Pelletizing Process & Equipment Selection for Compounds and Masterbatches

Cost Savings Techniques

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Sales Director Pelletizing - Greater China, Philippines, Vietnam
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Pelletizing Process & Equipment Selection for Compounds and Masterbatches

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  Cost Savings Techniques
  - Dry cut strand pelletizing systems
  - Types of dry cut strand pelletizers
  - Possibilities with underwater pelletizing
  - Customized solutions
  - Criteria to select on which pelletizing process is the most suitable one for my application
- Summary
About Maag-Automatik

The group is a merger of the two companies Maag Pump Systems AG and Automatik Plastics Machinery GmbH.

- Belongs to Dover Corporation, USA, $8 billion revenue, 34,000 employees
- Sales turnover 2011 - 2013 of Maag-Automatik: 130 → 145 mEUR
- Homepage: [www.maag.com](http://www.maag.com)

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Maag Pump Systems AG

- Headquarters: Obergallt, Switzerland
- 270 employees
- Technology leader for pumps/filters

Automatik Plastics Machinery GmbH

- Headquarters: Grossostheim, Germany
- 240 employees
- Technology leader for pelletizers
About Maag-Automatik

Maag-Automatik – taking care of you worldwide

USA
Charlotte

Brazil
Sao Paulo

France
Lyon

Switzerland
Oberglatt

Italy
Milano

Germany
Grossostheim

Russia
Moscow

China
Shanghai

India
Mumbai

Singapore
Singapore

Malaysia
Kuala Lumpur

About Maag-Automatik
About Maag-Automatik: Comprehensive solutions from a single source!

As an integrated group, the company offers complete systems as well as top-quality components spanning the entire production chain from the reactor or the extruder tip to finished pellets.

For customers this means:

- One stop supplier
- Perfectly adapted interfaces
- Less manpower required for engineering
Maag: Gear pumps and filtration systems for each individual application

- **Gear pumps & filtration systems for plastics production**
  - PET bottles
  - For Virgin Polymer production like PET, PA

- **Thermoplast extrusion pumps & filtration systems**
  - Window profiles or films
  - For Compound production or direct extrusion

- **Elastomer extrusion pumps**
  - For tyre production

- **Chemical and industrial pumps**
  - For fluids like acids and bases
About Maag-Automatik

Automatik: Your pelletizing systems supplier for all pellet shapes

Underwater strand pelletizing
- PET bottles or PA clothes
- For Virgin Polymer production like PET, PA

Dry cut strand pelletizing
- Handy cover, bumpers
- For Compound and Masterbatch production

Underwater pelletizing
- For Virgin Polymer, Compound and Masterbatch production

Drop pelletizing
- For waxes or low viscosity products
Pelletizing Process & Equipment Selection for Compounds and Masterbatches

Field of application

Dry cut with PRIMO / M-ASG / BAOLI or JSG

Underwater cut with SPHERO®

For pelletizing of
- PP + minerals, e.g. chalk, talcum, kaolin
- Technical polymers, e.g. ABS, PC, POM
- Polymer blends, e.g. PC+ABS, PPO+PS
- Masterbatches
- PP/PE + glass fiber (GF)
- PA + GF
- PET/PBT + GF
- Biopolymers
- and many other thermoplastics
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Pelletizing Process & Equipment Selection for Compounds and Masterbatches

From conventional up to automated performance

Principle
- Feed rollers grasp the dried strands
- The cut to pellets is done by cutting rotor and bed knife
Pelletizing Process & Equipment Selection for Compounds and Masterbatches

From conventional up to automated performance – overview

- **Conventional** strand pelletizing
- **Automated** (self threading), belt type strand pelletizing
- **Semi-automatic**, belt conveyor pelletizing system
From conventional up to automated performance – summary

**Conventional - WSG**
- For up to 50 strands or 2 t/h throughput rate
- For all kind of polymers
- Very flexible, low cost

**Automated - JSG**
- For up to 120 strands or 9 t/h throughput rate
- For specialized/reinforced compounds

**Semi-automatic - EBG**
- For up to 50 strands or 2 t/h throughput rate
- For highly filled, brittle, sensitive products
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### Types of dry cut strand pelletizers

The right dry cut strand pelletizer for each application!

