Starch continuous preparation systems
In-line thermal heater to cook starches for wet-end, sizing and coating applications

The ABB starch continuous preparation systems are designed to cook slurries of starches using an innovative patented in-line steam heater so as to obtain an optimal quality by uniform heating.

Starch products are used in the paper making process to increase the physical properties, upgrade the surface, as well as to improve the finish and gloss. A size preparation unit for sizing or coating starch has an economical interest because the internal cost for the starch preparation is lower than the purchase of modified starch.

Applications
- Wet End starch preparation (cationic starches)
- Sizing
- Coating starch

Constant efficiency whatever the type of starch
Corn, potato, tapioca, wheat, maize, etc.

Optimal quality of converted starch
- Tailor-made starch slurry with specific dry matter content and viscosity rate according to the required paper grade.
- Complete hydration (no uncooked, agglomerated residue).

High production capacity
- Up to 98 t/d per line, with the possibility of several lines operating in parallel.
- Flexibility and throughput control by modulation of the steam injector flow-rate according to the paper machine speed.

Reliable and accurate operation
- Adjustable temperature, dry matter content and viscosity parameters
- Complete and uniform heating performance.
- Stable and smooth operation.

Fully automated process
- Use as stand-alone system or integrated in every DCS or production control system.
- Easy and safe operation.

Low operational costs
- Use of any kind of starch without loss of quality.
- Energy consumption lower than in batch process.
- Low maintenance.

Range
The range includes 3 types according to the consumption of dry starch:

<table>
<thead>
<tr>
<th>Type</th>
<th>Consumption dry starch</th>
<th>Min. t/day(1)</th>
<th>Max. t/day(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>26</td>
<td>98</td>
</tr>
</tbody>
</table>

Concentration rate:
(1) Starch milk at 20%
(2) Starch milk at 30%
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**Features and performance**

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**Why jet cook?**
Jet cooking is the process of subjecting starch slurries to direct steam injection which instantaneously heats and vigorously mixes the rapidly swelling starch granules to achieve hydration, disassociation and dissolution of the starch chains.

In-line jet cookers integrate perfectly in the continuous paper process to obtain an even, controlled and optimised end product quality.

**How does the jet cooker work?**
Fresh water is blended with unswollen starch granules in a mixing tank to obtain a starch slurry. Then this starch slurry is pumped back through the venturi opening of the direct steam heater to accelerate the velocity within the mixing chamber and be cooked at 120-130°C by steam injection.

The quick heat transfer that occurs in the mixing tube results in steam condensation and dispersion into the starch slurry so that each starch granule hydrates and swells. This phase continues in the downstream retention coil to obtain the final product quality.

**Enzymatic conversion of native starch**
The starch preparation phase consists in the receipt and handling of dry starch, followed by a make-down step (starch is diluted in water) with accurate dosing and eventual storage (in case of batch process).

After enzyme addition to the starch milk, the slurry is pumped and injected in the first jet cooker for conversion. The quick heat transfer that occurs in the mixing tube results in steam condensation and dispersion into the starch slurry at 85°C so that each starch granules hydrates and swells instantly.

The starch slurry is then transferred to the reactor where the average starch chain length is decreased by the action of enzymes (reaction time is adjustable).

Converted starch is pumped and injected in a second jet cooker for an inhibition phase. This phase continues in the downstream retention coil where the temperature approximating 125°C enables the inhibition of enzymes.

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**Native starch make-down** | **Enzymatic conversion** | **Inhibition** | **Dilution**
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Temp. approx. 85°C | Temp. approx. 125°C | Temp. approx. 85-95°C

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![Diagram of starch continuous preparation system](image)
A fully automated operation
An accurate temperature control and the modulation of steam provide a stable operation even with variable flows and pressures (low pressure drop, no “hammering”).

The continuous starch preparation unit is easily connectable to PLC and DCS-based control systems to manage and monitor the operation remotely.

Integrated solution
ABB integrated solution includes the design, supply, installation and commissioning of the complete starch preparation unit with:
- storage silo/hopper for starch powder with the necessary handling and metering devices,
- starch slurry make-down and storage tanks,
- jet cooker and reactor for enzymatic conversion,
- transfer and circulation pumps and pipes to the working station,
- instruments and automation required for a process under control,
- related services for start-up, training and spare parts.

References
P.T. Fajar Surya Wisesa TBK, Indonesia
Dong Guan Nine Dragons Paper Industry Co. Ltd., China
Wuxi Long Chen Paper Co. Ltd., China
Zhejiang Long Chen Paper Co. Ltd., China
Ballarpur Industries Ltd., India
OJI Paper Co. Ltd., Tomioka Mill, Japan
Saija La Rochette Venizel, France
BiLT Graphic Paper Product Ltd., Ballarsha Mill, India
West Coast Paper Mill, India
OJI Paper Co. Ltd., Nantong Mill, China
T’PAP Sfax, Tunisia
Shandong Sun Paper Co. Ltd., Yangzhou, China
Shandong Huatai Paper Co. Ltd., China
Saica Partingdon Mill, UK
Arab Paper Waraq, Saudi Arabia
GPC Carton, Morocco
Europac Papeterie de Rouen, France
Varaka Paper Mill, Turkey
Visy Paper, Australia
Whakatane, New Zealand
Emami Paper, India
Yibin Paper Industry Co., Ltd., China
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