Welcome to BRÜCKNER.
Best practices in energy efficiency in textile finishing sector

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BRÜCKNER Energy consulting service

Energetic and environmental evaluation of processes in the textile industry
Contents

1. Your benefits
2. Our services
3. Our line of action
Is there a way to more energy efficiency?
Energy Cost Considerations

Life-Cycle Cost Analysis Stenter Frame

Conclusions of Cost Analysis:

- Energy Costs = 48% (heat energy) + 12% (electricity) = 60% is the major cost factor
- up to 35% of the heat energy costs can be saved with a heat recovery

remark: data derived from cost analysis of a BRUCKNER stenter over a 10 year period
Energy saving possibilities

Machine: Stenter with 2400 mm working width, 8 chambers, direct gas heating
Fabric: Woven fabric, 65% PES / 35% CO

Total thermal energy: 1398 kW

- Saving measures on chain or surface (insulation) can be ignored
- Exhaust air and water evaporation cannot be changed

→ BRÜCKNER has therefore focussed on performance
BRÜCKNER performance

- Optimized air circulation system (less guiding plates, minimized pressure loss)
  - Higher air circulation capacity with the same energy consumption
- Optimized nozzle design (size of nozzle holes adapted to working width)
  - Higher air outlet velocity at the nozzles
- Drying zones in alternating arrangement
  - Constant drying over the complete fabric width
- Circulating air flow can be reduced for narrower working widths
  - Less energy consumption with the same output
- Shortest distance between fabric and nozzle
  - Less drying time and less energy consumption
  - High water evaporation
Your benefits

→ The fabric can be dried / processed faster

→ Higher production output with the same energy consumption, or same production output with less energy consumption.

→ High-quality fabrics as result
2. Our services

a. Establishing / checking a machine layout for the production, to clarify the local demand and the production of existing material flows

b. Measuring and monitoring of consumption data

c. Proposals for saving energy based on consumption figures measured in one year period
3. Our course of action in three steps

**Step: evaluation of the process**

By establishing energy balances it is possible to make a distribution of the respective energy carriers to the processes in question.

In addition the produced emissions referred to the process can be determined.

- Process evaluation
  - Determination of energy-relevant processes
  - Determination of relevant process parameters
  - Establishment of energy balances
  - Calculation of emissions
Benefits of BRÜCKNER stenters in production output and energy efficiency

1,5m Thermo-compartments in staggered design

In order to achieve a maximum evaporation capacity, Brückner is using 1,5m thermo compartments with the patented Split-Flow® ventilation system, with a maximum air speed at the nozzle outlet.

Patented Venturi mixing unit

Pressure losses in the ventilation chamber are minimized thanks to our patented venturi mixing device, which mixes the circulating air with hot air from the burner.
Benefits of BRÜCKNER stenders in production output and energy efficiency

High-performance nozzles

Brückner has developed a type of nozzle, with minimum pressure loss. This nozzle saves 10% of electrical energy, while the evaporation capacity is increased by 3%.

**Advantages BRUCKNER nozzle:**
- Increase in evaporation capacity: +3%
- Savings in electrical energy (fans): -10%

<table>
<thead>
<tr>
<th></th>
<th>Poisson’s ratio ( \mu )</th>
<th>Pressure loss ( \zeta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>conventional hole nozzle with sharp edge</td>
<td>0.6 - 0.67</td>
<td>29</td>
</tr>
<tr>
<td>can extruded Brückner nozzle</td>
<td>0.9 - 0.95</td>
<td>24</td>
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</table>
Air circulating and nozzle systems

Measurement of air at the nozzle

**Top Nozzle** - 43.1 M/ Sec
**Bottom Nozzle** – 43.2 M / Sec

Brückner split-flow with 4 circulating air fans and 16 kW installed electrical power Per Chamber.

**Brückner has 23 % higher air velocity at the nozzle**
Higher air velocity results in higher water evaporation
Benefits of BRÜCKNER stenters in production output and energy efficiency

Highly efficient heat-recovery system

All Brückner dryers can be furnished with highly efficient heat recovery systems. Our fin-type heat exchangers have a much larger heat exchange surface than ordinary pipe bundle heat exchangers. Heat recovery units can help to save a significant amount of heat energy.

Low consumption of electrical energy

a) All electrical motors comply with IE2, which is the highest energy efficiency class

b) Interflow system: The kinetic energy from all motor speed reductions is recycled / fed back into an interflow system and from there back to the other motors. This sophisticated system minimizes energy losses during operation.
Design of the thermo chambers ➔ faster heating-up of the fabric

Thanks to the advanced air-management and its high evaporation capacity, heating up of the fabric takes place much faster on a Brückner stenter ...

Conventional stenters require 3 chambers until the set temperature has been reached. The Brückner POWER-FRAME stenter requires only two chambers and the new POWER-FRAME eco stenter only one!

