**Grinding**

**Dry process, Coarse grinding : Product size some dozens mm to some hundreds μm**

<table>
<thead>
<tr>
<th>Low Speed Shearing Screen Type Grinder</th>
<th>Low Speed Shearing Screen Type Grinder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Alpine Rotoplex Ro</td>
<td>Hosokawa/Alpine Compact Line CL</td>
</tr>
<tr>
<td>■ Durable casing structure made from cast iron.</td>
<td>■ Rotors in patented Alpine cross-scissor-cut technology.</td>
</tr>
<tr>
<td>■ Designed for easy cleaning and easy exchange of screens/cutters.</td>
<td>■ Robust framework construction in “triple-frame” technology.</td>
</tr>
<tr>
<td>■ Able to grind resin molded inferior goods of various shapes and sizes.</td>
<td>■ Electro-hydraulic dual opening system for mill top section and screen support for fast and comfortable access to rotor and grinding chamber.</td>
</tr>
<tr>
<td>■ Able to grind freshly molded high temperature scraps.</td>
<td>■ Gap elimination/minimization for optimal cleaning.</td>
</tr>
<tr>
<td>■ Cooling air and water are not needed due to its unique structure that is compatible to the high-speed rotor.</td>
<td>■ Machine sizes from 30 kW to 500 kW.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Type Screen Mill</th>
<th>Low Speed Shearing Model Screen Type Shredder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Micron Hammer Mill H, Hammer Breaker HB</td>
<td>Hosokawa/Gericke Nibbler NBS</td>
</tr>
<tr>
<td>■ When used as a grinding machine to powderize small lumps of materials, the Hammer Mill has a high capacity and only needs minimal auxiliary facilities, making it a very efficient machine.</td>
<td>■ The Raw Material can be easily fed into the machine due to its wide inlet.</td>
</tr>
<tr>
<td>■ Has a durable and simple structure.</td>
<td>■ The inlet and outlet are concentric on a plane, allowing for easy positioning.</td>
</tr>
<tr>
<td>■ Parts where wearing could take place can be easily replaced and the running cost is low.</td>
<td>■ Product sizes can be easily adjusted by switching screens.</td>
</tr>
<tr>
<td>■ Product sizes can be easily adjusted by exchanging the screens/grates through the side cover.</td>
<td>■ Due to the unique design of the screen, the residence time is short and generation of fines is minimized.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disintegrator</th>
<th>Coarse grinding for rubber bale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Rietz Disintegrator RD, RH, RA/RP, RI</td>
<td>Hosokawa/Rietz Rubber Chopper PB</td>
</tr>
<tr>
<td>■ Coarse grinding machine that can be widely applied to various industries such as the food industry for processing vegetables, fruits, fish meats, as well as chemicals, plastics (resins), pharmaceuticals, etc.</td>
<td>■ Generates a very large torque, with durable design.</td>
</tr>
<tr>
<td>■ It can perform dry milling or wet milling depending on the application.</td>
<td>■ Low abrasion and noise level due to operation at low rotation speeds.</td>
</tr>
<tr>
<td>■ The rotor is set onto a vertical, horizontal, or angled driving shaft.</td>
<td>■ Low required power level.</td>
</tr>
<tr>
<td>■ All models are structured in a manner for easy assembly, disassembly, and cleaning.</td>
<td>■ The temperature increase of the product is low, with minimal effect to the product quality.</td>
</tr>
<tr>
<td></td>
<td>■ Easy maintenance.</td>
</tr>
</tbody>
</table>

**Wet process (Emulsifying, Ultra fine grinding)**

<table>
<thead>
<tr>
<th>Wet Homogenizer</th>
<th>Wet Process Agitated Ball Mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Micron Disperse Mill D</td>
<td>Hosokawa/Alpine Hydro-Mill AHM</td>
</tr>
<tr>
<td>■ Uniform homogenization.</td>
<td>■ Easy Disassembly and Cleaning.</td>
</tr>
<tr>
<td>■ Easy adjustment.</td>
<td>The mill is equipped with either a stationary or mobile support unit that guarantees a simple disassembly procedure for cleaning and maintenance.</td>
</tr>
<tr>
<td>Depending on the material desired gap can be easily adjusted.</td>
<td>■ Wear protection. For the application which require special care for metal contaminations, the agitator disc and liner pipe can be coated with either high-grade ceramics or tungsten carbide. A mono-block ceramics structure is possible as well.</td>
</tr>
<tr>
<td>■ Recycling operation.</td>
<td></td>
</tr>
<tr>
<td>■ Compact and high capacity.</td>
<td></td>
</tr>
<tr>
<td>■ Oil bath lubrication, stainless steel material on liquid contact part.</td>
<td></td>
</tr>
<tr>
<td>■ Easy to handle, maintain and inspect.</td>
<td></td>
</tr>
</tbody>
</table>
Dry process, Fine grinding: Product size some hundreds μm to some dozens μm

**Screen Type Fine Impact Mill**

Hosokawa/Micron

Feather Mill FM, FM-P

- The particle size can be easily adjusted by changing the hammer rotation speed as well as the screen size.
- The Feather Mill is a suitable grinder for a wide variety of materials including heat sensitive ones.
- The pressure loss of the machine is very low, making it easy to incorporate the machine into any process line.

