

MAPAX[®]

Modified Atmosphere Packaging:
Complete solutions from BOC

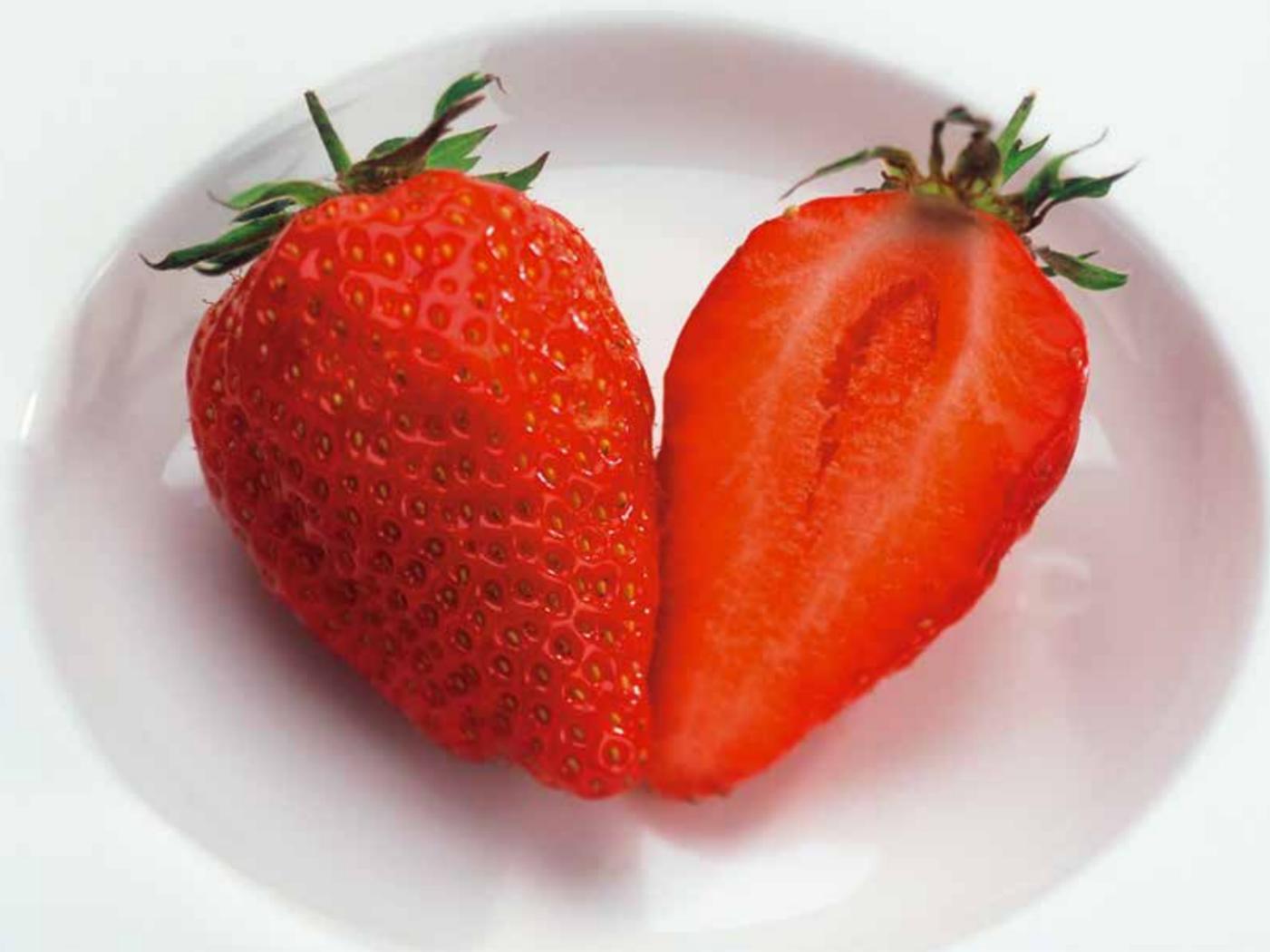


MAP – Modified Atmosphere Packaging

Drivers and challenges

Winning the race against time

With consumer expectations continually rising, good food today has to be healthy, safe, minimally processed and attractively packed. Yet they also want more convenient, easy to serve products with good storage characteristics at the same time. That means more demands on food producers and producers of packaging machines and materials.



