Heat Exchanger efficiency and considerations to reduce energy costs

Jimmy Moons - Tetra Pak®
Agenda

1. Introduction
2. Market trends
3. Pasteurization & regeneration
4. Innovations
5. Technology & Benefits
The food industry consumes almost a third of the world’s energy.

www.un.org/sustainabledevelopment/sustainable-consumption-production/
Market outlook/trends

► Sustainability is now a key consideration for consumers – 50% agree that every choice they make in their daily lives affects the environment*

► Food hygiene remains a global concern, with 36% of consumers citing food safety as a significant worry*

► Unscheduled downtime and disruption can be disastrous for producers in today’s tough economic climate, so reliability and durability are critical

*Source: Tetra Pak® Index Consumer Research 2021
Regenerative efficiency - milk pasteurisation

Regenerative efficiency in this example:

\[
R = \frac{(t_r - t_i) \times 100}{(t_p - t_i)}
\]

where:
- \( R \) = regenerative efficiency, %
- \( t_r \) = milk temperature after regeneration, °C
- \( t_i \) = temperature of raw incoming milk, °C
- \( t_p \) = pasteurisation temperature, °C

67 - 4 \times 100 = 90%

\[
\frac{67 - 4}{74 - 4} = 90\%
\]
Pasteurizer
Evolution on increased regeneration
# Upgrading an existing plate heat exchanger

<table>
<thead>
<tr>
<th>PHE</th>
<th>regen factor</th>
<th>steam consumption</th>
<th>ice water capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing pasteurizer</td>
<td>85%</td>
<td>165 kg/h</td>
<td>267 kWh</td>
</tr>
<tr>
<td>Upgrade pasteurizer</td>
<td>93%</td>
<td>54 kg/h</td>
<td>150 kWh</td>
</tr>
<tr>
<td><strong>difference</strong></td>
<td><strong>8%</strong></td>
<td><strong>111 kg/h</strong></td>
<td><strong>117 kWh</strong></td>
</tr>
</tbody>
</table>
Savings in money rather than percentage

- Reduction in steam consumption
- Reduction in ice water energy consumption

= savings
Secure your production with Tetra Pak® Plate Heat Exchangers
Specially developed plates for hygienic duties
Tetra Pak®
Plate Heat Exchanger H4 and H8
Secure path to hygienic heating and cooling
Maximise cleanability

The streamlined SmoothPort™ prevents buildup and maximizes cleanability and drainability.

Trademark belongs to Alfa Laval
Achieve uniform heat treatment

EquiFlow™ plate pattern optimizes media flow, enabling uniform heat treatment with minimal fouling.

Trademark belongs to Alfa Laval
CleanChannel™ facilitates the removal of particles during cleaning, securing the highest standards of hygiene.
**Sustainability**
Supporting the customer to make a difference

**Increased energy efficiency:**
- Improved heat transfer
- Reduced pressure drop

**Reduced impact on environment**
- 20% less impact than alternative, less steel used

**More efficient CIP – reduced consumption of:**
- Water
- Chemical
- Energy
H4 and H8 frame features

- Interchangeable corners
- Frame and pressure plate interchangeable
- Hygienic adjustable feet
Tetra Pak® Tubular Heat Exchanger

Industry-leading efficiency and exceptional reliability
Industry-leading efficiency & exceptional reliability

The Tetra Pak® Tubular Heat Exchanger

Get higher capacity, and greater robustness, flexibility, and reliability, with up to 40% loss in pressure drop (saving you up to 40% on your electricity costs*)

Offers lower total cost of ownership along with a lower overall carbon footprint too.

*electricity costs of the tubular heat exchanger pump only
The next generation of Tubular Heat Exchangers

Our tubular heat exchangers were already industry-leading. But we’ve made them even better.

- Unique, patent-pending Q corrugation = 40% reduction in pressure drop
- Improved protective covers for greater operational safety – better fastening and new, more durable plastic material
- Tubes available in unique sloping holding cell configuration to meet market requirements
- Greater flexibility to use tubular heat exchanger for different products
- Improved silicon O-ring for split rings gives better life against hot air/condensate
Why the Tetra Pak® Tubular Heat Exchanger?
Cost efficient, reliable & flexible, and class-leading food hygiene

BENEFITS AT A GLANCE

IMPROVED SUSTAINABILITY & COST EFFICIENCY
40% reduction in tubular heat exchanger electricity costs, lower carbon footprint, lower total operating cost.

GREATER ROBUSTNESS, RELIABILITY & FLEXIBILITY
Durable design, easy inspection and exchange of parts. Easy to configure, modify, and expand – endlessly customisable.

BEST-IN-CLASS FOOD HYGIENE/SAFETY
The only tubular heat exchanger with EHEDG certification. P2P also complies with US 3-A sanitary standard.
Energy savings
Unique, patent-pending Q corrugation

↓ = 40% reduction in pressure drop

↓ = up to 40% reduction in tubular heat exchanger electricity costs*

*Power calculated with the following formula:

\[ P(kW) = Q \times \left( \frac{H}{10} \right) \times (\text{Overall efficiency factor}) \]

Q = Capacity in litre per hour
H = Total head (bar)

\[ P2/P1 = 6/10 = 60\% \text{ therefore in the second scenario we can save 40\% on the electricity consumption} \]
Energy savings

Less pressure
= smaller, cheaper pump required

Higher capacity means smaller, cheaper tubular heat exchanger can be used
The floating protection system is a unique design with multiple, independently moving, floating (not fixed or welded) parts.

Key benefits
► No bellow, not fully-welded
► Eliminates risks of cracking
► Ensures uncompromising food safety
► Enables product-to-product heat regeneration for exceptional efficiency
► Improves equipment lifetime