Impact Type Screen Model Fine Grinding Mill

Hosokawa/Mikro

Pulverizer AP

- Continuous operation allows for high capacity milling of a wide range of materials.
- Particle top size can be easily controlled by changing the retainer screen.
- Designed for quick disassembly for cleaning and maintenance.
- Durable construction for long service life.
- AP-B, AP-1, and AP-2 models can be operated on its own by attaching air relief filters, allowing for easy operation.

**Impact Type Air Classifying Mill**

Hosokawa/Mikro


- By changing the air volume and classifying rotor speed, the particle size can be easily adjusted. This allows the operator to change product sizes during operation as well.
- Effective impact grinding for heat sensitive materials possible.

Impact Type Air Classifying Mill

Hosokawa/Mikro

E-ACM

- Enhanced model from the ACM for the effective grit reduction in the carbon black.
- All raw material flows through the grinding chamber without short pass.
- Recycle grinding of classified material.
- The grinding unit is normally incorporated into the carbon black process line as an in-line unit.

**Impact Screen Type Fine Grinding Mill**

Hosokawa/Micron

Victory Mill VP

- Due to its short residence time, generations of fines are minimized leading to a sharp and uniform particle distribution.
- The area ratio of the liner and screen can be adjusted to best suit the material specifications.
- It has a simple structure making maintenance very easy.
- Ideal for grinding heat sensitive materials such as synthetic resin and foodstuffs.

Impact Type Fine Grinding Mill with Pin Discs

Hosokawa/Alpine

Contraplex CW

- The wide grinding chamber structure allows generated heat to be discharged efficiently and prevents adhesion buildup.
- The high relative speeds generated by the two pin discs allow fine grinding.
- The strong impact generated by the pin discs allow an equally ground mixture made up by more than one substance.
- Ideal for raw materials with Mohs hardness 3 and lower.

**Impact Type Fine Grinding Mill**

Hosokawa/Alpine

Fine Impact Mill UPZ

- Wide range of flexible and interchangeable size reduction media to fulfill a host of different requirements for medium fine end product sizes.
- Simple grinding structure for easy assembly and disassembly.
- CIP/SIP compliant model available.
- The 100UPZ-c, manufactured specifically for pharmaceutical applications, can be easily disassembled for cleaning and is GMP compliant.

***Cryogenic Grinding Unit***

Hosokawa/Micron

Linrex Mill LX

- Materials that are difficult to grind at normal temperatures can be easily ground.
- Can produce particles with high flowability and acute angle shapes.
- Deterioration due to heat and oxidation, as well as flavor and aroma loss of foodstuff and spices are prevented.
- Can prevent odor, dust explosion, combustion, and noise that are accompanied with grinding.

**High Performance Cooling Type Mechanical Mill**

Hosokawa/Micron

Glacis GC

- Ultra-fine grinding of heat-sensitive materials
- Suitable for grinding heat-sensitive resins due to its high cooling efficiency. When grinding toner, the Glacis can produce products with the same average particle size (approximately 5μm) as products produced by jet mills.
- Energy-saving.
- Superior cooling efficiency.
- Compact design of the unit and system.
- Production scale test units.

**Three-in-one mill**

Hosokawa/Mikro

UMP Universal Milling System

- It is designed to suit the multiple application needs of the pharmaceutical and food industries.
- It can meet the requirements for coarse granulation to ultra fine grinding with particle size distribution control as well.
- Operators can quickly change grinding elements for different applications.
- Pins for ultra-fine grinding, Impact Hammers for fine grinding or Knife rotor for coarse grinding and granulation.
## Grinding

### Dry process, Ultra-Fine grinding : Product size some μm to some hundreds nm

#### Attrition Type Ultra Fine Mill

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Micron MEC,M</td>
<td>Grinding mechanism that utilizes the 3 largest grinding principles. (Impact, Shearing, Attrition)</td>
</tr>
<tr>
<td></td>
<td>Space saving: 65% more compact compared to past models. (Compared as a whole system)</td>
</tr>
<tr>
<td></td>
<td>Equipped with contaminant separation mechanism.</td>
</tr>
<tr>
<td></td>
<td>The Super Micron Mill M model uses the same attrition grinding mechanism as the renewed MEC model.</td>
</tr>
</tbody>
</table>

#### Impact Type Ultra Fine Grinding Mill

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Micron INN</td>
<td>High grinding capabilities. For example, in the case of grinding toner, 30-50% cost reduction (comparing energy consumption ratio) can be expected relative to conventional jet mills.</td>
</tr>
<tr>
<td></td>
<td>For high grade, high added value of products.</td>
</tr>
<tr>
<td></td>
<td>Easy particle size control.</td>
</tr>
<tr>
<td></td>
<td>Easy Maintenance and Inspection.</td>
</tr>
<tr>
<td></td>
<td>Wide variety of designs.</td>
</tr>
</tbody>
</table>

