



Aseptic packing

Bag in Box extends the shelf life of fresh and mildly conserved food products



List of contents

SUMMARY	3
1. THE CHALLENGE OF INCREASING SHELF	
LIFE OF PRODUCTS	4
1.1 Delaying product deterioration	5
1.2 Managing microbial activity	6
1.3 Achieving 'commercial sterility	7
1.4 Stabilising without loss of quality	8
2. VALUE ADDITION THROUGH BAG IN BOX	11
2.1 Vulnerable products and processes	11
2.2 Wide range of applications and ase of use	13
2.3 Wide variety of packing system options	15
2.4 Advantages for packing, transport and storage	17
2.5 Environment-related advantages	18
2.6 Aseptic aspects	19
3. VAN MEURS ASEPTIC BAG IN BOX	
FILLING MACHINES	

Aseptic packing

The manufacturers of food products are placing increasingly stringent demands on the production process. The entire course of manufacturing starting from the raw material to the final packing is closely monitored and wherever possible, inspected as well, by the manufacturer (and the distributor, who with his increasing clout, is not far behind). This is happening essentially because of the growing demand for high-quality - preferably fresh and natural - products, and for energy-saving production processes. One answer to these developments is to manufacture according to GMP (Good Manufacturing Practice), or to use hygienic or aseptic manufacturing processes.

Packing in Bag in Box is an increasingly important part of hygienic and aseptic manufacturing processes. Bag in Box packing containers are suited for liquid and paste-like products. The increasing demand for hygienic and aseptic packing will be examined in more detail in chapter 1, which follows. Chapter 2 looks at aseptic packing from the point of view of the Bag in Box system.

The specific aspects of aseptic Bag in Box filling machines such as the ones made by Van Meurs have been discussed in chapter 3.

1. The challenge of increasing shelf life of products

Consumers and the business class today prefer fresh or mildly conserved and user-friendly food products. Typically, such products are low in sugar, salt and fat, and contain as few preservatives as possible. However, these very factors offer an excellent breeding ground for micro-organisms. Due to the often mild pre-

servation process used, the product does not get properly sterilised. The combination of these two factors creates products which are highly vulnerable to the destructive action of micro-organisms. Thus these qualitatively high-value products end up having a considerably low shelf life. If it were possible to increase the shelf life of these products, there would be a number of interesting possibilities, such as : an increase in the accessibility and range of use, more efficient physical movement and storage of the products, possibly even a lower consumption of energy (these savings could be obtained through, among other things, a milder conservation process or the elimination of refrigerated storage), and often lower distribution costs as well.

Finding the right method for extending the shelf life for these highly perishable products without affecting their quality is indeed a difficult challenge. There are a number of factors which are to be taken into consideration in this connection. Stringent hygienic standards have to be maintained during the manufacturing process, storage and distribution, the net effect of which is to improve the shelf life of the product to a small extent. It has also been found that the general pattern for food products is to raise the product to the intermediate shelf life zone (which can extend from a few weeks to a few months).

The shelf life is therefore oriented more toward the conventional distribution and consumption pattern. Since milder preservation methods can be used, the product quality is also higher and the energy consumption and the environmental hazards are therefore correspondingly reduced.

The contamination of the product is avoided since the packing is done according to more hygienic standards.

There are several other product segments in which manufacturing under higher hygienic standards are a crucial factor. Some examples of this are : shorter sterilisation processes for cosmetic and pharmaceutical products, the non-refrigerated storage of certain chemicals, a higher quality in highly perishable products, and a longer shelf life of cleaning media.

1.1 Delaying product deterioration

Extending the shelf life is in actual fact delaying the point in time when spoilage commences. One can speak of spoilage when a product has an unacceptable quality, or is no longer suitable as a product of that type. This may happen due to : biological damage, such as microbial or enzymatic spoilage or through external damage such as through insects and vermin; chemical damage such as through taste-, colour and odour-modifying agents, through reaction with oxygen; physical damage such as dehydration, absorption of moisture, rupture or abrasion.

In principle, there are always various kinds of potential spoilage-causing elements present in the product. These various influences gain the upper hand on their way to the ultimate consumer. For extending the shelf life of the product, attention is focussed on the most important factors and elements causing the spoilage to happen. For example, for counteracting the effect of moisture absorption or colour change occurring due to the absorption

of oxygen, one may opt for packing materials which offer a higher physical barrier. Or, to counter enzymatic spoilage, it is sufficient to subject the product to heat for a brief period of time. The present article concerning Bag in Box will focus on preventing microbiological contamination.