<table>
<thead>
<tr>
<th>PRIMO E / BAOMO</th>
<th>PRIMO S / BAOLI</th>
<th>PRIMO Plus</th>
<th>M-ASG</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="PRIMO E/BAOMO" /></td>
<td><img src="image2" alt="PRIMO S/BAOLI" /></td>
<td><img src="image3" alt="PRIMO Plus" /></td>
<td><img src="image4" alt="M-ASG" /></td>
</tr>
</tbody>
</table>

- **PRIMO E / BAOMO**
  - PRIMO/BAOMO 60 (E) & 120 (E)
  - PRIMO 200 E
  - Bearing on one side
  - 100 - 1,500 kg/h
- **PRIMO S / BAOLI**
  - PRIMO/BAOLI 100
  - PRIMO/BAOLI 200
  - PRIMO/BAOLI 300
  - 500 - 3,000 kg/h
- **PRIMO Plus**
  - PRIMO Plus 100
  - PRIMO Plus 200
  - PRIMO Plus 300
  - PRIMO Plus 400
  - 800 - 5,000 kg/h
- **M-ASG**
  - M-ASG 600
  - M-ASG 900
  - 5.000 - 12,500 kg/h
## Types of dry cut strand pelletizers

For small throughputs and Masterbatch application

<table>
<thead>
<tr>
<th>PRIMO E / BAOMO</th>
<th>Most suitable for following application</th>
<th>In general</th>
</tr>
</thead>
</table>
| PRIMO/BAOMO 60 (E) & 120 (E) | - Standard products with fillers  
- Masterbatch  
- Recycling products  
- Biopolymers  
- Micro pellets (pellet dimensions ≤ 1 mm) - with specific installations  
- Elastomers - with specific installations | PRIMO E/BAOMO for small batch operations or laboratory applications.  
Simple access for cleaning and maintenance ensured by cantilevered bearing. |
| PRIMO 200 E | Bearing on one side | |
| 100 - 1,500 kg/h | | |
## Types of dry cut strand pelletizers

### Double-sided bearings for general purposes

<table>
<thead>
<tr>
<th>PRIMO S / BAOLI</th>
<th>Most suitable for following application</th>
<th>In general</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMO/BAOLI 100</td>
<td>- Standard products with fillers</td>
<td>PRIMO S/BAOLI for small to medium throughputs and for the most standard applications.</td>
</tr>
<tr>
<td>PRIMO/BAOLI 200</td>
<td>- Fiber Reinforced Compounds (e.g. GF)</td>
<td>Double-sided bearings assure a more constant cutting gap and greater robustness.</td>
</tr>
<tr>
<td>PRIMO/BAOLI 300</td>
<td>- Masterbatch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Recycling products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Biopolymers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Elastomers - with specific installations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 - 3,000 kg/h</td>
<td></td>
</tr>
</tbody>
</table>
## Types of dry cut strand pelletizers

### Highest robustness for high sophisticated application

<table>
<thead>
<tr>
<th>PRIMO Plus</th>
<th>Most suitable for following application</th>
<th>In general</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMO Plus 100</td>
<td>Standard products with fillers</td>
<td>PRIMO Plus for small to medium throughputs and more »challenging« products.</td>
</tr>
<tr>
<td>PRIMO Plus 200</td>
<td>Fiber Reinforced Compounds (e.g. GF or for LFT)</td>
<td>Double-sided bearings and highest robustness.</td>
</tr>
<tr>
<td>PRIMO Plus 300</td>
<td>Masterbatch</td>
<td>Easy exchange cutting head.</td>
</tr>
<tr>
<td>PRIMO Plus 400</td>
<td>Recycling products</td>
<td>The pelletizer for automatic systems (JSG).</td>
</tr>
<tr>
<td>PRIMO Plus</td>
<td>Biopolymers</td>
<td></td>
</tr>
<tr>
<td>PRIMO Plus</td>
<td>Micro pellets (pellet dimensions ≤ 1 mm)</td>
<td></td>
</tr>
<tr>
<td>PRIMO Plus</td>
<td>Elastomers</td>
<td>- with specific installations</td>
</tr>
</tbody>
</table>
# Types of dry cut strand pelletizers

The right dry cut strand pelletizer for each application!

