

Making our world more productive



# MAPAX<sup>®</sup> – Best for prepared foods and catering





Linde's MAPAX® portfolio meets today's food preservation challenges with bespoke gases and mixtures, application expertise and complementary installation, test and safety services.

## Prepared foods – a challenge due to the variety of ingredients

The deterioration of prepared foods varies considerably from one product to another. If meat is one of the main ingredients, as in ravioli or lasagna, it spoils differently than, for instance, pasta. One major difficulty associated with prepared foods is the introduction of microbial contamination during the manufacturing process. This means that stringent demands are placed on hygiene as well as on the raw materials during the production process. The most serious breakdown processes are caused by the growth of microorganisms and by oxidation. In addition, bakery products sometimes go stale, leading to rancidity, discolouration and loss of taste. A fresh pizza, for example, stored without modified atmosphere packaging (MAP) at 4°C to 6°C, spoils in about a week. High quality can be maintained for some extra weeks by packaging the product in a modified atmosphere with a low oxygen concentration and high carbon dioxide level. In the case of pizza, the concentration of oxygen should be less than 1.5%.

## Moisture and composition affect deterioration rate

Choosing the best CO<sub>2</sub> to N<sub>2</sub> ratio for prepared food packages depends on the deterioration processes that would otherwise limit shelf-life. The composition of food and, most importantly, the water activity determine the speed of microbiological growth, oxidation and enzymatic activity – as do the processing steps before packaging. As a rule, the higher the level of water activity, the higher the CO<sub>2</sub> concentration should be.

The values in the table to the far right are affected by the use of modified atmospheres. As described in our "MAP - Modified Atmosphere Packaging" flyer, the use of modified atmospheres provides extra support in ensuring the safety of chilled food.

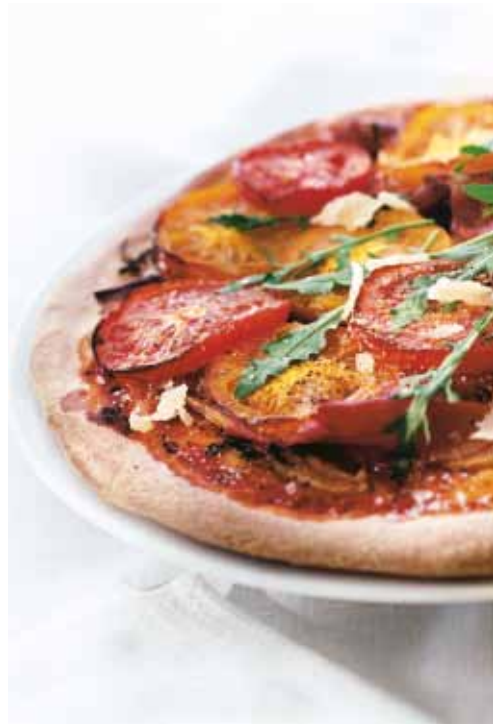
## Recommended gas mixtures for prepared foods and catering

Product	Gas mixture	Typical shelf-life		Storage temp.
		Air	MAP	
Fresh pizza	30–60% CO <sub>2</sub> + 40–70% N <sub>2</sub>	1 week	3 weeks	2–4°C
Fresh pasta	30–60% CO <sub>2</sub> + 40–70% N <sub>2</sub>	1 week	3 weeks	2–4°C
Sandwiches	20–30% CO <sub>2</sub> + 70–80% N <sub>2</sub>	3–7 days	10–28 days	2–4°C
Ready meals	30–60% CO <sub>2</sub> + 40–70% N <sub>2</sub>	4 days	21 days	2–4°C
Fresh herbs	0–5% O <sub>2</sub> + 5–20% CO <sub>2</sub> + 75–90% N <sub>2</sub>	1–3 days	10–18 days	2–4°C
Sliced onions	10–20% CO <sub>2</sub> + 80–90% N <sub>2</sub>	1 day	4–6 days	2–4°C
Wraps	20–30% CO <sub>2</sub> + 70–80% N <sub>2</sub>	2 days	6–10 days	2–4°C
Salad with chicken	30% CO <sub>2</sub> + 70% N <sub>2</sub>	1 day	6–10 days	2–4°C

### Multi-component products have special demands

Each product in a prepared food represents a complex challenge. Particularly difficult are varied combinations such as sandwiches, filled pasta, salads, pizza and spring rolls. Since several different ingredients, each with its own special inherent properties, make up the product, in-depth know-how is required to establish the right gas mixture that will best inhibit deterioration and maintain quality.