#### Jet Mill

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Alpine AFG, AFG-R, AFG-CR</td>
<td>CR ultra fine classifier is integrated in AFG for milling down below one micron.</td>
</tr>
<tr>
<td></td>
<td>The classifying wheel is designed on basis of the forced and the semifree vortex theory, resulting in sub-micron classification.</td>
</tr>
<tr>
<td></td>
<td>Combining with opposed jet mill technology,</td>
</tr>
<tr>
<td></td>
<td>Ceramics classifying wheel for metal free product is available.</td>
</tr>
<tr>
<td></td>
<td>Scale-up with multi-wheel classifier.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Alpine</td>
<td>High precision of cut.</td>
</tr>
<tr>
<td>Fluidized Bed</td>
<td>Suitable for toner grinding.</td>
</tr>
<tr>
<td>Opposed Jet Mills</td>
<td>Good accessibility for cleaning to minimize the downtime during a color change.</td>
</tr>
<tr>
<td>TFG</td>
<td>- A hydraulic mechanism permits the classifier head to be raised and then swung off to the side through 180°.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Micron MJT</td>
<td>Target(impact) type jet mill.</td>
</tr>
<tr>
<td></td>
<td>High grinding efficiency.</td>
</tr>
<tr>
<td></td>
<td>Easy adjustment of product size.</td>
</tr>
<tr>
<td></td>
<td>Highly precise classification possible as ground particles enter the classifying zone in highly dispersed conditions.</td>
</tr>
<tr>
<td></td>
<td>Easy Cleaning.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Alpine AS</td>
<td>Simple structure without rotating parts.</td>
</tr>
<tr>
<td></td>
<td>Unique grinding mechanism, which prevents coarse materials from entering the product.</td>
</tr>
<tr>
<td></td>
<td>Ability to grind low-melting point materials to a few μm.</td>
</tr>
<tr>
<td></td>
<td>Corresponds to GMP standards for easy disassembly and CIP/SIP.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Alpine MJQ</td>
<td>Target(impact) type jet mill.</td>
</tr>
<tr>
<td></td>
<td>High energy efficiency.</td>
</tr>
<tr>
<td></td>
<td>Low residue in the mill.</td>
</tr>
<tr>
<td></td>
<td>Very-easy-to-clean construction.</td>
</tr>
<tr>
<td></td>
<td>Designed for handling sticky materials.</td>
</tr>
<tr>
<td></td>
<td>All-ceramics construction is possible.</td>
</tr>
<tr>
<td></td>
<td>Applicable for neodymium iron boron for magnet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosokawa/Micron Pulvis PV</td>
<td>Energy efficient compared to jet mill.</td>
</tr>
<tr>
<td></td>
<td>Possible to grind down to ultra fine particles (sub-micron).</td>
</tr>
<tr>
<td></td>
<td>Easy particle size adjustment.</td>
</tr>
<tr>
<td></td>
<td>Ceramics construction possible for powder contact part.</td>
</tr>
</tbody>
</table>
Classification

**Air classifier: Product size** some hundreds μm to some μm

### Centrifugal Force Classifier

**Hosokawa/Micron**

- **Micron Separator MS**
  - The classification range is wide and is suitable for a wide variety of applications. \((D_{50}=3 - 150\mu m\) is possible)
  - No sealing air is required, this allows for a low energy consumption and simpler ancillary equipment.
  - The wheel blades are very robust and exchangeable replaced. Wear protection is also available.
  - The classification size can be easily controlled by changing the speed of the wheel.

**Hosokawa/Alpine**

- **Turboplex Classifier ATP**
  - Horizontal classifying wheel.
  - Robust design.
  - Ultra-high fineness values.
  - Sharp top-size limitation.
  - Stable operation even at fluctuating feed rates.
  - Universal in use.
  - Sophisticated technology.
  - Easy classifying wheel exchange.
  - Low maintenance costs.
  - Multi rotor design enables fine cut point in scale-up models.

### Centrifugal Force Classifier

**Hosokawa/Alpine**

- **Turbo Twin Double Classifier TTD**
  - Low energy costs as well as low investment costs per ton of end product.
  - High fines yield and maximum fines capacity.
  - Extremely robust and durable construction.
  - Classifying wheel supported in bearings on both sides.
  - Dual-flow fines discharge.
  - Optimized product feed direct to classifying wheel.
  - Direct drive with reinforced motor bearing.

### Inertia Force Classifier

**Hosokawa/Alpine**

- **Cliffis CF**
  - High classifying efficiency.
  - For the top cleaning of toner, it gives very high classifying efficiency.
  - Way-out Design.
  - It doesn’t require a Coanda wall and simplify the internal structure.
  - Easy maintenance.
  - Quick and easy disassembling/cleaning procedure due to no moving parts and smooth interior design.

---

Flow of Micron Separator with Glacis

Flow of Turboplex with ACM pulverizer
Mixing

Batch or Continuous operation

Conical Mixer, Vrieco Nauta mixer series
Hosokawa/Vrieco-Nauta Vrieco Nauta Mixers
- Swift mixing with minimal energy consumption.
- Mixing deviation converges quickly with little variation.
- Minimal damage to particles.
- Low heat generation.
- Easy to discharge material with little residue.
- Large machines possible.
- Easy to clean.
- No seals within the material bed.
- Simplifying processes.

