MIKRO ACM®
Air Classifying Mill

HOSOKAWA MICRON POWDER SYSTEMS

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MICRON POWDER SYSTEMS

Combining the resources of

A L P I N E   •   M I K R O   •   M A J A C   •   M I C R O N   •   V R I E C O - N A U T A

MIKRO ACM® - AIR CLASSIFYING MILL

The Mikro ACM® - Air Classifying Mill is an air swept mechanical impact mill with a dynamic air classifier designed to grind an extensive range of materials down to a D97 of 20 microns. The Mikro ACM® Air Classifying Mill is available in a range of sizes and can be supplied for laboratory use or large production environments. Capacities range from 0.5 lb/hr on a laboratory mill to several tons per hour on a production machine.

DESIGN & FEATURES:
- Grinds and classifies in one step
- Designed to process soft to medium hard materials with a Mohs hardness ≤ 5
- Designs available for Chemical, Mineral, Food, and Pharmaceutical applications
- Machines available from 1 HP laboratory models to 600 HP production models
- Excellent top size control while producing narrow particle size distributions
- Heavy-duty, durable construction

Mikro ACM® Air Classifying Mill – expanded view

Mikro ACM® - Air Classifying Mill – Model 300

OPTIONS & ACCESSORIES:
- Construction in Steel, Stainless Steel, Specialty Alloys and Titanium components
- Wear protection includes AR Steel, Stellite, Tungsten Carbide, Ceramics and wear protective coatings
- PSR 10 bar (g) designs for containment while processing explosive materials
- Various hammer and classifier configurations
- Bearing vibration and temperature monitoring
- High temperature design options
- Bearing and classifier purge options
- Independent & coaxial drive options
- High speed drive optional

MIKRO ACM® - AIR CLASSIFYING MILL MODELS

The Mikro ACM® - Air Classifying Mill is available in 15 different model sizes with many variations and options to enhance performance in a wide range of applications.

Mikro® ACM Model	Rotor Power (HP)	Classifier Power (HP)	Max. Rotor Speed (RPM)	Approx. Air Flow (ft³/min)	Scale Up Factor	Optional Designs & Configurations							
						Coaxial Drive	Independent Drive	Easy Access/ Easy Clean	High Speed Rotor	Pressure Shock Resistant	E-ACM	Superfine Configuration	High Temperature Operation
1 ACM	1	1	22,000	60	NA		✓						
2 ACM	3	1	10,500	200	0.3	✓		✓	✓	✓			
10 ACM	10	1.5	7,000	500	1	✓	✓	✓	✓	✓	✓	✓	✓
15 ACM	15	2	7,000	750	1.5	✓	✓	✓	✓	✓			✓
30 ACM	30	5	4,600	1,500	3	✓	✓	✓	✓	✓	✓	✓	✓
40 ACM	40	7.5	4,600	2,000	4	✓	✓	✓	✓	✓		✓	✓
75 ACM	75	10	3,000	3,750	7.5	✓	✓	✓	✓	✓		✓	
100 ACM	100	15	3,000	5,000	10	✓	✓		✓	✓	✓	✓	✓
125 ACM	125	20	2,100	6,250	12.5	✓	✓			✓			
150 ACM	150	30	2,100	7,500	15	✓	✓			✓	✓		✓
200 ACM	200	25	2,000	10,000	20	✓	✓			✓	✓	✓	✓
250 ACM	250	40	2,000	12,500	25	✓	✓			✓	✓		✓
300 ACM	300	50	2,000	15,000	30	✓	✓			✓	✓	✓	✓
400 ACM	400	100	1,500	20,000	40	✓	✓						
600 ACM	600	150	1,500	30,000	60	✓							

Data provided in this chart is a guideline only and does not represent a performance guarantee.

DESIGNED, MANUFACTURED AND ASSEMBLED IN THE USA

Hosokawa Micron Powder Systems invented the Mikro ACM® - Air Classifying Mill in 1962 to address the requirement for even finer size reduction. Since then many design enhancements make the Mikro ACM® - Air Classifying Mill better than ever, assuring maximum performance, dependability and durability.

All Hosokawa equipment is inspected and tested to meet strict standards before it is shipped to our customers. The Mikro ACM® - Air Classifying Mill and System come with our pledge of performance and guaranteed dependability.