MAP is an important aid and safety measure, since prepared foods kept in the wrong environments can spoil very quickly, especially in the case of food products with a neutral pH value.





### Minimum growth conditions for selected microorganisms in chilled modified atmospheres

Type of microorganism	Minimum pH value for growth	Minimum $a_w$ for growth	Minimum growth temperature
<i>Aeromonas hydrophila</i>	4.0	na*	0.0°C
<i>Bacillus cereus</i>	4.4	0.91	4.0°C
<i>Clostridium botulinum</i> (proteolytic A, B and F)	4.8	0.94	10.0°C
<i>Clostridium botulinum</i> (non-proteolytic E)	4.8	0.97	3.3°C
<i>Clostridium botulinum</i> (non-proteolytic B and F)	4.6	0.94	3.3°C
<i>Clostridium perfringens</i>	5.5	0.93	5.0°C
<i>Enterobacter aerogenes</i>	4.4	0.94	2.0°C
<i>Escherichia coli</i>	4.4	0.9	4.0°C
Lactobacilli	3.8	0.94	4.0°C
<i>Listeria monocytogenes</i>	4.4	0.92	-0.1°C
Micrococci	5.6	0.9	4.0°C
Moulds	<2.0	0.6	<0.0°C
<i>Pseudomonas</i> species	5.5	0.97	<0.0°C
<i>Salmonella</i> species	3.8	0.92	4.0°C
<i>Staphylococcus aureus</i>	4.0	0.83	7.7°C
<i>Vibrio parahaemolyticus</i>	4.8	0.94	5.0°C
Yeasts	1-5.0	0.8	-5.0°C
<i>Yersinia enterocolitica</i>	4.5	0.96	-1.3°C

na\* = data not available

## Meeting the needs of the catering industry

The catering industry has always been challenged to supply fine foods that are fresh and of the highest quality. Last-minute production is very often required to fulfil these demands. In most cases, this is an inefficient and very expensive way to operate. By using Linde's MAPAX® technology in your kitchen or production facilities, you will reduce stress to a minimum and be able to plan the coming days or weeks of production even more effectively. Well-organised food production coordinated with MAPAX technology will clearly improve utilisation of human and production resources, give you better control over purchasing and storage and extend your shelf-life. The most common and beneficial way of using this packaging method in catering, hotel or restaurant kitchens is to get ahead of the "mise-en-place" production. For example, if you slice cheese and ham for the breakfast buffet on a daily basis, you can reduce this task to once or twice a week. The number of slices stays the same, but you work more efficiently. This is also true when preparing fresh meat cuts for the grill. Packing sandwiches and chilled food for out-of-hours service and other market segments is a cost-efficient and hygienic way of selling your produce.



To reach the desired shelf-life and maintain the good quality of your products, it is vital to keep constant control over both the product and packaging temperature.

## Sandwiches packed using MAPAX

Preparing sandwiches is a complicated process where different items are placed on top of each other, for example brown bread with butter, prawns, mayonnaise, lemon, lettuce, parsley and red pepper, or baguette with butter, ham, cheese, lettuce and red pepper, or brown bread with butter, smoked salmon, scrambled eggs, lettuce and parsley. The individual items influence each other because they provide different conditions for bacterial growth. By packaging in MAP, the shelf-life is extended by 5–7 days if the product is packed in 30% CO<sub>2</sub> in N<sub>2</sub> at a storage temperature of 2–4°C. A typical packaging material is PA/PE. The use of MAPAX technology for packaging sandwiches makes it possible to prepare them in advance and thereby reduce labour costs in the evenings and at the weekends, for example.



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