Conical Mixer
Hosokawa/Vrieco-Nauta Vrieco Nauta Mixers VN Type
- Newly designed shaft seals prevent lubricant from leaking into the product.
- Minimized the number of fasteners in the machine interior.
- Compact design gearbox and swing arm reducing height.
- Sanitary design with safe seals on the drive assembly.
- Reduction of gear losses reducing energy consumption.
- Many options available.

Conical Mixer
Hosokawa/Vrieco-Nauta Vrieco Nauta Mixers DBX Type
- Cantilever mixing screw design throughout the model range increases cleanability.
- Drive unit uses direct drive motors increasing safety and maintainability.
- Improved transmission efficiency reduces the energy consumption.
- Vacuum type DBX-RWV can be used for drying and reaction processes. (refer to dryer section)

Conical Mixer
Hosokawa/Vrieco-Nauta Vrieco Nauta Mixers NX Type
- Standard model of the Vrieco Nauta Mixer.
- For volumes below 300 liters, the mixing screw is cantilevered. For volumes above 600 liters, the standard bottom support is the pin joint.
- NXW type has 2 mixing screws offering short mixing time.
- NXR type has a faster mixing screw tip speed, offering kneading effect, for applications such as pasting.

Conical Mixer
Hosokawa/Vrieco-Nauta Vrieco Nauta Mixers - D2SX Type
- Equipped with a additional satellite mixing screw.
- Mixing time is less than half of the single mixing screw type Vrieco Nauta Mixers, with approximately 30% increase in energy consumption.

Conical Mixer
Hosokawa/Vrieco-Nauta Vrieco Nauta Mixers DBY, LV
- Laboratory model mixers.
- DBY type uses the same Vrieco Nauta Mixer mixing principle.
- Small and portable.
- Screw speed can be adjusted (for LV model) freely between 100 - 200 rpm.
- Maintenance free bearings require no lubrication.
- Simple design making for easy cleaning and disassembly.

High Speed High Shear Mixer
Hosokawa/Micron Cyclomix CLX
- Unique mixing action.
- Fast mixing time with high level of homogeneity and material dispersion.
- Jacket with highly heat transfer efficiency.
- Easy discharge of material with almost no holdup of material.
- Easy to clean.

Conical High Speed Mixer
Hosokawa/Micron Vitomix VX
- Short mixing time.
- Achieves swift and homogeneous mixing with efficient mixing principle.
- Wide range of applications.
- Combines a gentle low shear mixer and a mid shear mixer in one machine.
- Easy discharge of material, no residue.
- Easy to clean.
- Compact design.
- No seals in material bed.

Continuous Mixer
Hosokawa/Bepex Turbulizer TX, TCX
- Compact continuous mixer with high capacity. (11 ton/h on model TX-30)
- Can break up agglomerates.
- Adding and dispersing liquids.
- Jacket for heating and cooling.
- Increases in powder handling.
- Continuous process for labor savings.
- Easy cleaning.
Particle Design

**Composing, Synthesis of nano oxide particles, Spheronization**

**Dry Particle Composing Machine**

**Hosokawa/Micron Mechanofusion System AMS**
- Production of composed particles, control of particle shape (rounding, flattening) and precise mixing.
- Can be used for numerous combinations of particles.
- Wide range of capacities available.
- Control of material temperature is possible with cooling jacket.
- Dry process requires no post drying.
- Processing in inert gas such as nitrogen and argon is possible.

**Dry Particle Composing Machine**

**Hosokawa/Micron**

**Nobilta NOB**
- One machine can be used for mixing, composing, surface treatment, and spheronization.
- Nobilta can be used for particle design of nano sized particles.
- Nobilta can be used to mix a wide range of particle sizes from nano level to micron sizes.
- Compact, low running cost.
- Easy to disassemble, clean, and reassemble.
- Nobilta can process heat sensitive, abrasive, sticky, hard to handle materials.

**Dry Particle Composing Machine**

**Hosokawa/Micron**

**Nanolocular NC-Lab-P**
- Firm and dense mechano chemical bonding of nano powders.
- To achieve operation under low temperature plasma, vacuum and inert gas condition.
- It is possible to process materials under vacuum and inert gas conditions with low temperature plasma irradiation.

**Nano Particle Synthesizer**

**Hosokawa/Micron**

**NanoCreator FCM**
- Can produce almost all types of oxidized nano-particles.
- Compact design. (FCM-MINI)
- Easy to disassemble and clean. (FCM-MINI)
- Can produce nano-particles with the same principle as the small scale. (FCM-400F)
- Can produce 100 to 200g of material per hour. (FCM-400F)
- [Production rate depends upon composition of the material produced.]

