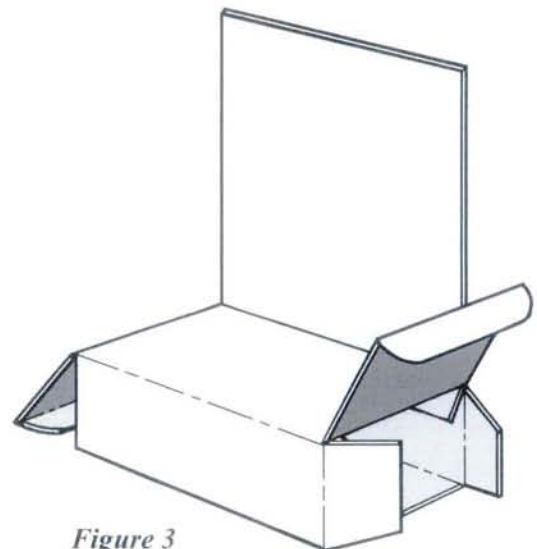


Figure 3



**GLUED SLEEVE
with
INTEGRAL
HEADER CARD**

This is a simple, single working score glued sleeve, but because of the unconventional location of the non-working scores, has a striking curved front display panel when erected. It works best with the grain in the short direction to encourage front panel curl.

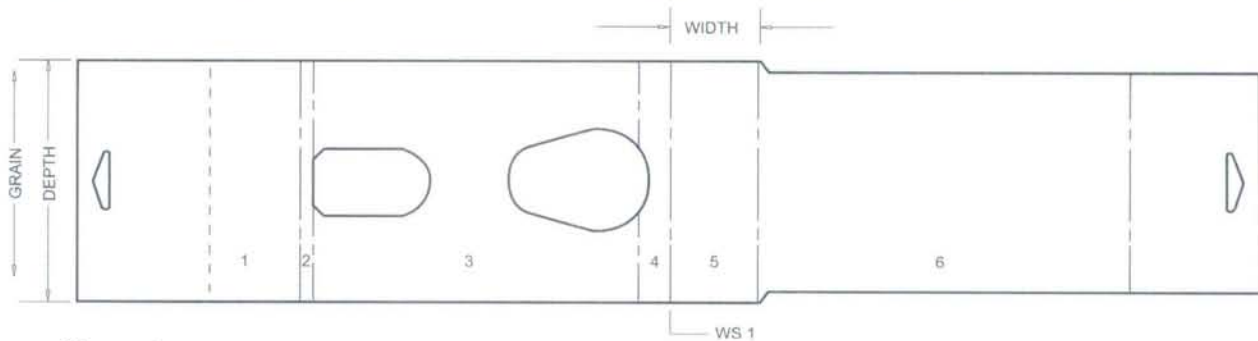


Figure 1

Note: Combined length of panels 1, 2, and 3 equal the combined length of panels 4, 5, and 6.

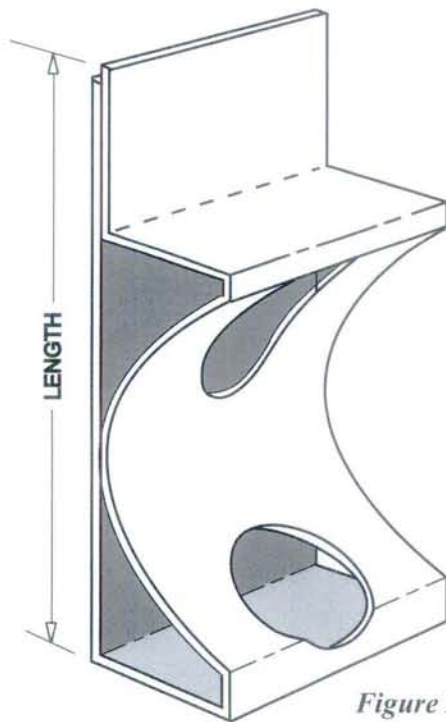


Figure 2

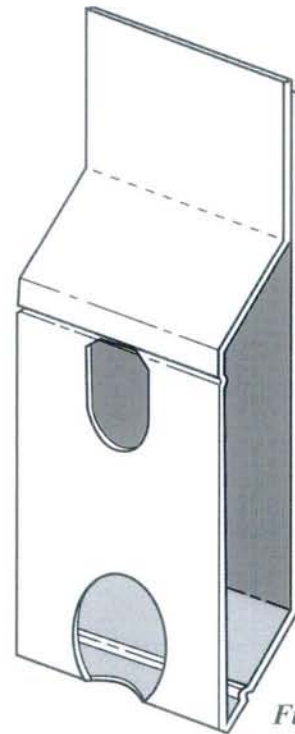
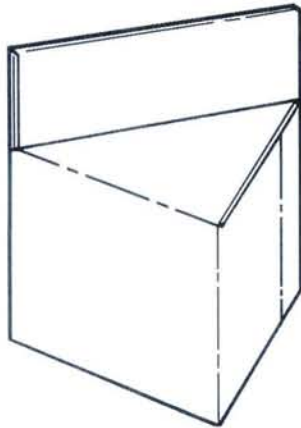


Figure 3

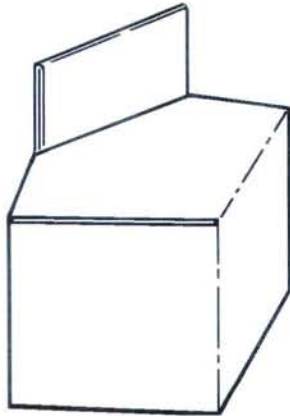
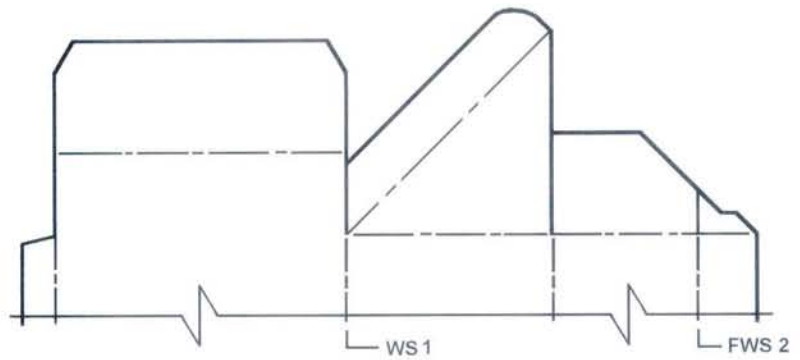


**CROSS-SECTION
ALTERNATIVES to
RECTANGULAR
TUBE**

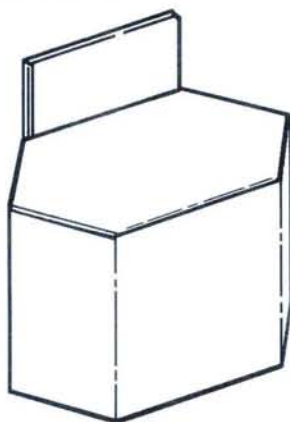
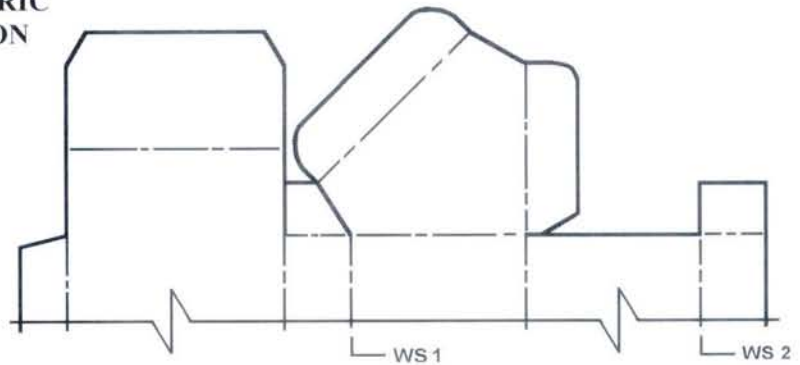
Header cards are generally developed off a free edge of a main body panel or as an extension off the manufacturer's joint. The prior examples are based on the more common rectangular tube, but it should be understood that they can be adapted to other cross-sections as well. Three of the many alternative possibilities are illustrated below.



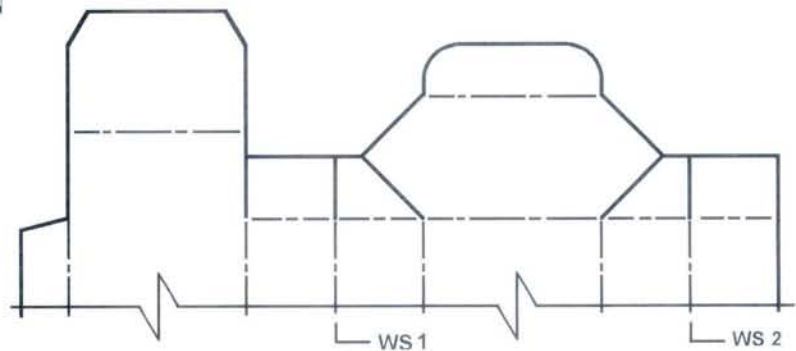
TRIANGLE



**ASYMMETRIC
PENTAGON**



HEXAGON



**PARTITION with
FULL HEIGHT
TWO-PLY
SEPARATION**

One of the most simple, yet most effective partition systems available, this style offers full two-ply separation in both longitudinal and transverse directions. It can be hand formed and inserted or fully automated, and works for double rows of product in any even count (2 x 2, 2 x 3, 2 x 4, 2 x 5, etc.).

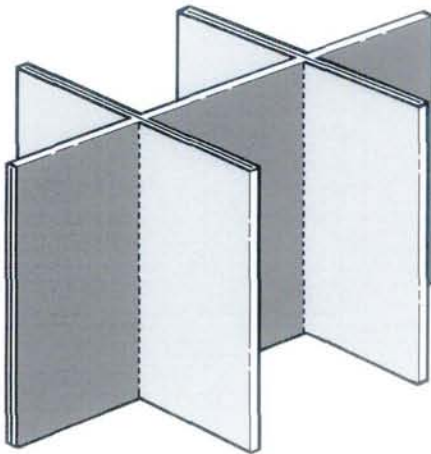


Figure 1

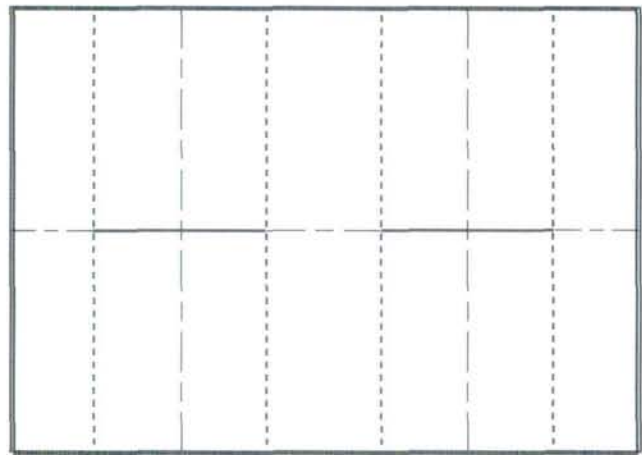


Figure 2 ← GRAIN →

**PARTITION with
FULL HEIGHT
TWO-PLY
SEPARATION**

Similar in concept to the partition above, this style eliminates the exposed raw upper edges of the transverse partition elements and adds base panels, making it more attractive for upscale products where presentation is as important as product protection. Typically used in conjunction with a tray style carton, it may be produced as a separate unit as shown here or integrated into the tray blank.

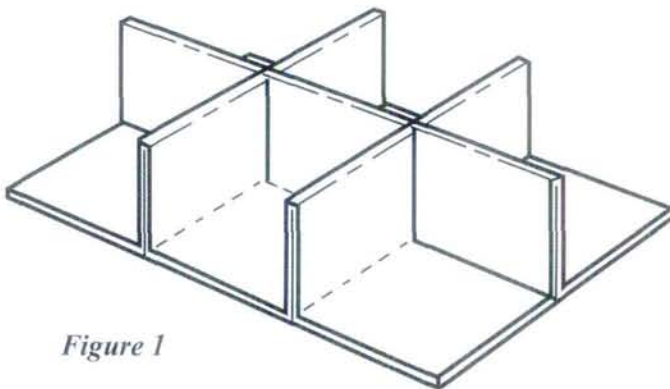


Figure 1

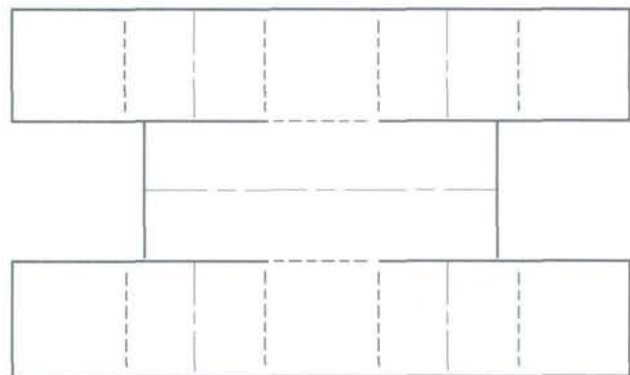


Figure 2 ← GRAIN →



**PARTITION with
INTERNAL
LONGITUDINAL and
TRANSVERSE
DIVIDER TABS**

This is a practical solution when limited product separation is required; for example, the tangent point of adjacent bottles or jars. An application of this technique can be seen on page 3.302 where the longitudinal and transverse tabs are separating two rows of beverage bottles.

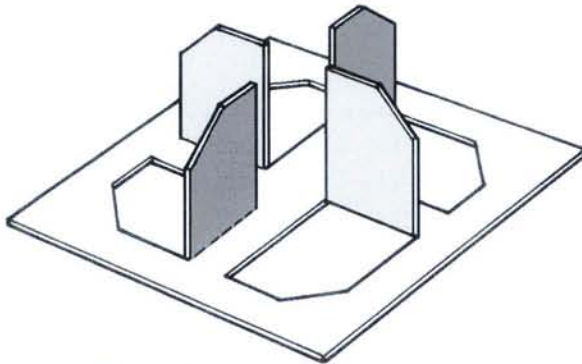


Figure 1

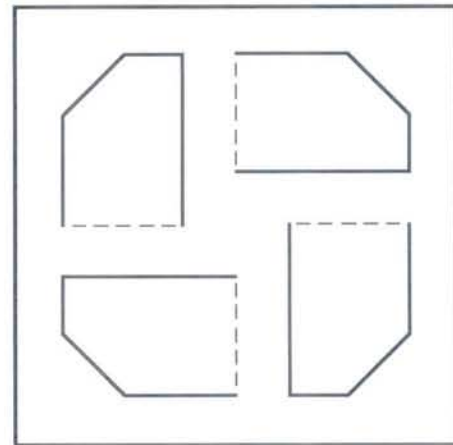


Figure 2

**ONE-PIECE
SINGLE PLY
NESTED
TAB PARTITION**

This partition style is not applicable to all bottle or jar profiles. It provides longitudinal and transverse separation points but not full bottle separation, as does the style illustrated at the top of page 6.301. However, this is a simple and economical style for a primary container where full separation is not required.

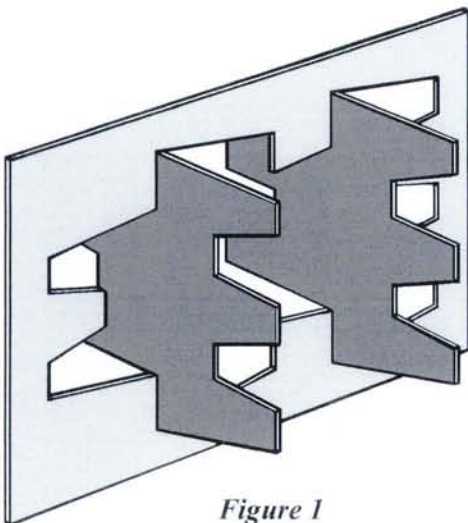


Figure 1

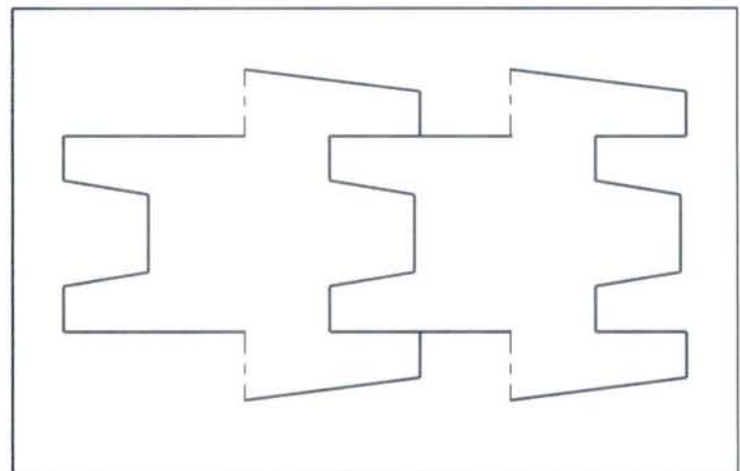


Figure 2



**MULTI-PIECE
SLOTTED and
INTERLOCKED
PARTITION**

An ageless design that is simple yet effective. These slotted longitudinal and transverse partition elements provide full cell protection and can be assembled automatically or by hand. It can be produced in virtually any count arrangement.

