Pasta Technology for High Quality Flour Pasta

Agenda

1	Introduction & Influence of Raw Material
2	Dough Preparation
3	Drying Process
4	Innovation in the Pasta Processing
5	Summary

Production of Pasta – Focus on Dough preparation

Up-stream processing

Cleaning / Milling / Classifying

Dosing

Semolina or flour

Water

Additives

Dough & Structure development

Mixing

Extrusion

Drying & Structure stabilsation

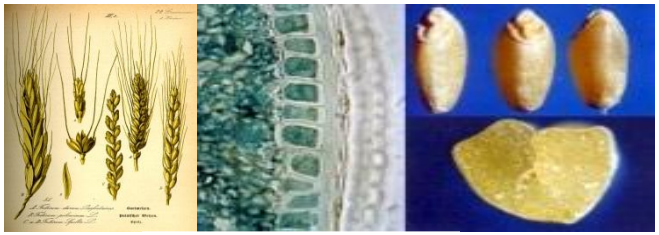
Drying

BÜHLER

Raw Materials in Pasta Processing.

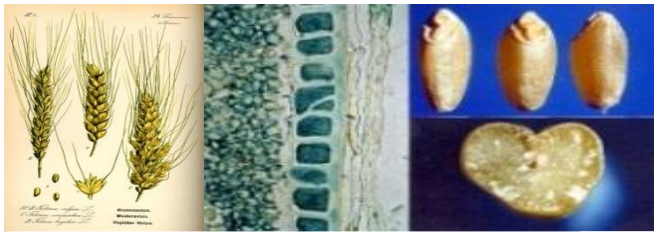
Wheat

Triticum Durum



Durum Wheat

Titricum Aestivum



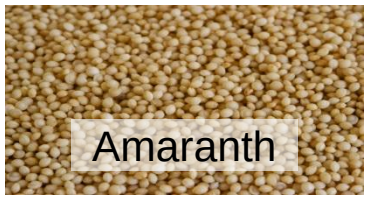
Hard Wheat (Bread Wheat)

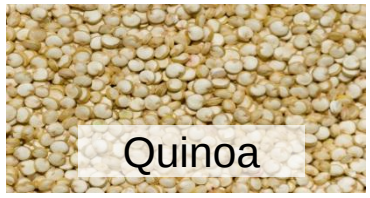
Soft Wheat (Cookie Wheat)

Gluten free

Cereals

Pseudo Cereals

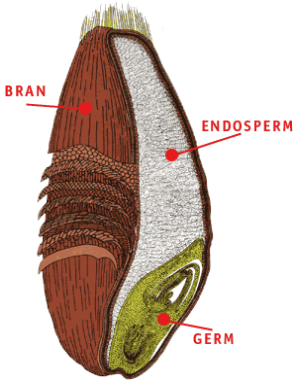




Pulses

Process know-how from grain to pasta.

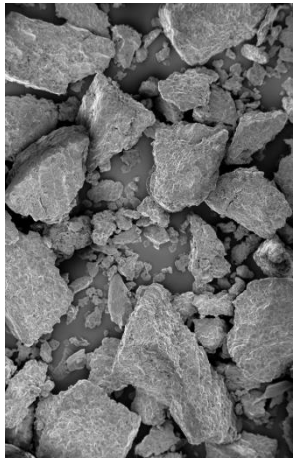
Properties of the raw material wheat influencing pasta quality.



Grain properties affecting pasta quality

(Improvements achievable in wheat supply chain)

- Wet gluten quantity and quality → Cooking quality
- Kernel virtuousness → White spots (only for Durum)
- Yellow pigment content → Colour of pasta



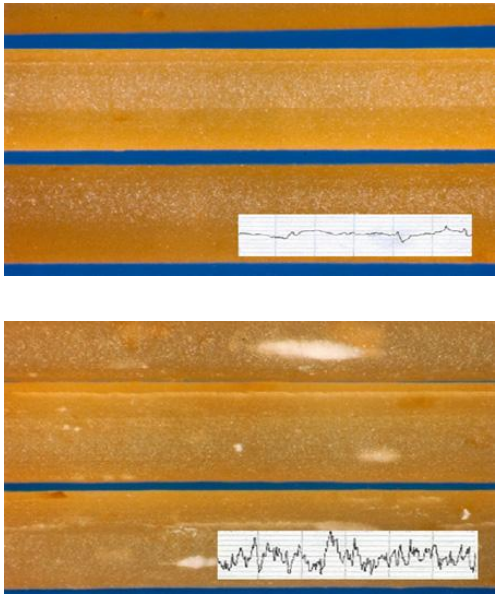
Semolina / flour properties affecting pasta quality

(Improvements achievable in milling processes)

- Ash content / extraction rate → Red-brown colour of pasta
- Narrow and fine granulation → Homogeneity of pasta
- Brown and black bran particles → Brown and black spots
- Damaged starch content → Stickiness of cooked pasta

Pasta Semolina & Noodles Flour.
Finished Product Quality Influences.