The challenge: maintaining freshness

From the very moment fruit is picked, corn is harvested or fish caught, a race against time begins. Natural deterioration and spoilage (caused by internal factors like water content, pH and micro-organisms) threaten both quality and shelf life. However, external factors like hygiene and temperature levels also pose a threat to product freshness. How the product is handled during processing is therefore critical and the packing stage is particularly important for prolonging shelf life and guaranteeing food safety.

The solution: Modified Atmosphere Packaging (MAP)

Modified Atmosphere Packaging, using food-grade gases and special packaging materials provides the means to ensure food quality and a good shelf life.

MAP can reduce spoilage which means fewer returns. The technology has the potential to open up new markets for fresh and chilled food while simplifying distribution logistics.



MAP – Modified Atmosphere Packaging

Spoilage starts immediately

Microbial and chemical/biochemical action are the primary reasons for food degradation. Microbial deterioration starts immediately after harvest or slaughter. Micro-organisms are found everywhere in our surroundings and so good hygiene is a key factor in any process. The exact ways in which microorganisms induce spoilage vary, though, depending on the type of organism and the foodstuff itself.



Preserving and protecting

Conventional preservative methods that physically or chemically alter the product are being progressively replaced with ones that leave the product unchanged.

Modified atmosphere packaging can ensure high quality and good shelf life while retaining the original taste, texture and appearance of the food. MAP gas mixtures usually consist of the gases that make up the air we breathe: carbon dioxide (CO₂), nitrogen (N₂) and oxygen (O₂). The right mixture of these will depend upon the foodstuff and its properties.

Deterioration

Foods are biological substances. Freshness and shelf life are affected by their basic properties just as much as by external factors.

Intrinsic factors affecting quality:

- the type and quantity of micro-organisms
- water content
- pH
- cell respiration
- food composition

External factors:

- temperature
- hygiene
- gas atmosphere
- processing methods

Low temperature – a highly effective inhibitor

Temperature is one of the most important factors controlling microbiological activity. Most microorganisms multiply optimally in the 20 to 30°C range and show reduced growth at lower temperatures. Careful temperature monitoring is therefore vital during all food handling and distribution stages. Chilling alone, however, will not solve all microbiological problems, so other defences must be resorted to, such as a modified atmosphere.



Low temperatures are very important to the shelf life of chilled foods

Table 1: Typical shelf life in air and using MAPAX®

Food	Typical shelf-life in air	Typical shelf-life with MAPAX®
Raw red meat	2 – 4 days	5 – 8 days
Raw light poultry	4 – 7 days	16 – 21 days
Raw dark poultry	3 – 5 days	7 – 14 days
Sausages	2 – 4 days	2 – 5 weeks
Sliced cooked meat	2 – 4 days	2 – 5 weeks
Raw fish	2 – 3 days	5 – 9 days
Cooked fish	2 – 4 days	3 – 4 weeks
Hard cheese	2 – 3 weeks	4 – 10 weeks
Soft cheese	4 – 14 days	1 – 3 weeks
Cakes	several weeks	up to one year
Bread	some days	2 weeks
Pre-baked bread	5 days	20 days
Fresh cut salad mix	2 – 5 days	5 – 10 days
Fresh pasta	1 – 2 weeks	3 – 4 weeks
Pizza	7 – 10 days	2 – 4 weeks
Pies	3 – 5 days	2 – 3 weeks
Sandwiches	2 – 3 days	7 – 10 days
Ready meals	2 – 5 days	7 – 20 days
Dried foods	4 – 8 months	1 – 2 years



The BOC solution: MAPAX®

MAPAX® provides a range of tailored solutions for every site set up and product.