EFFICIENT & ECONOMICAL OPERATION

OPERATION

The Mikro ACM® - Air Classifying Mill requires air or gas for the conveying, size reduction and air classification of the product being processed. Air or gas is introduced to the Mikro ACM® - Air Classifying Mill via the main air inlet and the product inlet. As much as 30% of the total air volume can be introduced at the product inlet depending upon the application. Feed material is pneumatically conveyed under vacuum or mechanically conveyed by an auger, into the feed inlet of the mill along with the process air. Ideally, material is fed at a constant rate via a volumetric or gravimetric feeding device.

After passing through the feed inlet, material enters the grinding zone. At this point, material comes in contact with the face of the rotating hammers, where impact takes place and the material is fractured into smaller particles. Situated around the perimeter of the grinding chamber is a "multiple deflector liner". This component assists in slowing the peripheral velocity of the product and deflecting it back into the hammer path for more efficient impact and size reduction.

The product is then conveyed upwards by the air stream through a shroud and baffle assembly that changes the direction of the product/air mixture while directing it to the classification zone. The shroud and baffle assembly also provides a separation of the mill internal area into two zones; a grinding zone and a classifying zone.

Once the product enters the classification zone, the particles are presented to the rotating classifier wheel, where based upon size and density, the particles either pass through the classifier or oversize particles are rejected and flow back to the grinding zone for additional size reduction. The processed product/air mixture then exits through the mill outlet.

There are two main parameters that are used to control and change particle cut point or maximum particle size; air volume through the mill and rotational speed of the classifier. The air flow through the mill generates a drag force to convey the particles to the classifier and the rotational speed of the classifier generates a centrifugal force that rejects the particles away from the classifier. When these two forces are equalized for a given particle mass, that particle has an equal probability of being accepted or rejected at the face of the classifier wheel. Based upon varying these opposing forces either through a change in air volume, or a change in classifier speed, the particle top size cut point can be controlled.
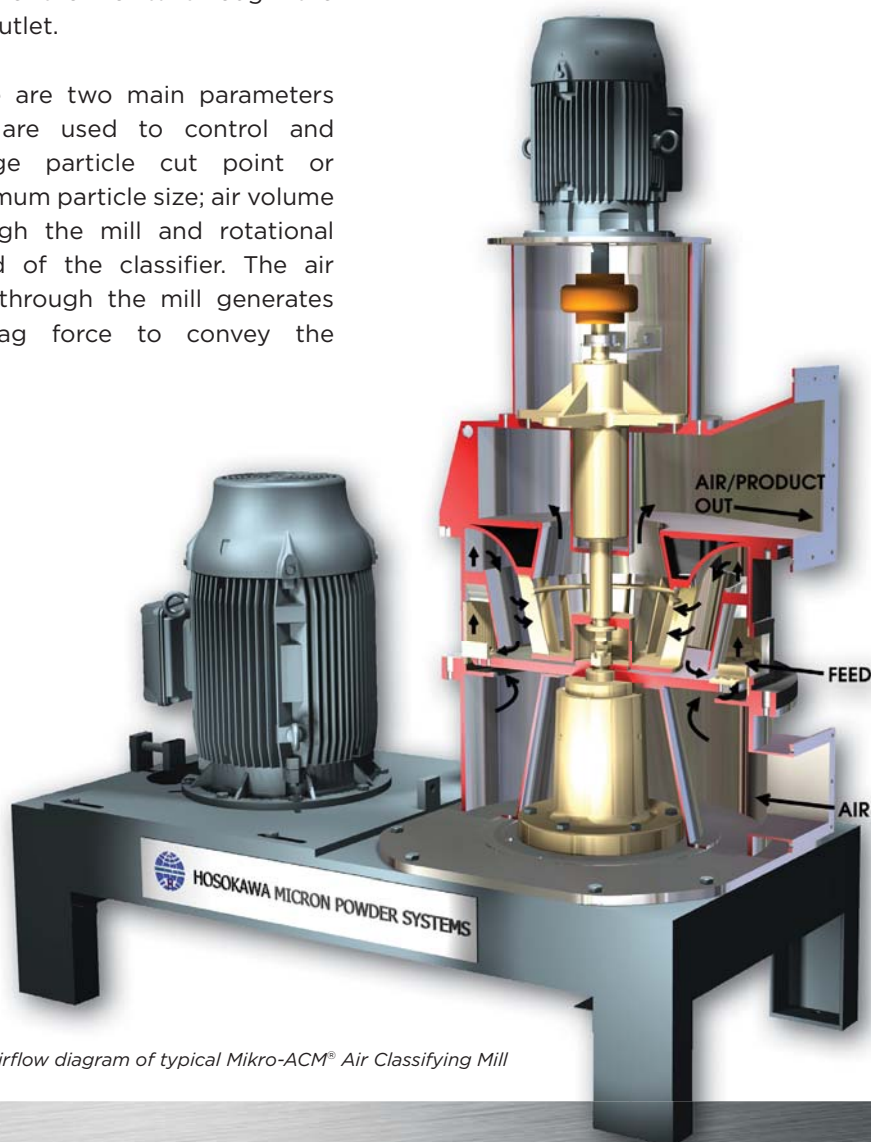
Airflow diagram of typical Mikro-ACM® Air Classifying Mill