Uneven Granulation

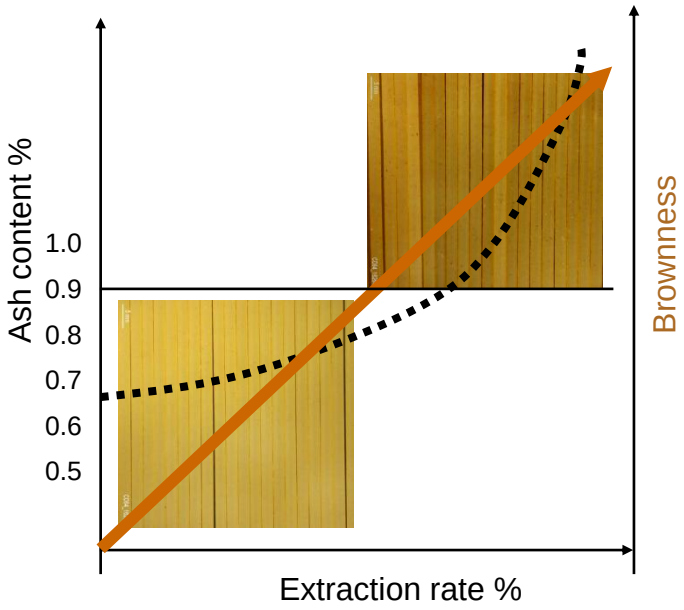


Uneven Vitreosity

WHITE SPOTS

ROUGH PASTA SURFACE

Ash Content



Pasta Raw Materials.
Main characteristics.

Coarse Semolina (Durum)

- Protein Content ~ 12-13% dm
- Wet Gluten Content ~ 26-30%
- Ash Content depending on local legislation
- Granulation: 0% > 500 µm
  20-40% > 355 µm (the lower, the better)
  35-55% 200-355 µm
  10-20% 125-200 µm
  5-15% < 125 µm (the lower, the better)

Fine Semolina (Durum)

- Protein Content ~ 12-13% dm
- Wet Gluten Content ~ 26-30%
- Ash Content depending on local legislation
- Granulation: 0% > 355 µm
  0-30% 315-355 µm
  45-65% 200-315 µm
  10-30% 125-200 µm
  5-15% < 125 µm (the lower, the better)

Wheat Flour (HW)

- Protein Content ~ 10-12% dm
- Wet Gluten Content ~ 26-27%
- Ash Content < 0.55%
- Granulation: 0% > 355 µm
  0-20% 200-355 µm (the higher, the better)
  10-25% 125-200 µm
  10-30% 90-125 µm
  0-60% < 125 µm (the lower, the better)

Non-Wheat Flours & Pulses (Gluten Free)

- Granulation: 0% > 250 µm; 90% < 200 µm

Gluten Free Cereals/Pseudo Cereals:

- Amylose Content ~ 20-25% dm (the higher, the better)

Pulses:

- Protein content ~ 21-26%
- High quality of protein: amino acid composition complementary to wheat
- Fiber content

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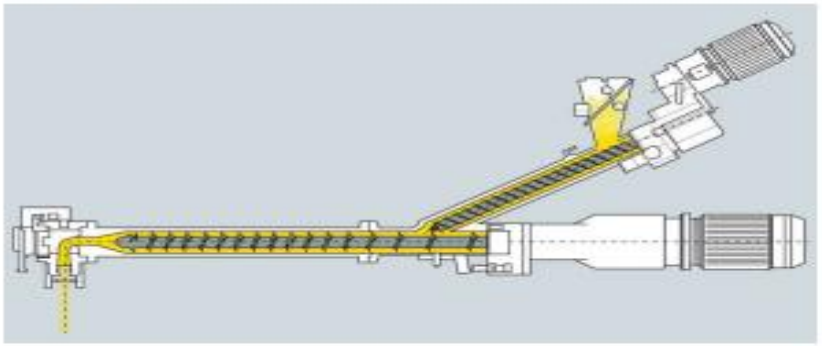
Pasta technology for high quality flour pasta

Dough preparation: available technologies based on raw materials used and product goals

Priomatik™ and Polymatik™.

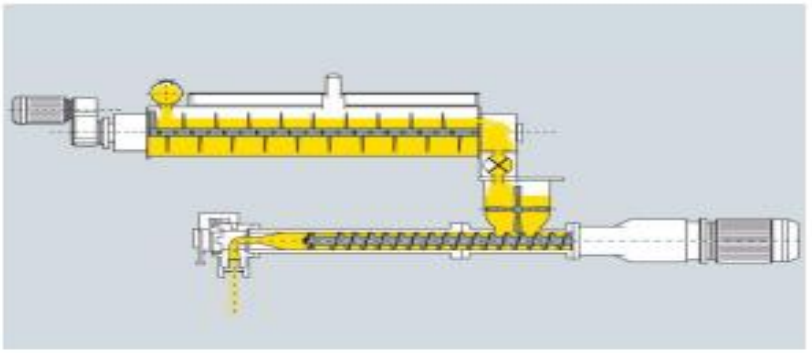
Two perfect press solutions for top pasta quality.

Polymatik™



- for fine semolina, flour & and gluten free materials
- highest hygienic standard
- fast recipe changes

Priomatik™



- especially suited for coarse semolina
- long retention times for full hydration of coarse semolina

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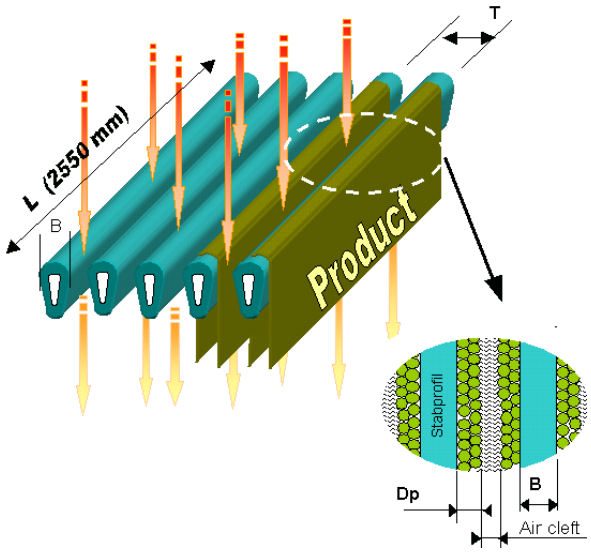
Principles of Pasta Drying.
Objectives