1.2 Managing microbial activity

Micro-organisms are generally everywhere since they are spread easily through the air, human beings, insects and such like. The microbiologist makes a distinction between bacteria, mould, yeast and viruses. Viruses often need a living host and do not therefore enter products directly. If ambient conditions



are favourable, micro-organisms can multiply very rapidly indeed. A single micro-organism can multiply into countless micro-organisms within a very short period of time. This is a highly desirable phenomenon if one is producing wine, yoghurt or beer, but a highly undesirable in other cases, where one then speaks of microbial contamination. One speaks of microbial contamination if the number

of undesirable micro-organisms and/or the waste products generated by them render the product unacceptable. Undesirable micro-organisms can be distinguished into contamination-causing and illness-causing (pathogenic) micro-organisms. Pathogenic micro-organisms can spoil the product without human beings coming to know of their existence through the five senses. Microbial contamination can render the taste of food products unacceptable, or may be injurious to the health if ingested. Known examples of taste-spoilage of products are mould formation on cheese and the souring of milk due to the waste products of lactic acid bacteria. The presence of, for example, toxic waste products or pathogenic (disease-causing) micro-organisms in products (for example, salmonella) may be highly injurious to health if ingested.

The microbiological stabilisation of a product can be achieved through the following : by restricting the growth of undesirable micro-organisms; or by rendering micro-organisms inactive by destroying them or by restricting their growth.

Microbiological stabilisation is not concerned with the removal of all existing micro-organisms but to reduce the number of undesirable micro-organisms to below a specific critical value and thus to prevent them from rising above this critical value during the shelf-storage period of the product. In many of these cases, specific bacterial counts are used as an indication for these purposes. The bacterial count is the number of micro-organisms per gram of product which is capable of multiplying if favourable conditions arise. This provides an indication of the contamination level. Just as for human beings,

micro-organisms also have to have specific living conditions in order to be able to grow, such as for example, the presence of water, the right temperature, oxygen and nutrition. If one or more of these elements is removed, the number of micro-organisms can be limited to below spoilage levels.

Microbiological stability can be achieved through a play-off between product characteristics, packing, manufacturing processes and distribution chains. However, other factors also have an effect, such as the quality of the raw materials and other additives, product treatment, and the method of operation of the operator.

1.3 Managing microbial activity

The prevention of microbiological spoilage is possible through finding an optimum balance between preservation methods and packing systems. Preservation consists in using a treatment process for extending the shelf life of the product. The most suitable preservation method depends upon the properties of the product, the desired shelf life, and the desired final quality of the product.

For example: heating will kill some of the micro-organisms. The degree to which micro-organisms can be reduced depends upon the temperature and the duration of such heating. Pasteurisation consists in heating for a specific period of time, between 60 and 100o C. This will kill most disease-causing organisms. Sterilisation consists in heating for a period of time at temperatures above 100o C, at which theoretically speaking, all micro-organisms will be killed.

If a perishable product is kept under refrigeration, pasteurisation is adequate. The spoilage-causing micro-organisms do not proliferate under such conditions.

Where products are to be stored at room temperature and in the absence of additional growth-retarding factors such as a low pH,

Commercial sterility:

The term commercial sterility refers to the complete elimination of all micro-organisms. One uses the term commercial sterilisation in the food sector. A product is not necessarily free of all micro-organisms. There may be micro-organisms which survive the sterilisation process, but cannot multiply. Commercial sterility indicates the absence of toxic elements, pathogenic micro-organisms and other micro-organisms which can multiply during storage and distribution of the product.

sterilisation will be necessary. This is not possible for all products. Intensive heating may seriously damage the quality of the product. UHT may be a solution for a number of these products. The basis of UHT is rapid heating and sterilisation of the product to a high temperature before packing, followed by filling into pre-sterilised packing containers under sterile conditions after cooling.

Such heating is applied for a few seconds at temperatures above 130°C. The micro-organisms can be sufficiently reduced using a combination of high temperature applied for

short durations, there is an adequate reduction in the number of microbes and the fall in the quality of the product slows down much more sharply in comparison to conventional sterilisation techniques.

Even the brief amount of time for heating and cooling brings down the damage to the quality of the products to negligible levels.

Examples of liquid products which may be heated with UHT are milk, juices, cream, yoghurt, wine and salad dressings. However, UHT may also become a product with small solid particles such as baby foods, tomato products, fruit and vegetable juices and soup. Larger solid particles will offer problems. The process conditions enable the use of all conventional formats and types of packing, subject to the condition that they satisfy the applicable requirements.

There are many options available for stabilisation. One can achieve a retardation in the growth of micro-organisms by lowering the temperature, by drying or dehydrating or demoisturising the product, lowering the pH, osmosis (through salt or sugar), adding preservatives or by changing the air composition (for example, gas packing). Apart from conventional heating methods, systems based on microwave energy and electrical conductivity seem to offer new possibilities. Radiation is also one of the possible methods of killing the micro-organisms.

In conventional stabilisation techniques, the product is packed and processed in the sealed packing container itself. It is however, also possible to first process the product and then pack it. This trend is gaining ground at the present moment. In aseptic packing, the sterilised product is placed inside the sterilised packing in a sterile environment. The most important advantages of this technique are a greatly lowered thermal load on the product along with reduced energy consumption as well.

