PELLETIZING TECHNOLOGY
EXTRUSION AND SPHERONIZATION

HOSOKAWA ALPINE Compaction
A Division of HOSOKAWA ALPINE Aktiengesellschaft
With the technologies of low-pressure extrusion and spheronization, cylindrical, rounded and spherical pellets are produced for versatile applications in the fields of:

- **Pharmaceutical**
- **Food**
- **Chemical**

Powdery or pasty feed materials are softly transformed to dustfree pellets with the required appearance.

**Materials of Construction, Finishes**

Although all of the product contact parts of the gear pelletizer series, the BEXTRUDER series and the BEXROLLER series are constructed from stainless steel, you can request custom construction from other materials such as Hastelloy.

The following finishes are available:
- Bead blasted finish
- Brush finished
- Mechanically and electropolished

**Drives/Electrics**

For the drives usually gear motors with frequency converters are used. The standard design of the motors is IP 54/IP65.

The machines are suitable for ATEX zones 1 and 21.
**Gear Pelletizer AGF**
Extrusion of stable cylindrical pellets
- Conical feed chamber
- Counter rotating gear tooth type rolls
- Nozzle bores between the teeth with various sizes and profiles
- Even product integrity

**Applications**
- Improvement of handling and metering properties
- Dust-free cylindrical pellets
- Smooth surface
- High pellet stability

Pages 4 - 5

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**BEXTRUDER ABX**
Soft product densification
- Cylindrical extrusion chamber
- Counter rotating rotors
- Mixing and densification
- Screen baskets with different perforations and wall thicknesses

**Applications**
- Improvement of handling and dosing properties
- Low dust cylindrical pellets with large surface
- Good deformation properties
- Low densification
- Loose structure, good solubility

Pages 6 - 7

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**BEXROLLER ABR**
Rounding from pellet to sphere
- Spheronization
- Rotating disc with various surface
- Intense rolling movement of granules
- Gap purge air

**Applications**
- Optimum flowing, dosing and handling properties
- Rounding of pellets or forming of spheres
- Pellets of uniform size, shape and surface
- Dust-free, attrition resistant product
- Narrow particle size distribution

Pages 8 - 9

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**Pelletizing Processes**
- Batch process
- Continuous process
- Batch-continuous process
- Multiple-stage arrangements
- Process with aeration and size reduction

Page 10

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**ALPINE Technology**
- Technical testing center
- Customer site visits and seminars
- Manufacturing
- Research and design
- Systems design
- Feedback and control systems
- Automation
- Validation

Page 11

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**Product Types**
- Flakes
- Granules
- Briquettes
- Pellets
- Spherical granules

Page 12
Gear Pelletizer AGF
Extrusion of stable cylindrical Pellets

Gear pelletizer with cantilevered shafts and gasketed cover for dust-free operation

The Working Principle
Below the feeding hopper a pair of gear type toothed rolls are counter rotating. Product is pulled in by the rolls and pressed through nozzle bores which are situated between the teeth. In the press channels the product is densified into cylinder shaped pellets. The pellets emerge at the inside of the hollow gear type toothed rolls.

The Construction
In most cases, gravity force feeding is sufficient. For extremely bad flowing products agitating elements are installed in the feed hopper. A special feed hopper with an agitator designed like a screw is used for viscoplastic feed materials.

The rolls are sealed at both sides by cheek plates against lateral material escape. For the same working principle according to the case of application the optimum roll bearing is used. The model AGF-GMS uses mill shafts, and the model AGF-GCS has cantilevered shafts.

For improvement of product discharge inside the hollow rolls, adjustable cutting knives are installed, which are easily accessible.

A gasketed cover ensures dust-free operation and is especially suitable when purging is done with inert gas or solvents are present.

a Pair of rolls with press nozzles bored in solid extrusion rolls
b Pair of rolls with nozzle inserts
Toothed Rolls and Nozzle Plates
Press rolls can be designed with nozzles bored in solid extrusion rolls or with exchangeable nozzle inserts. If at product changeover a different nozzle geometry is necessary, the nozzle inserts are easily and quickly changed.
Densification is determined by the relation of nozzle diameter to nozzle length. Through counterbores the nozzle length can be shortened. The appropriate choice of the press rolls, tooth shape, nozzle diameter and nozzle length depends on the charged material and on the required product properties.

The Product
The pellet diameter is determined by the diameter of the press channel. With gear type pelletizing machines stable cylindrical pellets with a diameter range of 1 to 10 mm can be produced. The cylindrical pellets dispose of a smooth surface, a constant diameter and are only

Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>Drive</th>
<th>Roll</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGF-GCS 200</td>
<td>4.0-7.5</td>
<td>200</td>
<td>40-100</td>
</tr>
<tr>
<td>AGF-GCS 300</td>
<td>18,5</td>
<td>300</td>
<td>80-120</td>
</tr>
<tr>
<td>AGF-GMS 200</td>
<td>11,0</td>
<td>200</td>
<td>80-100</td>
</tr>
<tr>
<td>AGF-GMS 300</td>
<td>22,0</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>AGF-GMS 300</td>
<td>30,0</td>
<td>300</td>
<td>2 x 200</td>
</tr>
</tbody>
</table>

Usual nozzle design
1  Press nozzles bored in solid extrusion rolls
2  Press nozzles bored in solid extrusion rolls, shortened by counterbores
3  Nozzle inserts with short length (small L/D ratio)
4  Nozzle inserts with large length (high L/D ratio)
Principle of Operation
In the product chamber of the machine two rotors are counter rotating. The upper rotor with inclined positioned baffle plates provides for a good mixture and conveys the material evenly downwards. The lower rotor is designed with bent arms. This rotor densifies the material and conveys it through the cylindrical screen basket.