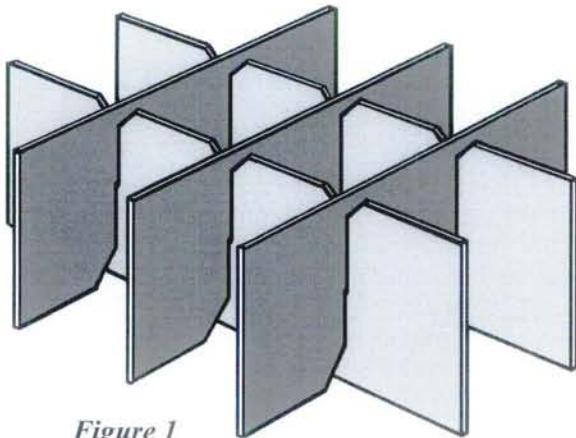


Figure 1

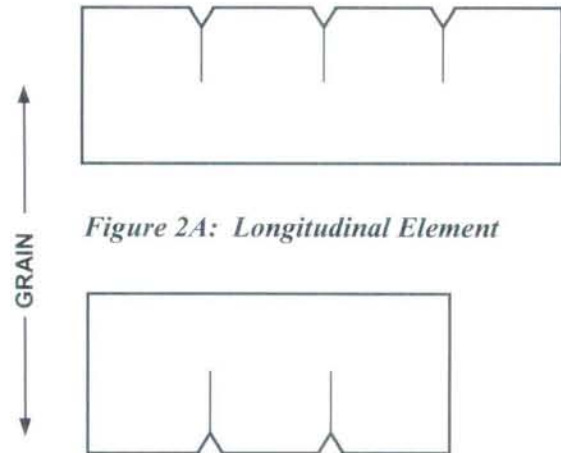


Figure 2A: Longitudinal Element

Figure 2B: Transverse Element

**ONE-PIECE
SLOTTED and
INTERLOCKED
PARTITION**

This design works well for tall bottles (wine, liquor), offering good high and low tangent point separation. As illustrated, it is a nine-count partition. It can be adapted to either six or twelve count configurations as well. It is particularly effective when made from small flute paperboard.

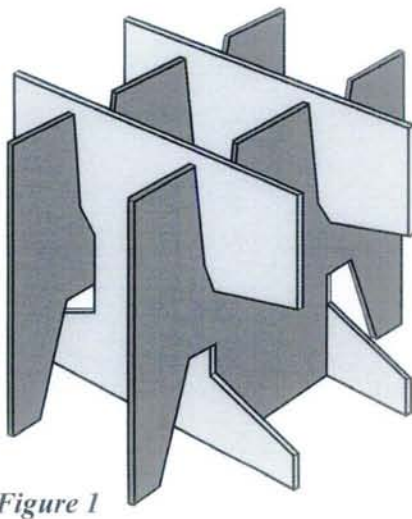


Figure 1

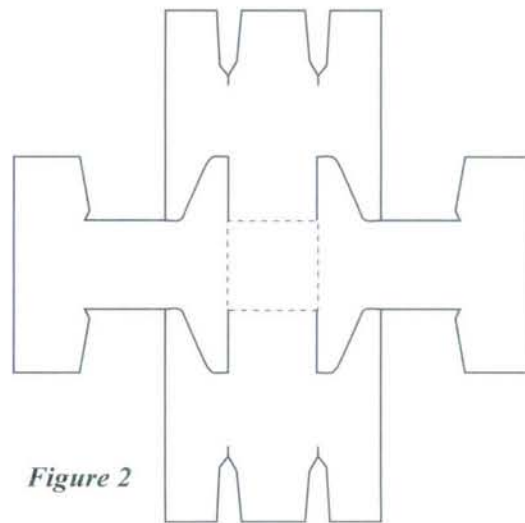


Figure 2



Non-Carton Structures
Counter Top Easel Displays

COUNTER TOP
EASELS

Counter top easel displays are frequently made from paperboard and converted on conventional carton equipment. Figures 1A and 1B illustrate the most common form of easel lock; however, the locking arrangement in Figures 2A and 2B is in general use as well.

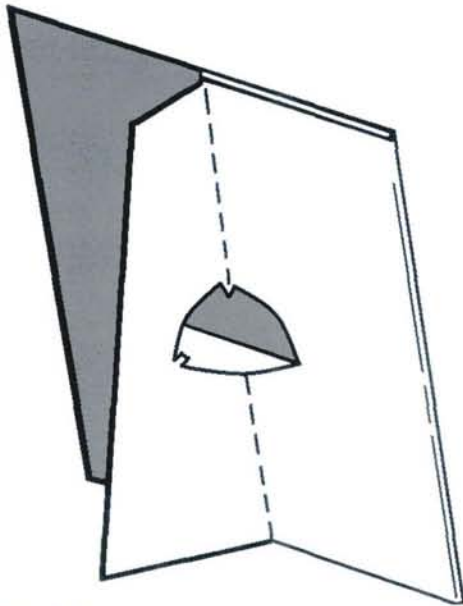


Figure 1A

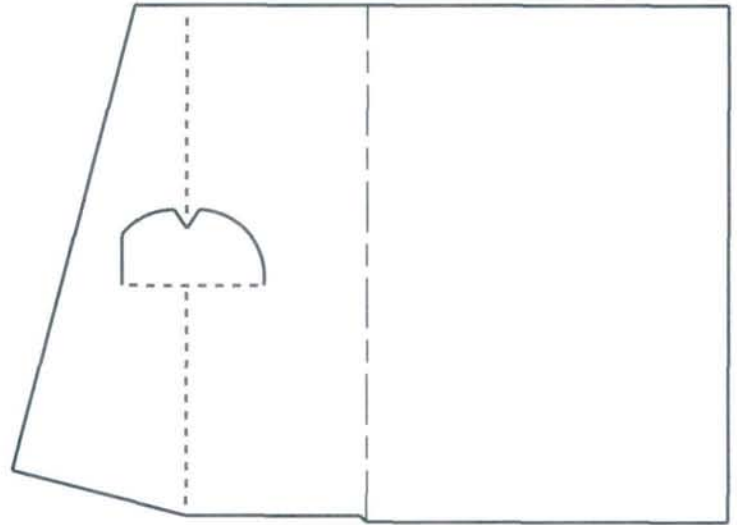


Figure 1B

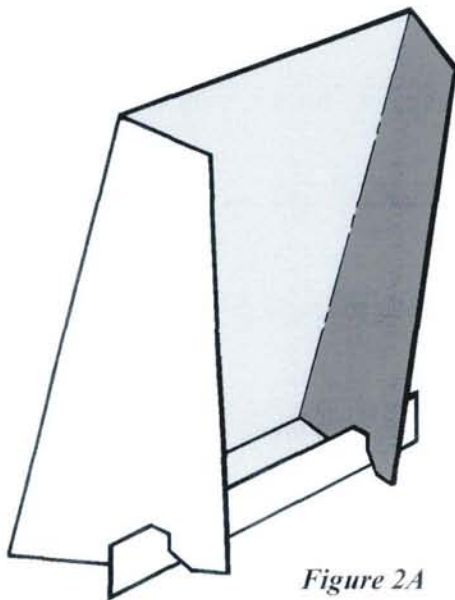


Figure 2A

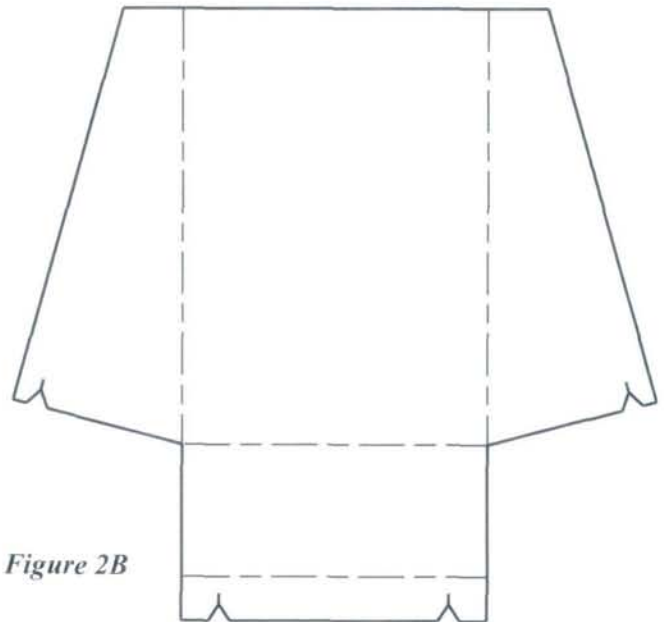
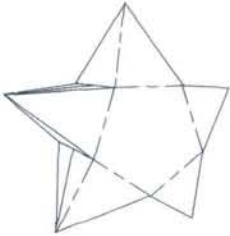


Figure 2B



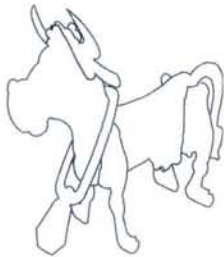


While some of the items in this category are loosely based on tube or tray styles and may also contain product, the primary thrust of this grouping is to illustrate the level of creativity that may be achieved with paperboard design. Sound converting techniques and functionality are evident, but for the most part these structures are purely entertainment. The structure itself is the “product” in many cases.



ORNAMENTS and ORNAMENTAL CARTONS

Many of these structures can hold product, but each has a strong secondary decorative function. Sound converting techniques and functionality are evident, but mostly they are just plain fun.



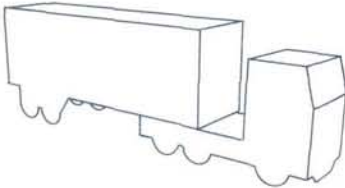
FIN, FUR and FEATHER

Lions and tigers and bears, oh my? No, but a collection of fish, birds and furry friends that hint at how creative one can be when transforming paperboard into creatures big and small.



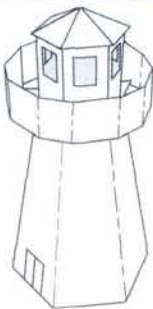
TOYS, GAMES and PUZZLES

These playthings may come in the form of a carton punch out, as a tip-on or carton insert, or in some cases as a free-standing paperboard product.



LAND, SEA and AIR

Planes, cars and trucks make up this “transportation” grouping.



BUILDINGS

Lighthouses and doll house type structures fall into this group.



**HOLIDAY ORNAMENT
(Tube)**

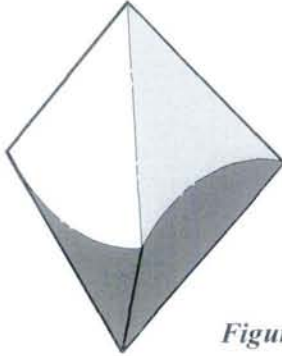


Figure 1

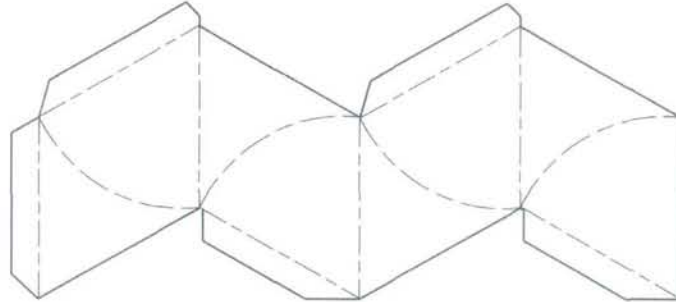


Figure 2

**HOLIDAY ORNAMENT
(Tongue Locked Tube)**

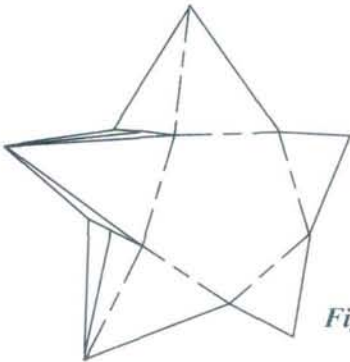


Figure 1

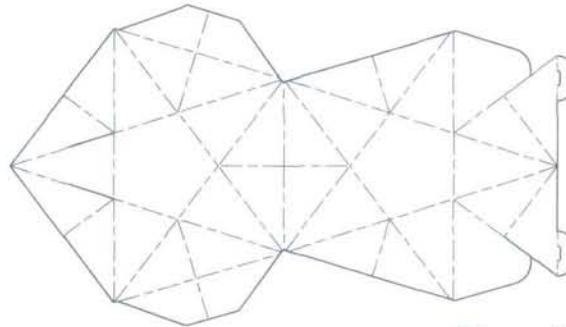


Figure 2

**STAR SHAPED CARTON
(Hinge Cover Tray)**



Figure 1

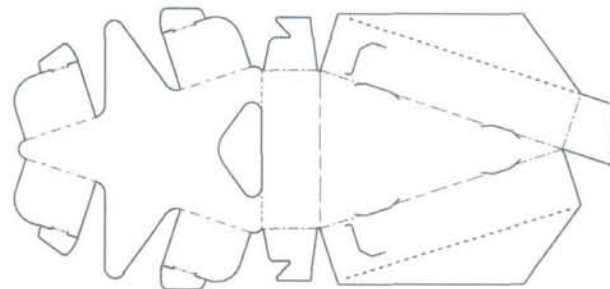


Figure 2



CHRISTMAS TREE CARTON
(Automatic Bottom/Tuck Top)

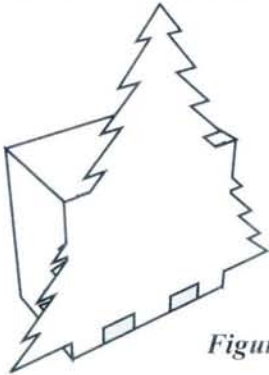


Figure 1

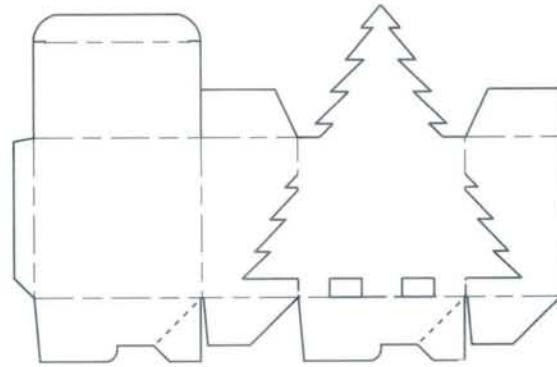


Figure 2

PUMPKIN CARTON
(Automatic Bottom/Tuck Top)



Figure 1

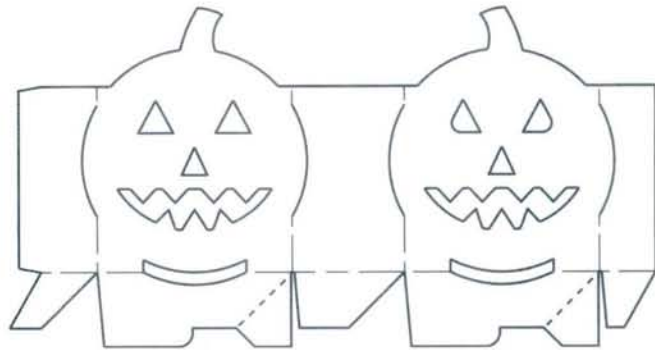


Figure 2

“LANTERN” STRUCTURE
(Tuck Bottom with Platform Locked Top)