Advantages:
• increase in production output
• better heat setting results
• shorter dwell times required
• shorter dryer length required
Benefits of BRÜCKNER stenters in production output and energy efficiency

Superior air and temperature uniformity

The special design with staggered 1.5m-compartments, double the amount of heaters and Venturi mixing devices results in an unmatched uniformity in ventilation and temperature distribution. Uniformity is crucial for drying and heat-setting of sensitive fibres like elastane, polyamide, polyester etc. This Brückner-design leads to the following advantages:

• The **drying process** can run faster and more energy efficient as there are no wet spots across the width.
• The **heat-setting process** can run faster / with reduced dwell times and more energy efficient as the fiber structure is heated up very evenly. Ordinary stenters require extended dwell times to compensate inaccuracies in temperature distribution. The heating process can start earlier due to the higher heat transfer to the fabric (faster uniform heating up).
POWER-RELAX  3 Relax dryer with suction zone and two air blowing passages
The new developed air-through drying passage

By using the exhaust air of the second and third passage of the dryer, the fabric can be treated in the first passage without any additional energy. This so called suck-through concept offers up to 25% higher production capacity by investing 25% less energy.
POWER-RELAX 3 with preheating passage and through-flow drying concept

The new BRUCKNER relaxation dryer with three fabric passages and the new developed energy saving concept offers you the following advantages:

- first passage suck-through drying chambers
- second and third passage: regular drying and tumbling chambers
- up to 25% more drying efficiency and evaporation capacity by using 25% less energy
- the relaxation dryer is designed for open-width and tubular fabrics
- separate temperature regulation in each 1.5 m gas-heated chamber on all three drying passages
- integrated heat-recovery system for additional energy savings (optional)
- automatic lint screen cleaning system (optional)
BRÜCKNER Product Portfolio
Heat Recovery and Air Purification Systems

- Heat Recovery Systems Air to Air
- Heat Recovery Systems Air to Water
- Vortex Scrubber Systems
- Spray Scrubber Systems
- Electrostatic Filters
- Integrated Systems
- Comparison of different systems
Benefits of BRÜCKNER heat recovery and air purification systems

- Energy savings of up to 20% (depending on the process)
- Significant reduction of production costs
- Short payback periods
- Modular design / possibility to expand systems step by step
- Maintenance friendly systems
- Possibility to upgrade existing BRÜCKNER and non-BRÜCKNER machines
- Solving of exhaust air problems
- Compliancy with environmental regulations
- Taking advantage of government subsidies (depending on the country)
<table>
<thead>
<tr>
<th>Type of Heat Recovery</th>
<th>Efficiency</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating Heat exchanger</td>
<td>80%</td>
<td>• high efficiency thanks to large heat exchanger surface</td>
<td>• high maintenance effort due to rotating parts and sealings</td>
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<td></td>
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<td>• heat exchanger can only be cleaned with compresses air or steam</td>
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<td></td>
<td>• no external cleaning due to large dimensions of heat exchanger (Ø=2m / 1000 kg)</td>
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<td></td>
<td></td>
<td>• intense scaling can not be removed</td>
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<td></td>
<td></td>
<td></td>
<td>• system only suitable for exhaust air with moderate impurities</td>
</tr>
<tr>
<td>Plate Heat Exchanger</td>
<td>75%</td>
<td>• high efficiency thanks to large heat exchanger surface</td>
<td>• requirement for frequent cleaning of heat exchangers</td>
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<tr>
<td></td>
<td></td>
<td>• internal / inline cleaning with steam and/or melt-off cleaning</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• compact and thus maintenance friendly design for external cleaning (e.g. in water bath)</td>
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<tr>
<td>Pipe Bundle Heat Exchanger</td>
<td>60%</td>
<td>• no clogging of heat exchanger with chemicals and lint</td>
<td>• bulky design and thus difficult handling for maintenance</td>
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<tr>
<td></td>
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<td></td>
<td>• no internal / inline cleaning with steam or melt-off cleaning</td>
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<td></td>
<td>• very work intensive external cleaning due to large dimensions of heat exchanger and pipe by pipe cleaning via scraper</td>
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<td>• system only suitable for clean exhaust air</td>
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Heat-recovery and air purification systems – overview product portfolio

Brückner offers entire system solutions for heat recovery and air purification:

1. Heat recovery air/air
2. Heat recovery air/water
3. Scrubber
4. Electrostatic filter
Four stage heat recovery and air purification system

Four stage system:

1. Heat recovery air/air
2. Heat recovery air/water
3. Nozzle scrubber
4. Electrostatic filter
Two stage heat recovery air/air and air/water

**Heat recovery air/air**: utilisation of hot exhaust air to heat up fresh air, which is fed back into the stenter.

**Heat recovery air/water**: utilisation of remaining heat energy in exhaust air to generate hot water (e.g., for washing, dyeing, bleaching).

**Example**: heat setting at 190°C

- **hot exhaust air from the stenter**
- **fresh ambient air** to be heated up
- **heated up fresh air** going back into the stenter
- **cooled down exhaust air** used to heat up cool water from in heat recovery air-water
- **cold exhaust air** going out of the chimney

**Remark**: Cooling of exhaust air from 190°C to 50°C results in condensation of impurities. This oil is collected and separated from residual water through oil skimming process.
Thank you for your kind attention.