Material	Product	Mill Material
Food Ingredients		
Cane Sugar	20 Mesh	90% < 325 Mesh (12x)
Soya Flake	1/4"	98% < 80 Mesh
Milk Crumb	20 Mesh	99% < 400 Mesh
Whole Kernel Corn	3/8"	99% < 30 Mesh
Cocoa Press Cake	65% < 100 Mesh	99% < 200 Mesh
Xanthan Gum	1/8"	97% < 325 Mesh
Enzymes (Cryogenic)	150 μm	90% < 110 μm
Chemical		
Barium Sulfate	60 μm	97% < 14 μm
Carbon Black	900 PPM > 44 μm	10-25 PPM > 325 Mesh
Sodium bicarbonate	200 μm	50% < 10 μm
Phenolic Resin	1/2"	97% < 200 Mesh
Zinc Sterate	1/8" Flakes	97% < 38 μm
Potassium Phosphate	240 μm	90% < 48 μm
Soda Ash	100 μm	50% < 15 μm
Powder Coatings	1/4" Chips	50% < 25 μm
Thermo Plastic Polymer	2-5 mm	90% < 1070 μm
Mineral		
Hydrous Kaolin	325 Mesh	6.5 Hegman
Talc	80 Mesh	50% < 7 μm
Hydrated Lime	80 Mesh	97% < 25 μm
Soft Limestone	1/4"	99% < 25 μm
Trona	200 μm	50% < 10 μm
Diatomaceous Earth	1 mm	50% < 12 μm
Magnesium Oxide	40 Mesh	99% < 325 Mesh
PET Coke	100 μm	50% < 10 μm
Lithium Carbonate	100 μm	50% < 4 μm

APPLICATIONS

The Mikro ACM® - Air Classifying Mill system is available in a wide range of sizes, materials of construction, finishes, pressure & vacuum designs, system configurations and control schemes.

Due to the Mikro ACM® - Air Classifying Mill's air to material ratio requirement, heat sensitive materials can be handled without product degradation. When milling hygroscopic materials, conditioned inlet air can be used to reduce moisture in the system. In high temperature drying applications, the bearing housing can be insulated and air purged to protect the bearings. The mill can also operate with chilled air for heat sensitive materials to prevent build up and for more efficient grinding.

If your application requires frequent product changeover with cleaning in between, you may want to consider our Mikro ACM-Easy Access Air Classifying Mill design. This mill incorporates several unique features that allow it to be quickly and easily disassembled and cleaned.

Watch a short demonstration.

MAINTENANCE & CLEANING

The Mikro ACM® - Air Classifying Mill is the most durable industrial workhorse on the market. It is designed for continuous size reduction of a wide range of Specialty Chemicals, Pharmaceuticals, Food Ingredients and Minerals. Like any machine, the Mikro ACM® - Air Classifying Mill requires routine inspection and maintenance to continuously operate at peak performance. The internals of the mill should be inspected periodically for wear and preventative maintenance should be carried out on a systematic timetable.

Hosokawa's Aftermarket Department stocks parts for Hosokawa's Mikro Brand products and can usually ship parts within 24 hours. To reduce the potential for unscheduled production interruptions, we strongly recommend that maintenance procedures be followed.