Figure 1

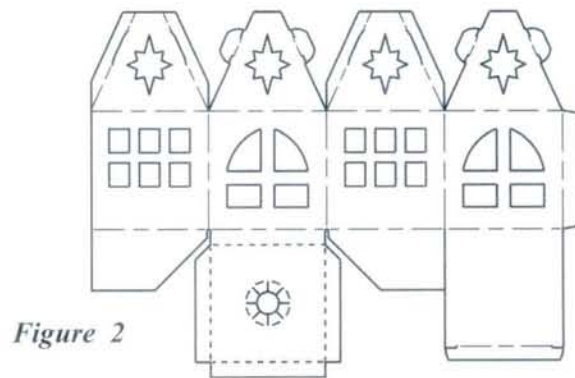


Figure 2



**CRAZY COW
(Slottie)**



Figure 1

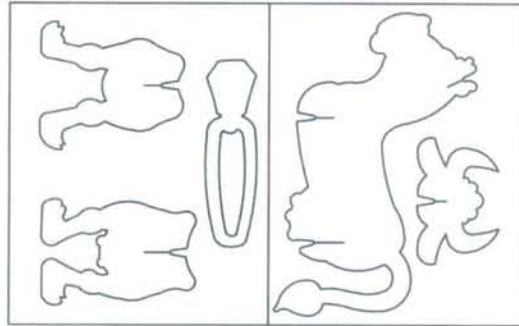


Figure 2

**DEER
(Punch-Out Card)**

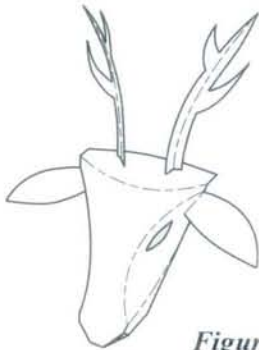


Figure 1

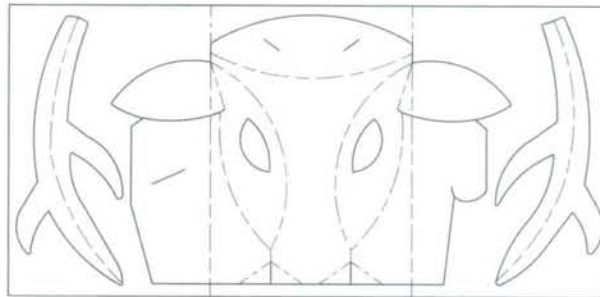


Figure 2

FISH CARTON



Figure 1

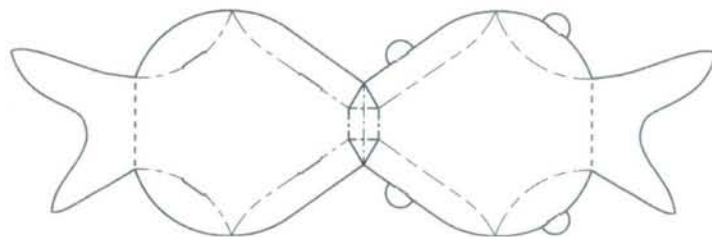


Figure 2



**COMPUTER BANK
(Punch-Out Card)**

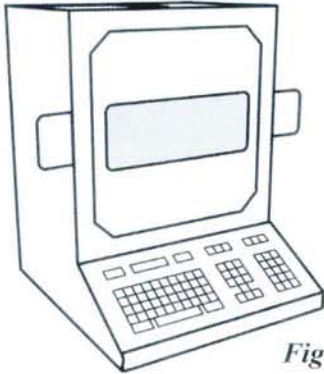


Figure 1

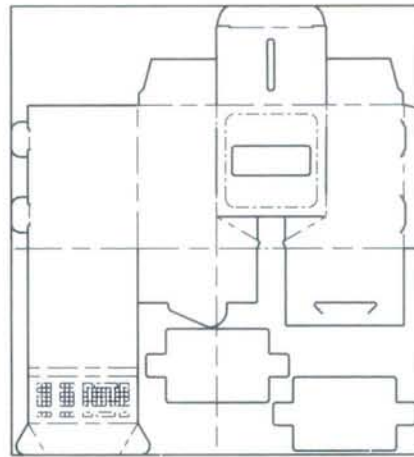


Figure 2

PUZZLE CARD

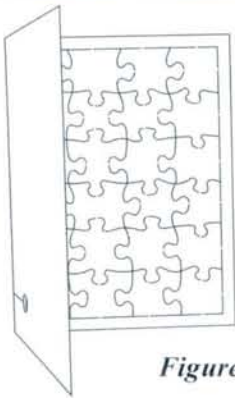


Figure 1

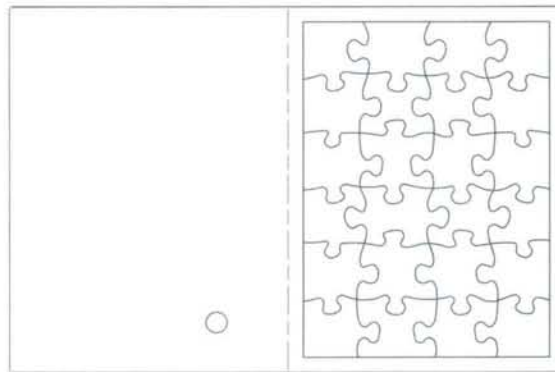


Figure 2

POP-UP BOOK

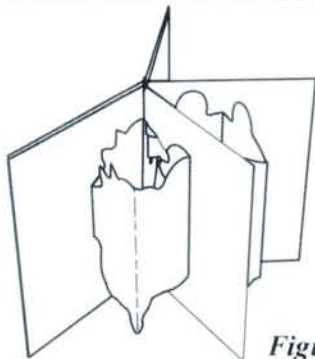


Figure 1

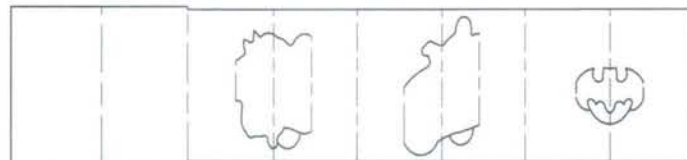


Figure 2



Non-Carton Structures

Novelty Structures - Land, Sea, and Air

PUNCH-OUT CAR

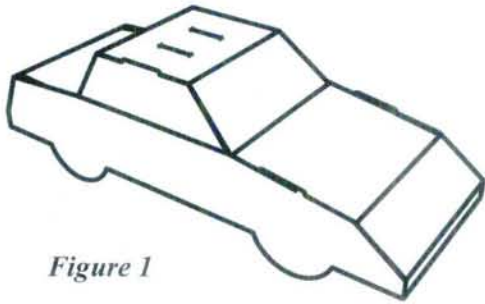


Figure 1

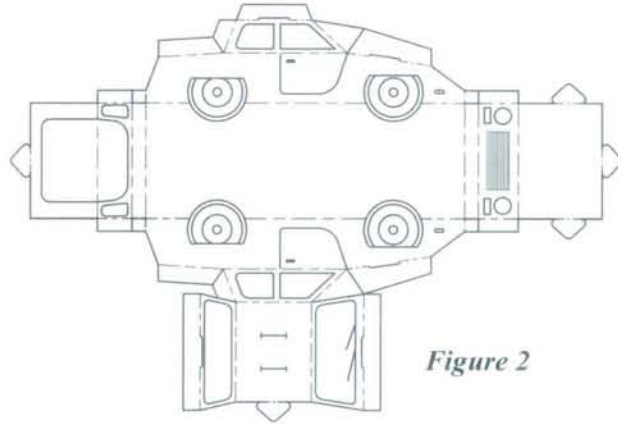


Figure 2

FIRE TRUCK

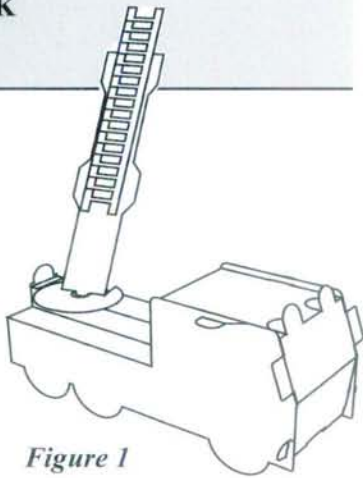


Figure 1

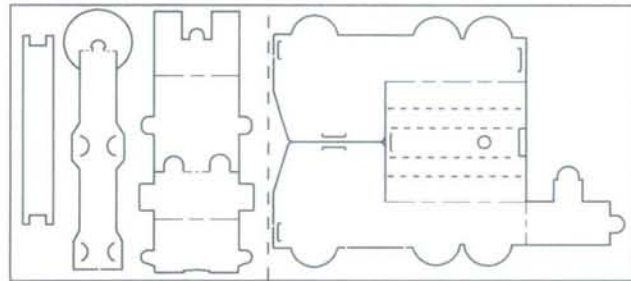


Figure 2

EIGHTEEN WHEELER

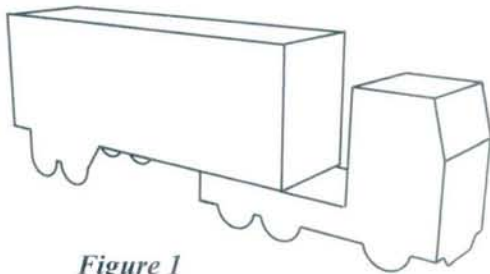


Figure 1

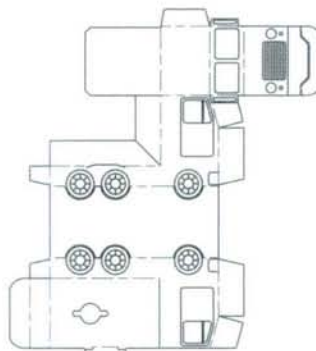


Figure 2

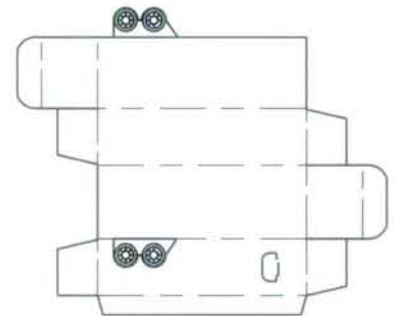


Figure 3



PICK UP TRUCK

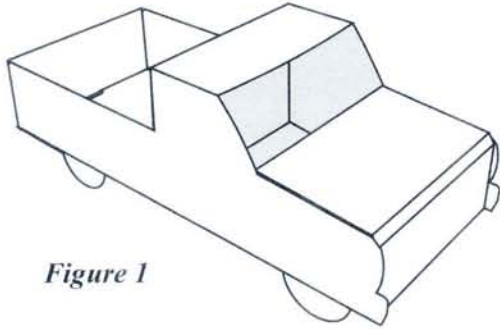


Figure 1

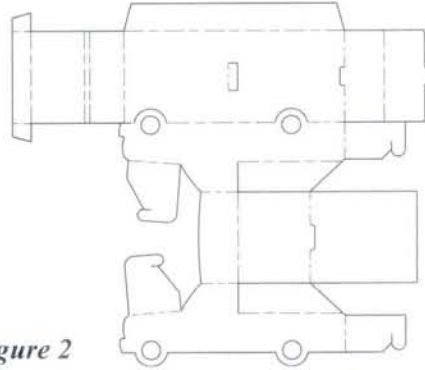


Figure 2

DELIVERY VAN

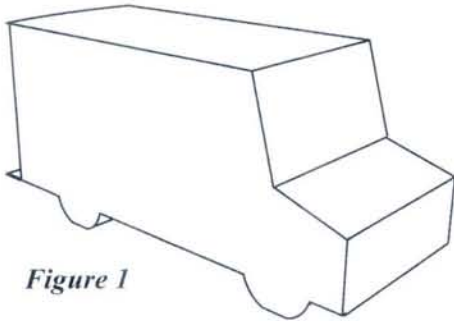


Figure 1

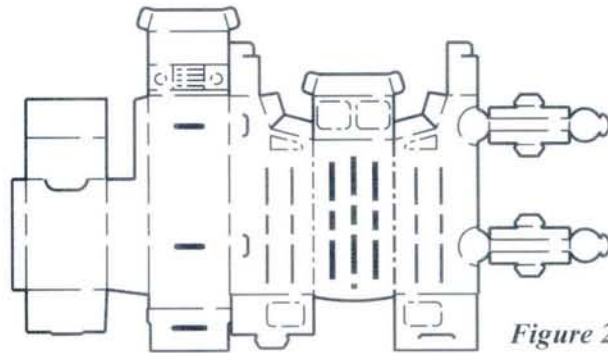


Figure 2

AIRPLANE
(Punch-Out Slottie)

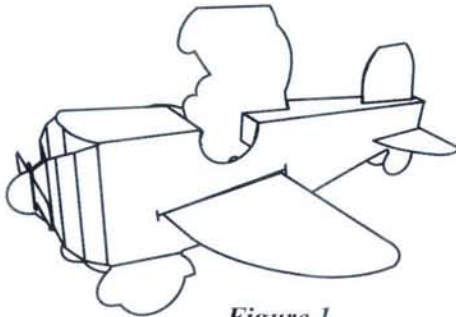


Figure 1

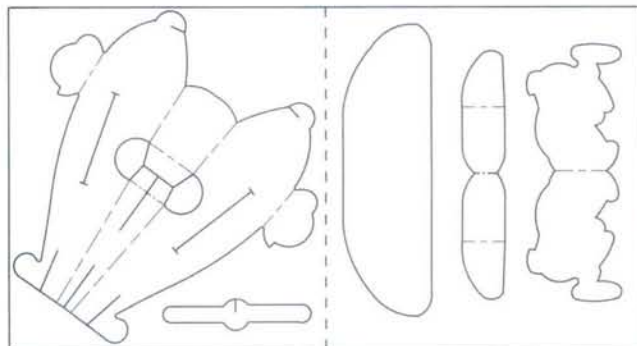


Figure 2



LIGHTHOUSE

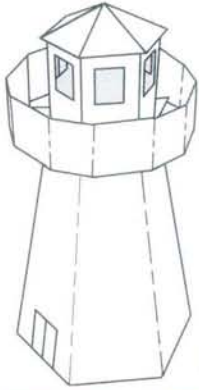
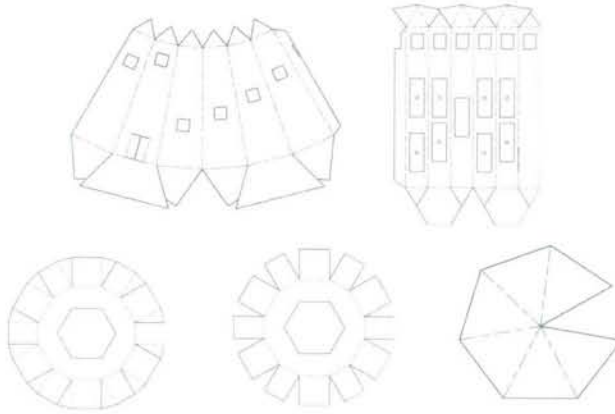


Figure 1



Figures 2 - 6

HOUSE

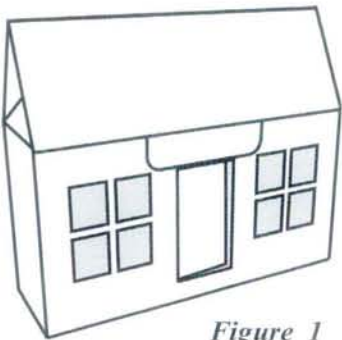


Figure 1

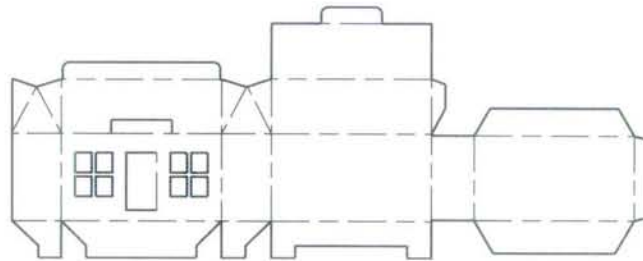


Figure 2

HOUSE with CHIMNEY



Figure 1

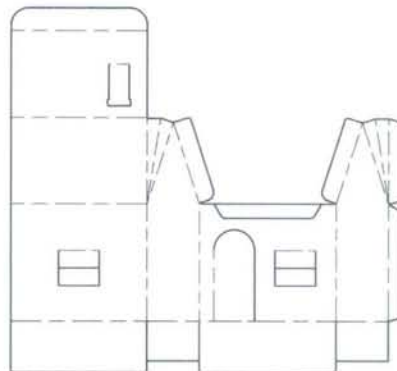


Figure 2



7.000

PAPERBOARD PACKAGING:
SPECIAL FEATURES

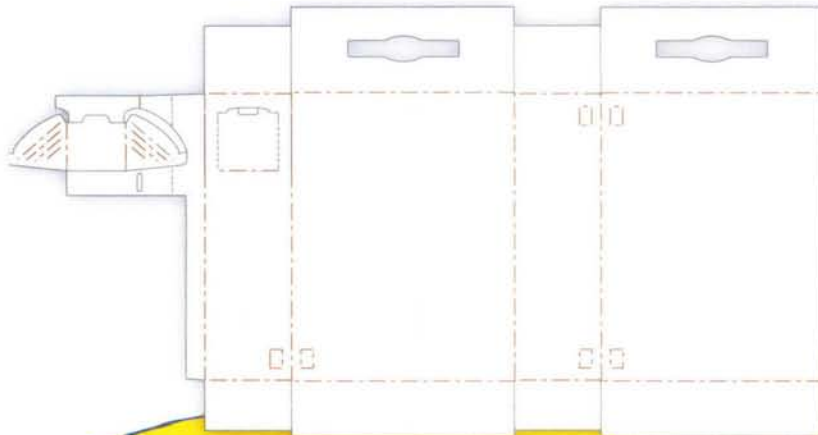
CARTON STRUCTURES



7.000

OVERVIEW : SPECIAL CARTON FEATURES

- 7.100 *Tear Strips and Opening Features*
- 7.200 *Handles and Carrying Features*
- 7.300 *Sift Resistant Features*
- 7.400 *Cushioning Features*

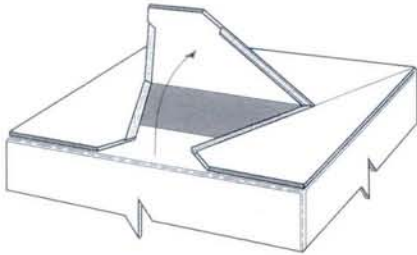


IDEAS AND
INNOVATION
SECOND EDITION

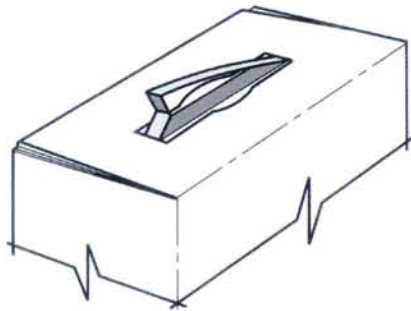
7.000
FEATURES



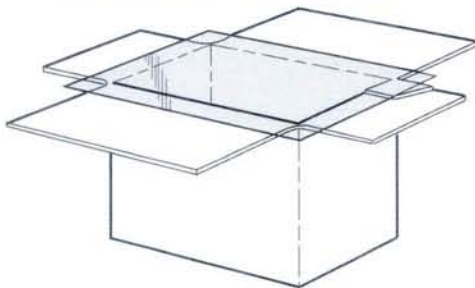
This section includes items such as zippers, opening features, carrying means and handles, cushioning, and sift resistant features which may be incorporated into a number of different structures. These features go beyond basic carton categories and provide added convenience and/or product security.