1.4 Stabilising without loss of quality

Consumers and commercial users are constantly demanding higher quality in products. For maintaining quality, the chemical loading (for example, using preservatives) or physical loading (for example, intensive sterilisation) which the product can withstand is quite limited. Using a light product stabilisation process followed by hygienic packing, is perhaps the best solution for a large number of products and applications, taking into account the variety of parameters which now have to be met.

Increasingly, process equipment will be chosen on the basis of microbiological requirements. The equipment has a very important effect on the quality of the product from the microbiological point of view. This is the case where the equipment causes re-contamination of the product. Depending on the hygiene-related options selected, one can distinguish between three types of packing equipment:

Overview of stabilisation methods

Energy Supply

- Heat treatment based processing :
 - Sterilisation : Heating to about 120 oC
 - Pasteurising : Heating to about 80 oC
 - Aseptic techniques
 - New techniques : di-electric and micro wave treatment, electrical conductivity heating.
- Processes using ionising radiation

Reduction of Temperature

- Processes with cooling
- Temperature conditioning, for example 15°C
- Normal cooling and refrigeration between 4 and 7 degrees Celsius
- "Chill fresh" between 0 and 2 degrees Celsius
- Processes involving freezing: deep freezing upto -30 degrees Celsius

Lowering of water activity (Aw)

- Concentration processes
- Drying processes
- 'Intermediate moisturising' processes

Chemical conditioning

- Lowering the pH
- Preservation media

Conditioning the storage environment

- Packing and sealing
- Clean atmosphere packing
- Controlled atmosphere storage
- Modified atmosphere or gas-based packing

Other stabilisation processes

- Filtration
- Centrifuging/bactericidal treatment
- Ultraviolet light treatment
- Ultrasonic treatment

Combination/synergy/'hurdle'-technology

- Hygienic packing plus one or more of the stabilisation processes mentioned above

1. GMP equipment

GMP equipment is an adequate option because it does not have any adverse effect on the product. After cleaning the equipment, there are no product remnants left behind, although the surface may still contain the relevant micro-organisms. For example, if used when the product is pasteurised in the packing container, or if the product itself has life-inhibiting conditions for micro-organisms. If during packing, re-contamination takes place, the micro-organisms can be killed at a later stage or cannot proliferate further.

Good Manufacturing Practice (GMP)

GMP is a preventive system with specifications, standards and procedures according to which the manufacturing process is to be carried out. This ensures the achievement of the highest level of quality, consistency and constancy. The process is also quite safe, and manufacturing also takes place very efficiently and the legal rules and regulations relating to the product in question are also adequately satisfied thereby. The specifications for product quality are translated into specifications for raw materials, the production process, personnel and so on. If all the production factors satisfy the specifications, the chances of achieving a consistent product quality are the highest.

2. Hygienic equipment

Hygienic equipment is used because heavy re-contamination may have an adverse effect on the ultimate product quality. After cleaning the equipment, there must be no micro-organisms remaining behind in the product contact area.

Hygienic equipment is used, for example, in connection with packing perishable products which are to be stored under refrigeration.

3. Aseptic equipment

Aseptic equipment is used if after the stage in which micro-organisms are killed, further micro-organisms are to be prevented from re-entering the product. Hygienic equipment is impervious to micro-organisms. For example, it is used for packing of milk intended for extended storage periods and UHT milk, which can be stored at room temperature. Even the smallest amount of re-contamination will lead to unacceptable levels of product spoilage. The product characteristics (pH, the absence of hydrogen and other life-limiting conditions), the production process (whether the micro-organisms are killed or are they suppressed), and the conditions of transport and storage (whether the micro-organisms can proliferate or not), are important factors for microbiological stability and the selection of process equipment. Here is an example, by way of illustration: if the product has a pH value of more than 4.6, various types of pathogenic micro-organisms can multiply easily. It is therefore necessary to kill the micro-organisms and to prevent re-infection from taking place. This can be done by packing the product aseptically. If the pH is less than 3.0, there are no known spoilage-causing micro-organisms which can multiply within the product. The product is then microbiologically stable. Even other living conditions for micro-organisms such as a low A_w (water activity), due to a high salt content can make the product microbiologically stable. It will be adequate to have packing done according to GMP specifications.

Products with a pH value between 3.0 and 4.6 are microbiologically vulnerable and therefore need a hygienic approach before their shelf life can be extended.