<table>
<thead>
<tr>
<th>Type</th>
<th>PRIMO E / BAOMO</th>
<th>PRIMO S / BAOLI</th>
<th>PRIMO Plus</th>
<th>M-ASG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRIMO/BAOMO 60 (E) &amp; 120 (E)</td>
<td>PRIMO/BAOLI 100</td>
<td>PRIMO Plus 100</td>
<td>M-ASG 600</td>
</tr>
<tr>
<td></td>
<td>PRIMO 200 E</td>
<td>PRIMO/BAOLI 200</td>
<td>PRIMO Plus 200</td>
<td>M-ASG 900</td>
</tr>
<tr>
<td></td>
<td>Bearing on one side</td>
<td>PRIMO/BAOLI 300</td>
<td>PRIMO Plus 300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100 - 1,500 kg/h</td>
<td>500 - 3,000 kg/h</td>
<td>PRIMO Plus 400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>800 - 5,000 kg/h</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.000 - 12.500 kg/h</td>
<td></td>
</tr>
</tbody>
</table>
## Key differentiating features from customer perspective

<table>
<thead>
<tr>
<th>Feature</th>
<th>Customer benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Shortest unguided length</td>
<td>1 Ensures best pellet quality</td>
</tr>
<tr>
<td>• Very fast cleaning possible</td>
<td>2 Guarantees less downtime / highest product yield</td>
</tr>
<tr>
<td>• High value materials</td>
<td>3 Heavy-duty construction design for a long lifetime</td>
</tr>
<tr>
<td>• Easy cutting head exchange</td>
<td>Maximum machine availability for PRIMO Plus / ASG</td>
</tr>
<tr>
<td>• Sound insulation</td>
<td>Very efficient for values below 85 dB(A)</td>
</tr>
<tr>
<td>• Service network</td>
<td>Reliable worldwide service available</td>
</tr>
<tr>
<td>• Experiences &amp; References</td>
<td>No. 1 in the world - see attached Ref. file!</td>
</tr>
</tbody>
</table>

Approx. 3,000 references in Asia!
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**Cost Savings Techniques**

- Dry cut strand pelletizing systems
- Types of dry cut strand pelletizers
- Possibilities with underwater pelletizing
- Customized solutions

- Criteria to select on which pelletizing process is the most suitable one for my application

- Summary
Possibilities with underwater pelletizing

Process overview

Key:
1 Start-up valve
2 Die plate
3 Cutting chamber
4 Motor with cutting head
5 Pellets carried by process water
6 Centrifugal dryer
7 Process water treatment

Amongst others:
For highly filled and brittle products
Possibilities with underwater pelletizing

Streamlined cutting chamber and turbine-like design of the cutting head

**Principle**
- Hot melt comes out from a die
- The cut to pellets is done underwater directly afterwards
Possibilities with underwater pelletizing

Overview of SPHERO’s product family to be used for compounding

- **SPHERO® 50**
  - Operating throughput up to 400 kg/h (filled polymers: up to 600 kg/h)

- **SPHERO® 70/100/140**
  - Operating throughput up to 8,600 kg/h

- **SPHERO® S 100/140**
  - Operating throughput up to 3,000 kg/h
Possibilities with underwater pelletizing

Overview of product family

SPHERO® 50
- Operating throughput up to 400 kg/h
  (filled polymers: up to 600 kg/h)

SPHERO® 70/100/140
- Operating throughput up to 8,600 kg/h

SPHERO® S 100/140
- Operating throughput up to 3,000 kg/h

Example:
Pellet dryer with process water system
Possibilities with underwater pelletizing

SPHERO S: First presentation at the Chinaplas 2014

Applications:
Compounding/Masterbatch/Recycling
based on:

- Polyolefins, e.g. LDPE, HDPE, PP
- Styrene polymers, e.g. PS, SAN, ABS
- Acrylic resins, e.g. PMMA, APN
- Polyesters, e.g. PET
- Polyamides, e.g. PA 6, PA6.6
- Polyurethanes, e.g. TPU
- Hot-melt adhesives
- and other...

Fillers as CaCO₃, fly ash, talc, chalk, TiO₂, carbon black, wollastonite and other inorganic materials are used.
Additionally pigments and other additives or stabilizers are possible.