**Spheronization**

**Hosokawa/Micron**

**Faculty S Series F-S**
- Multi Functions: Dedusting, Surface treatment, Spheronization, Densification, Separating impurities in one cycle.
- Possible to simplify processes.
- Operator friendly equipment. (easy adjustment of parameters)

**Schematic figure of particle composing**

**Cross sectional view of composite particle**

**Selection chart**

- **Vrieco Nauta mixer**
- **Vitomix**
- **Cyclomix**
- **Mechanofusion**
- **Nobilta**

**Flow of Nobilta of system**
Drying

Direct Heating Flash Dryer
Hosokawa/Micron DMR-H
- High drying ability and no adhesion inside.
- Fine and dry product.
- Easy control of particle size.
- Easy control of moisture content in the product.
- Compact installation.
- High energy efficiency.
- Various options:
  - Construction material of ceramics for the powder contact parts. Specially designed screw feeder for cake material.

Indirect Heating Agitating Media Dryer
Hosokawa/Micron Xerbis XB
- Slurries/Solutions can be directly dried.
- Drying slurries with high viscosity and cohesive nature.
- Energy saving.
  - With a closed circuit system, running cost can be drastically reduced.
- Wear protection.

Indirect Heating Dryer
Hosokawa/Bepex Solidaire SJ
- High dispersion effect enables to dry high moisture content material and caked material to product moisture content to several %.
- Paddles break the agglomerates contained in the material and avoids secondary agglomeration generated while drying to produce powdery products.
- Drying time can be controlled by adjusting angles of paddles and/or rotating speed of rotor.
- With inert gas operation such as N₂, as a carrier, it is possible to operate.

Indirect Heating Dryer
Hosokawa/Bepex Torusdisc TD
- Compact structure with large heat transfer area. Reduced heat loss to outside, and effective use of heat energy.
- High heat transfer coefficient. For dry powder, heat transfer coefficient is 20-35kJ/m²·h·K, wet powder: 30-60kJ/m²·h·K, slurry, 60-230kJ/m²·h·K.
- Wide operating application for drying, heating, cooling, vacuum drying and combined operation with hot air.

Indirect Heating Dryer
Hosokawa/Micron Thermo Processor MTD
- Wide application with different rotor designs.
- F type has higher plug flow property suitable for low moisture material.
- M type has higher mixing ability suitable for sludge like material.
- High heat transfer efficiency.
- Reduce adhesion due to dual rotor construction.
- Compact unit with large heat transfer area.
- Large heat transfer capacity and heat transfer coefficient.

Indirect Heating Dryer
Hosokawa/Vrieeco Nauta Vacuum Dryer DBX-RWV, NXV
- High heat transfer coefficient: Material dependence, but normally U=50-2000W/(m²·K)
- Low energy consumption.
  - ca. 5.5-13kW for 2,000 liter/batch size.
- Limited gas tight part.
- Easy discharge and very little residue in the vessel.
- Easy to clean.

Lyophilisation
Hosokawa/Micron Active Freeze Dryer AFD
- Efficient and contamination-free.
- Faster and less labor intensive than the traditional tray freeze drying process.
- High Quality.
- Compact.
- Typical applications include pharmaceuticals like antibiotics, proteins, collagen and API’s, and food & food additives.
Agglomeration

Continuous compaction, Fluidized bed by batch operation, Continuous wet process

Roller Compactor
Hosokawa/Alpine
Briquetting Machine, Compactor CS MS
- Roller press.
  The most economical way for briquetting and compaction.
- Briquetting.
  The size of the briquette normally starts at 10 mm and goes up to 120 mm.
- Compaction.
  The compaction process is normally used to form dust-free granules to less than 10 mm.

Roller Compactor + Crusher
Hosokawa/Alpine
Pharmapaktor + Flake Crusher
C250 or L200/50P + FC
- C250: Designed for pharmaceutical industry.
- L200/50P: Pharmaceutical, food and chemical industry.
  - It has small capacities up to 150 kg/h.
  - Very robust machine;
    specific pressing forces up to 30 kN/cm.
- Clean and simple construction without hydraulics pressing mechanism.

Gear Roll Compactor
Hosokawa/Alpine
Gear Pelletizer GCS GMS
- Can be produced cylindrical pellets with controlled hardness.
- Easy to disassemble and clean gear rolls.
- Can be heat and cool the feed.
- Can be decrease binder volume.

Fluidized Agglomerator
Hosokawa/Micron
Agglomerator AGM-PJ
- Diversity in functions.
- The unit is equipped with pulse jet dispersion mechanism.
- Short process time.
- Space-saving, energy saving, low running cost.
- 4 kinds of agglomeration effects:
  Fluidising, agitation, tumbling, and pulse-jet.

Fluidized Agglomerator
Hosokawa/Micron
Agglomerator AGM-SD
- Single unit produces agglomerates from liquid material by the combination of spray agglomeration and fluidized bed agglomeration by unique agglomeration cycle “Layering”.
- Realize the value-added agglomerates.
- Possible to batch or continuous operation.
- Easy cleaning.

Continuous Agglomerator
Hosokawa/Schugi
Flexomix FX, FXD
- Highly soluble agglomerates. (instant product)
- Continuous process.
- Short residence time.
- Compact machine with large capacity.
- Saving energy process.
- Highly applicable for high liquid adding ratio.
- Multi components processing.
- Self-cleaning mechanism.
- Easy maintenance.