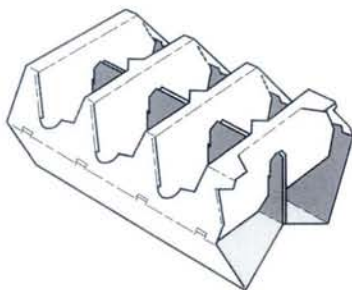
7.100 TEAR STRIPS and OPENING FEATURES



7.200 HANDLES and CARRYING DEVICES



7.300 SIFT RESISTANT FEATURES



7.400 CUSHIONING FEATURES

**“J” CUT
ZIPPER
TEAR STRIP**

Several variations of this most popular form of zipper opener are available as standard rule configurations from commercial die rule sources. The “J” cuts may be directly opposed as shown below, or staggered to distribute tearing forces more evenly.

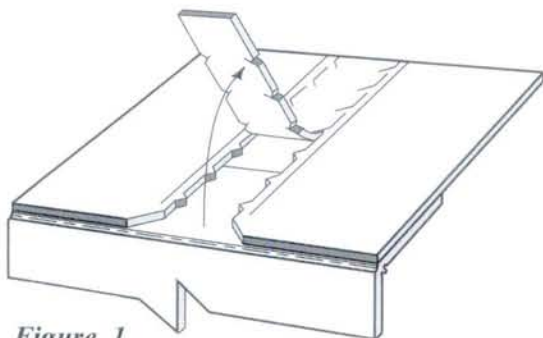


Figure 1

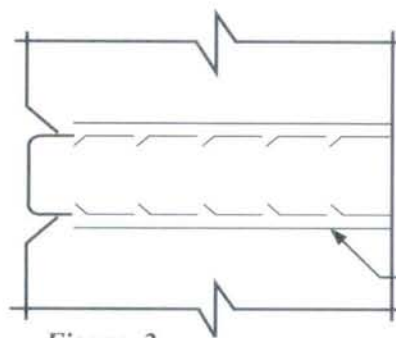


Figure 2

**DOUBLE
CUT SCORE
TEAR STRIP**

Slightly more complex to convert than the “J” cut, this style is less prone to failure from top liner delamination. It is an attractive option to the “J” cut if it is important to avoid cutting completely through the paperboard surface (sift resistance, infestation resistance, etc.).

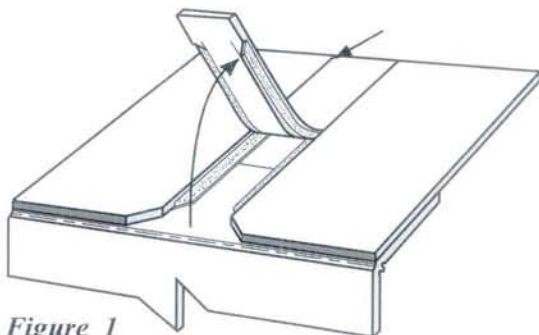


Figure 1

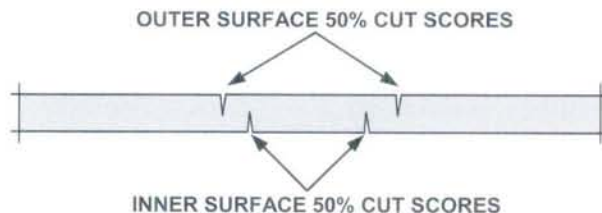


Figure 2

**REINFORCED
TAPE
TEAR STRIP**

While there are additional material and converting costs associated with this tear strip, it may be an attractive option to the “J” or double cut score zipper for heavy caliper or small flute paperboard.

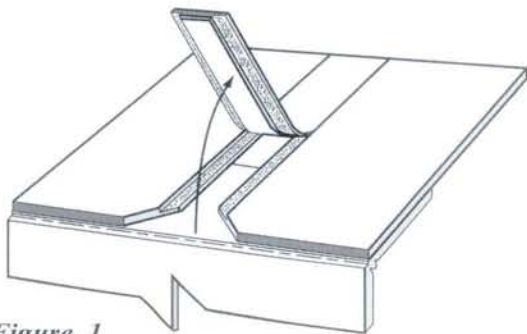


Figure 1

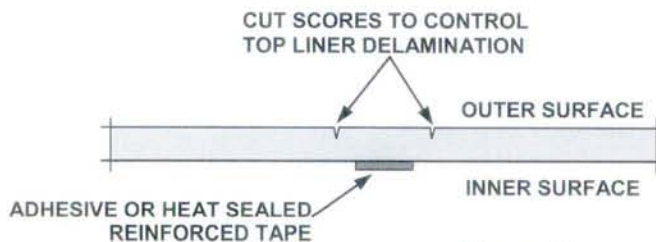


Figure 2

**“J” CUT
OPENING FEATURE**

This type of opener typically starts at the edge of a panel and angles outward to remove a major portion of the panel for easy product access. Two configurations are illustrated below.

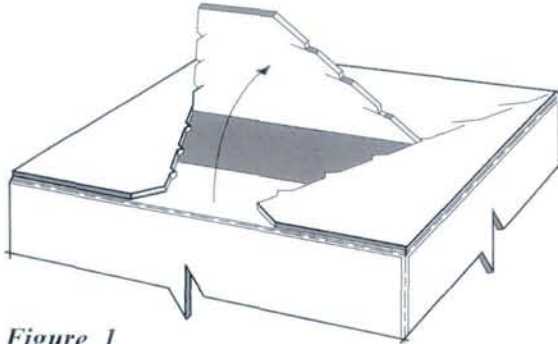


Figure 1

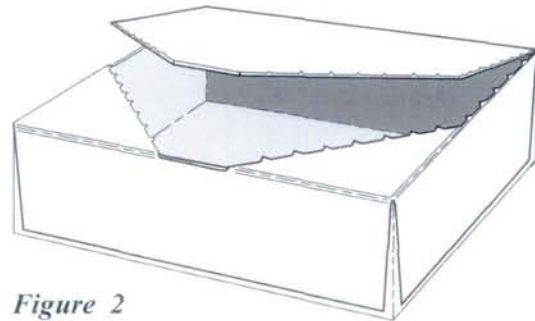


Figure 2

**DOUBLE
CUT SCORE
OPENING FEATURE**

As in the case of the double cut score tear strip illustrated on page 7.101, this double cut score opener is an alternative to the “J”, or saw tooth, cut style opener.

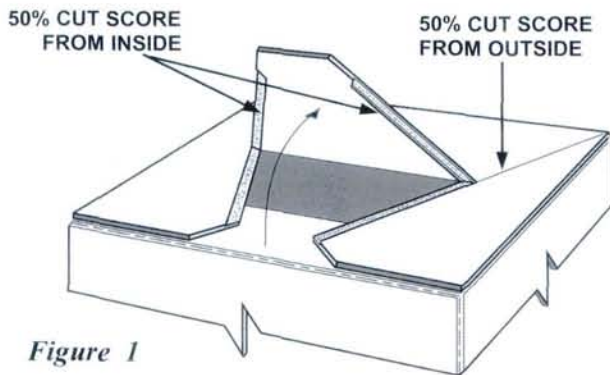


Figure 1

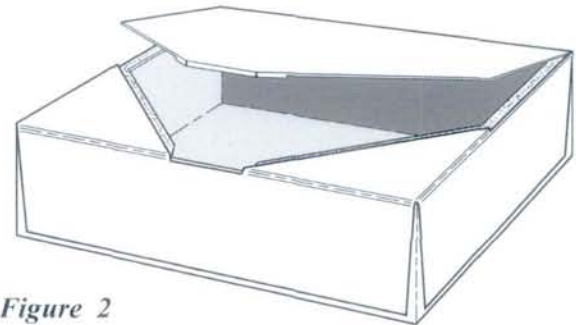


Figure 2

**SAW TOOTH CUT
OPENING FEATURE**

The small “saw tooth” weakened line is created by notching a serrated die rule to form what appears to be a series of parallel diagonal cut lines. Several versions of this rule are available from commercial die rule sources.

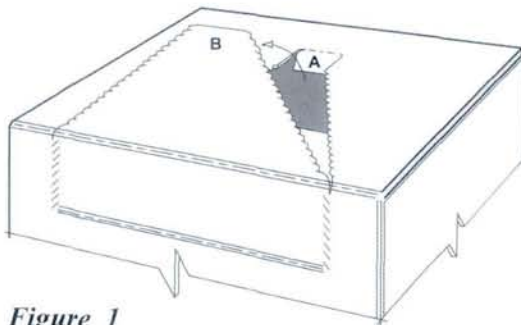


Figure 1

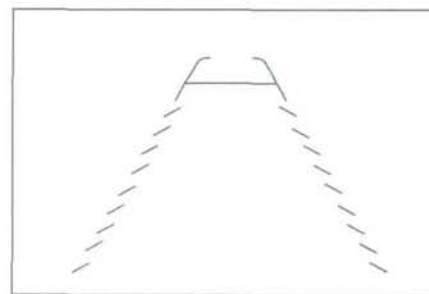


Figure 2



**ROUND or
ELLIPTICAL
STRIPPED-OUT
FINGER HOLE**

This is the most fundamental type of finger hole carrying means. It is particularly effective for can or wide mouth jar multi-packs. The package is carried by reaching through the apertures to grasp the tops of the cans or jars.

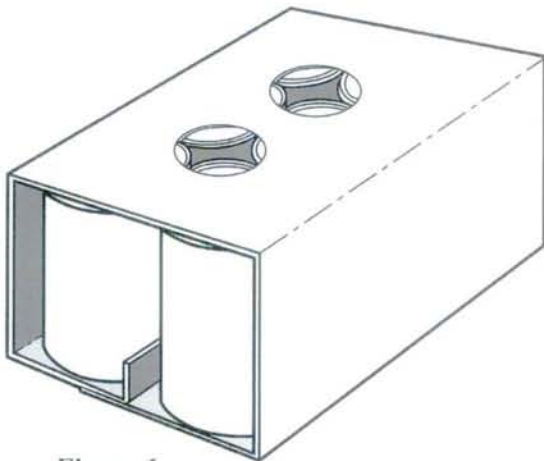


Figure 1

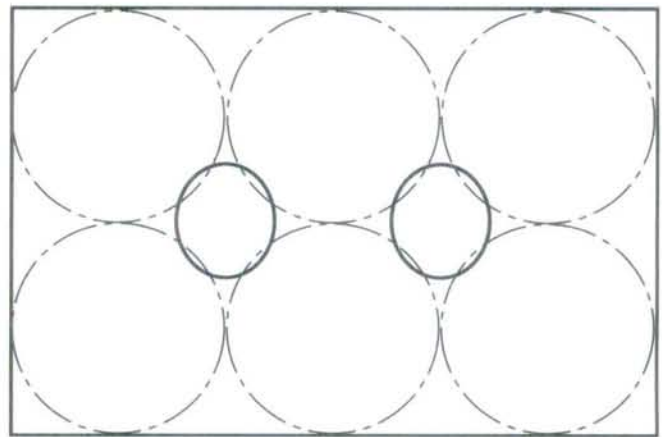


Figure 2

**PIE-SHAPED,
NON-STRIPPED
FINGER HOLE**

This functions much like the example above, but this version offers better dust and dirt protection because the top is a solid surface until the package is lifted. Note that the tabs are struck from the board covering the void area between adjacent cans.

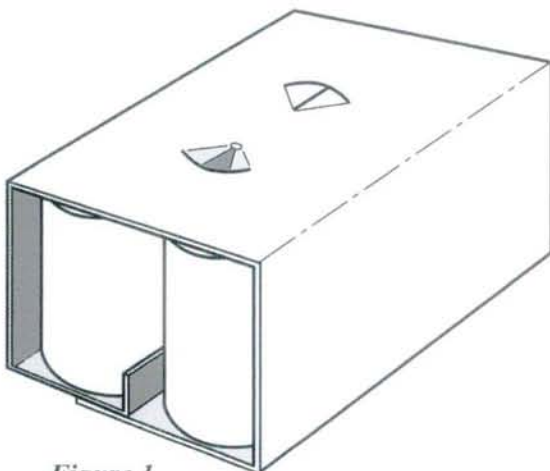


Figure 1

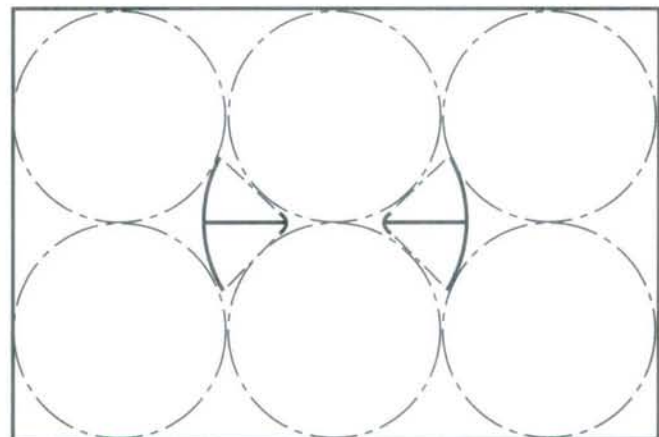


Figure 2



Handles and Carrying Devices
Aperture Type Carrying Means

SINGLE PLY
FINGER HOLE

This finger hole detailing is most commonly seen on multi-pack wraps for narrow neck bottles. The curved score and the radii at the ends of the arced cut help reduce high stress points which increases tear resistance.

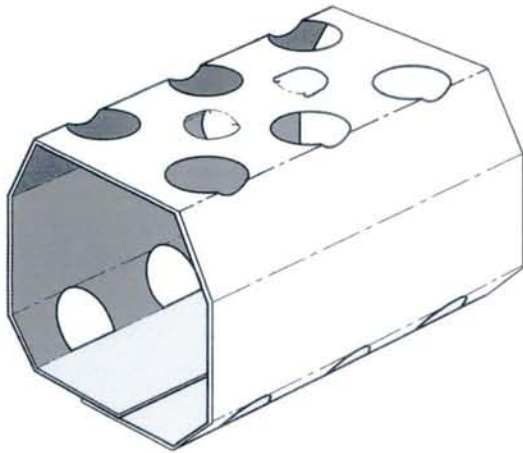


Figure 1

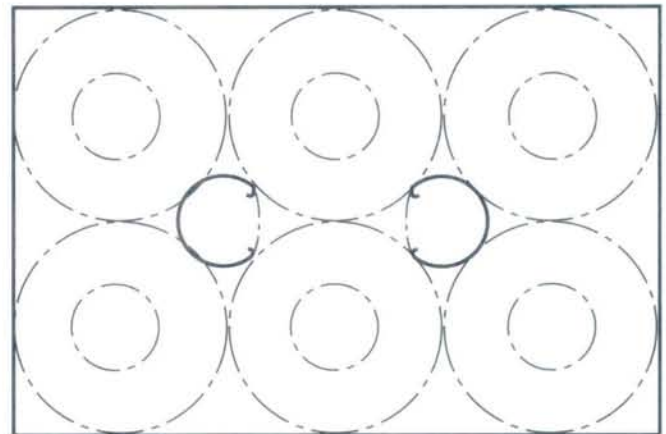


Figure 2

SINGLE PLY
HAND HOLE

This hand hole design is almost exclusively associated with packs of 12 or more cans. It functions best when used on a substrate with high tear resistance such as solid unbleached sulfate with added wet strength. It is frequently used in conjunction with other multi-pack features such as end closures or dispensing devices covered by active U.S. or foreign patents.

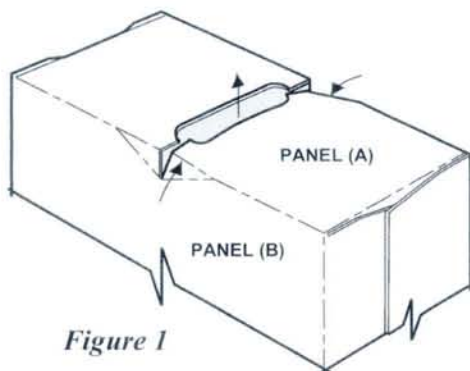


Figure 1

NOTE:

By lifting along one side of the aperture, panel A bows upward, and facets (D) of panels B and C flex inward. This disperses stress thus reducing the potential of tear failure.

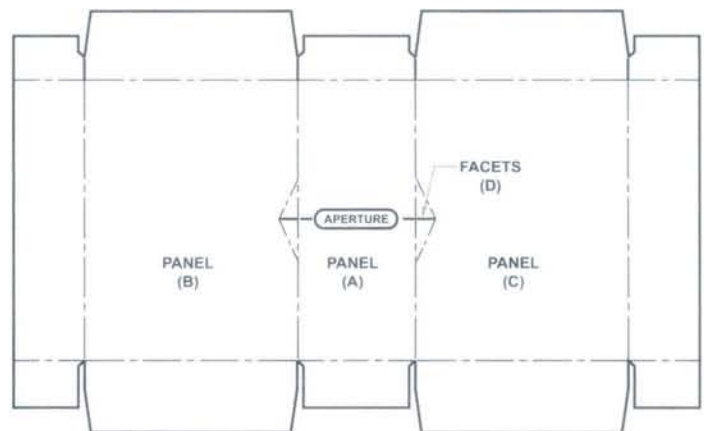


Figure 2



**TWO PLY
STRAP STYLE
HANDLE**

The manufacturer's joint is centered on a side panel to create a two ply handle. This handle works well as a multi-pack for cans. As seen in Figure 1, as the strap is lifted it wraps around the body portion of the outboard cans. Note: For best results, the dust flaps should be adhesively secured to the inner end closure panel.