Aseptic packing has undergone a tremendous amount of development during the last few years. Packing systems are becoming increasingly more flexible, and more unprecedented levels of differentiation are now becoming possible. In general, there are three different types of systems with which aseptic packing can be done:

1. Consumer packing in the range of approx. 100 ml to 2 litres, including drink cartons, plastic bottles and glasses, standing bags, glasses, glass and tin.
2. Bag in Box systems having volume of between 200 ml and 1,000 litres for both the consumer market as well as the restaurant business and the food processing industry. Examples are soft drink concentrates and sauces.
3. Industrial bulk packing systems having a content of 25 to 1,000 litres for, for example, cream and tomato products [HN2].

Aseptic packing :

Aseptic packing means free from disease-causing germs. Aseptic packing consists in filling a sterile product into a sterilised packing container at room temperature followed by sealing the packing in a sterile environment. Aseptic production is done in two stages:

1. Aseptic manufacturing: this gives the product commercial sterility.
2. Aseptic packing: this ensures that the product remains sterile.

Higher quality at lower costs:

In general, the quality of an aseptic product is better than a conventionally sterilised product. A major advantage of successful product stabilisation is that the quality of the packed product becomes independent of the size of the packing container. This is often very important for sensitive products or very large packing containers. Another advantage of aseptically packed products are the relatively less stringent requirements as regards temperature and shape consistency of the packing material in comparison to the conventional stabilisation processes. This often offers additional design possibilities and cost price advantages. Other financial benefits for companies, such as lower investment and higher flexibility may also be important factors, depending on the application in question. Energy saving will be achieved by energy recovery during the continuous heat-treatment stage and through using milder preservation techniques.

There has been a lot of discussion about the question of whether Bag in Box systems are suitable for aseptic packing or not. Various investigation institutes including The Netherlands Institute for Dairy Research (NIZO) and the TNO Food in Zeist have investigated the problem and they came up with an affirmative answer.

These institutes can assess machines and test them for cleaning characteristics, pasteurising characteristics, steam-sterilisation characteristics and imperviousness to bacteria. The guidelines and testing methods laid down by

the European Standards Institute (CEN) and the European Hygienic Equipment Design Group (EHEDG). The laboratories are authorised by the Government and authorised to carry out hygienic and aseptic tests.

2. Value addition through Bag in Box

The primary objective of packing is to supply the right quantity of product to the user in the desired manner. A number of aspects must be taken into consideration in this connection. This requires finding a balance between often conflicting requirements of parties in the manufacturing chain of the product. The system must be capable of combining highly divergent product-, packing-, environmental-, and application aspects. The applications where the Bag in Box packing system can be used are constantly increasing, which offer a very great value addition, particularly in aseptic applications.

**Bag (primary packing) + Box
(secondary packing) + filling machine =
Bag in Box - system**

2.1 Perishable/vulnerable products and processes

The Bag in Box system is suitable for liquid products but the system is also suitable for semi-liquid and paste-like products which can be filled in and which later become paste-like or can crystallise within the packing, such as margarine.

The hygienic and aseptic packing in Bag in Box above all offers value addition for perishable liquids and liquid products with a short

shelf life. The shelf life can be extended without damaging the quality of the product, in particular the taste, consistency, colour and food value of the product.

Many new genetically manipulated materials, fat-replacing elements of egg whites and other natural ingredients are all excellently suitable for packing with aseptic techniques. This new generation of ingredients is in general, microbiologically vulnerable and not resistant to the heating which takes place in traditional manufacturing processes.

However, this method is being increasingly used for non-perishable products with a short shelf life, which must in the normal course be stored under refrigeration. Microbiological stability can be achieved using a combination of product characteristics, pre-sterilisation followed by aseptic packing. Refrigerated storage can, as far as the microbiological point of view is concerned, even be eliminated altogether. The same goes for products which have to be filled hot for microbiological reasons. Packing is being done this way to an increasing extent, and because of the absence of the risk of re-infection in aseptic filling, the hot-filling method of obtaining microbiological stability is now becoming redundant.

Bag in Box is being used increasingly even for products with a long shelf life which were so far being sterilised. What is being striven for is an optimum between the shelf life required and the intensity of the preservation process.

This ensures that the maximum quality is obtained [HN3]. Products such as soups and sauces are excellently suited for this process.

Through hygienic and aseptic packing in Bag in Box, it is possible to pack relatively large quantities of microbiologically stable and vulnerable products. It was not possible so far to sterilise large quantities of these products in the single packing. It would take a long time before the core of the packing container reached the sterilisation temperature, which would again lead to unacceptable reductions in quality. Bag in Box however offers adequate protection against external influences. The exceptions to this are specific products such as for example, certain types of pharmaceuticals which require 100% inertness of the packing material.

Milk was the first food product which was packed in Bag in Box. This method was first introduced in the UK in 1960. The milk was sold in refrigerated dispensers in milk bars, restaurants and cafeterias. Large quantities of UHT milk are still packed in three gallon Bag in Box packing containers and are sold in the open.

In addition, there are products which may react with the inner bag which is made of plastic, such as certain solvents, as a result of which protection of the product against the environment is rendered inadequate.