Continuous Extruder
Hosokawa/Bepex
Extrud-O-Mix EM
- Cylindrical and hard agglomerates.
- High kneading ability.
- Possible to process several materials at once.
- Improve powder handling.
- Continuous process.
- Easy cleaning.

Flow of Flexomix
Feed and Discharging

Feed, Discharging, Densification, Filling & Weighing

Feeder
Hosokawa/Micron
Finetron FT-N

- Stable and accurate feeding.
- Can feed materials that were difficult to feed with traditional screw feeders.
- A range of models with a wide feeding range.
- A single drive unit can adapt to 8 models.
- Can be used if loss in weight mode with an optional scale.
- Easy to clean and disassemble.

Tank Discharger
Hosokawa/Micron
Actitron ACT ACT

- Can be used to discharge material from any kind of powder storage tank or silo.
- Can discharge first in / first out basis.
- Very small chance of flash flow due to the mass flow effect.
- Segregation is minimal during discharge.
- Can be adjusted depending upon the powder characteristics.
- Simple and robust design.

Densification
Hosokawa/Micron
Denspack DEN

- Compact construction, big densification effect.
- Densification with no damage to the powder.
- Continuous operation possible with the integrated self cleaning mechanism.
- Can be easily integrated into production systems.
- Can operate even with sticky powders.
- Can be used as a feeder or discharger simultaneously with densification.
- Running cost is low due to low energy consumption.

Filling and Weighing System
Hosokawa/Stott
Filling and Weighing System STS

- Can be used to fill and weigh various bags and containers.
- No dust generation ensures a clean working environment.
- Work is conducted safely and easily with high work efficiency.
- Guaranteed high weighing accuracy.
- Compact construction.
- Can be incorporated into various systems.
- Many options available.

Pharma design Finetron

Principle of Denspack

Stott big bag system BBS

Flow of Actitron

Flow of combination with Denspack and Stott filling&weighing system
## Laboratory Technology

### Laboratory machines, Measuring instruments (Powder characteristics, Size, etc.)

#### Table Top Lab Equipment

<table>
<thead>
<tr>
<th>Hosokawa/Alpine</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Picoline</td>
<td></td>
</tr>
<tr>
<td><strong>Jet milling, Impact milling, Ultrafine classification</strong></td>
<td>Hosokawa/Alpine</td>
</tr>
<tr>
<td>Multi-processing System 100AFG, 50ATP, 50ZPS, 100AS, 100UPZ, PV-150, MUT-LAB, F-LAB</td>
<td></td>
</tr>
<tr>
<td><strong>Small sample processing.</strong></td>
<td>One to a few gram samples.</td>
</tr>
<tr>
<td><strong>Minimizing scale-up risk.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>R&amp;D purpose.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Function Modules.</strong></td>
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</tr>
<tr>
<td><strong>Feeder and dust collectors (for short test + for continuous operation) are provided for each module.</strong></td>
<td></td>
</tr>
</tbody>
</table>

#### Powder Property Evaluation

| Hosokawa/Micron |  |
| Powder Characteristics Tester PT-X |  |
| **Wettability Analysis** | Hosokawa/Micron |
| Peneto Analyzer PNT-N |  |
| **Particle Sizing** | Hosokawa/Alpine |
| Air Jet Sieve e200LS |  |
| **Wet Sieving** | Hosokawa/Micron |
| Viblette VBL |  |
| **Online Particle Size Analysis** | Hosokawa/Micron |
| Optizizer XO |  |
| **Powder Characteristics Evaluation** | Hosokawa/Micron |
| Aggrobot AGR-2 |  |
| **Particle Size and Electrostatic Charge Distribution Analysis** | Hosokawa/Micron |
| E-spart Analyzer EST-G |  |

**Table:**
- Small sample processing.
- One to a few gram samples.
- Minimizing scale-up risk.
- R&D purpose.
- Function Modules.
  - Various modules are provided; classifier head, housings, mills and motor adapters.
  - Feeder and dust collectors (for short test + for continuous operation) are provided for each module.

**Wettability Analysis**
- Veritable all-rounders.
  - Opposed jet mill AFG/Target jet mill MJT
  - Ultrafine classifier ATP
  - Classifier mill ZPS
  - Spiral jet mill AS
  - Fine impact mill UPZ
  - Agitating Media Mill PV
  - Spheronization F

**Particle Sizing**
- Suitable for chemicals, minerals, pharmaceuticals, food, plastics & cosmetic applications.
- Determines particle size for dry powders from 20μm to 4,750μm.
- Economical to own and operate for easy, fast & accurate analysis.
- Capable of calculating particle size points at 0.01 to 99.99% using the Rosin-Rammler Law.
- Suitable for operation on 100-240 volt, 50/60 Hz power.

**Wet Sieving**
- Efficient sieving by strong vibration.
- Shortens sieving time.
- JIS Ø75mm sieve drum.
- Huge amount of slurry processing is possible.
- High end model with optional functions to set the best operating conditions.

**Online Particle Size Analysis**
- Online measuring of PSD.
- Light and robust body.
- Easy disassembling and cleaning.
- A range of sampling options.
- Built to ISO13320. (Laser diffraction and scattering method, particle size distribution measurement)
- IP65 protected.
- ATEX options available.