Dedicated sales and technical specialists will help you develop the exact MAPAX® solution for your products. Our Food Technology Centre will allow you to trial and test those solutions.

The centre also houses state of the art freezing and chilling technologies.

Our specialist technical team and MAP experts also provide technical and safety support and training.



Food grade gases

The MAPAX® gas range has been created to meet the special quality requirements of the food industry, to assist customers in complying with strict food standards legislation in packaging, storage and distribution. We can provide the traceability and safety guarantees required by law.

Nitrogen N₂

Nitrogen is an inert gas and is used to exclude air – and in particular oxygen. It can be employed as a 'balance gas' to make up the required volume in a gas mixture, helping to prevent the collapse of packs with high moisture or fat-containing foods, (the latter absorb carbon dioxide from the modified atmosphere).

Carbon dioxide CO₂

Carbon dioxide inhibits the growth of most aerobic bacteria and moulds, so the higher the level of CO₂ the longer the achievable shelf life. However CO₂ is readily absorbed by fats and water, so most foods will absorb it and this can cause film on product packs to collapse.

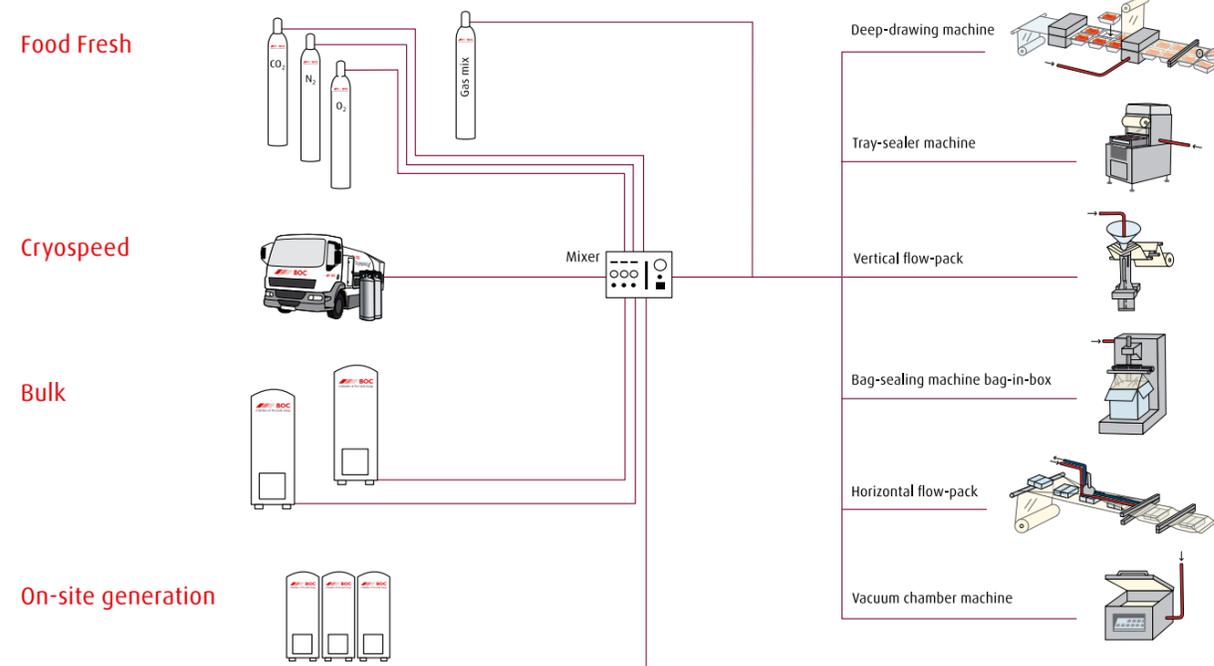
Oxygen O₂

Oxygen causes food deterioration and is therefore undesirable. However, it will maintain the fresh colour of red meats and also inhibits the growth of anaerobic organisms in some types of fish – so there are occasions where it is needed.



