

Cooking and Pasteurisation Applications

Industrial applications using combined microwave processes

Purpose of this appendix

This document presents a selection of real application examples and process configurations developed for different product types. Its purpose is to help identify the most suitable technology for the product characteristics, packaging format and required production performance.

The configurations described are indicative and illustrate possible application scenarios. The final solution is defined during project development through an analysis of the customer's specific requirements, application trials and validation of process parameters.

TECHNOLOGIES	APPLICATIONS	APPROACH
Microwaves + conventional heating	Pasteurisation and cooking	Product trials > plant configuration

A flexible platform for different products

The cooking and pasteurisation methods described in the catalogue can be implemented in several process configurations. The choice depends on product characteristics, packaging type, the required thermal result and the customer's production objectives. Microwave technology provides rapid volumetric heating; electrothermal systems using hot air, steam or contact heating complete the treatment where surface control, temperature holding or cycle stability is required. Integrating these two technology groups enables tailored processes with shorter times and greater uniformity.

Technical and commercial note

The power, temperature and time values given in the application examples are based on practical experience and do not replace project-specific engineering. Each solution must be verified through product trials, taking account of the microbiological target, packaging format and required production capacity.

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Cottura di piatti pronti, ricette e carni.....	Errore. Il segnalibro non è definito.
Verdure, frutta e snack ad alto valore aggiunto	Errore. Il segnalibro non è definito.
Nuova opportunità: verdure premium cotte direttamente sottovuoto.....	Errore. Il segnalibro non è definito.
Processo produttivo esemplificativo	Errore. Il segnalibro non è definito.
Benefici attesi	Errore. Il segnalibro non è definito.
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From application example to industrial solution

The examples in this appendix illustrate the range of products that can be processed and how M.I.T. combines microwaves, conduction, hot air, steam and packaging management.

Validation using the customer's actual product remains the decisive step.

Recommended approach

1. Product analysis: formulation, weight, geometry, moisture content, packaging and thermal target.
 2. Application trials: assessment of the temperature profile, uniformity, sensory quality and packaging behaviour.
 3. Process definition: power density, chamber temperature, residence time and holding method.
 4. Plant sizing: production capacity, line configuration, automation and integration with cooling or packaging.
 5. Final validation: performance, process safety and agreed microbiological requirements.
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The line offers an adaptable process platform. The combination of technologies is designed around the product, the desired result and the customer's production model.

Pasteurisation of packaged or unpackaged products

Microwave pasteurisation, used alone or combined with electrothermal technologies, is particularly attractive when treatment must be completed quickly, when products are already packaged, or when thermal stress must be limited.

Application	Configuration	Indicative parameters	Customer value
Packaged pizza base	Radiant belts/plates with optional microwave-assisted rapid heating	100 °C at the core for 5 min; at 16 kW/m ³ : 85 °C in approx. 1 min	Shorter heating time than radiant plates alone, with reduced thermal exposure of the product.
Cooked vegetables	Microwave-assisted rapid heating + steam or convection holding	16 kW/m ³ ; approx. 60 °C in 1 min	Modular process: microwaves accelerate heating to the target temperature; holding completes pasteurization.
Nuts and dried fruit	Microwaves + hot-air chamber	16 kW/m ³ ; air at 95 °C; 4 kg heated to 90 °C in approx. 8 min	Microwaves provide rapid heating; hot air provides holding and treatment stabilization.
Packaged fresh pasta	Microwave treatment in sealed packs + convection holding	64 kW/m ³ ; 85 °C in approx. 2 min	Rapid pasteurization without compromising packaging integrity or product presentation.
Fresh fish in trays	Microwaves + continuous conventional heating	32 kW/m ³ ; 100 °C; adjustable line speed of 0.5 m/min	Treatment directly in the final packaging to support shelf life and standardization.



Cooked vegetables



Packaged pizza bases



Dried fruits



Skin-packed fish

Research evidence The University of Foggia study on microwave treatment of fresh pasta reports effectiveness comparable to traditional heat treatments, with shorter heating times and less impact on the shape and transparency of plastic pouches.	<i>Excerpt from the study published by the University of Foggia, "Use of microwaves for the pasteurisation of fresh pasta", by F. Castelvetri, R. Massini, L. Miglioli and C. Ferrari.</i> <i>For pasteurisation of vacuum-packed fresh pasta, microwave treatment is comparable in effectiveness to conventional heat treatments using steam or hot air. Unlike steam, microwaves do not alter the shape or transparency of plastic pouches and require much shorter heating times, particularly compared with hot air. Microwaves can also be used to pasteurise fresh pasta packaged in rigid trays or sealed flexible plastic packs without removing the air. These packs offer better product presentation but are unsuitable for conventional heating methods.</i>
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Baking bread products, biscuits and pastries

For baked products, microwaves can be integrated with conventional heating to accelerate energy transfer into the product and improve treatment uniformity.