**Powder Characteristics Evaluation**
- Two dynamic properties can be measured.
  - Stress-strain of powder bed.
  - Tensile properties of powder bed.
- Cohesive force between particles and test pieces can be measured.
- Compressive force can be measured to forecast the fracture of granules/agglomerates.
- Temperature control is possible up to 100 deg C (Option).

**Particle Size and Electrostatic Charge Distribution Analysis**
- Measuring simultaneously size and charge of each particle in real time base.
- Applicable for mono- and dual-component toner.
- Enhanced software.
- Adapt to simple environmental test laboratory.
- New feeder for measurement of fine toner.

**Wettability Analysis**
- To evaluate the affinity between powder and liquid, i.e. wettability by measuring the speed and mass of the liquid penetrating into the powder bed.
- No special pretreatment required.
- Applicable sample and liquid (solvent)
  - Sample: Powder, porous block, fibers, sheet like materials, and powder coated foils.
  - Liquid (solvents): Water or organic solvent with high flowability like as oil.

**Particle Sizing**
- Veritable all-rounders.
  - Opposed jet mill AFG/Target jet mill MJT
  - Ultrafine classifier ATP
  - Classifier mill ZPS
  - Spiral jet mill AS
  - Fine impact mill UPZ
  - Agitating Media Mill PV
  - Spheronization F
Bag Filter

**Pulse jet type**

**Hosokawa/Micron Pulsjet Collector, Standard Type SP**
- A square housing with filters arranged efficiently inside.
- Filter area up to 108m².
- Can be shipped completely assembled.
- Side removal type.
- Suitable for cases where there is height limitation.

**Hosokawa/Micron Pulsjet Collector, Standard Type SP-K**
- A square housing with filters arranged efficiently inside.
- Cartridge type filter.
- Maximum filter area is 250m².
- Side removal type.
- Big filter area with small installation space.

**Hosokawa/Micron Pulsjet Collector, Standard Type TNP**
- A square housing with filters arranged efficiently inside.
- Filter area up to 175m².
- Side removal type.
- Top removal type - Filter replacement is done from the top, clean area.

**Hosokawa/Micron Pulsjet Collector, Standard Type QPA**
- A square housing with filters arranged efficiently inside.
- Filter area up to 540m².
- Side removal type.
- Suitable for cases where there is height limitation.

**Hosokawa/Micron Pulsjet Collector, Standard Type TKP**
- A square housing with filters arranged efficiently inside.
- Filter area up to 1166m².
- Top removal type - Filter replacement is done from the top, clean area.

**Hosokawa/Micron Pulsjet Collector, Standard Type TKPD**
- A square housing with filters arranged efficiently inside.
- Filter area up to 1166m².
- Top removal type - Filter replacement is done from the top, clean area.

**Hosokawa/Micron Pulsjet Collector, Standard Type TQPJ**
- A square housing with filters arranged efficiently inside.
- Filter area up to 1781m².
- Top removal type - Filter replacement is done from the top, clean area.
- Long filter type, with filter dia. 165mm and length 6m or over.

**Hosokawa/Micron Pulsjet Collector, High Vacuum Type CP**
- A cylindrical housing with filters arranged efficiently inside.
- Maximum design pressure is 55kPa.
- Filter area up to 87m².
- Top removal type - Filter replacement is done from the top, clean area.
- Suitable for cases where there is height limitation.

**Hosokawa/Micron Pulsjet Collector, High Vacuum Type TCP**
- A cylindrical housing with filters arranged efficiently inside.
- Maximum design pressure is 55kPa.
- Filter area up to 64m².
- Top removal type - Filter replacement is done from the top, clean area.

**Hosokawa/Micron Pulsjet Collector, High Vacuum Type HP**
- A cylindrical housing with filters arranged efficiently inside.
- Design pressure is from 0 to 1MPa or over.
- Filter area up to 34m².
- Jacket is available for cooling or heating.
Bag Filter

Pulse jet type, Shaking type, Small bag filter, Discharger

**Pulse jet type**

- **Hosokawa/Micron Super Clean Pulsjet Collector SCP**
  - A cylindrical housing with filters arranged efficiently inside.
  - Sintered pleats filter made from ultra high molecular weight PE.
  - High collection efficiency.
  - Low contamination.
  - Compact.
  - Filter area up to 41m².
  - Side or Top removal type.
  - Washable with water.

- **Hosokawa/Micron Bag in-Bag out Pulsjet Collector BBP**
  - High safety of work.
  - Filter replacement is done by push-push method, reducing operation time compared to conventional bag filter.
  - Small install area.
  - Wet in place. (WIP, Possible to be washed with water)
  - High dust collection performance.
  - Filter area up to 45m².

- **Hosokawa/Micron Sinter Pulsjet Collector PSLC**
  - High collecting efficiency.
  - Compact.
  - Stable pressure drop across filter.
  - High durability.
  - Heat resistance, anti-static filter.
  - Filter area up to 72m².
  - Plastic sintered filter elements with PTFE coating offers high collection efficiency and dust detachability.