- Reduction of water content from ~31 %wb to <12.5 %wb
  - Stabilization of shape
  - Creation of a very stable product with high shelf life

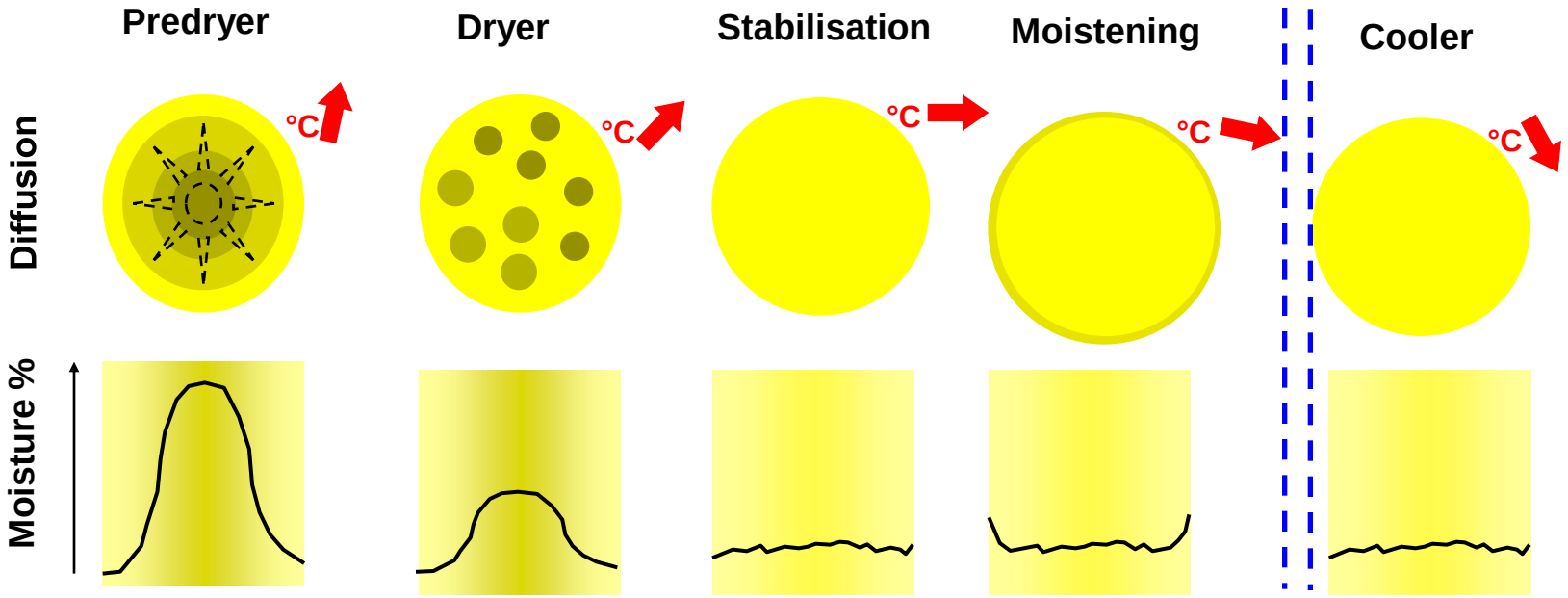
Pasta drying is not only the simple removal of water, but also influences:

- Formation of structural and textural pasta properties
- Determination of pasta colour, surface properties and appearance

Principles of Pasta Drying.
Moisture Gradient during Drying.