Machine and Construction
The speeds of the rotors are adjustable, independent from each other. For the optimum process adjustment the lower rotor is equipped with a measurement of torque.

The drive is situated according to the application below or above the product chamber in a closed housing. When the drive is positioned below the extrusion chamber, the product discharge can be effected with a vibrating chute or with a rotating disc. With a drive above the product chamber the product falls freely downwards to the next process step.

Rotor Exchange and Cleaning
The rotors have plug connections to the drive shafts. Rotors and basket screen cylinders are very accessible and can be easily changed. The BEXTRUDER can be cleaned and retrofitted in a very short time.
**Technical Data**

<table>
<thead>
<tr>
<th>Model</th>
<th>Drive kW</th>
<th>Throughput</th>
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<tbody>
<tr>
<td>ABX 150</td>
<td>3</td>
<td>1 - 300 kg/h</td>
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<tr>
<td>ABX 300</td>
<td>8</td>
<td>200 - 800 kg/h</td>
</tr>
<tr>
<td>ABX 450</td>
<td>11</td>
<td>400 - 1600 kg/h</td>
</tr>
<tr>
<td>ABX 600</td>
<td>17</td>
<td>800 - 3200 kg/h</td>
</tr>
</tbody>
</table>

**Accessories**
- Different rotors
- Screen baskets with different hole diameters and different wall thicknesses
- Outside rotating cutting knife
- Vibration discharge chute
- Rotation disc for product discharge
- Blow-off ring for product cooling and separation

**The Product**
Product extruded with the BEX-TRUDER has a loose structure with large surface area and good deformation properties. The diameter of the cylindrical pellets can range from 0.3 to 3 mm. The product exhibits good dispersion, compression and dissolution properties.
The Machine
In the cylindrical product chamber a horizontal disc is rotating. The drive with frequency converter and electric control enables exact speed regulation. For fast cleaning the disc can easily be exchanged. A gap air purge prevents the product from reaching the area below the disc. The purge air quantity is adjustable and can be adapted to assist optimum product movement.

Accessories
- Discs with different surfaces and profiles
- Jacketed product chamber
- Profiled product chamber wall
- Pneumatically operated discharge
- Height adjustable weir for continuous product discharge
- Cascade arrangement
- PLC
**The Product**

The pellets perform intense rotating and rolling movements in the product chamber. With increasing spheronization time the pellets round off and are transformed, if the material disposes of good deformation properties, to perfect spheres with smooth surface and narrow particle size distribution. The product is dust-free.

**Technical Data**

<table>
<thead>
<tr>
<th>Model</th>
<th>Drive kW</th>
<th>Quantity appr. dm³ *</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABR 150</td>
<td>0,55</td>
<td>0,1 - 0,4</td>
</tr>
<tr>
<td>ABR 300</td>
<td>1,5</td>
<td>0,3 - 1,5</td>
</tr>
<tr>
<td>ABR 450</td>
<td>4,0</td>
<td>2 - 10</td>
</tr>
<tr>
<td>ABR 600</td>
<td>7,5</td>
<td>5 - 25</td>
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<tr>
<td>ABR 750</td>
<td>11</td>
<td>6 - 30</td>
</tr>
<tr>
<td>ABR 900</td>
<td>15</td>
<td>20 - 100</td>
</tr>
</tbody>
</table>

* depend on product

Alteration of the pellet shape during spheronization dependent on time

![Diagram showing the alteration of the pellet shape during spheronization](image)

\[ \psi^2 = 4\pi A / U^2 \]
Pelletizing Processes
Versatile Process Technology

Production of cylindrical pellets with short length of temperature sensitive product

Dosing
Mixing
Humidification
Extrusion
BEXTRUDER
GCS
Spheronization
BEXROLLER
Drying
Coating

Pelletizing
GCS

Cooling, separating, aeration

Size reduction
BEXMILL

Screening

Dust recovery

1. Pellet breakage
Dust agglomeration
Spheronization

2. Spheronization
Dust agglomeration

3. Spheronization
Polishing

Spheronization 3-step continuous and batch
The ALPINE Test Center
Extensive know-how is available in the BEPEX test center to provide technical and economical solutions. Customer tests are performed daily in our testing facilities - a laboratory for pharmaceutical applications as well as a test center providing both the complete machine equipment and a pilot plant used for scale-up of processing plants. Our analytical lab can quickly analyse the product. The results of our tests are not only the production of samples or machine configurations but also an individual system design and complete process engineering for your needs.

Development and Design
To accommodate our technology to your application we use modern CAD and our own fabrication. We develop and manufacture new machines, plants and processes to be able to produce granules with specially tailored properties. Due to the intensive and world-wide cooperation especially with sister companies and research institutes we have a high development potential at our disposal, which we can offer for your application.

Control and Automation
Process Logic Control (PLC) is standard and can easily be interfaced with other main process control and data logging systems on your plant. Our COMPACT CONTROL enables process automation and visualisation including process monitoring, data gathering and diagnosis of errors.

Validation
We can validate both machines and plants according to your given standards (IQ and OQ validation).

Extrusion test with subsequent spheronization to determine form-factors and required spheronization time.
HOSOKAWA ALPINE
Agglomeration Technology
We bring your powder into shape

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The ALPINE Technologies
Machines and complete plants for
- Compaction
- Briquetting
- Granulation
- Size reduction
- Pelletizing
- Extrusion
- Spheronization

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