Supply options

Food grade gases can be supplied in several ways: cylinders; Cryospeed; bulk; and through on-site generation.



Cylinders

BOC Food Fresh cylinders and Manifolder Cylinder Pallets (MCP) have been developed for food businesses using modified atmosphere packaging (MAP). Food Fresh cylinders can be supplied as single gases or as mixtures. Your BOC sales and technical specialist will advise on the appropriate mixing equipment, or pre-mix cylinders. Where a pre-mix gas is chosen, BOC will advise on the exact gas mixture for packing your product.

Cryospeed

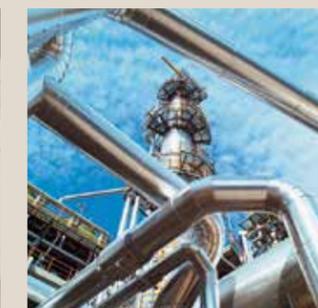
BOC's Cryospeed service gives you access to larger volumes of oxygen, nitrogen and carbon dioxide in cryogenic liquid form. These are stored in fully maintained stainless steel vacuum-insulated vessels on your site and are filled by our Cryospeed operators. Our storage vessels are set up for the pressures, flow rates and sizes appropriate to each customer. All rented vessels are fully maintained under the supply agreement with BOC.

Bulk

High gas volumes can be stored in BOC bulk cryogenic vessels. These are installed at the customer's site, providing a continuous and secure supply of oxygen, nitrogen or carbon-dioxide. Our Customer Engineering Service (CES) designs, installs and maintains the vessel in line with customer requirements and in compliance with all the relevant regulations (such as the Pressure Systems Safety Regulations 2000). Our On-Stream service can also cover customer-owned systems.

On-site generation

For those needing generated nitrogen, the BOC Ecovar-mini range provides an on-site generation solution at a range of pressures, flow rate and purity. On-site generation requirements are assessed on a site-specific basis to ensure the resulting set-up will cater for your needs now and in the future.



The BOC solution: MAPAX®

Food technology services

BOC works closely with the food industry to develop state of the art technologies and applications. Our Food Technology Centre (FTC) in Thame, Oxfordshire, offers the opportunity for customers to trial and test new products.

Our facilities can be used for shelf life trials of products packed in mixtures of nitrogen, oxygen, carbon dioxide and argon. Other gases and mixtures are also available.

The FTC is equipped with the latest gas mixing technologies. Its Chamber MAP Unit and Head Space Analysers can be used to validate gas mixtures. This ensures the most appropriate and effective gas mixture for each product. Portable gas mixing units and analysers are available for site trials.

Hot or cold pre-treatment of products can be carried out at the FTC. This includes blanching, frying, microwave heating and conventional cooking, ensuring that factory conditions are replicated as closely as possible.

Conference facilities, with audio and visual presentation media, DVD player, printer, wireless internet connection, are available for customers at the FTC.

The centre also houses state of the art freezing and chilling technologies.

To make an appointment, please contact your account manager. Alternatively, call us on 0800 111 333 (UK), or 1890 355 255 (ROI).



Food grade gas equipment

BOC will recommend and supply a full range of equipment for use with food grade gases in Modified Atmosphere Packaging.

The equipment includes:

- two stage regulators
- heated regulators
- bore hoses
- cylinder trolleys
- safety stands and brackets

To discuss your requirements, please contact your account manager, or alternatively call us on 0800 111 333 (UK), or 1890 355 255 (ROI).

Technical support and services

BOC and our parent, The Linde Group, has dedicated MAP technical specialists to support and aid our customers. They can advise on a variety of topics, from gas mixture selection and achieving longer shelf life to analysis techniques.

We work closely with our customers in order to provide you with the most up to date advice and support for your packaging processes.

Safety

Safety is a top priority for all our customers, as well as for BOC. We have a full range of safety products and personal protective equipment (PPE) to all requirements. We will work with you to assess your site and employee requirements, in order to deliver all the safety products you need.