Application	Configuration	Indicative parameters	Customer value
100 g bread rolls	Microwaves in a heated chamber	13 kW/m ³ ; 200 °C; 2 min 30 s	Rapid cycle supporting uniform cooking throughout the product.
Breadsticks	Microwaves in a heated chamber	22 kW/m ³ ; 100 °C; 3 min	Fast, repeatable baking of thin products.
Biscuits	Microwaves in a heated chamber	16 kW/m ³ ; 180 °C; 2 min 30 s	Fast processing with control over the final result.
Tart	Microwaves in a heated chamber	14 kW/m ³ ; 200 °C; 7 min	Also suitable for substantial sweet products with fillings.



Bread rolls



Bread stick



Tart

Cooking ready meals, prepared dishes and meat

For ready meals and complex recipes, the combined action of internal microwave heating and conventional surface heating can shorten process times, retain moisture and enable in-pack processing when suitable packaging materials are used.

Application	Configuration	Indicative parameters	Customer value
Frico	Microwaves in a heated chamber	26 kW/m ³ ; 60 °C; 2 min 30 s	Rapid cooking with surface colour differing from conventional cooking. Flavour typical of freshly cooked food.
Frittata	Microwaves in a heated chamber	21 kW/m ³ ; 100 °C; 2 min	Characteristic rise with natural colour retention. Flavour typical of freshly cooked food.
Lasagne / ready meal	Microwaves in a heated chamber	16 kW/m ³ ; 200 °C; 10 min	Shorter cooking times for prepared dishes, including those made with fresh pasta without pre-blanching.
Chicken and meat dishes	Microwaves in a heated chamber	22 kW/m ³ ; 200 °C; 3 min	Reduced loss of juices and better preservation of product characteristics.



Frico



Frittata



Lasagne/ready meal



Meat



Chicken



Meat-based dishes

Cooking directly in the packaging

The availability of microwave-compatible materials makes cooking and pasteurisation in the final packaging a viable option. The solution is not tied to a specific format: packaging must be compatible with the process temperature and technology.

Vegetables, fruit and high-value snacks

Microwave cooking can help preserve the colour, flavour and sensory characteristics of vegetables. Rapid volumetric heating is also useful for producing puffed snacks and adding value to food raw materials or by-products.

Application	Configuration	Indicative parameters	Customer value
Vegetables and fruit	Microwaves, mainly method 4	13 kW/m ³ ; 2 min	Flexible application across different vegetables and cut formats.
Potatoes for boiling	Microwaves only	32 kW/m ³ ; 4 min	Uniform cooking without water or steam.
Emmental snacks	Microwaves in a heated chamber	32 kW/m ³ ; 100 °C; 2 min 30 s	Adds value to trimmings generated when shaping cheese.
Polenta snacks	Microwaves in a heated chamber	32 kW/m ³ ; 75 °C; 1 min 30 s	Converts a low-value raw material into a puffed snack.
Potato crisps	Microwaves in a heated chamber	32 kW/m ³ ; 75 °C; 1 min 30 s	A crispy snack cooked without oil.



Vegetables



Vegetables & fruit



Potatoes



Emmental snacks



Polenta snack



Potato crisps

New opportunity premium vegetables cooked in vacuum packs

The versatility of the line makes it possible to develop a range of fresh vegetables that are vacuum-packed raw and then microwave-cooked directly inside the pack. The application is intended for professional foodservice, catering, central kitchens and prepared-food production facilities



Vacuum-packed vegetables



Ready-to-use format



Line&packs

Value proposition

A ready-to-use ingredient combining perceived quality, standardisation and quick preparation. Chefs retain the freedom to finish and customise dishes while starting from a controlled, consistent culinary base.

Illustrative production process

1	Select, wash and cut vegetables to the required size.
2	Add herbs, seasonings or other recipe ingredients, if required.
3	Place the raw product in a suitable pouch and vacuum-seal.
4	Cook rapidly as the product passes through the microwave line.
5	Cool under controlled conditions and store the finished product chilled.

Expected benefits

- Gentle cooking without contact with external water.
- Preservation of taste, aroma, natural colour, texture and moisture.
- Less available oxygen and reduced exposure to high temperatures thanks to rapid heating.
- Vegetable juices retained in the pack can be used in the finished dish.
- Consistent quality between batches and less preliminary work in the kitchen.

Professional applications

- Lasagne, pasta bakes, risottos and sauce bases.
- Elaborate side dishes, garnishes and accompaniments for meat or fish.
- Fillings, stuffings, smooth soups, purées and sauces.
- Ingredients ready for brief reheating or finishing in the kitchen.

Packaging behaviour

During cooking, the expansion of residual gases and the formation of steam may cause the pouch to inflate temporarily. This behaviour is expected: the line and pack format must be sized to allow controlled expansion without compromising packaging integrity. Once the pouch returns to room temperature, the vacuum is restored.