Throughput: ≈ 700 - 3,000 kg/h
Pellet size: ≈ 2.5 - 5 mm
Possibilities with underwater pelletizing

Choice of process water treatment

- Compact construction with key components (pumps, water tank, heat exchanger, etc.) tailored to application needs

- Water filtration unit available with choice of
  - inclined screen,
  - drawer filter,
  - curved sieve or
  - automated vibration filter sieve
### Choice of pellet dryers

- Wide choice of dryers from three product families
  - Most effective and economical drying system can be selected for each individual application

- **AERO impact dryer** provides gentle drying, e.g. for products which tend to generate dust

- **CENTRO centrifugal dryer** is ideally suited for standard underwater pelletizing applications

- **DURO belt dryer** avoids movement of pellets against dryer components, thus preventing abrasion, e.g. for abrasive or sensitive products

### Impact and centrifugal dryers

- For brittle products
- For standard application

### Belt dryer

- For glass fiber reinforced products
### Key differentiating features from customer perspective

<table>
<thead>
<tr>
<th>Feature</th>
<th>Customer benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Frame-mounted construction</td>
<td>1 Easy access to all components</td>
</tr>
<tr>
<td>• Streamlined cutting chamber</td>
<td>2 Pellets flow quickly out, avoid clumping</td>
</tr>
<tr>
<td>• Knife head in turbine-like design</td>
<td>3 8 mm knife wear zone, no knife turning necessary</td>
</tr>
<tr>
<td>• Cutting head pressure</td>
<td>Automatic control or manually adjusted</td>
</tr>
<tr>
<td>• Easy, rapid start-up</td>
<td>Less product loss, high productivity</td>
</tr>
<tr>
<td>• Choice of pellet dryers</td>
<td>Wide range of centrifugal, impact or belt dryers</td>
</tr>
<tr>
<td>• Improved energy efficiency</td>
<td>Reduced operating costs</td>
</tr>
<tr>
<td>• Quality product, quality service</td>
<td>German craftsmanship, worldwide service network</td>
</tr>
</tbody>
</table>
Pelletizing Process & Equipment Selection for Compounds and Masterbatches

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Customized solutions
- Criteria to select on which pelletizing process is the most suitable one for my application

Summary
Customized solutions –
Dry cut strand pelletizing

Micro pellets and LFT application – by different cutting rotors

<table>
<thead>
<tr>
<th>Micro pellets</th>
<th>120 teeth</th>
<th>Normal pellets</th>
<th>30 teeth</th>
<th>Long pellets</th>
<th>6 teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellet length</td>
<td>&lt; 1mm</td>
<td>Pellet length of approx.</td>
<td>1.5 - 5 mm</td>
<td>Pellet length of approx.</td>
<td>12 - 15 mm</td>
</tr>
</tbody>
</table>

Micro pellets 120 teeth
Pellet length < 1mm

Normal pellets 30 teeth
Pellet length of approx. 1.5 - 5 mm

Long pellets 6 teeth
Pellet length of approx. 12 - 15 mm
Customized solutions – Dry cut strand pelletizing

Soft polymer kit for elastic/rubberlike products – e.g. TPE or TPU

- Designed to use with all kind of dry cut strand pelletizers; for soft and rubberlike polymers, such as thermoplastic elastomers, soft PVC and PU
- The kit ensures a better guiding of the flexible strand towards the cutting spot and hence it provides a good pellet quality (avoids an oblique cut)
- Just modify cutting rotor, cutting ledge and strand inlet part
- Allow strand pelletizing down to a hardness of approx. 60 shore A or even less
Customized solutions – Underwater pelletizing

Micro pellets

- Micro pellets with dimensions of 0.5 mm and smaller (depending on product)
- Change of die plate, screens of water separator, dryer, classifier
- Melt pump required

<table>
<thead>
<tr>
<th>Product</th>
<th>Pellet dia.</th>
<th>Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET + UV stab.</td>
<td>0.8</td>
<td>300</td>
</tr>
<tr>
<td>EPS</td>
<td>0.5</td>
<td>400</td>
</tr>
<tr>
<td>PE</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>HDPE</td>
<td>0.8</td>
<td>20 - 200</td>
</tr>
<tr>
<td>PVC</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>TPU</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>TPE</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>0.6</td>
<td>25</td>
</tr>
</tbody>
</table>

References for productions lines for spherical micro pellets
Customized solutions – Underwater pelletizing