The types of products which can be packed in Bag in Box, whether or not aseptically include: detergents, pharmaceuticals, cosmetics, chemicals and food products. Within these product types, there are a multitude of examples which can be cited, including: bakery raw materials, egg products, juices and juice concentrates, dairy products, paint, jam, honey, aromas, photography related and structural chemicals and adhesives.

100% ease of use for the baking industry

"Thanks to aseptic filling in Bag in Box, we have been able to introduce a whole new product line", says Paul Asbreuk working in Koninklijke Zeelandia. "There is a strong demand in the market for a coating jelly which can be applied directly. In contrast to traditional products, such jelly's does not need to be 'buffered up' with water or fruit juice.



Paletta Spray, "100% ease of use for the baking industry", is a spray-on coating jelly. Paletta Spray is aseptically packed in 13 kg Bag in Box packing system and is suitable for mechanical processing.

This jelly does have a high water content, however. We are very well positioned to manufacture this product. But the high water content makes the jelly microbiologically vulnerable. Without adequate measures, the product would no longer have a sufficiently long shelf life. It is not possible to sterilise such products. It would lead to damage to the product or would be not be economical. With aseptic filling, we can now guarantee a shelf life of 3-6 months. Furthermore, after this period, the reduction in the quality of the product will take the form of discoloration and not "microbiological infection", explains Asbreuk. He has a lot to say about the Van Meurs packing machine. Asbreuk continues "Since recently we have started filling about 40% of our products aseptically in 15 kg Bag in Box containers. The products which are not aseptically filled have a lower water content and therefore have a higher shelf life. We fill these products in quantities of 3, 12 and 15 kg, to tanks of 200 to 400 kg. This machine is a workhorse and can be installed easily, is easy to operate and easy to clean. This is very important in our line of business and in our company".

2.2 Wide range of applications and ease of use

Bag in Box can also be used for the entire life cycle of the product in a very large variety of markets:

- Industrial and institutional use: for economical (intermediate) storage of for example, fruit and vegetable juices. Thanks to the large choice of different types of secondary packing options, the packing quantities can go to as high as 1000 litres
- Restaurants and catering applications: for (intermediate) storage and dosing of soaps, tomato products, juices, dairy products, (milk, cream, ice-cream mixtures and milk shakes) and egg fluids. This market also has a strong growth potential in the consumer market for fresh and mildly preserved products.
- Domestic use: for transport, storage, dosing and dispensing of for example, wine, sherry, cider and mineral water.

The system is suitable for all conceivable types and formats of primary and secondary packing. The filling unit can be optimally adapted to the needs and desires of various users. In comparison to alternative packing methods such as rigid containers, Bag in Box packing containers are easy to use, to carry, empty and to store. The highly efficient use of space in the packing makes possible very efficient packing and distribution. In general, secondary packing is stable and perfectly stackable.

Thanks to the wide range of applications for which the flexible inner bag can be used, air does not enter the bag. For the same reasons,

there is no air in the product when the bag is empty. This characteristic brings with it the following advantages:

- It prevents re-infection through the air;
- It prevents the product from 'clucking' when it is poured out of the packing container.
- The shelf life of oxygen-sensitive products is increased.
- It is possible to pack lightly effervescent products in this packing system.

The possibility of fitting a drain cock or other dosing system according to the needs and desires of the client makes the product-packing combination extremely user-friendly. The packing can be emptied very easily. The flexibility with which the inner bag can be placed is extremely high. The packing can also be cleaned very easily. This is important in connection with possible re-use, and in connection with packing dangerous materials, in which the empty containers contain only a very small quantity of remnant product. Depending on the options selected, there is a wide range of possibilities for attractive printing on the packing itself. This brings with it the possibility of being able to communicate promotional messages to the user, for example, and to promote the product as well thereby. In a number of applications, Bag in Box can be placed in a dispenser with additional promotional capabilities.

***Prise d'eau mineral water tap:
quality and ease in one:***

"The Bag in Box packing system of Van Meurs perfectly matches the requirements of our clients and the requirements of our product," says Ruud Rutten, Sales Manager at TWM Bronwater, producer of Prise d'eau. He goes on to say: "Prise d'eau is a high quality mineral water from Tilburg. The unique characteristically 'soft' taste and purity of the product demand very high standards of the packing and the packing process as well.

Filling the product must be done aseptically in order to prevent contamination of the product and to lend the water the desired shelf life. Thanks to the vacuum, and the adaptability of the bags, no air enters the product and the water quality remains consistent even during use.



The Prise d'eau mineral water tap made by TWM Bronwater is an extremely user-friendly aseptic packing system which fully meets the high hygiene requirements of the product.