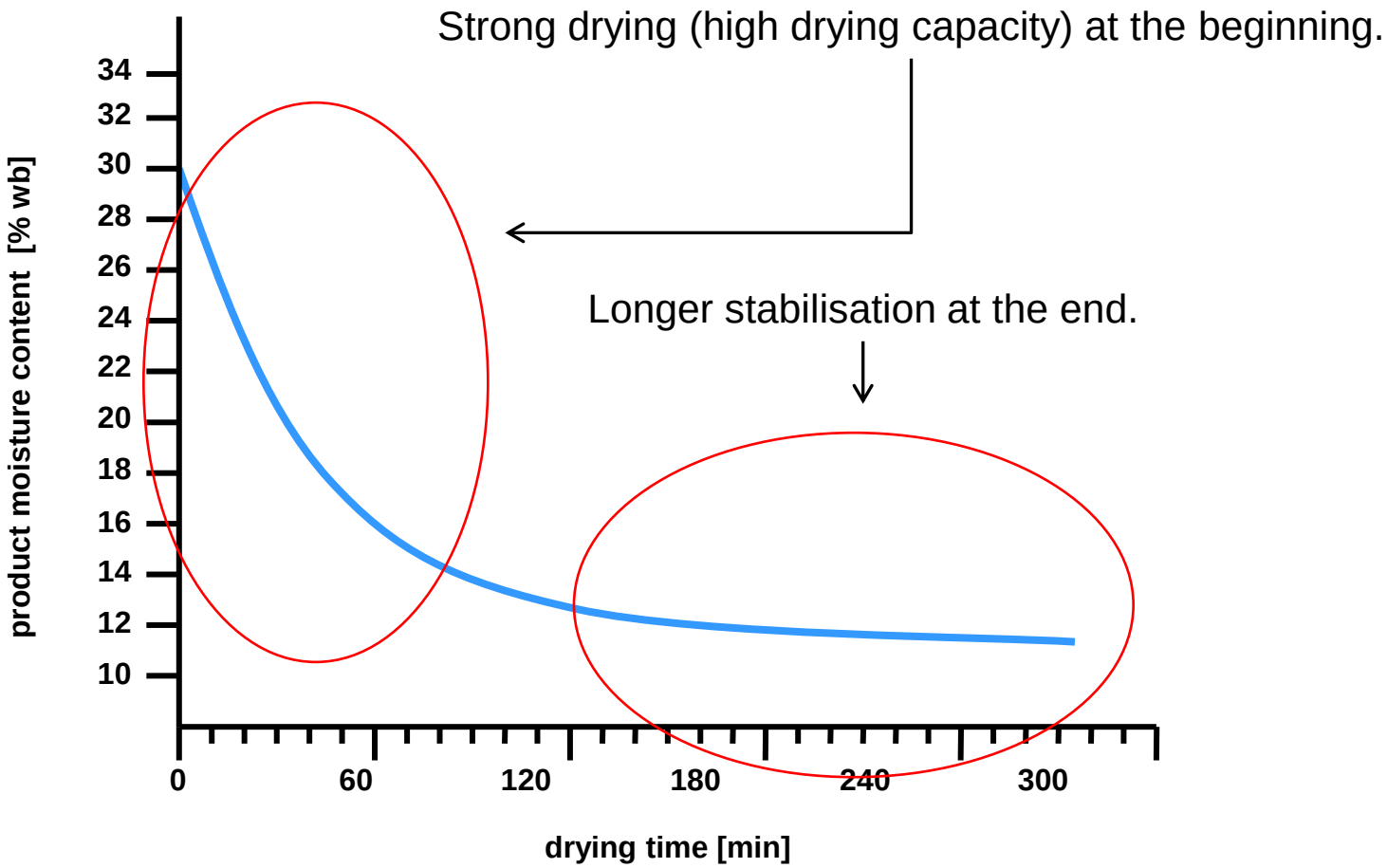


- Adequate drying speed in every drying zone
  - no case hardening
  - reduced risk of crack formation



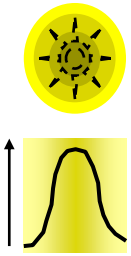
Drying: a key step for Pasta quality.

Typical drying diagram for long goods.



Possible complications and defects.

Cracking in PASTA during and/or after drying.



Shrinking of PASTA during drying generates structural stresses.

When these forces exceed the material strength, cracking will occur.

Cracking during the drying-process is a direct consequence of *case hardening*. – too fast drying kinetic

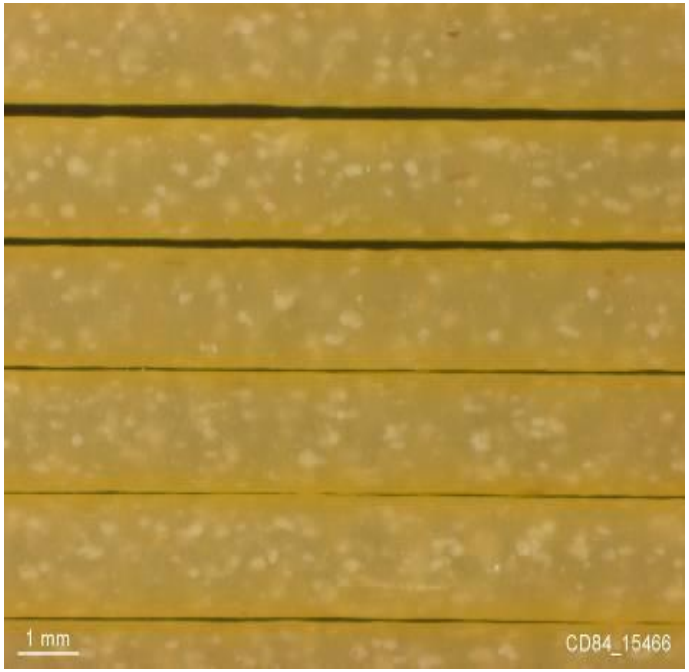
Cracking <u>after</u> the drying-process can occur when stresses in PASTA are created again and intensified.

OBJECTIVES:

- **sufficient stabilization**
- **correct final moisture content**

Possible complications and defects.

“Burnt“ PASTA during drying.

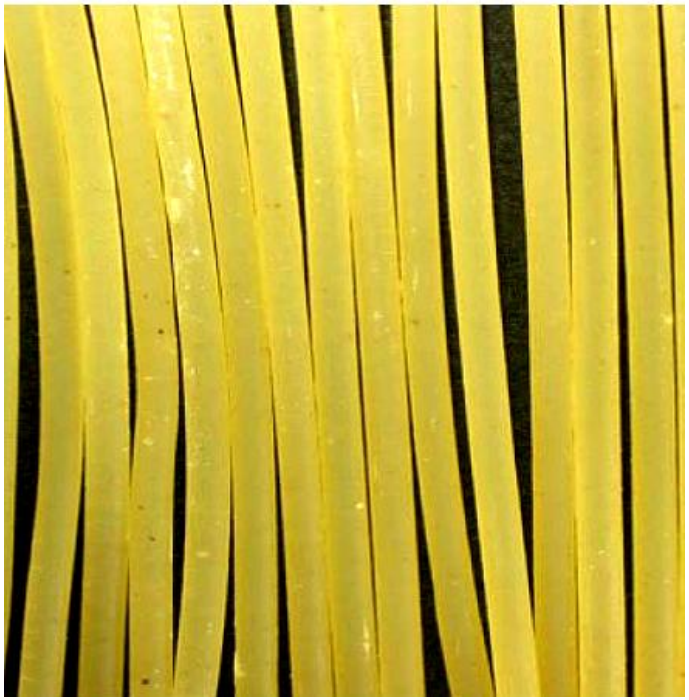


Burnings occur particularly at the beginning of the drying process at too intensive drying kinetics due to the application of too high temperatures, in very short time (flushing).

OBJECTIVES:

- **correct drying kinetic (speed; extreme conditions)**
- **focus: beginning of drying process**

Possible complications and defects.
Sticking of PASTA during drying.