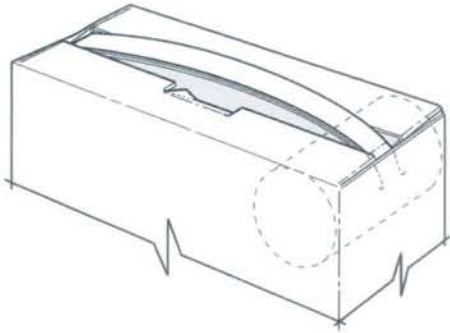


Figure 1

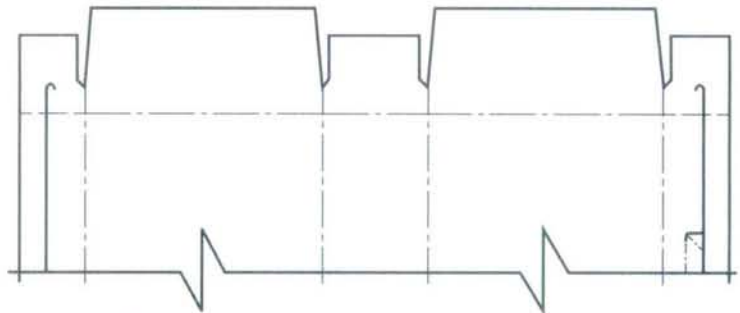


Figure 2

**THREE PLY
HINGE-UP
HANDLE**

This is another direction that can be developed off the manufacturer's joint centered on a side panel. The handle would typically be laid flat against the side panel for shipping and display. A simpler two ply version eliminates outer ply #1. Another two or three ply flush handle developed off a manufacturer's joint centered on a side panel is illustrated on page 3.301 in Multiple Packaging.

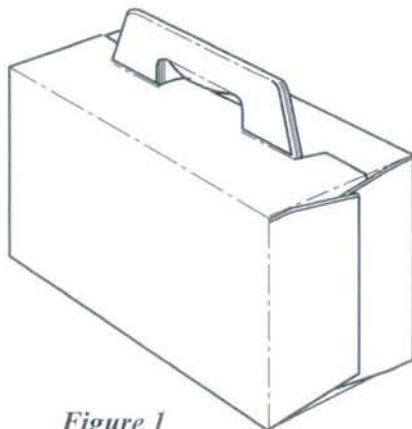


Figure 1

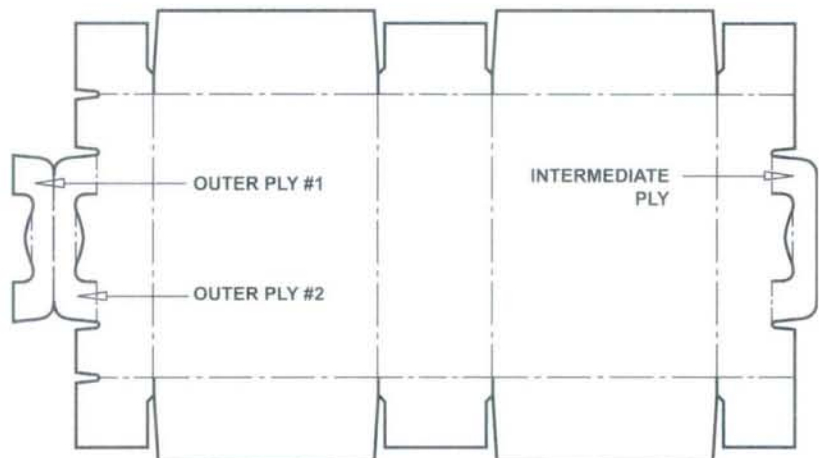


Figure 2



**REINFORCED
APPLIED PATCH
HANDLE**

This handle has been an industry standard for decades. It is typically applied to the underside of the inner closure panel of a full overlap seal end carton as part of the finishing operation.

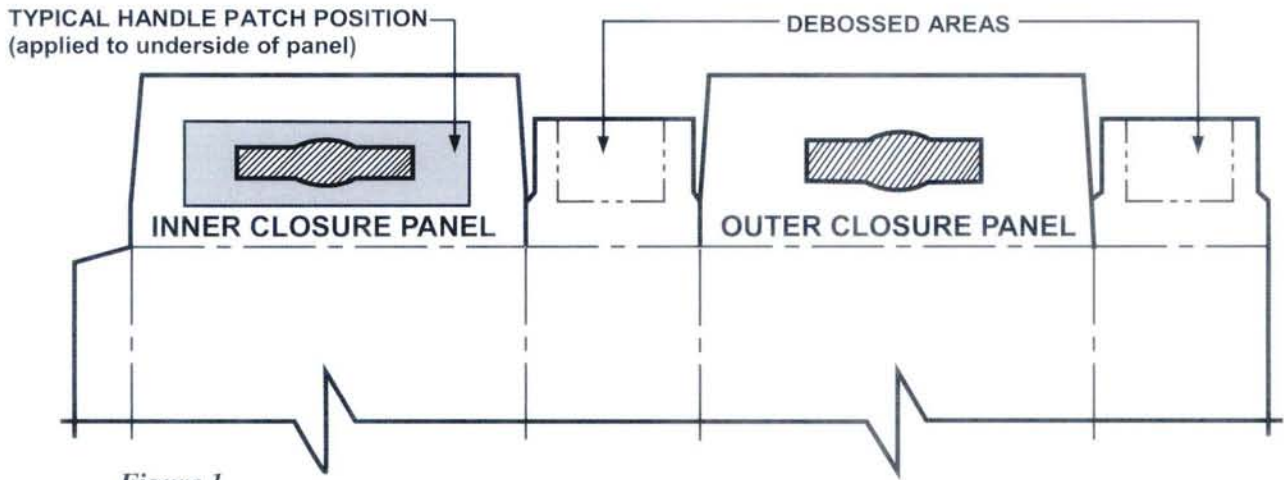


Figure 1

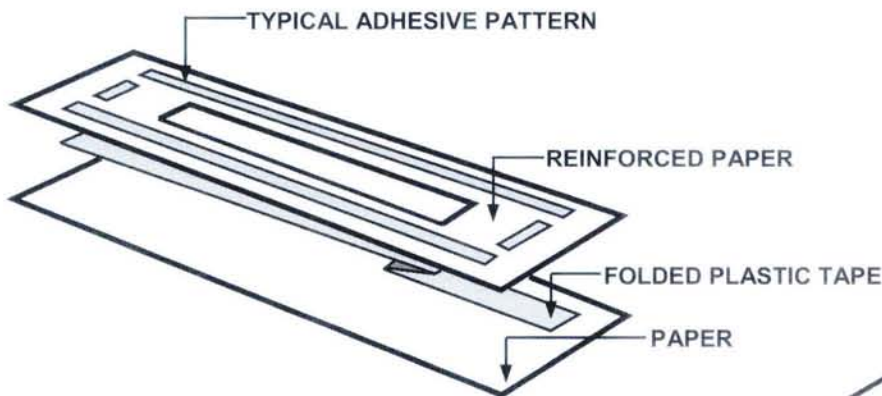


Figure 2: Reinforced patch handle component parts

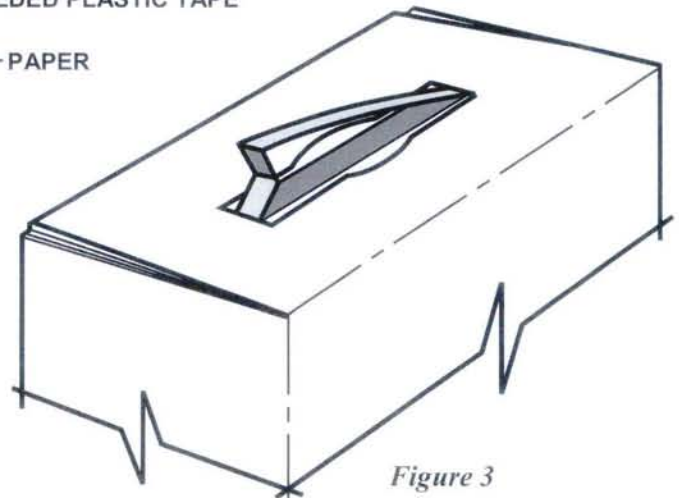


Figure 3



**TWO-PIECE
INJECTION MOLDED
PLASTIC HANDLE**

This is a heavy duty handle most frequently associated with heavy caliper or small flute paperboard. It is shown here as a handle with a separate reinforcing bar; however, for lighter products the reinforcing bar may be deleted.

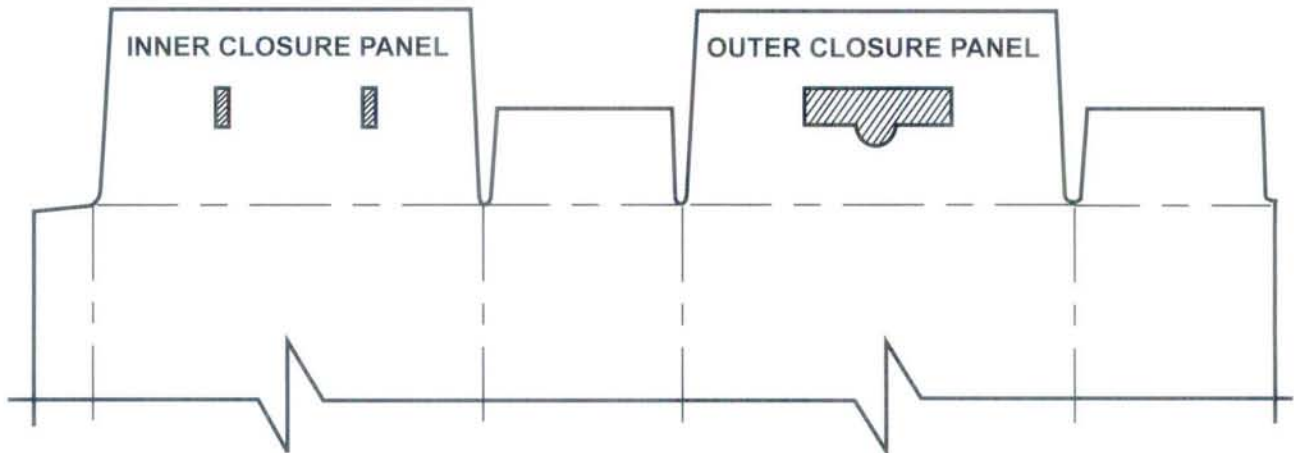


Figure 1

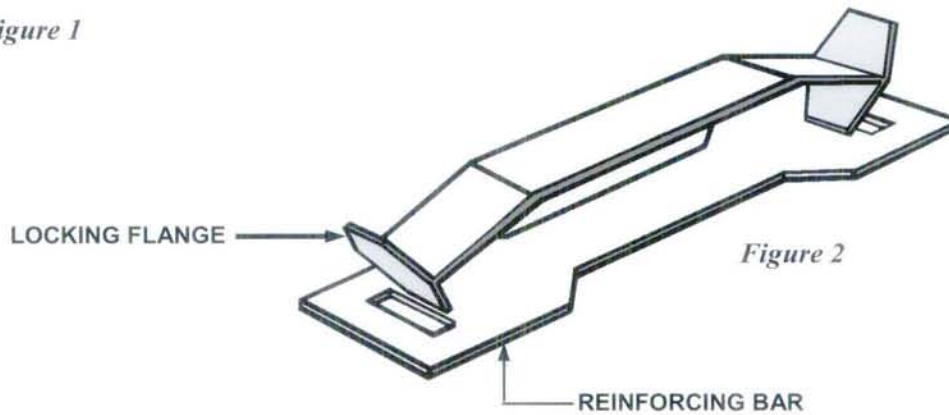


Figure 2

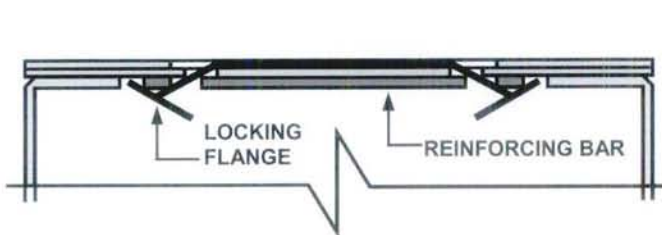


Figure 3A: Cross-section showing handle in its "at rest" position.

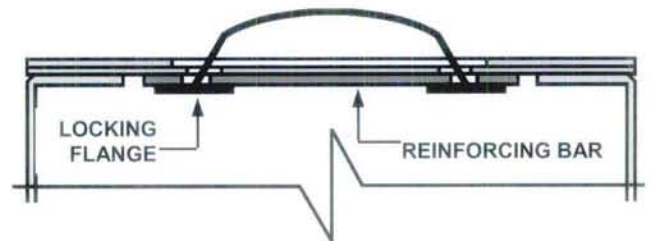


Figure 3B: Cross-section showing handle in its carrying position.



**PAPERBOARD with
APPLIED FILM or
FILM-PAPER PATCH**

This represents a very positive method of closing off potential corner sifting. With an extrusion coating on the inside of the paperboard, film webs are created in the corners. The film is sealed across these webs and to the inner surface of the dust flaps and end closure panels.

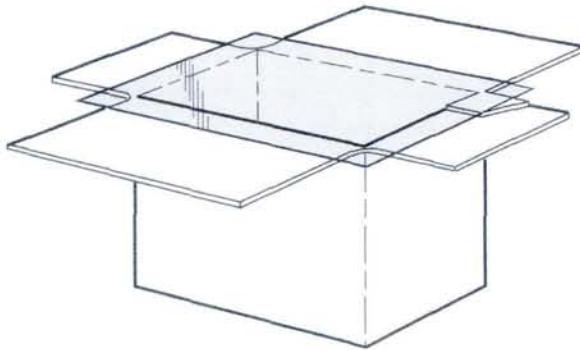


Figure 1

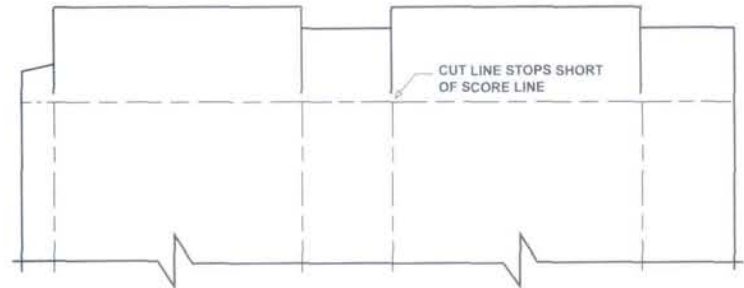


Figure 2

**WEBBED
PAPERBOARD
CORNER GUSSETS**

This concept works best with an extrusion coating on the inside. As the dust flaps are folded in, the film and a portion of the adjacent paperboard delaminate to create corner webs.

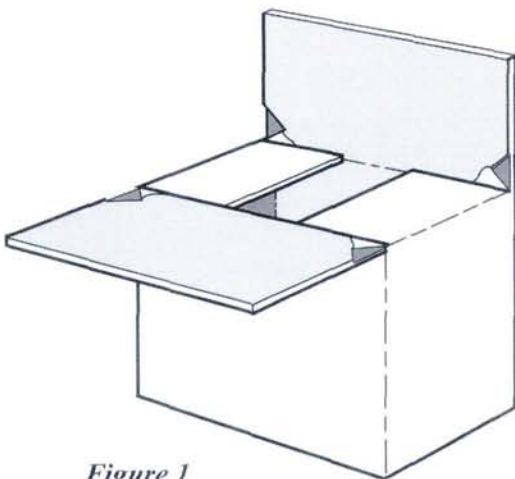


Figure 1

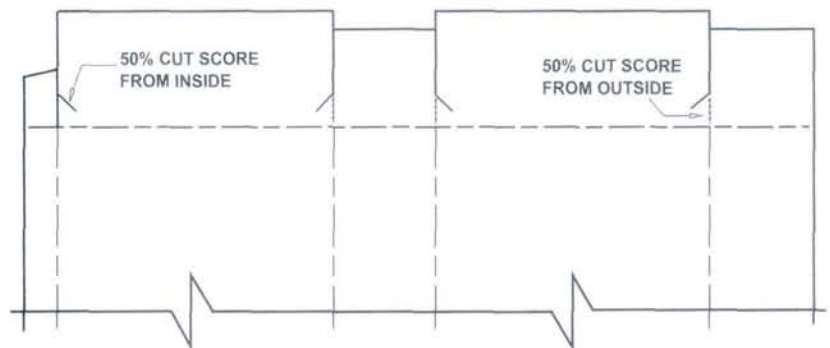


Figure 2



**FILM or PAPER
END CLOSURE
STRIPS**

The applied end patch is an effective sift resistant feature. It requires an extra converting step and is, therefore, more expensive than those styles with integral corner closing features.

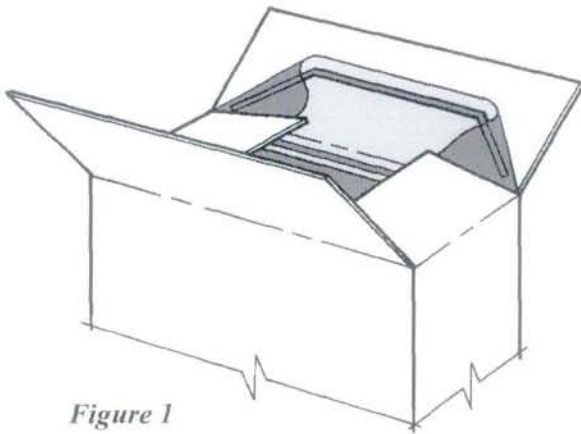


Figure 1

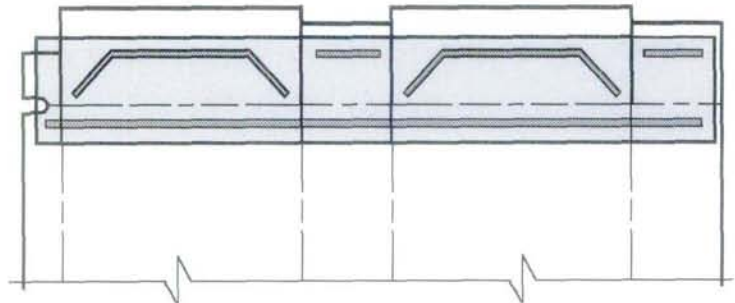


Figure 2

**EMBOSSSED and
DEBOSSSED PANEL /
MODIFIED
CLOSING ROTATION**

Changing the closing sequence of the classic seal end carton to inner major panel in first, followed by the dust flaps, and adding emboss and deboss patterns to select areas of the end closure panels results in an effective sift resistant structure without added material or converting steps.