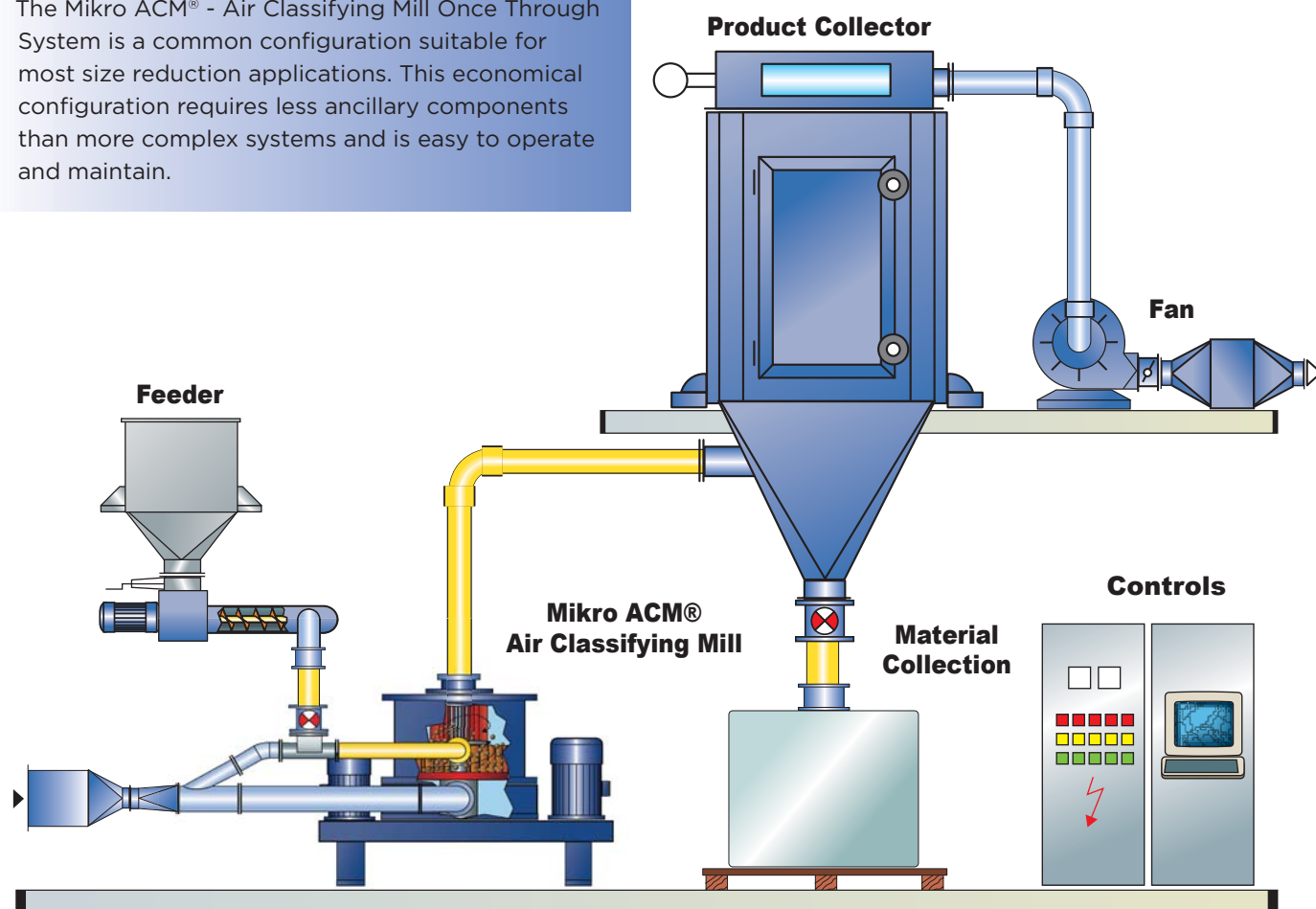*Mikro ACM® Air Classifying Mill – Model 10*

SYSTEM CONFIGURATIONS

The Mikro ACM® - Air Classifying Mill is designed to produce finer materials with sharper particle size distributions than most other impact milling technologies. In certain applications, a median particle size as low as 5 microns can be achieved.