Conditions for sticking of PASTA is a too high surface moisture content (free surface water) in combination of physical contact among PASTA pieces/strings.

High PASTA surface moisture contents can be reached especially due to too high relative humidity that can cause condensation.

Risk is present at any stage between two drying zones, but is higher at the beginning of the drying process.

OBJECTIVES:
- **correct moisture (beginning of process)**
- **correct parameters between zones**
- **air distribution**

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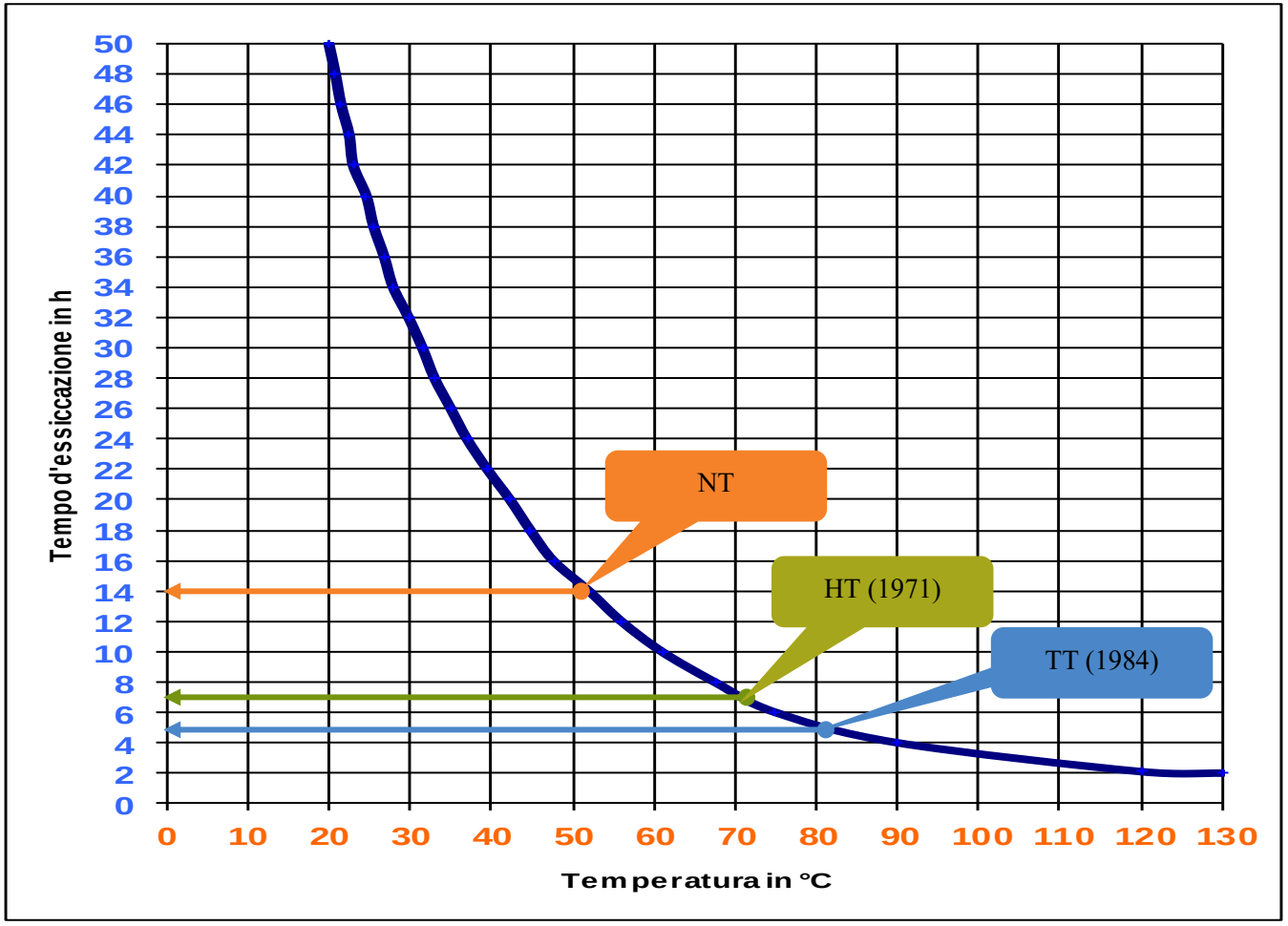
High-Temperature (HT) Drying and Pasta properties.

Evolution of the drying process over the last decades.



Development steps in pasta drying in respect of :

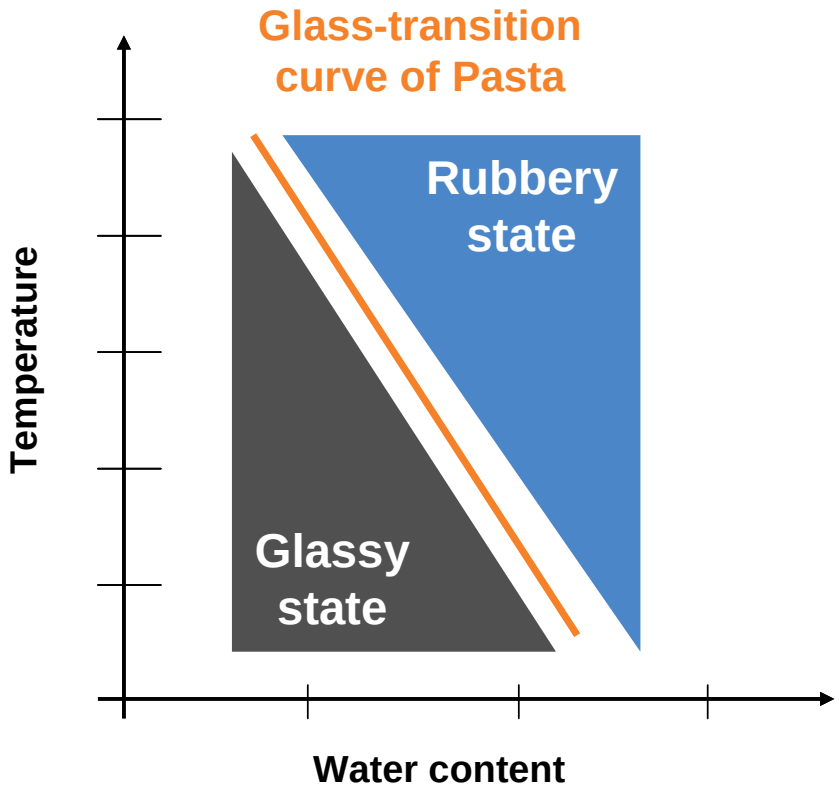
- Temperatures
- Duration
- Pasta quality
- Process control