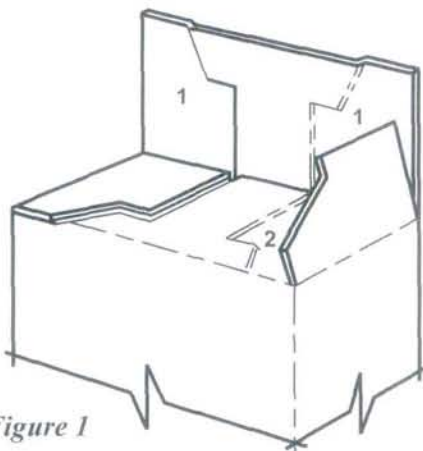


Figure 1

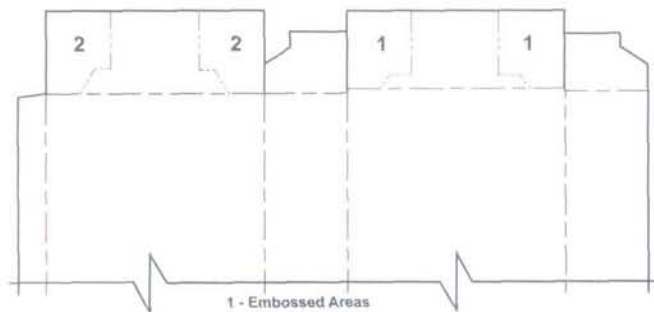


Figure 2

Note: This rotation and emboss/deboss pattern may be used in combination with an integrated paperboard or applied metal or plastic pour spout. (Refer to pages 4.522 and 5.306.)



**FOSE with
INTEGRAL FLAPS
OFF ENDS of
INNER MAJOR PANEL
(Van Buren Ear)**

The familiar "Van Buren Ear" carton is one of the oldest and most successful sift resistant structures. It has long been associated with the packaging of powdered soaps and detergents. Sift resistance can be further enhanced by caulking the joint between the "ears" and the inner major panel. This is illustrated in Figure 3.

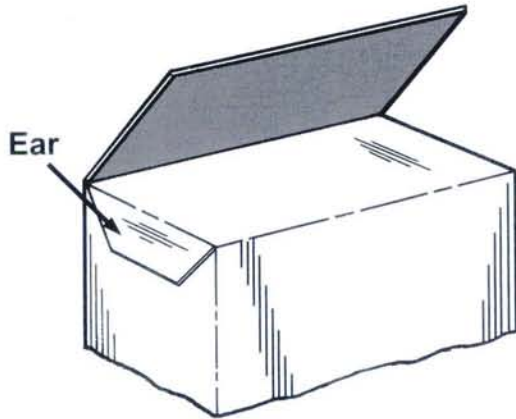


Figure 1

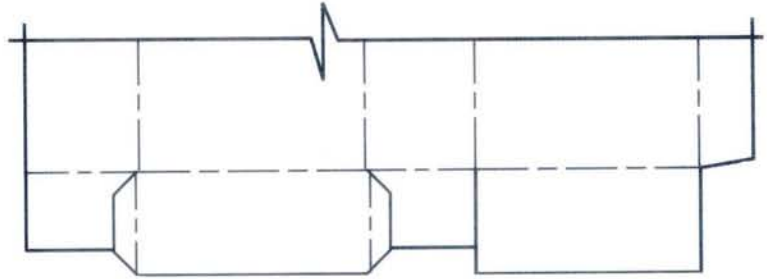


Figure 2

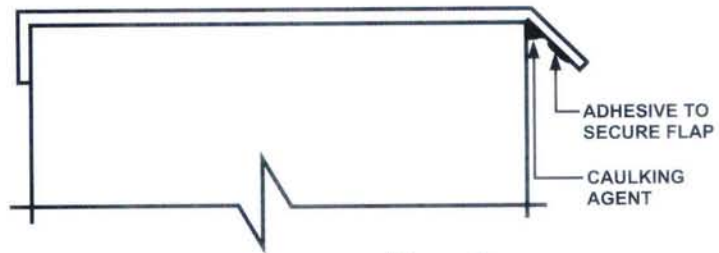


Figure 3



**PLATFORM with
REINFORCING FLAPS**

As illustrated, the platform serves as a cushioning device for products vulnerable to end damage. With the addition of an aperture, the platform becomes a positioning device. Note: This type of platform may also be referred to as a “dummy” or “false” end wall.

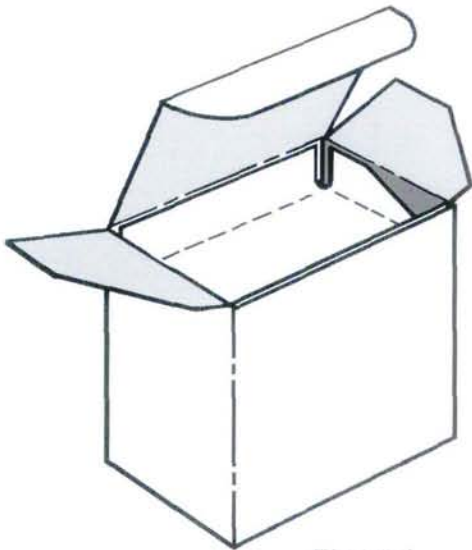


Figure 1

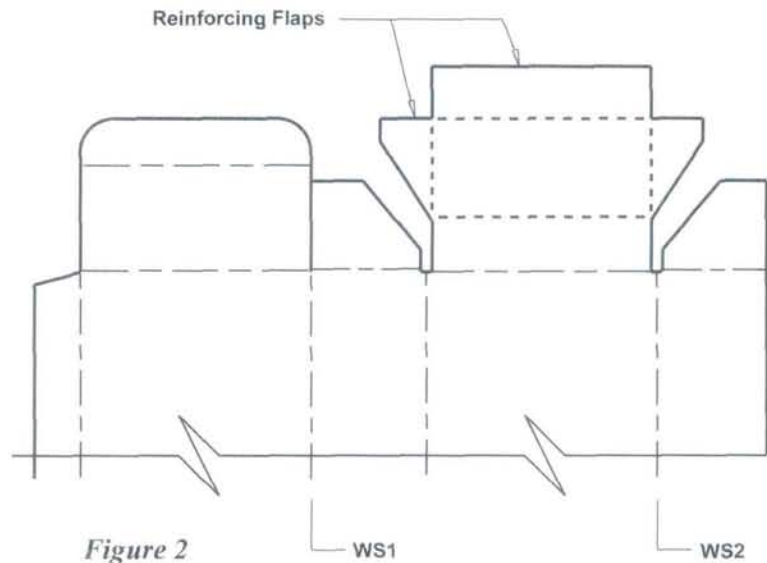


Figure 2

**TRIPLE CELL,
DOUBLE TRANSVERSE
PARTITION with
REINFORCED END
PLATFORM**

This structure combines the key elements of the triple cell, double transverse partition shown on page 1.632 and the platform with reinforcing flaps shown above to provide cushioning top, bottom and sides. It is a good solution for products vulnerable to edge or corner damage.

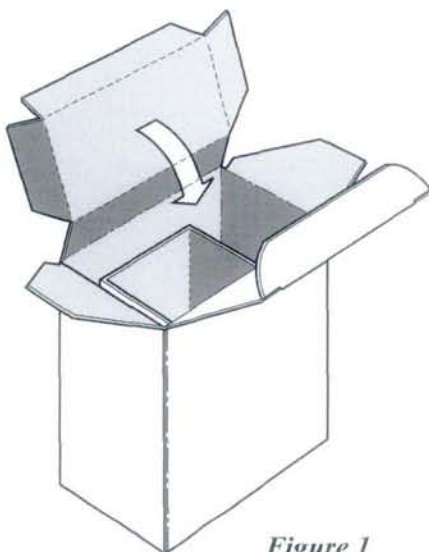


Figure 1

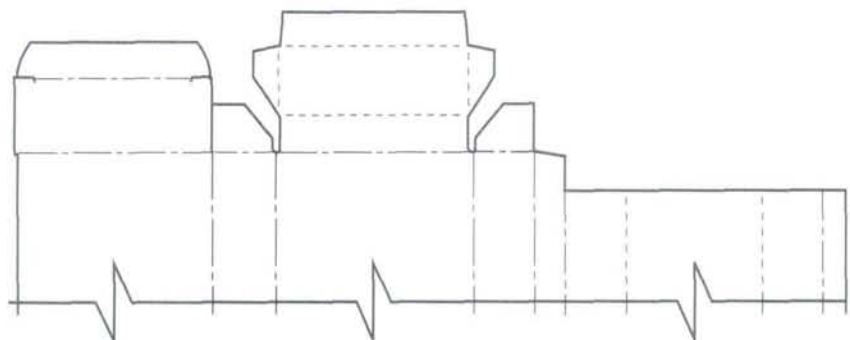


Figure 2



**SLEEVE with
GUSSETED END and
SIDE PLATFORM
CUSHIONING MEANS**

This style is closely identified with the packaging of specialty light bulbs. It is simple and direct, yet isolates a fragile item, such as a light bulb, side-to-side and top-to-bottom.

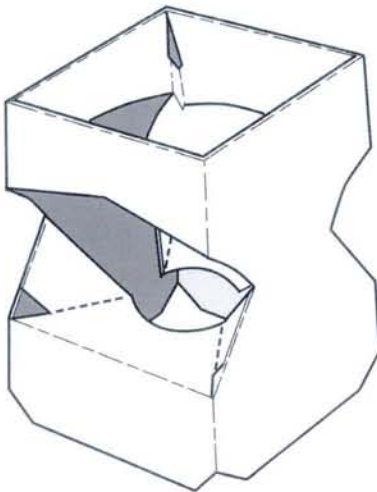


Figure 1

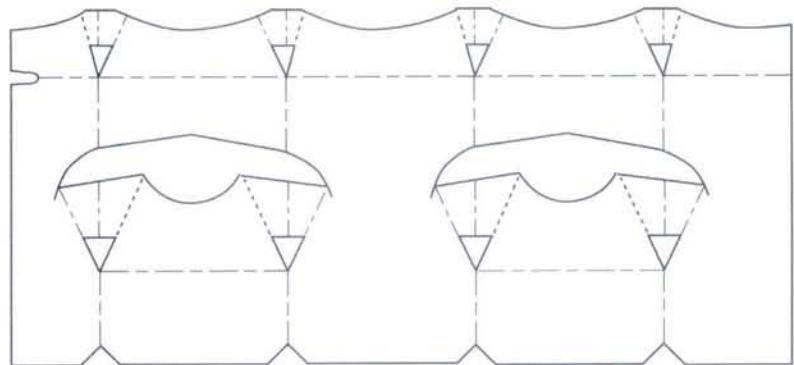


Figure 2

**SLEEVE with
ARCULATE FRONT &
REAR PANELS and
PLATFORM
CUSHIONING MEANS**

This is an alternative approach to the one illustrated above. It, too, is closely identified with the packaging and display of specialty light bulbs. To facilitate proper bowing of the front, rear and internal platform, the grain has been run end-to-end instead of around the body panels as would be the normal practice.

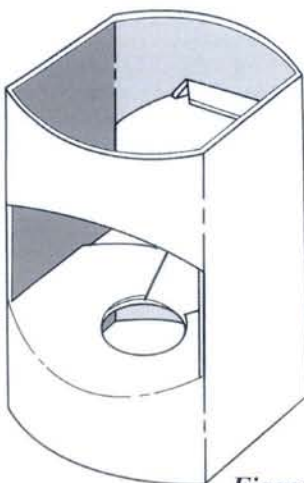


Figure 1

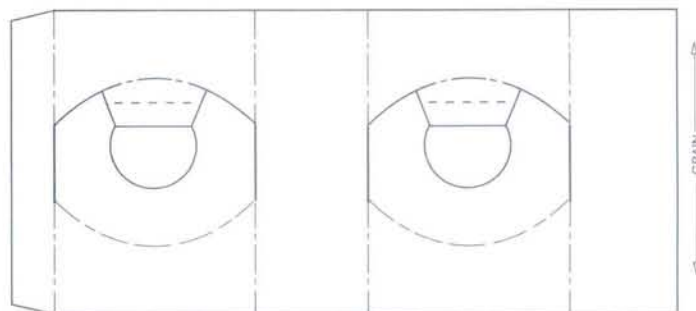


Figure 2

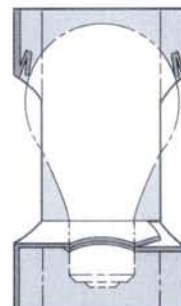


Figure 3



EGG CARTON

This package originated in Europe. While foam polystyrene dominates the U.S. egg packaging market, this structure demonstrates how paperboard can address the cushioning of fragile items such as Christmas ornaments, hollow chocolate “eggs” or specialty light bulbs.

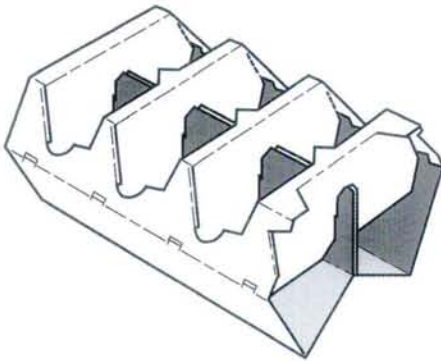


Figure 1

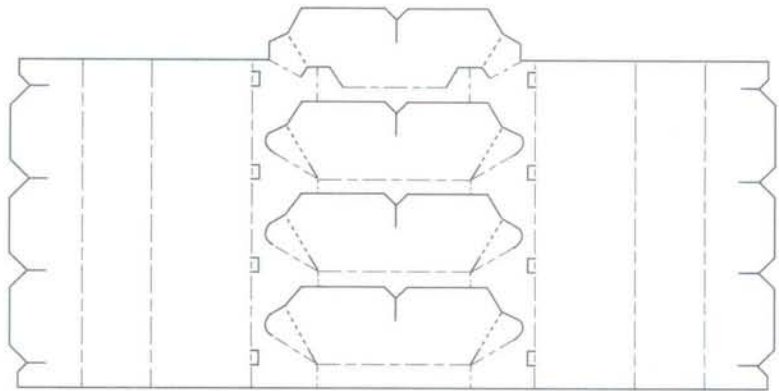


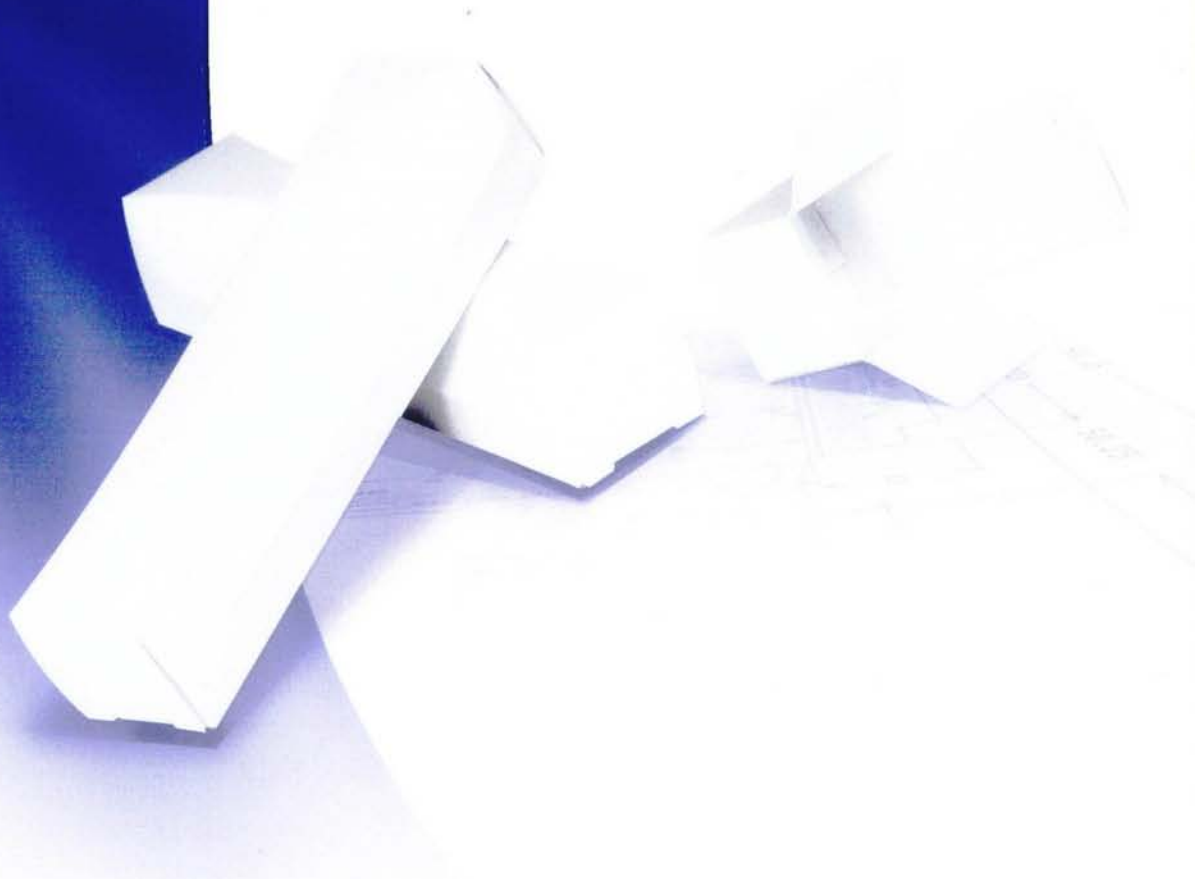
Figure 2



8.000

PAPERBOARD PACKAGING:
APPENDICES

IDEAS AND INNOVATION



8.000

APPENDICES

- 8.100 *Glossary of Packaging Terms*
- 8.200 *References and Resources*



A

Abrasion Damage caused to the surfaces of a carton by friction or the rubbing of adjacent objects such as other cartons or the walls of shipping containers; also referred to as rubbing and scuffing.