**Belt dryer** for abrasive and sensitive products – e.g. GF filled products

- Designed to use with underwater pelletizers *(instead of a centrifugal dryer)*; for brittle pellets – e.g. with high chalk compositions – and abrasive pellets – e.g. **polyamide with 50% glass fibers** and more

  - Efficient and gently drying thus higher production yield and less dust compared to conventional types of pellet dryers
  - Pellets with extremely low residual moisture of < 0,1 wt % can be produced

- **Nearly no wear during operation**
  - Leads to highest machine availability and cost reductions for cleaning and repair
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- Summary
### Selection criteria: Comparison of the pellet shapes

<table>
<thead>
<tr>
<th>Process</th>
<th>Underwater pelletizing</th>
<th>Strand pelletizing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellet shape</td>
<td>Spherical</td>
<td>Cylindrical</td>
</tr>
<tr>
<td>Bulk density</td>
<td>+ ~ 10 % higher</td>
<td>-</td>
</tr>
<tr>
<td>Fines / dust</td>
<td>+ ~ 10 % less</td>
<td>-</td>
</tr>
<tr>
<td>Behavior during heating up or cooling down</td>
<td>+ Point contact thus less sticking tendency</td>
<td>- Surface contact thus higher sticking tendency</td>
</tr>
<tr>
<td>Pellet size distribution</td>
<td>- ± 15 %</td>
<td>+ ± 5 %</td>
</tr>
<tr>
<td>Influence to polymer respectively to the process</td>
<td>- Pressure drop $\Delta p &gt; 60$ bar due to smaller bore diameters at the die plate, thus higher temperatures inside the melt, thus higher shear rate</td>
<td>+ Pressure drop $\Delta p &lt; 30$ bar</td>
</tr>
</tbody>
</table>
### Selection criteria: Comparison of the processes

#### Criteria for the selection of the »right« pelletizing system

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer demand</strong></td>
<td>- Which product/pellet shape is desired from the customer of our customer?</td>
<td>+</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>- Are there already systems existing? How often are product changes?</td>
<td>+</td>
</tr>
<tr>
<td><strong>Local conditions</strong></td>
<td>+ Less required space with underwater pelletizer!</td>
<td>-</td>
</tr>
<tr>
<td><strong>Invest</strong></td>
<td>- Less with conventional strand pelletizing WSG, same level with all automatic systems</td>
<td>+</td>
</tr>
<tr>
<td><strong>Manpower</strong></td>
<td>+ More necessary with conventional strand pelletizing, but more professional skill required with underwater pelletizing</td>
<td>-</td>
</tr>
<tr>
<td><strong>Emission / Immission</strong></td>
<td>+ Better with underwater pelletizing because it's a closed system!</td>
<td>-</td>
</tr>
<tr>
<td><strong>Wear costs</strong></td>
<td>- Depends on product: standard + for underwater, GF-filled + for strand pelletizing</td>
<td>+</td>
</tr>
<tr>
<td><strong>Product characteristics</strong></td>
<td>- Which fillers/reinforcements are used? Is the product e.g. water sensitive?</td>
<td>+</td>
</tr>
<tr>
<td><strong>LCC/Cost of ownership</strong></td>
<td>- Life Cycle Cost calculation would be great. Not easy to get all figures!</td>
<td><a href="http://world-class-manufacturing.com/LCC/lcc_calculation.html">http://world-class-manufacturing.com/LCC/lcc_calculation.html</a></td>
</tr>
</tbody>
</table>

*Source: automatik pelleting systems*
### Selection criteria: Comparison of the processes

Product characteristics influence the selection of the pelletizing system decisively

- **PE/PP + 50 - 80% fillers**
  - UWP

- **PA6 + 30 - 50% GF – avoid damage of machine parts**
  - Wear resist. versions required: WSG, JSG, EBG, (UWP)

- **Product sensitive to moisture / Biopolymers**
  - EBG (belt type strand pelletizing) with air cooling

- **Shear sensitive melt**
  - WSG, JSG, EBG

- **Masterbatch with small production lots which means frequent product change required**
  - WSG with PRIMO E pelletizer (cantilevered design)
### Selection criteria: Comparison of the processes