Ecothermatik™: Innovative Drying Technology.

Concept from material science applied to food: the glass-transition curve.

Glass transition controlled drying.

- Science based concept
- Stress-less drying process
- 75 minutes stabilization
- Excellent cooking properties



Ecothermatik™: Innovative Drying Technology.

Concept from material science applied to food: the glass-transition curve.

Glassy state:

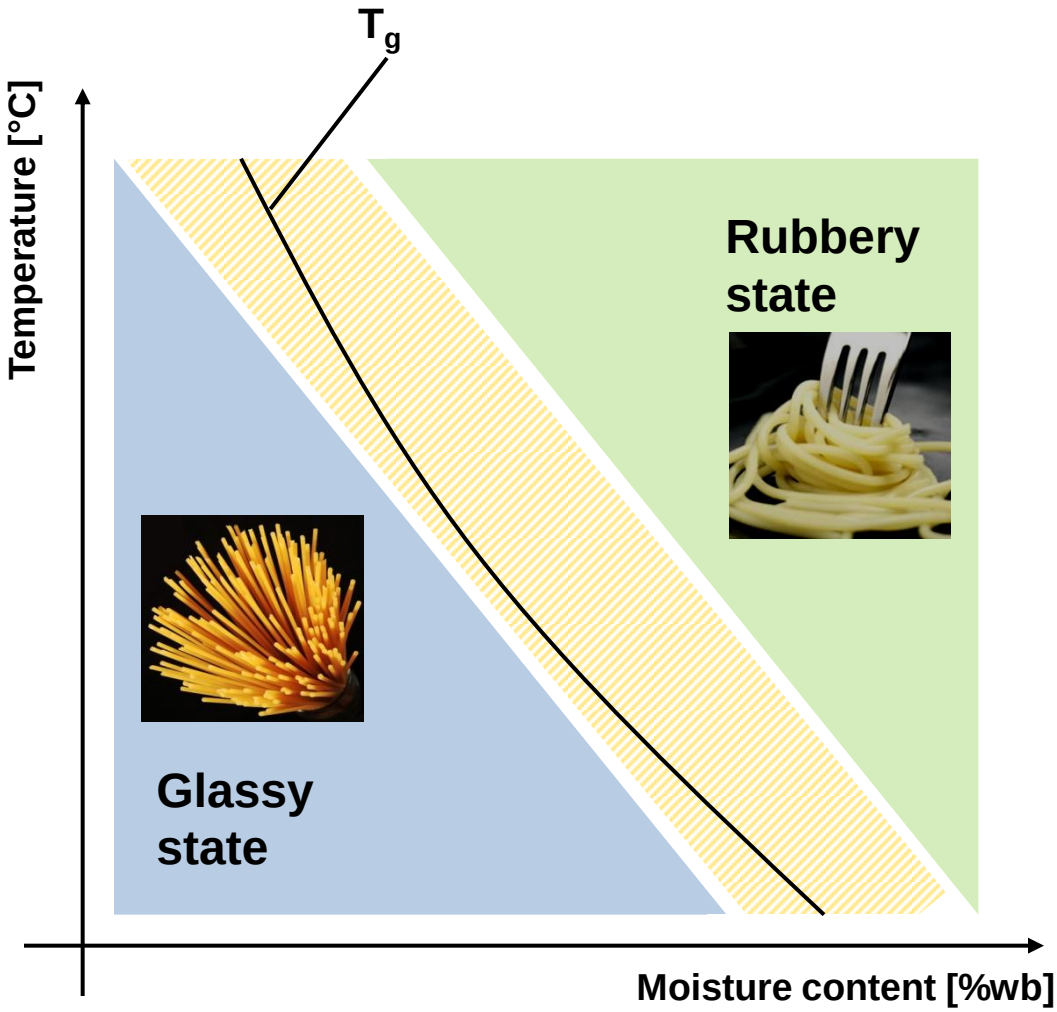
→ low mobility of molecules

→ high viscosity
→ high structural stress (cracks)

Rubbery state:

→high mobility of molecules
→ easy cross linking of Gluten

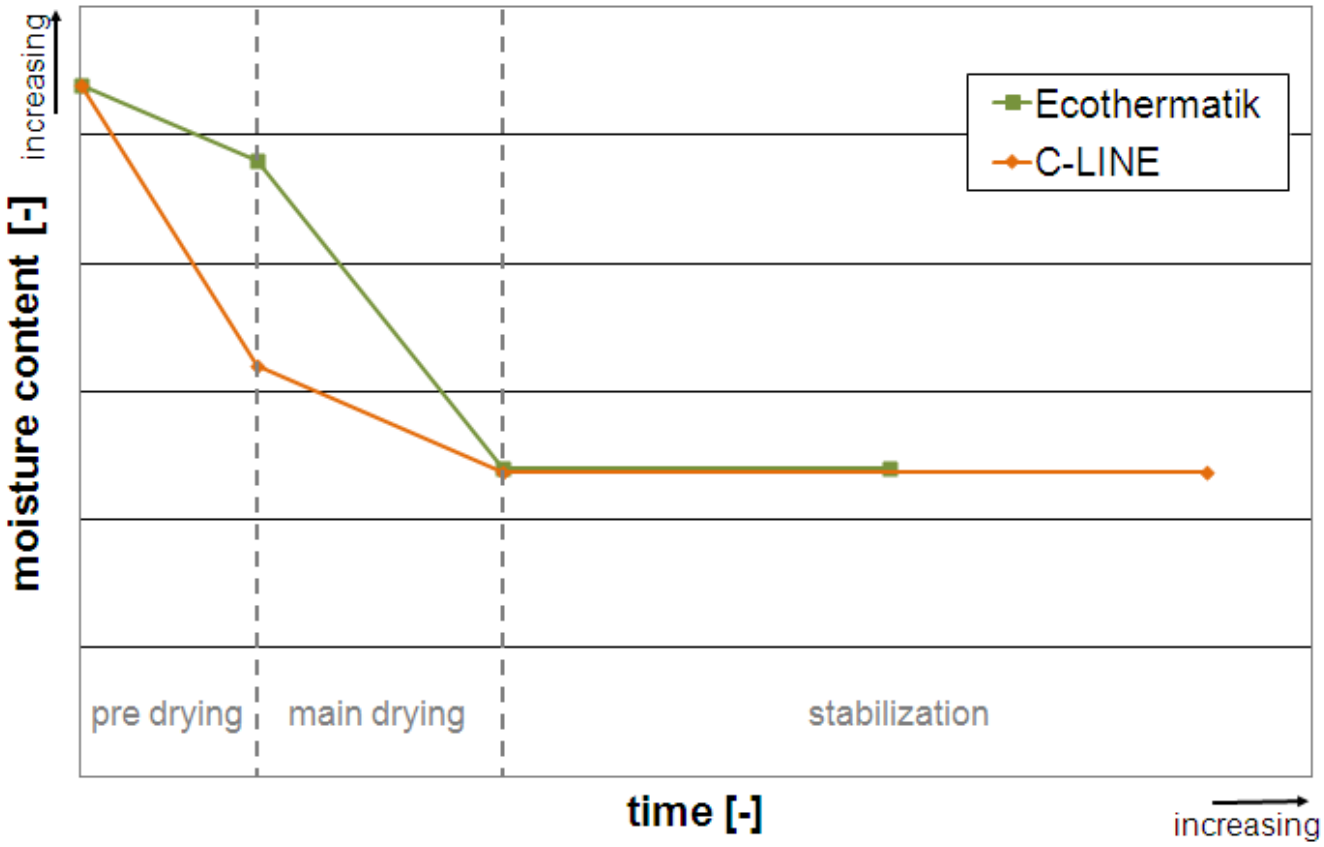
→ low viscosity
→low structural stress
→ best conditions to avoid cracks



Ecothermatik™: Innovative Drying Technology.

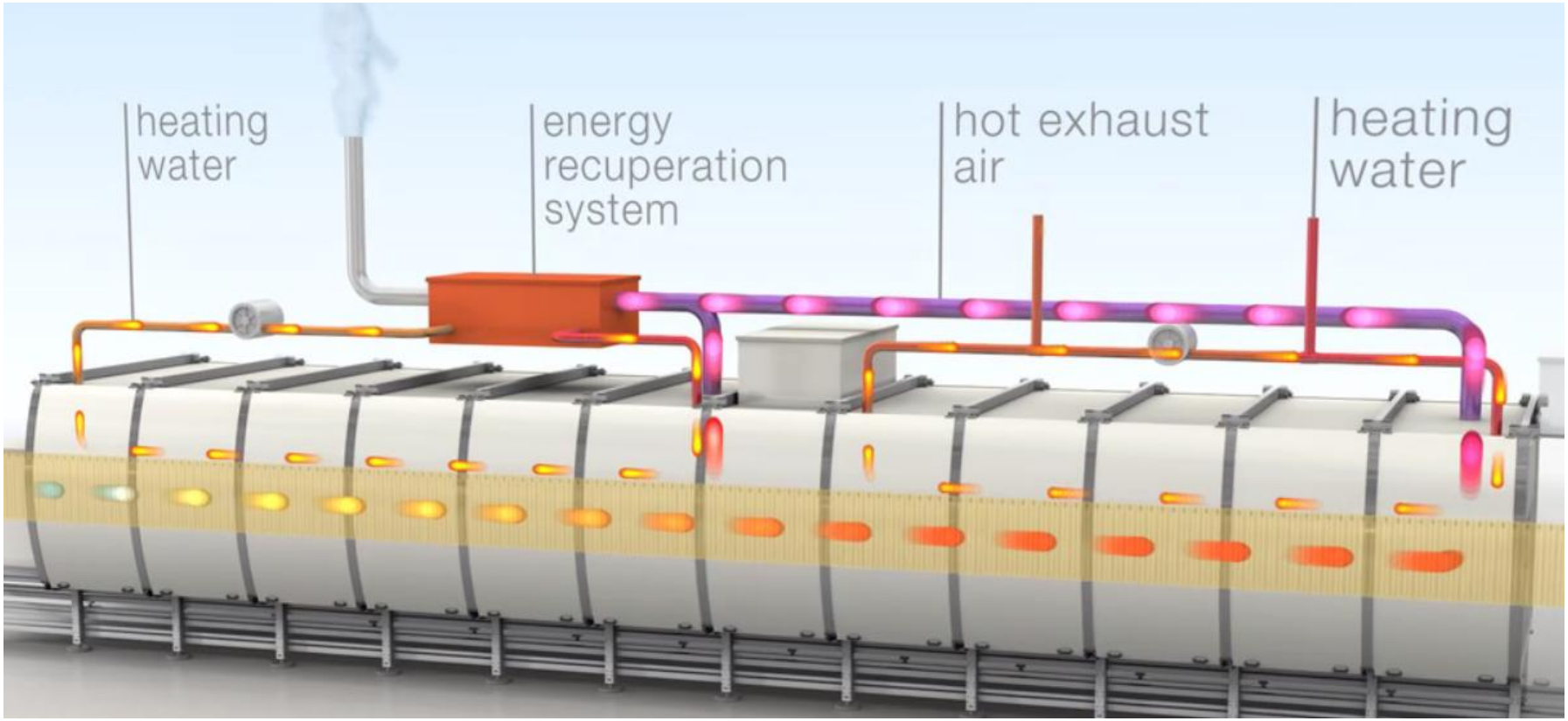
Benefit of gentler drying in Rubbery state : reduced stabilization time.