The Mikro ACM® - Air Classifying Mill is the main component of the size reduction system, however, additional ancillary components are required for a fully functional system.
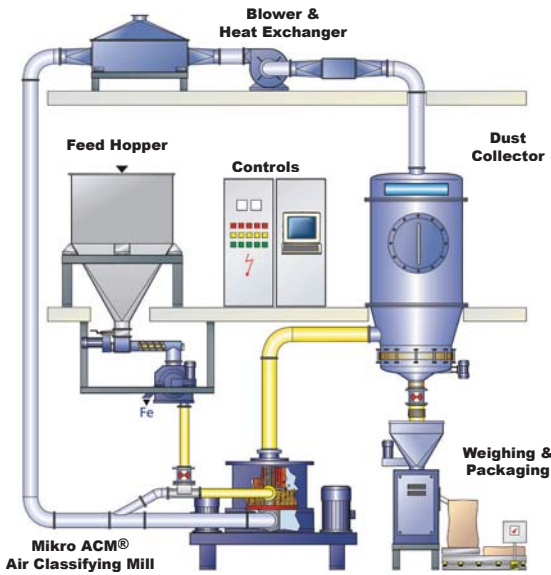
• A **feeder** is required to accurately dispense product into the milling system.

• A **product collector** is required to separate the product from the gas stream and collect the material.

• **Airlocks** are used for feeding the system, containing system pressure and product discharging.

• A **fan** is required to generate the airflow to convey, mill and classify the product.

• Adequately sized **ducting** is required to connect the system components and contain and convey the product.

• **Instrumentation** and **valves** are required to sense and regulate the various operating parameters of the system.

• A **control system** is required to operate, monitor and control the output of the system.

ONCE THROUGH SYSTEM

• The Mikro ACM® - Air Classifying Mill Once Through System is a common configuration suitable for most size reduction applications. This economical configuration requires less ancillary components than more complex systems and is easy to operate and maintain.

Product Collector

Fan

Feeder

Mikro ACM®
Air Classifying Mill

Material
Collection

Controls

Blower &
Heat Exchanger

Feed Hopper

Controls

Dust
Collector

Weighing &
Packaging

Mikro ACM®
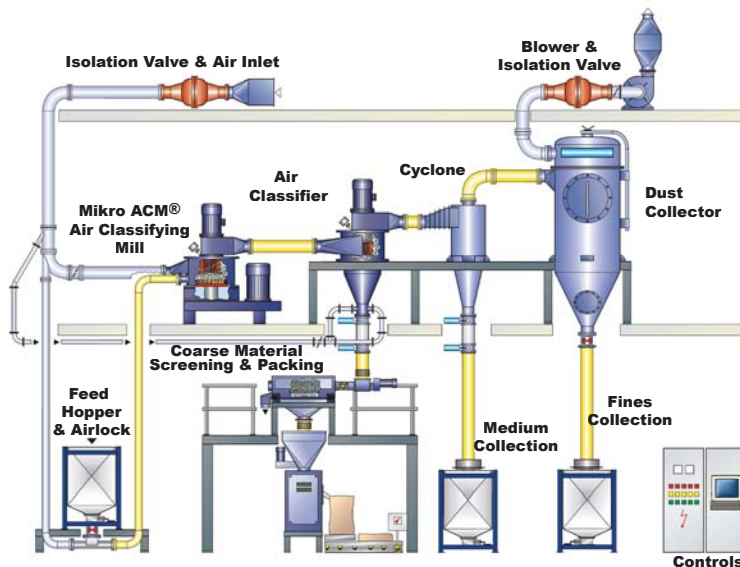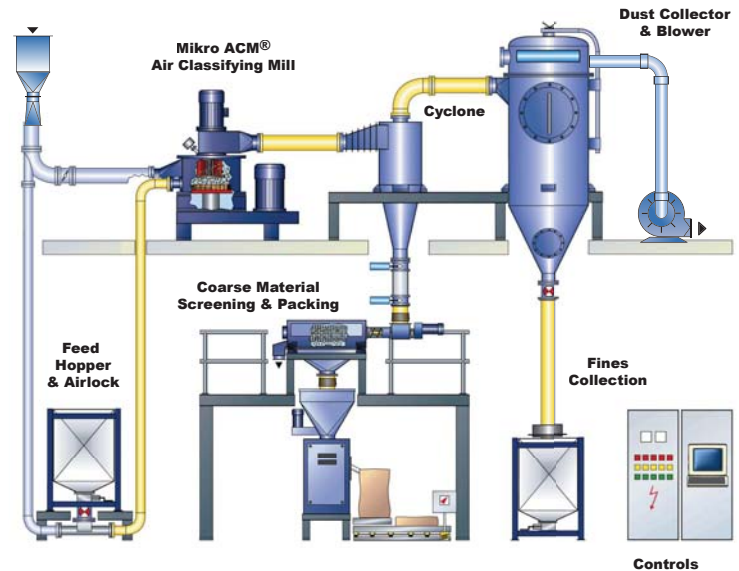Air Classifying Mill