We work with our customers to ensure compliance with all the relevant food legislation and directives. This is achieved through on-site audits and checks. Our dedicated team can provide all necessary information and documentation on our gases and systems.

Complying with safety legislation like the Pressure Systems Safety Regulations 2000 (PSSR) can be complex and time consuming. We have created our OnStream service to help you achieve proper system safety and hassle-free compliance, allowing you to concentrate on your core business. Our service engineers are backed by a technical support team of specialist engineers who are experienced in the design, refurbishment, installation, commissioning and maintenance of an extensive range of industrial gas storage and distribution systems. Our service, which enables customers to comply fully with the regulations, covers initial inspection, preventative maintenance schedules, remedial recommendations, production of Written Scheme of Examination (WSE) and 365 day, 24 hours a day response to emergency calls.



The MAP market

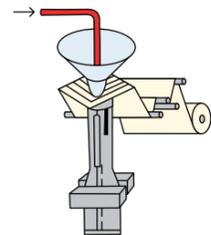
BOC is more than just a supplier of gas. Our MAPAX® service is founded on close cooperation with packaging suppliers and machinery manufacturers. This collaboration enables us to meet demands for efficient and cost-effective packaging of foodstuffs. By exploiting the advantages of MAP technology in the right way and by adapting methods to each application, we can offer solutions that make it possible for customers to develop new products for new markets.

Packaging machines

There are five main groups of packaging machines used with MAP technology, for different kinds of product. The basic mode of operation is the same for all of them.

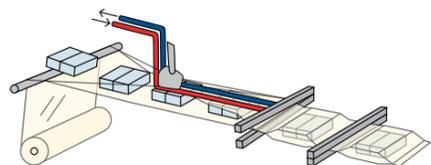
First, a pack (either produced on site or prefabricated) is filled with the product. Then the air in the package is replaced by a modified atmosphere. Finally, the package is sealed. These steps can be carried out manually or automatically. Atmosphere modification is achieved by gas flushing or vacuum extraction, followed by gas injection. The amount of gas needed

depends on the type of machine. In gas flushing, the air in the pack is progressively replaced by a continuous gas stream that gradually replaces the air surrounding the food product before the package is sealed. Since this is a continuous process, the packaging rate can be high. In the vacuum process, air is extracted from the package and the resultant vacuum is broken by injection with the desired gas mixture. This two-step process is slower than the gas flushing method. However, because the air is almost totally removed, the control of residual oxygen levels is better than gas flushing.



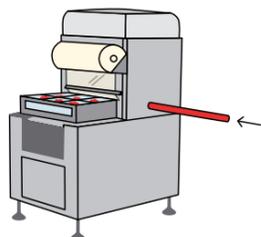
Vertical flow packing

A film is formed into a tube which is pinched together at one end, the other end being sealed over an injection pipe. Product is portioned out into the tube, which is then sealed at the other end and cut off. Gas is continually fed through the tube to purge the air. This type of machine is mostly used for powdered and bulk products such as coffee and peanuts as well as diced foodstuffs. Gas flushing may sometimes be necessary before packing.



Horizontal flow packing

The foodstuffs are fed into a horizontal flowing tube that is constantly formed by a packaging machine. The tube is sealed and cut off along both sides of the product. Gas is flushed through the resulting bag, purging the air. This is quick and the machine uses less complex film materials than the deep-drawing machine. It is typically used with bakery products, sausages, cheese, pizza and green salads. One technique that can be used here is BDF (Barrier Display Film) which is employed to pack the food product on a tray in MAP. The trays then pass through a heating tunnel where the film shrinks around the packages, enclosing them in the modified atmosphere.



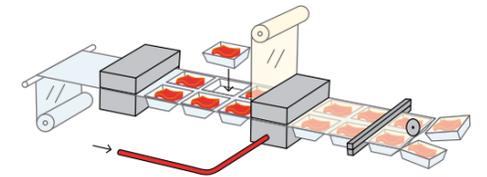
Tray sealer

The tray sealer can be operated manually, semi-automatically (illustrated here) or continuously. This machine is similar to the deep-drawing machine but the bottom trays, into which the product is put, are readymade rather than formed during the process. A wide range of trays can be used with the tray-sealer. This type of machine can be used for most food products, e.g. ready meals, salads, meat and fish.