- *Stress-free* pre-drying by lower speed kinetic and low shrinking rates.



Save 40 % of thermal energy recuperated from exhaust air.

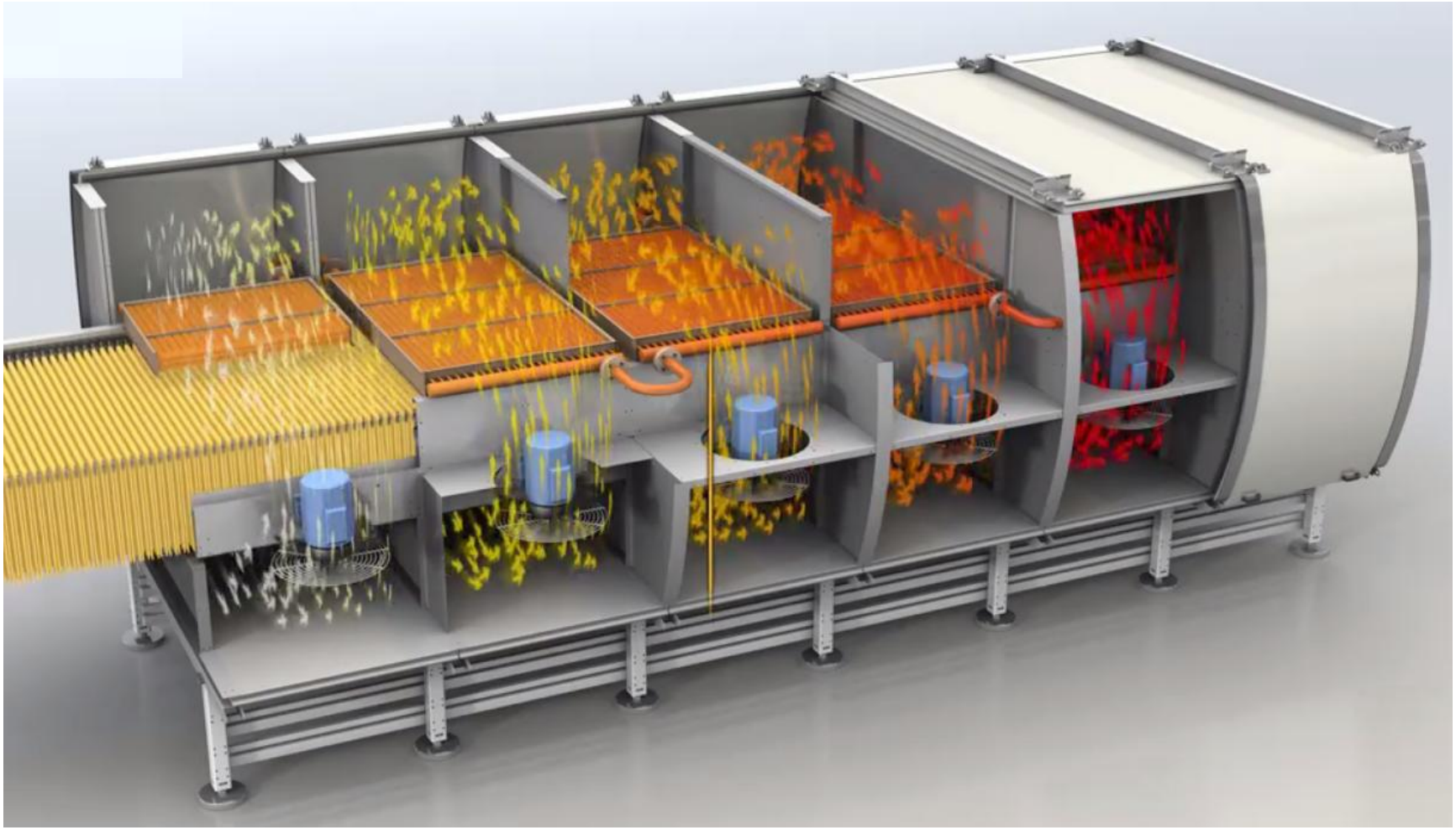
Reuse of energy to heat process water.



Save 20 % of cooling energy by reuse of backflows.
Intelligent thermal system fully integrated into the line.

Save 10 % of electrical energy.

By efficient fans & optimised aerodynamics for circulating air.



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Ecothermatik™ long goods pasta dryer.
Summary.

Ecothermatik™ long goods pasta dryer – energy efficiency and top pasta quality.

- 40 % less thermal energy, 20 % less cooling energy, 10 % less electrical energy.
- Therefore much higher margins.
- Top pasta quality thanks to drying in a rubber-like state.
- User friendliness and food safety.