The dispensing tap, the self-service system also ties in perfectly with the increasing demand on the part of clients as regards ease of use. Other aspects of the Bag in Box which our clients value very highly are the environmental aspects and the high space-economy. This makes the tap very handy to use at home, on boats, or in caravan trailers (5 litres) or in the office canteen, conference hall or shopfloor (15 litres). The client did not ask for it, but the fact that the packing can be removed for re-use is definitely a big plus.

The efficient use of space also brings with it several advantages such as in connection with pallet stacking, the home consumer, on the retailer's shelf, and in refrigerated storage. As far as our company is concerned, this machine enables us to work with an almost endless variety of filling volumes. Finally the costs of the Bag in Box packing container is quite low in comparison to its alternatives in this line."

2.3 Wide variety of packing system options

Bag in Box consists of a plastic inner bag, in some applications, this plastic inner bag is also termed the 'liner' with a filling opening and a cap. In some cases, the filling opening also has a drain opening which is fitted with a valve/cock. The bag is supported by a secondary packing container such as a cardboard box, a plastic crate or a plastic or steel barrel.

2.3.1 Primary packing

The protective functions of the bag are oriented to providing the product with an adequate barrier against oxygen and water vapour. The valve fits exactly in the filling opening, which is designed to form an integral part of the bag during the manufacturing process. The combination of cover and filling opening is also used by the end user as a liquid dispensing bag and as a dispenser for some special applications. Various types of such units are used, to suit different kinds of client requirements and preferences. The bag and the sealing system are crucial components in the aseptic Bag in Box packing system. Almost all combinations and sealing systems can be used. What is important

in making a particular selection are primarily product requirements, the shelf life desired, and the handling and logistical pattern.

For determining the most suitable type of bag, one must take into account the following:

- The required strength of the bag, for example, whether several layers are required as required for packing large volumes, or for transporting material over long distances;
- The required barrier against oxygen, moisture, light, smells/aromas and such like;
- The required resistance to high or 'just right' low temperatures;
- The desired recycling characteristics of the packing containers;
- The matching with the external packing container.

In order to be able to satisfy these requirements, the material has a multi-layer construction, with variations in the materials and thicknesses of the same. Depending on the application, one can have the following combinations:

1. Polythene (LDPE or LLDPE): for example, for refrigerated products with a short shelf life;
2. Polythene/Polyamide/Polythene: for an extra mechanical strength in the material

Voorbeelden invloed van materiaalkeuze en opslagcondities op de houdbaarheid van producten

<i>Product</i>	<i>Bag material</i>	<i>Storage conditions/shelf life</i>
Dairy products (ice-cream/yoghurt-mix/cream/milk fat)	PE	- mix/cream/milk fat) - 45 days more shelf life with aseptic manufacturing with refrigerated storage/transport.
Wine	Metallised PET/PE	No special storage conditions, 9 months
Fruit and tomato juice concentrate	gemetalliseerd PET/PE of PE/PA	Aseptic : upto 18 months possible
Egg products (egg yolk and salted egg yolk)	PA/PE o3 metallised PET	Refrigerated storage and transport plus aseptic manufacturing: upto a few weeks

3. Polythene/Ethene vinyl alcohol (EVOH)/Polythene: where a strong barrier against gases and water vapour is required.
4. Polythene/metallised Polythene tereftalate (MPET)/Polythene: for a combination of good barrier-characteristics, reasonable levels of temperature resistance, and a light barrier.



The cap and the valve are made of a mixture of thermoplastic rubber and polyolefins (PE or PP) or are simply made of polythene. The selection of the material of the bag have a significant effect on the shelf life of the packed product and the application. Some products, for example, tomato puree are filled in hot. This requires an extra rigidity and heat resistance in the bag material. An optimum balance has to be found between the cost of the bag and the extra functionalities. The costs of the bag depend primarily on the type of material, material consumption (the size and thickness of the bag) and the type of sealing system. The table below shows a number of examples of product characteristics, material selection, storage conditions, and the shelf life obtained.

The most important considerations associated with selecting the right sealing system are:

- Whether or not opening is to be done manually;
- The sealing system of the packing container/tamper proofing;
- The type of sealing.

The varieties in the types of sealing systems available are numerous, and just as is true of bags, it also applies here that the selection depends mainly on the application. The sealing systems can be divided, among other things into various types of screw caps, push caps which can/cannot be removed by hand, plugs which can no longer be removed, caps with a tube for dispensers, caps with a valve for dispensers, punch-through caps, drain cocks, liquid dispensing bags; the sealing systems also differ in the materials of which they are made.

2.3.2 Secondary packing

The secondary packing, namely the box, provides additional protection for the inner bag, and also makes storage and transportation easier, and if required, the box will carry the printed images and text. The selection of the secondary packing depends on the size of the bag and the use intended for the product. For the secondary packing, one can make a selection between bulk bags, buckets, plastic crates, tanks, snap-open containers, boxes of various sizes, covered steel barrels and aluminium containers.