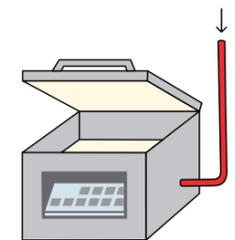
Deep-drawing machine

Film is heat-formed into a tray on a lower conveyor belt and the product is then added. Air is extracted, gas injected and the loaded package is sealed by welding on a film from an upper conveyor belt. This machine is suitable for meat, fish and prepared food.



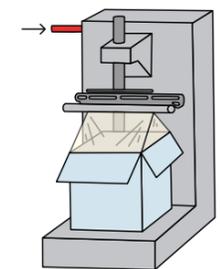
Vacuum chamber

The product is inserted into prefabricated bags or trays. The packages are placed in a chamber from which the air is extracted and the pressure equalised with gas. The packages are then sealed by welding. This machine type is suitable for small production volumes at a relatively low cost.



Bag-sealing machine (bag-in-box)

Prefabricated bags are filled with product. A snorkel probe is introduced into the bag and air extracted. Gas is then fed in, the snorkel is removed, and the bag is sealed. This type of equipment is used for large packages of meat, poultry and fish, for example.



— Gas flow
— Gas analyser

Perfect food comes in perfect packaging

Tailored solutions for all kinds of product

Packaging materials are crucially important for food quality and shelf life. Many sophisticated solutions have now been developed to prevent the rapid deterioration caused by oxygen, light and bacteria – or by foreign odours and tastes that may come into contact with the product.

A manufacturer choosing suitable packaging designs and materials has many important decisions to make, as well as complying with the relevant regulations.

Packaging materials

Packaging films are selected according to the characteristics of the food product. Film permeability, water vapour transmission rates and sealing characteristics all need to be matched with MAP properties. The high barrier films, foils and other materials form the substrates for MAP packages when formed into trays, lids or bags.

Our research strives to incorporate environmentally friendly materials (in terms of both manufacture and disposal) and to ensure that the modified atmosphere will be retained during the lifetime of the product. Several different materials are often combined into a multi-layered structure, each layer having its own function.



The BOC solution: MAPAX®

MAPAX® brings you a full range of tailored solutions to meet the packaging requirements of the food industries. Our BOC specialists will recommend the most suitable gas, equipment and safety products for your process, site and employees.

The MAPAX® gas range has been created to match the special quality requirements of the food industry. They comply with the strict food standards and legislation regarding packaging, storage and distribution. We can provide the traceability and safety guarantees demanded by the law.

BOC's dedicated field and in-house specialists have in-depth knowledge of the options available to you. We will work with you to develop the right gas mixture for the products being packed.

To discover more about BOC solutions for your market sector, please ask your account manager to send you the following market sector quick guides:



Meat & poultry



Fish & seafood



Dairy



Bakery & dried food



Prepared & catered food



Fruit & vegetables

BOC – turning ideas into solutions.

BOC is a member of The Linde Group, the leading global gases and engineering company. BOC is the UK's largest provider of industrial, specialist and medical gases, as well as related products and services. As a leader in the application of technology, we are constantly looking for new ways to provide our customers with high quality products and innovative solutions.

At BOC we help our customers to create added value, clearly discernible competitive advantage and hence greater profitability. To achieve this we have a comprehensive range of products and services, and technical support which can be customised to meet the individual requirements of our clients.

To keep ahead of the competition in today's market, you need a partner for whom quality, service, process and productivity optimisation are an integral part of customer support. We are there for you and with you, helping to build your success.

BOC's reputation has been forged through partnerships – with customers, with relevant regulatory authorities and with key suppliers. In this way, we deliver comprehensive and consistent benefits to you.

BOC – world-leading knowledge and resources adapted to local requirements.

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