<table>
<thead>
<tr>
<th>Type of polymer</th>
<th>System preferred: Underwater</th>
<th>Strand</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compounds with additives and fillers &gt; 50 %</td>
<td></td>
<td>X</td>
<td>Preferred system for high viscosity polymers or polymers with fillers is UWP. Often polymer is too brittle to be drawn with a conventional strand pelletizing system.</td>
</tr>
<tr>
<td>Compounds with additives and fillers</td>
<td>X</td>
<td>X</td>
<td>Both systems can be used.</td>
</tr>
<tr>
<td>Compounds with GF reinforcements &lt; 30 %</td>
<td>X</td>
<td>X</td>
<td>Both systems can be used.</td>
</tr>
<tr>
<td>Compounds with GF reinforcements &gt; 30 %</td>
<td></td>
<td>X</td>
<td>Preferred system for high reinforced abrasive polymers is strand pelletizing especially JSG for higher throughput because of excessive wear and higher moisture at UWP.</td>
</tr>
</tbody>
</table>
### Selection criteria: Comparison of the processes

<table>
<thead>
<tr>
<th>Type of polymer</th>
<th>System preferred:</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot sizes 5,000 kg and higher</td>
<td>Underwater ☒</td>
<td>Mostly just for black or white Masterbatch production recommendable.</td>
</tr>
<tr>
<td>Small lot sizes or &lt; 5,000 kg</td>
<td>Strand ☒</td>
<td>The strand pelletizing system is much more easier &amp; faster to clean compared to an UWP system – and this cleaning time = downtime – is decisive for the choice!</td>
</tr>
<tr>
<td>Throughput rate &gt; 1,000 kg/h</td>
<td>☒</td>
<td>Both systems can be used.</td>
</tr>
<tr>
<td>Throughput rate &lt; 1,000 kg/h</td>
<td>☒</td>
<td>In most cases a conventional strand pelletizing system is the lower invest and allows more flexible product changes.</td>
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</tbody>
</table>
The right equipment selection = Cost Savings Techniques is decisive to achieve the maximum level of profitability!

- Pelletizing systems are available in a wide range of variations and should be adapted exactly to the product to be pelletized.

- The right selection – either with strand or with underwater pelletizers – provides
  - higher product yields,
  - less operator actions,
  - better product quality

which results in »earning more money«

⇒ We are able to consult objectively and we would be more than happy to assist you and to be your partner!
Investment versus life-cycle-costs or the »Iceberg Principle«

»Cheap is always expensive!«

10 - 30 %
= part of the life cycle costs for a machine/pelletizer

70 - 90 %
= Follow-up costs

First impression:
The pellet quality which satisfy your customer!

- Planning
- Invest
- Down time
- Product loss
- Quality costs
- Energy
- Maintenance
- Spare parts
- Operators
- Upgrades
- …
Investment versus life-cycle-costs or the »Iceberg Principle«

Machine Availability Calculation

<table>
<thead>
<tr>
<th>#</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tbody>
<tr>
<td>1</td>
<td>Automatik's dry cut strand pelletizer versus competition - Calculation sheet for machine availability</td>
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<td>2</td>
<td>Comparison of Automatik (APU) dry cut strand pelletizing systems PRIMO/SARLA/BAOMO and strand pelletizers of competitors</td>
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<td>3</td>
<td>Dry cut strand pelletizer of competitor</td>
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<td>4</td>
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<td>5</td>
<td>System availability: 80% Standard: 0% Yearly calculation: 0 Production hours/day</td>
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<td>6</td>
<td>Total production rate: 0 kg/d</td>
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<td>7</td>
<td>Sales price per kg material: 0.00 EUR/kg Exchange rate: 0.125</td>
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<td>8</td>
<td>Turnover: 0 EUR</td>
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<tr>
<td>10</td>
<td>PRIMO/SARLA/BAOMO of Automatik</td>
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<td>17</td>
<td>Result of this difference in system availability per time</td>
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<td>Yearly calculation based on: 0 Hours per year</td>
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<td>Results in:</td>
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<td>20</td>
<td>- more production: 0.00 h</td>
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<td>21</td>
<td>- more turnover: 0 EUR per machine</td>
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<tr>
<td>23</td>
<td>Just by 1,00% higher machine availability!</td>
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</tbody>
</table>

Low-cost machine

High-quality machine

Result = more product
Result = more turnover

= more turnover
Pelletizing Process & Equipment Selection for Compounds and Masterbatches

Thank you!

Andreas Weidner
Sales Director Pelletizing - Greater China, Philippines, Vietnam
26/28 May, 2015