2.4 Advantages for packing, transport and storage

The correct packing method will, to a large extent, determine the success of the entire production chain. Bag in Box is a fast, cheap, flexible and user-friendly way of filling, transporting, storing and distributing materials. The system provides a high value-addition in places where the following operational aspects are important: A relatively cheap packing system which is easy to use, easy to clean and set up and can be flexibly used for a wide variety of packing applications. The packing system is in general cheaper than other alternatives in the same line. The operation of the machine is generally done by an operator. The entry of the packing material, the stacking of boxes and the removal of filled packing containers will replace all or half the workforce otherwise employed for the work, depending upon the level of automation opted for. The packing machine can be cleaned thoroughly and is excellently suited for Cleaning in Place and Cleaning in Processing. The same machine can be used to fill almost all the possible container formats. European machinery guidelines have come into force on the 1st of January 1995. This means that manufacturers of machines must ensure that the machines satisfy the requirements concerning hygiene during the manufacturing process and for safety and health of the operating personnel.

Limiting the risks

Bag in Box packing machine seem to be a preferred option for filling many non-sterile products. "Risk Limiting" is cited to be the reason for this. Evert Schilstra, Managing Director of Hyproca Dairy BV uses an aseptic Bag in Box



The Van Meurs Bag in Box filling machine. The simplicity of this unit almost eliminates operator error.

packing system for non-sterile purified cream for the baking industry. He explains: "If we sterilise our product, it will lose its unique taste and aroma characteristics. But at the same time, the product is also microbiologically extremely vulnerable. We therefore do whatever we can within the possibilities to keep down the contamination levels of the product as low as possible. As a consequence, the life of the product gets extended." Gerrit Bosch of Nive BV adds that this is the most important reason why machines should be easy to use and user-friendly. He explains: "we use the aseptic packing machine for various Bag in Box packing containers and for buckets as well. The line is cleaned with CIP. The chance that mistakes would be made during change-overs and during cleaning is of course very much there. But the simplicity of the machine, the ease of maintenance and operation greatly reduce the chances of this happening."

If boxes are opted for, these can be supplied in sheets. The storage of empty packing containers takes a lot of space. The end user can easily remove these packing media and can place them in the garbage disposal system.

2.5 Environment-related advantages

In general, the power consumption of the system is lower than alternative units in the same sector. The pre-sterilisation enables far greater energy recovery possibilities than traditional sterilisation processes such as autoclaves. In general, milder preservation processes are used, which also use less energy. The heating also does not need to penetrate to the core of the packing container in order to make possible a minimum time- and temperature exposure. In a number of applications, it is also possible to eliminate refrigerated storage and distribution. The inner bag can be removed easily from the secondary packing. Both the packing containers can be sent for recycling thereafter. If the bag contains remnants of toxic materials, the bag can be destroyed very easily. The storage of empty packing containers also takes up relatively less space. The end user can easily remove these packing containers and place them in the recycling system. If other materials are used for the box, it is often possible to have returnable packing containers. The system satisfies all the conventional national and international standards and specifications, rules and regulations, such as for example, the Food and Drugs Act, the FDA and the GMP.

2.6 Aseptic aspects

The aseptic Bag in Box filling system enables manufacturing according to the specifications of Good Manufacturing Practice - and also enables hygienic and aseptic packing. The advantage is that a number of critical factors are satisfied. The most important advantages

of aseptic manufacturing and packing are:

- The pre-sterilisation of all surfaces and areas with which the packing material may come in contact, and also the maintenance of the sterility of the same.
- The assembly of a sterile product in a sterile packing container under aseptic conditions. The transportation of sterile products and sterile packing containers must be done under aseptic conditions.
- Cleaning with full removal of all product remnants and packing material remnants from the concerned circuits.

The risk of contamination is decided by a large number of possible sources of contamination which must all be individually controlled. Possible sources of contamination are:

- The product itself.
- The environment within which manufacturing and packing has been done.
- Storage
- Transportation

With the Bag in Box packing system, these individual factors can be identified easily.

2.6.1 Sterile primary packing

The sterility of the primary packing container, the internal bag is obtained through gamma ray radiation of at least 25 kGy. The whole bag including the filling mouth and the closing cap are sterilised in this process. The cost of this sterilisation process amounts to approx. 10 to 25 cents per packing container. While filling the bag, the sterility may be compromised through the jamming of the filling opening. A steam or chemical spray may in such cases, be useful.

In order to limit re-infection, damage must be prevented to the extent possible. Damage may result from the following factors:

- Mechanical damage (for example, through fork-lift trucks, palletisers or the stacking of pallets);
- Changes in the properties of the material due to poor storage conditions (too much heat, too much damp, too much light, etc);
- Distortion within the filling machine (for example, due to excessively high temperatures or mechanical or chemical stressing)

Classification of hygienic equipment

Hygienic Equipment : Class I

Equipment which can be cleaned 'in place' and from which undesirable micro-organisms can be removed without dismantling the machine.