Absorption The penetration of one substance into another; for example certain printing inks into boxboard.

Adhesive 1) Any viscous substance such as animal or vegetable glues, resins, dextrans or paste used in the manufacture and closure of folding cartons; or used to bond one material to another as in laminating. 2) A material used to bond two surfaces together; i.e., hot melts, latex, or animal based glues.

Anti-oxidant Board Boxboard chemically treated to increase the shelf life of foods containing fats and oils by retarding rancidity of such products when packaged in cartons made of it. The treatment does not change the appearance of the board and is non-toxic and odorless.

Anti-tarnish Board Boxboard chemically treated to retard development of tarnish which may result from packaging non-ferrous items, such as brass and silver.

Aqueous (inks/coatings) Water based inks and coatings widely used in the industry, replacing solvent based materials to reduce or eliminate the use of volatile organic chemicals (VOC's) from the converting process.

B

Back Liner See "Bottom Liner."

Band A strip of paper or board wrapped around the top, bottom, and sides or ends of a package or other object to cover them without being turned in.

Basis Weight The specification of boxboard as density of weight per unit area. In the U.S., it is measured as "pounds per thousand square feet" and in Europe, as "grams per square meter" (gsm). It ranges from a light weight of 60 pounds per thousand square feet to as heavy as 200 pounds per thousand square feet in a single ply; however, any one machine is ordinarily not capable of making this complete range.

Beater A large mixer in which stock is prepared. The fibers are mechanically treated in the beater while additional ingredients are mixed in.

Ben Day A shadowing effect in printing derived from engravings made by a mechanical shading machine.

Bending Board A descriptive term applied to any boxboard which, when properly scored, will sustain a single fold through 180 degrees without breaking the outer fibers or separating the plies.

Bending Chipboard The least expensive grade of boxboard used in the manufacture of folding cartons, composed principally of recycled fiber.

Billboard 1) Term used to describe the front or face panel of a carton as it sits in the display rack. 2) The pop-up display panel of the typical counter display. (See page 4.201.)

Bimetal Plate A lithographic plate used for long runs. The printing image basis is copper or brass while the non-printing area is aluminum, stainless steel, or chromium.

Binder An agent used to bond components of materials such as coatings or pigments. Also a substance that promotes fiber bonding between sheet plies.

Blank A folding carton after cutting and creasing but before folding and gluing.

Blanket A rubber surfaced fabric used in offset lithography which is clamped around the cylinder and transfers the image from plate to paper.

Blanking The action of separating out individual carton blanks from the waste or scrap portion of the master (production sheet). Typically performed as a second operation on a cutting press, the first operation being cutting and scoring a printed sheet.

Bleaching The process of chemically treating pulp fibers to reduce or remove coloring matter so as to whiten or brighten the pulp. Example: Solid bleached sulfate paperboard (a white sheet) versus solid unbleached sulfate (brownish-tan in color).

Blister 1) As related to the papermaking process, a defect caused by air pockets in the paperboard or in the case of laminates or multi-ply paperboard, areas of



poor or non-existent adhesion between plies. 2) In packaging terms, a thin bubble or dome of semi-rigid plastic attached to a piece of paperboard to form a package (blister pack).

Bogus Papers and paperboards which are manufactured from inferior materials in imitation of higher quality grades.

Bottom Liner The surface of the boxboard which forms the interior of the carton, also called the “back-liner.”

Box 1) A term describing unit container made from (a) non-bending grades of paperboard, i.e., set-up box; or (b) shipping container containerboard grades of corrugated or solid fiber, i.e., corrugated or solid fiber boxes. 2) The term used to distinguish set-up, corrugated or solid fiber unit containers from cartons made from bending grades of paperboard.

Boxboard A term used to describe bending and non-bending grades of the fibrous material used in the manufacture of folding cartons, set-up boxes, fiber cans and the like. In the folding carton industry this term is used interchangeably with the terms “board,” “paperboard,” or “folding boxboard.” (See “Paperboard.”)

Brightness The quality of white intensity as measured by the percent of reflectance of a boxboard surface compared to a standard block of magnesium oxide by means of an optical instrument and expressed in “points of brightness.” The recognized test procedure is TAPPI Standard T 452m.

Brush Finish A finish produced by running dried clay coated boxboard against rapidly revolving cylindrical brushes.

Bundle 1) The unit of boxboard containing sheets weighing 50 pounds. The quantity of sheets varies with their size, weight and caliper; but the weight of 50 pounds per bundle is fixed. 2) Bundle also refers to a quantity of finished cartons.

C

CAD See “Computer Aided Design.”

Calender A group or stack of rollers between which paperboard is passed under controlled conditions of

speed, heat and pressure, in order to give the material thickness, coating or surface finish.

Caliper A dimensional term used interchangeably with the word “thickness” in connection with paperboard. It is expressed in units of thousandths of an inch and is usually written decimally but may be referred to as “points.”

CAM See “Computer Aided Manufacture.”

Carded Packaging Type of packaging that consists of a stiff paperboard card onto which a product is held by a preformed plastic blister (blister card) or by a film vacuumed onto the product and card (skin or contour packaging). Blister cards are usually covered with a special coating that allows the blister to be heat sealed to the card.

Carton A unit container made from bending grades of boxboard. It is a shortened term for “folding carton,” the preferred designation for folding boxes, folding paper boxes and folding paperboard boxes. The word carton does not refer to set-up boxes, corrugated or solid fiber shipping containers.

Carrier Board A term referring to board, usually Kraft, used for beverage carriers. It is often specially treated to impart water resistance since beverage carriers encounter significant moisture. (See “Wet Strength.”)

Cellulose Fiber Paperboard’s primary component. A carbohydrate constituent of the walls and skeletons of vegetable cells having the chemical composition of (C₆H₁₀O₅)_n.

Chase A metal frame in which plates are locked for diecutting and letterpress printing.

Chipboard A low quality, non-test paperboard made of waste paper for use where a specific strength or quality are not necessary. May be bending or non-bending grades.

Clay-Coated Board A high grade bending boxboard, the top surface of which has been coated with a fine clay that provides an excellent printing surface.

Coated Unbleached Kraft (CUK) A grade of paperboard made entirely of virgin, unbleached pulp using the chemical papermaking process. Usually made on a fourdrinier machine.



Coating A substance applied in liquid form to the surface of boxboard to enhance and protect printing or impart special functional properties. Coatings include varnishes, water based, and energy curable coatings such as ultraviolet (UV) or infrared (IR).

Color Transparency A full-color positive image on a transparent support rendered in natural colors, used in the preparation of multicolor printing plates.

Color Control Measurements taken during the printing operation to insure that the inks match the approved progressive color proofs or other color standards for a carton; and to maintain uniformity of ink film thickness and color value during the production run.

Colored Boxboards Any grade of boxboard colored during manufacture by the addition of pigments or dyes to the liner pulp in the beaters.

Computer Aided Design (CAD) A computer drafting software used to design folding cartons. The CAD program also provides information for layout and manufacture of the dies that will be used to cut and crease the cartons (Computer Aided Manufacturing or CAM).

Computer-to-Plate (CtP) An entirely digital workflow used to design and transfer graphics and copy to the printing plate output device (plate setter) without the use of films.

Containerboard A general term applied to both solid fiberboard and corrugated fiberboard which are used in the manufacture of shipping containers. Containerboard grades include medium and linerboard.

Contour Packaging The overwrapping or covering of an irregular-shaped object with a flexible film applied in connection with a paperboard base. The air surrounding the product is exhausted, causing the film to fit or cling closely to all parts of the packaged item. Also referred to as "Skin Packaging."

Converter A manufacturer who fabricates folding cartons from boxboard and other packaging materials. In general, any manufacturer who fabricates packaging materials from various unfinished, raw materials.

Corrugated Board A structure made from containerboard grades of paperboard. Corrugated

consists of a medium, that has been fluted on a corrugator, to which one (single-face) or two (double-face) sheets of linerboard are attached to create the structure. A double-face corrugated container is referred to as a single-wall container. Corrugated is primarily used for shipping containers. The height of the fluted medium varies and is referred to by a letter. Common flute sizes are A, B, C, E, F, G and N.

Count The actual quantity of sheets of a given size, weight and caliper required to make a bundle of 50 pounds.

Counter Plate A component containing channels or grooves affixed to the press plate on the cutting press, which in combination with the die creasing rule, defines the fold lines of a carton. (See page 0.301.)

Creasing The production of the score or folding line in a sheet of boxboard made by pressing the board with a steel rule into a counter or female pattern on the metal surface of a platen or cylinder jacket of a cutting and creasing press.

Cross-Direction The side-to-side direction of a paper machine or the web of paperboard made on it. May also be referred to as cross machine direction (CMD) or opposite direction (OD).

Curl In paperboard, a deflection from a flat plane. Cross-direction curl is the effect of environmental conditions. Machine direction curl is caused by the tendency of the paperboard to conform, or take a set to, the curvature of the roll or core onto which it is wound.

Cut 1) The term properly applies to wood engravings and other surfaces manually engraved. It is frequently used inappropriately to mean photoengraving. 2) To pierce or shear completely through a sheet of paperboard; i.e., to cut carton blanks from a sheet of paperboard.

Cut Score Piercing partially through a sheet of paperboard. (See pages 0.409 - 0.411.)

Cut and Crease Score An alternative to a crease score wherein the fold line is made up of a series of alternating cuts and creases. (See pages 0.409 - 0.411.)

Cutting and Creasing Die Steel rule forms used on cutting and creasing presses to cut and score sheets of boxboard into folding carton blanks.



Cylinder Board Boxboard made on a papermaking machine characterized by the use of a series of cylinders or molds, each laying down a single layer (or ply) of fiber, which permits wide variation in the thickness or weight of the finished board as well as a variation in the furnish used in the different layers, or plies, of the sheet. There is a grain in the direction in which the web travels.

Cylinder Machine A paperboard making machine consisting of wire cylinders revolving in vats containing furnish of different types. Each cylinder deposits a layer of furnish on the moving web or blanket to form separate layers, the fibers of which are combined under pressure into a single sheet as the water is squeezed out. (See page 0.107.)

D

Dampeners Cloth-covered or rubber rollers that distribute the dampening solution to the lithographic press plate.

Debossing Trade jargon for what can more precisely be described as negative embossing. Debossing may be accomplished by using 1) matched dies to form a depressed surface in the paperboard, or 2) a male die (slug) only to depress an image such as code numbers or a manufacturer's logo into the surface of a paperboard substrate.

Die A form used for shaping, cutting or stamping out parts and blanks. Usually made from hard metal but may be made of wood or other suitable material.

Diecutting The cutting of paperboard or paper by a die.

Die Stamping The process of reproducing a design, figures or lettering from engraved plates of copper, steel or other metal, usually on a die-stamping press.

Die Sheet An accurate imprint or transfer made on vinyl or oiled sheet from the die form so that the print image can be brought into exact register with the cutting and creasing rules. Also called a "strike" sheet.

Direct Imaging A process replacing off-press plate-making employing a laser imaging head to create printing plates on press. (See page 0.302)

Direct-to-Plate See "CtP."

Display A folding carton style designed to provide a point-of-purchase unit for holding a number of individual packages or products.

Doctor Blade 1) The part of an inking system on a gravure or flexographic press which scrapes off or removes surplus ink from the printing cylinder before the image is transferred to the sheet or web of board or paper. 2) Also used on other machines to remove excess amounts of coatings, adhesives or other materials being applied to boxboard sheets.

Drier A substance added to ink and other material to accelerate its rate of drying.

Dust Flaps The narrow flaps extending from each side of a carton or from the sides of a top or cover that turn down into the carton before closure to keep foreign particles out.

E

Electron Beam (EB) An alternative protective coating curing technique to ultraviolet (UV) or more conventional heat drying of varnishes or lacquers.

Electrotypes Duplicate printing plates made by the electrical deposition of copper or nickel over molds pressed from original engravings or type. For maximum press life, electrotypes may be chrome plated. For economy, several small electrotypes may be molded or soldered together to make a pattern plate from which actual duplicate printing plates are in turn produced.

Embossing 1) Raising letters or areas of a design above the flat surface of carton blanks or paper sheets by means of pressure applied through the action of male and female dies on cutting and creasing presses. 2) Embossing done by means of engraved rollers on sheet and web fed converting equipment.

Embossing, Blind The embossing of a design on unprinted paper or paperboard.

Engraving In the graphic arts and converting industries, this term is often used in referring to original photoengravings from which the actual printing plates are duplicated or produced.

Etching The process of making a design on a metal plate by a corrosive substance or by cutting it with a sharp tool.



F

Facing(s) A marketing term indicating the outwardly visible panel of a carton at retail display (facing panel) or the number of cartons displayed in a given set of vertical and horizontal dimensions; i.e., 8 facings in a 2' x 2' display rack.

Felt The porous belt which carries the newly formed paperboard through the papermaking machine until the sheet is stable enough to continue without support.

Fiber 1) A small thread-like cellulose unit of vegetable growth obtained from plants such as trees, sugar cane, cotton, jute, etc., from which paper and board are made. 2) In packaging, this designates converted paperboard products such as fiberboard, fiber boxes, fiber containers or fiber drums.

Fiberboard The general term indicating boxboard that contains center plies of a different furnish than that used for the top and bottom liners.

Filler 1) The inner ply or plies of a multiple layer boxboard. 2) A loading material, such as clay, used in coating paper or board.

Film A flexible plastic material, generally transparent, used as windows in cartons; or for overwraps and laminates. It is extruded, cast or calendered.

Finish The term used to designate the density of boxboard and the change in smoothness incidental to change of weight. There are four standard finishes designated by numbers 1 to 4; the number 1 indicating the lowest density and number 4 the highest density.

Flap One of the closing members of a folding carton, an envelope or corrugated container.

Flexography A printing process where fluid, quick drying ink is transferred by a relief-molded, flexible rubber plate to a fast-moving web through rotary action. (See page 0.405.)

Flock Finely cut cloth fibers blown or shaken on adhesive-coated boxboard or cartons to produce a velour or suede finish.

Foil Thin gauged aluminum used in packaging as a laminate to board, or as an overwrap, to increase eye appeal and to provide functional properties such as resistance to heat, grease and water.

Foil Stamping The impressing of lettering or a design through foil upon a carton blank by means of a heated die or type. Also called "hot stamping."

Folding Carton Generally accepted designation of containers made by bending grades of plain or printed boxboard, cut and creased in a variety of sizes and shapes; delivered to the user in a flat, or glued and collapsed form.

Forty-eight/Forty (48/40) Term referring to a pallet size of 48" by 40" which optimizes space utilization of trailers and most warehousing systems.

Fourdrinier Machine Paperboard making machine (usually solid board) using an endless traveling wire screen on which the furnish is deposited. The screen shakes as it travels, knotting the fibers into a homogeneous sheet. Some grain direction discernible.

Frame Structural description of the end and/or side wall components of a tray type of folding carton, diecut and scored to form a shoulder or enclosing border to protect and enhance the display of the contents.

Furnish The mixture of pulp, paper scrap, sizing, water, dyes, and other additives fed to the wet-end of a paper or board making machine from which paper or board is formed. The wet-end furnish is approx. 94% water; finished sheet ranges from 5% to 7 % water.

G

Glassine A supercalendered, smooth, dense, transparent or semi-transparent paper manufactured primarily from chemical wood pulps. It is grease resistant and when waxed, lacquered or laminated is highly impervious to the transmission of moisture vapor. It is used extensively as a protective carton liner or inner bag for food and many other products.

Gloss The term used to express shine, sheen or luster of the surface of boxboard or cartons. It varies according to the nature of the board stock itself, or may be imparted to the board or carton blank by coating, printing, or laminating.

Glue A commonly used synonym for the word adhesive. The term should actually apply only to those gelatinous adhesives extracted from the bones, skin, etc., of animals and fish by hot water.



Gluing The operation of applying an adhesive substance to the surface of a material which causes it to bond or adhere to another.

Glue Flap Structural element of a folding carton blank used to adhesively secure one panel to another.

Grain The longitudinal arrangement of the fibers in paper or paperboard which results as they settle in the direction parallel with the travel of the paper or board machine. Direction of the grain is important in carton design because greater tearing strength exists across the grain, and greater tensile strength in grain direction. Grain is more pronounced in paperboard made on a cylinder machine than on paperboard made on a fourdrinier machine.

Gravure Printing (Rotogravure) An intaglio printing process using cylinders on which an image is etched in the form of a series of cells. These cells are filled with ink and the excess removed by means of a doctor blade. Ink from the wells is transferred by the rotary action of the press to the board in either sheet or web form. (See page 0.404.)