- **Hosokawa/Micron Pulsjet Collector CP-K**
  - A cylindrical housing with filters arranged efficiently inside.
  - Cartridge type filter.
  - Maximum filter area is 202m².
  - Top removal type.

**Shaking type**

- **Hosokawa/Micron Dust Collector DR**
  - Local dust collector.
  - Compact.
  - Energy saving.
  - High collection efficiency.
  - Manual or automatic shaking mechanism.
  - Blower is already included.

**Clean air supplier**

- **Hosokawa/Micron High clean collector HDR**
  - Can make the clean atmosphere (ISO class 6-7) for the dusting room.
  - No exhaust gas.
  - Middle class filter.
  - Option: HEPA filter.
  - Easy transporting by casters.
  - Maximum air volume is 56m³/min.

**Rotary airlock**

- **Hosokawa/Micron Rotary Airlock RV**
  - Mounted at the bottom of the bag filter.
  - Easy assembly and disassembly.
  - 7 litters per revolution for RV-20K and -20IND types.
  - 28 litters per revolution for RV-30IND type.

**Discharger**

- **Hosokawa/Micron HUV discharger**
  - Mounted at the bottom of the bag filter.
  - Scraping off the powder accumulated on the bottom of the bag filter by vanes.
  - Usually it is used for a material which tend to form bridges or in the case where there is height limitation.
**Containment, Cleanroom**

**Containment System**

**Hosokawa/Micron Isolator / Glovebox**
- Offer a system suitable for required OEL levels. 
  Max. 30ng/m³ or below is possible.
- System design utilizing three dimensional CAD and mock-up models.
- System layout is possible in consideration of processes before and after, and traffic line of hazardous materials.
- System in consideration of operatability and cleanability can be offered.

**Containment System**

**Hosokawa/Micron Safety Booth HSB**
- Offer flexible design and best suitable system meeting operating conditions.
- Countermeasures on nano-risk : Capture nano-size particles by HEPA filter keeping safety working atmosphere.
- OEL 1 - a few micro gram/m³ is possible : With combination of screen with glove ports it is possible to realize the isolator-class performance.

**Clean Booth**

**Hosokawa/Micron Mobile Laminar Booth**
- Main frame and dedusting area can be disassembled for transportation.
- Uniform horizontal airflow prevents workers from generated dusts.
- Cleanliness of installed area is increased as exhaust air is filtered by intermediate HEPA filter.
- Because of no exhaust to outside of the room, pressure balance is ensured in the installed area and there is no big influence on the room temperature.

**Clean Booth**

**Hosokawa/Micron Clean Booth**
- Enables clean atmosphere locally : Individual design meeting working procedure is possible.
- It is possible to set the cleanliness : ISO class 3-8 are available.
- Temperature control is possible : With addition of air conditioning function.

**Air Shower**

**Hosokawa/Micron Air Shower HAS**
- Special design is possible : Can offer high efficiency air shower suited for installed area and purpose.
- Suitable airflow : Suitable air speed can be set for best dedusting performance depending on the objects.
- Main material : Steel of stainless steel plate.

**Air Shower**

**Hosokawa/Micron Clean-Sphere Air Shower**
- Solves all problems such like, spreading of dusts, re-attachment of dusts on worker clothes, and dust inhalation by workers.
- Multi air nozzles produces washing air (100m/s 5times faster than normal) hitting the clothes and remove dusts efficiently.
- Complete down-flow prevents re-scattering of dusts.
- Highly cleaned air down-flow is possible using HEPA filter.
- Structure is simple and maintenance is easy.

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**Occupational Exposure Band**

<table>
<thead>
<tr>
<th>OEL (µg/m³, 8h TWA)</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &gt; 1000</td>
<td>Protection tools / mask, gloves</td>
</tr>
<tr>
<td></td>
<td>Local dust collector</td>
</tr>
<tr>
<td>2 100 ~ 1000</td>
<td>Packing head (Filling process)</td>
</tr>
<tr>
<td></td>
<td>Laminar booth</td>
</tr>
<tr>
<td>3 10 ~ 100</td>
<td>Safety booth + Safety cabinet</td>
</tr>
<tr>
<td></td>
<td>Safety booth + Screen</td>
</tr>
<tr>
<td>4 1 ~ 10</td>
<td>Isolator (Standard design)</td>
</tr>
<tr>
<td></td>
<td>Isolator with machine</td>
</tr>
<tr>
<td></td>
<td>Isolator (Special design)</td>
</tr>
<tr>
<td>5 &lt; 1</td>
<td>Spiral jet mill 100AS in isolator</td>
</tr>
<tr>
<td>6 &lt; 0.1</td>
<td>Fluidized opposed bed jet mill AFG in isolator</td>
</tr>
</tbody>
</table>
Services

Toll processing / Aftersales & Maintenance for customer service

Toll Processing

Our toll processing business is based on our accumulated experience and know-how of powder technology. Our toll center is equipped with our major machines to meet any requirement of the customers. (from a prototype of new products to large scale production.)

Aftersales / Maintenance service

We offer spare parts, maintenance works, and repair/modification works. Hosokawa service team can help you to ensure your equipment is running in tip top condition for extended life benefits.