Hygienic Equipment : Class II

Equipments which can be cleaned after dismantling, and from which the undesirable micro-organisms can be removed after re-assembly.

Aseptic equipment

Hygienic equipment which is impervious to micro-organisms.

2.6.2 Requirements of the equipment

For aseptic packing, the filling installation must be capable of being cleaned easily (preferably 'in place', in other words, without it being necessary to dismantle the machine), suitable for disinfection, and bacteria-proof.

The cleaning process must remove or destroy micro-organisms. In order to ensure that the equipment can be easily cleaned in place (without dismantling), there are no spaces and cracks or places where the cleaning medium flows slowly. The equipment must be bacteria-proof to ensure that micro-organisms do not come in from the non-product side into the product side. For these reasons, moving axles leading from the sterile to the non-sterile areas or vice-versa should be avoided to the extent possible, unless the same are sealed against the entry of micro-organisms. In order to prevent undesirable problems during cleaning of product contact surfaces, or moving parts of the machine must, to the extent possible be located outside the product contact area. If 'in place' cleaning is used, the moving parts must be set in motion during the cleaning process. The choice of cleaning procedure depends on the type of product which is being packed, and thereby also determines the type of soiling which the machine undergoes.

2.6.3 Eliminating external influences

The risk of contamination can be reduced by limiting the time for which the product is exposed to ambient air. The packing must thus be closed as quickly as possible after filling. In the Bag in Box packing system, the opening, filling and closing of the bag takes place in a position within the filling machine. In addition, the filling area is carefully conditioned so that all in all, the damaging effect of environmental elements is negligible. If necessary, filtration and heating may be used for reducing the concentration of micro-organisms in the air. In heating, the external air or air coming out of

the housing of a machine is sucked and passed through a quick-heating system. The air is heated here (often to 400°C), and then cooled to a temperature which is suitable for the packing system in question, and then passed back to the packing machine. During filtration, the micro-organisms get trapped against the filter surface. The disadvantage in filtration is that filters need to be sterilised; dry, modern filters on the other hand require to be replaced only once or twice in a year without any need for sterilisation in the intervening period.

3. Van Meurs Aseptic Bag in Box filling machines

The Bag in Box filling machines made by Van Meurs are excellently suited for making it possible to obtain aseptically packed products as described above. The conventional requirements for aseptic packing have been explained in the previous chapters. For aseptic filling using the Bag in Box filling machine made by Van Meurs, the following requirements will have to be satisfied in addition to all the conventional requirements:

- The primary packing must be flexible. Sterility cannot be guaranteed in the case of rigid primary packing containers.
- The full filling cycle prescribed for aseptic packing must be completed.

What follows is a brief description of the filling cycle for aseptic machines made by Van Meurs.

1. Sterilising the filling area

The filling section is sterilised using steam and sterile air just before commencing production. Thereafter continuous pressure with sterile air is maintained within the filling area.

2. Opening and filling:

The operator places the inner bag inside the machine. The gripper removes the seal. The overpressure with dry, sterile air protects the gripper and the seal against re-infection. The filling valve connects to the filling opening of the bag and forms a hermetically sealed area. The inner bag is vacuum dried within the space of one second. This prevents the product from foaming, even at high filling speeds. Thereafter, the inner bag is filled until the correct filling volume is reached. The filling valve then closes. The remaining oxygen can be removed from the packing container if desired by injecting the remaining area in the packing container with steam or gas, if so desired. The decision to do this or not depends upon the product specifications. The steam will condense, as a result of which there will be a slight under-pressure in the packing container. The gas will replace the air present.

3. Sealing the bag:

Finally, the gripper replaces the seal. The bag automatically falls free of the gripper, and the filled and sealed packing container is removed. Cleaning in Process (CIP), which is an integral part of the filling cycle, is then carried out. This system sterilises the filling opening which steam, while the machine is placing the seal back on the filled packing container. Condensed steam is immediately removed by the vacuum while the sterilised filling opening is dried with sterile air. After each production run, all the machine parts which had come into contact with the products are cleaned, and if necessary sterilised: Cleaning in Place (CIP). The CIP method which is used depends upon the wishes and desires of the client and the production process in which the system is placed. The advantages of the aseptic Bag in Box filling method of Van Meurs are:

- The filling machines can be universally used in all conventional Bag in Box packing containers of every conceivable volume and type of seal.
- The machines are easy to operate (move and clean, etc), flexible in use, and easy to maintain.
- Even small particles, (of upto 25 mm) can be filled in aseptically.
- The system has been thoroughly tested by an independent Inspection Institute (NIZO) for all the requirements of aseptic packing.

This text has been prepared with great care. However, Van Meurs BV employees and the author do not accept any responsibility or liability for consequences if any arising as a result of any inadequacies or inaccuracies in the information contained in the present manual.



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