Greaseproof Board Paperboard which has been treated or laminated to provide resistance to the penetration of greasy or oily substances. Treatment may include such coatings as casein, lacquer, hot melt polyvinyl, resin or silicate. Glassine and other greaseproof papers may be laminated to board to provide this quality.

Grippers The metal fingers that clamp onto the edge of the paperboard and control its flow through the press.

H

Halftone The printed reproduction of a photograph, painting or other art subject whose varying tone values are derived from different sized, closely spaced dots of ink transferred from engravings, plates or cylinders into which the original image has been made photographically through a fine mesh screen pattern. Such reproductions are generally made in conjunction with letterpress, offset and gravure printing, and to a lesser extent flexography.

Halftone Engraving A metal or plastic plate from which the tone values of halftone reproduction are

obtained during the printing operation. While the term may be used alone it is usually prefaced by another word to indicate the material from which it is made; such as copper, zinc, magnesium or plastic.

Halftone Negative (or Positive) The exposed photographic film or glass onto which the tone values of a subject are converted through a halftone screen. The negative or positive image is transferred in the succeeding steps toward the preparation of a halftone film for plate/cylinder preparation.

Heat Seal The uniting of two or more surfaces by the fusion of coatings or base materials under controlled conditions of temperature, pressure and time.

Heat Seal Coatings Materials applied to board, in a liquid form, and dried which may be reactivated by heating to about 225° to 250° F.

Holography The method of producing a three dimensional image in foil or film utilizing interference patterns from a split laser beam.

Hot Stamping The impressing of letters or a design through foil upon a carton blank by means of a heated die or type. (See page 0.412.)

I

Impression Transferring an image to boxboard from a printing plate, blanket or cylinder by one of the printing processes. It may be a single color design or one in a series of multi-color patterns.

Imprint 1) The trademark or legend reproduced on a carton during the process of printing to identify the manufacturer. 2) The subsequent printing of additional identifying information on a previously printed carton blank such as stock retail boxes.

Infrared (IR) Invisible, low energy light of wave lengths longer than those of visible light, felt as heat. In the folding carton converting process, a technology used to instantly cure or set inks or coatings on the printing press. IR is an alternative to conventional heat or UV setting (drying) of inks or coatings.

Inhibitor A substance added to the furnish, coating or laminate of boxboard to retard or prevent deterioration of a carton or its contents by chemical reaction.



Ink A fluid or viscous substance consisting of pigments, dyes or other materials dispersed in a carrier or vehicle by means of which a printing press imparts the desired image on boxboard. Character of the ink varies according to the printing process and application.

Ink Receptivity The degree of penetration of printing inks on the surface of boxboard.

Insert A piece of paperboard which is not an integral part of a carton but is used in connection with one carton to perform a special function in separating, holding, or protecting the contents in position as a block, base, cushion, compartment or partition. Such inserts may serve as platforms, steps or frames for displaying the products within a carton.

J

Jordan A machine which mechanically bruises pulp fibers, causing fibrillation and hydration, while serving to produce a more uniform mixture of water and other fibers.

K

Knife Hardened steel rule with a sharpened and honed edge to facilitate cutting; also referred to as “cutting rule.”

Kraft Paper or paperboard made from virgin pulp produced by the sulfate process. Natural kraft is unbleached and has a characteristic light brown color; bleached kraft is a sheet having a higher brightness rating than natural kraft.

K.D.F. A term used by public carriers in referring to boxes (cartons) other than corrugated when Knocked Down Flat.

L

Lacquer A type of coating, applied in liquid form to boxboard, for protective or decorative purposes.

Laminated Board A combination of different kinds of boxboards, films, foils, papers or other materials bonded by adhesives in webs or sheets. May also be designated as “lined board.”

Laser An extremely intense, focused light beam for precise exposure or burning of detailed images. In the

folding carton converting process, a common method employed in the “cutting” (burning) of the slots in a die board to accept cutting and scoring rule.

Letterpress Printing The printing process by which ink is transferred from the raised portions of printing plates or type to board. (See page 0.404.)

Liner The outer or inner ply of a sheet of cylinder board.

Lithography A printing process using plates whose printing surfaces are partially water repellent and partially ink (oil) repellent. The plates are made of flexible sheets of metal, such as zinc or aluminum, or of two metals as in bimetal plates. Plates are photographically imposed, chemically etched and run on either sheet-fed or roll-fed presses. The term lithography is often shortened to “litho.” (See page 0.405.)

Litho-laminating The process of laminating litho pre-printed sheets to a single-face corrugated structure, forming a complete double-face structure.

M

Machine Direction (MD) The direction of a paperboard sheet or web which is parallel to the paper machine length.

Make-Ready General preparatory operations prior to the actual production of printing, or cutting and creasing. It usually involves the adjustment of the impression by overlaying or underlaying the printing plates; the cutting of the female part of the die. Also used in connection with finishing machines such as gluer, waxer, windower.

Manila Board Boxboard made principally from mechanically ground wood pulp used largely for packaging foods. It has a light straw color and a suitable surface for printing.

Manufacturer’s Joint The mechanical connection between two panels to create a tube. In the classic four-panel tube, the manufacturer’s joint is comprised of a flap and an adhesively secured overlying panel.

Metallic Ink Bronze or aluminum powder suspended in an appropriate vehicle and applied as a printing ink to produce designs with a metallic luster on the surface being printed. In addition to natural metals, lustrous



tints of other colors may be produced by adding small amounts of transparent color to aluminum inks.

Mil A unit of measure used in the paper making and converting industries to define paperboard thickness. One mil equals one thousandth of an inch (0.001) or 1 “point.”

Mini-Flute An alternative term for small flute paperboard. Refer to “Small Flute Paperboard.”

Mist Lined Chipboards Colored manila top liner boxboard containing some long black fibers to give a mist effect on bending chipboard. Also referred to as “Mist Grey Chipboard.”

Moisture Content The amount of water in boxboard expressed as a percent of factory paper weight of the test sample.

Moistureproof A coating, extrusion or laminated barrier which resists the passage of moisture through a package.

Moisture Vapor Transmission Rate (MVTR) The mass of water vapor transmitted through paperboard when exposed to various humidity levels. Also referred to as “moisture vapor transfer rate” or “water vapor transmission/transfer rate” (WVTR).

N

News Vat Lined Chipboard A combination boxboard made on a cylinder machine from chip and news liner waste newspaper stock.

Nick A small indent or ground out area in the cutting edge of a die rule to create a small gap in the cut surface of paperboard. In the converting process, the technique used to contain individual carton blanks within the master sheet as the sheet progresses from the cutting and creasing stage to the blanking stage on the cutting press.

O

Offset Lithography The lithographic printing process by which a photographically made ink receptive image on flexible metal plates is transferred by means of a rubber blanket to boxboard or the material being printed. (See page 0.405.)

Offset Powder A powder applied to the surface of a litho-printed sheet to prevent the ink from transferring (offsetting) to the surface of the adjacent sheet as the sheets are stacked off the delivery end of the printing press.

Overprint To print additional material, such as a varnish or another color, on a previously printed sheet.

Overwrap A plain or printed sheet of paper, foil or flexible film applied over a filled carton or tray for decorative or protective purposes.

P

Package A container that provides protection and identification, and promotes the sale and use of a product.

Pallet A low, portable platform of wood, metal, plastic, or fiberboard which facilitates the handling, storage, and transportation of materials as a unit.

Panel A face, side, top or bottom of a folding carton.

Paperboard A general term describing a sheet of fibrous material usually made on a cylinder or fourdrinier machine from either virgin wood fiber (pulp), recycled paper stock (old newspapers, old corrugated), or a combination of these fiber sources. Paperboard differs from paper in that it is heavier, thicker, and more rigid. The two general classifications of paperboard are containerboard, which is used principally in making corrugated and solid fiber boxes; and boxboard, the bending grades of which are used in the manufacture of folding cartons.

Patent Coated Boxboard A combination white vat lined board made on a cylinder machine. One or both sides of the board consists of bleached raw material and center plies are generally of less expensive grade.

Perfecting The printing of at least one color on both sides or surfaces of a substrate, such as paperboard, in a single pass through the press. A “perfecting press” is a press capable of performing this operation.

Plate In relation to the paperboard printing process, a flat or curved device or image carrier which receives and transfers ink from the press to the paperboard substrate. Also referred to as a printing plate.



Platen The flat mounting plates of a press to which the entire printing assembly is fastened.

Plotter 1) A device driven by a CAD system to produce an image on a film, paper or paperboard substrate. 2) A plotter/samplemaker: A device which, in addition to the functions noted above, can produce prototype cut and scored, flat paperboard samples.

Ply One of the layers of boxboard formed on a multi-cylinder paperboard making machine. Each cylinder adds one web or ply to others which are pressed together and dried to achieve the desired thickness.

Point A term used to designate the thickness of paperboard. One point equals one thousandth of an inch, or one mil. (See "Caliper.")

Polymerization A chemical reaction in which the molecules of a monomer (simple chemical) are linked together to form large molecules whose weight is a multiple of that original substance.

Prepress Collective activities of preparing copy for printing. In an analog workflow, it includes color separation, production of films, analog proofs, using the film to make printing plates, and the make-ready of the press. In a digital workflow, this would include manipulating digital files for producing the printing plates, digital proofing, and make-ready of the press.

Proof A trial impression made in conjunction with a printing process to determine the need for corrections. Impressions must be taken singly from each colorplate of a set, showing each color alone and in combination with each of the other colors in proper sequence. Proofs should be made on the board and with the inks to be used for actual production.

Pulp The basic cellulose fibers resulting from the disintegration of wood, rags or other vegetable matter by chemical, mechanical, or a combination of processes from which all paper and paperboard are made.

R

Ragger A device which removes rags and similar contaminants from recycled material during the pulping operation. Normally installed on a beater machine.

Raster Image Processor (RIP) A computer process that converts image areas to an electronic bitmap. An integral part of the computer to press (CtP) or "filmless" printing process.

Recycled Material (Fiber) Reclaimed material which, after repulping, is used as one of the two principal furnishes for paper or paperboard. This includes boxboard cuttings, over-issue newspaper, reclaimed corrugated containers, mixed paper, tabulating cards, envelope cuttings, kraft cuttings, etc.

Registration (or Register) Accuracy of imposition to secure correct alignment of the printed color-to-color areas of a multi-color design image and of the design-to-scores shown on a die sheet. The correct placement of the design on the printed areas or items. Color-to-color is usually referred to as "printing register." Design-to-scoring is called "cutting register."

Regular Number The quantity of boxboard sheets, 25" x 40" (1,000 square inches) required to make a bundle of 50 pounds.

Reverse Plate A plate on which the reproduction of an original design is produced in negative form.

Rotary Die The die used in the rotary diecutting process.

Rotary Diecutting Cutting and creasing by means of arcuate metal dies mounted on a backup cylinder so as to permit continuous cutting and scoring of a paperboard sheet.

Rotary Press A press on which both the printing and impression surfaces are cylindrical.

Rotogravure An intaglio printing process using cylinders on which an image is etched in the form of a series of cells. These cells are filled with ink and the excess removed by a doctor blade. Ink from the wells is transferred by the rotary action of the press to the board in either sheet or web form. (See "Gravure.")

S

Score A disruption, such as a notch, groove, cut or partial depth cut, in the surface of a substrate such as paperboard. (See pages 0.409 - 0.411.)



Scrap Material A product made non-usable for its original purpose during the manufacturing process, or spoilage depreciation, which may be reclaimed as a raw material or as a component of another material or product. The trim areas between cartons on a sheet.

Semi-Bending Chipboard Chipboard which when properly creased will take a 90° bend without showing pronounced failure in the top liner fibers.

Set-Off The unintentional transfer of printing inks or coatings from the printed surface of one sheet to the back of another.

Set-Up Box A stiff paperboard box in three dimensional construction, typically fabricated from grades of non-bending chipboard, which is over-wrapped with printed paper or covering materials and delivered “set-up” and ready to use; as distinguished from a folding carton.

Shell A plain, unprinted carton designed to be overwrapped with plain paper, printed paper or other material.

Shipping Container A corrugated or solid fiber box used to pack and transport products or packages.

Sift Proof A carton constructed in such a way as to prevent granular or powdered contents from escaping.

Silicating A surface treatment using silicate to lay the fibers and produce a smooth finish on board and minimize dusting.

Sizing Material added to the furnish for paper or board, or the application of material to paper or board which increases the resistance of the sheet to penetration by liquids.

Skin Packaging See “Contour Packaging.”

Slitter A machine which cuts rolls of boxboard in the long direction utilizing adjustable disk knives or blades mounted on shafts.

Small Flute Paperboard A term preferred by the folding carton industry to identify small height corrugated grades (E, F, G, and N flute) which can be converted on folding carton equipment, as opposed to larger flute grades (A, B, and C) used primarily for shipping containers. May also be referred to as “Mini-Flute” or “Small Flute” corrugated.

Solid Bleached Sulfate (SBS) A grade of paperboard made entirely of virgin bleached white pulp using the chemical papermaking process. Usually made on a fourdrinier machine.

Solid Unbleached Sulfate See “Coated Unbleached Kraft.”

Standard Size A boxboard sheet 25” x 50” in size which is the basis for all board computations.

Starch An organic medium added to paperboard to add stiffness and a degree of water absorption resistance.

Stiffness The resistance of the board to deflection from an external source, often measured in Taber units. This property varies significantly between grain and cross-grain directions and will vary with moisture content of the board.

Stock A term referring to the materials that go into a sheet of paperboard in the state in which they exist just prior to going through the papermaking machine.

Stock Box A carton which is manufactured in large quantities in advance of sale and sold in smaller quantities, usually to retailers.

Stripping Removal of excess board around or in carton blanks after diecutting. This may be done either by hand or mechanically.

Styles Construction variations of the folding carton. Styles may be identified by descriptive names or the proprietary designations of their inventors or manufacturers. In the Federal Specification “Boxes, Folding Paperboard” (PPP-B-566a) styles are listed by Roman numerals with variations in construction referred to as “types” with Arabic numbers, and “classes” with lower case letters.

T

Taber Unit Unit of measurement used to determine the stiffness (resistance to bending) of a material such as paper or paperboard.

Tear Strip A perforated band made in a carton blank to facilitate opening the package after it has been filled and sealed. A narrow ribbon of film, cord, etc., usually incorporated mechanically in a wrapper, overwrap, or the carton itself.



Thumbhole A semi-circular or triangular cut made in the sides or ends of cartons to facilitate opening of the package. Semi-circular openings used on multi-packs for inserting fingers to carry the package.

Tray Style Carton A structure developed from a flat blank comprised of a base and at least three hinge-connected side or end panels, which in turn are connected at the corners by adhesive or mechanical means to form an open top carton.

Trim Size The maximum width that can be efficiently produced on a paperboard manufacturing machine, printing press or paperboard converting machine, minus an allowance for trimming off edges. The size of something after a trimming operation.

Tube Style Carton A structure developed from a flat blank comprised of a series of three or more hinge-connected panels, which have the free vertical edges of the outermost panels connected by adhesive or mechanical means to form a carton open at both ends.

U

U-Board A “U”-shaped boxboard configuration of a body and two ends or sides, scored to provide rigidity and facilitate overwrapping of product with flexible packaging material.

Ultraviolet (UV) Inks Solventless printing inks which incorporate liquid photopolymers that release free radicals on exposure to large doses of ultraviolet light. The radicals cause the ends to polymerize into a dry resin, eliminating the need for drying time.

Ultraviolet (UV) Coatings Coatings which are cured, or dried, by exposure to ultraviolet radiation. These coatings offer excellent gloss, as well as chemical and rub resistance.

Universal Product Code (UPC) A computerized method of registering sales information on products identified by the system. Electronic scanners are used to read pre-designated product codes at the point of purchase. This information is instantly fed into a computer which provides pricing information, accumulates inventory data, and synthesizes sales analysis data.

UPC Symbol A pattern of bars and spaces (which can be electronically read by a scanner) applied to a product container for use in implementing the Universal Product Code system. The symbol contains a numeric code identifying both the manufacturer and product.

UV Printing Printing with ultraviolet inks.

V

Vat-Lined Board Cylinder boards which have one or both of the surface linings composed of furnish different from the inner plies. They may be colored.

Vertical Reciprocating Press Press in which both the form and impression cylinders move up and down in a reciprocating motion.

Virgin Material (Fiber) Fiber gleaned from organic materials such as wood chips which has not been previously used in the manufacture of another product.

W

Water Based (inks/coatings) See “Aqueous” (inks/coatings).

Waxing The application of paraffin to printed board or carton blanks as a preservative coating resulting in a high-gloss or impregnated finish.

Web A continuous sheet of boxboard or other flexible material coming from the machine which produces it. It may be slit and rewound into rolls or cut into sheets. Also refers to belt or blanket on which boxboard is conveyed through papermaking machines. Roll stock is used on some printing and converting equipment.

Wet Strength Board A specially treated board, usually kraft, that is resistant to moisture. Wet strength board is often used for beverage carriers, frozen foods, or in applications where the board will be exposed to excessive amounts of moisture, condensation, etc. (see “Carrier Board.”)

Window A diecut opening in a carton blank which provides visibility of contents, usually covered with a transparent film. Sometimes referred to as an aperture.





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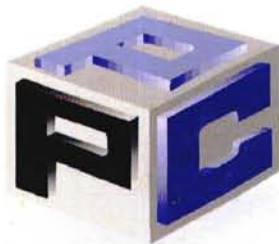
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