Fe

CLOSED LOOP SYSTEM
• The Mikro ACM® - Air Classifying Mill can also
be configured in a Closed Loop System which
is specifically designed to recycle inert gas or
conditioned air and reduce overall system
energy requirements

Mikro ACM®
Air Classifying Mill

Dust Collector
& Blower

Cyclone

Coarse Material
Screening & Packing

Feed
Hopper
& Airlock

Fines
Collection

Controls

MILLING SYSTEM WITH CYCLONE
• A cyclone can be integrated into most
Mikro ACM® - Air Classifying Mill systems for
product collection to reduce downtime for
cleaning the dust collector.

Isolation Valve & Air Inlet

Blower &
Isolation Valve

Air
Classifier

Cyclone

Mikro ACM®
Air Classifying
Mill

Dust
Collector

Coarse Material
Screening & Packing

Feed
Hopper
& Airlock

Medium
Collection

Fines
Collection

Controls

EXPLOSION RESISTANT SYSTEM
WITH SECONDARY CLASSIFICATION
• For potentially explosive powders, equipment
and ducting are designed to withstand a
maximum pressure up to 10 bar(g) and
the system inlet & outlet are isolated for full
pressure containment.

GRINDING CHAMBER

The grinding chamber of the ACM houses both the components of the classifying and grinding zones. They include the impact rotor and hammers, the liner assembly, the shroud and baffle assembly and the classifier wheel. The grinding chamber can be designed to operate to 10 bar(g) overpressure for explosive materials.

ROTOR & HAMMER OPTIONS

Rotors are normally supplied as single discs; however options include reduced diameter rotors for use with heavy duty liners, and rotor discs with replaceable wear plates for abrasive applications. Hammers are bolted to the rotor disc and can be easily removed and replaced. Options include:
• **Bar Hammers** – for fine size reduction and maximum impact.
• **Pins** – for producing coarse particle size distributions and to minimize the generation of fines.
• **J-Style Hammers** – for size reduction of fibrous materials.

LINER

A liner is located at the grinding chamber wall. There are two basic types of liners; the multiple deflector (MD) liner is for fine size reduction and the smooth liner is for coarse size reduction and to minimize the generation of fines. The purpose of the liner is to provide for more efficient size reduction by slowing the peripheral speed of the particles and to deflect them back into the impact hammer path.
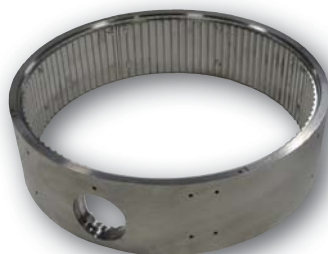
SHROUD & BAFFLE ASSEMBLY

The shroud and baffle assembly serves two purposes; one is to separate the internal parts of the mill into a grinding zone and a classification zone, the other is to act as a flow straightener and provide for the recirculation of the air/material mixture to the classifier and then back to the grinding zone.

DYNAMIC CLASSIFIER

The classifier is a device used to separate particles into fine and coarse fractions. The selection of the classifier wheel type is application dependent. Classifiers can be provided in short to long configurations with varying numbers of blades and blade type. Basic designs include radial or canted blade configurations.

WEAR PROTECTION

When grinding abrasive materials, pharmaceutical products or food ingredients, Hosokawa offers options to protect your mill from premature wear and to maintain the purity of product. Internal surfaces and contact parts, including the liner, grinding elements, classifier and chamber can be constructed of mild steel, stainless steel, ceramic or coated with special alloys, like tungsten carbide.

CONTROLS

Most Mikro ACM® - Air Classifying Mill systems use an advanced PLC and an Operator Interface Terminal (OIT) to monitor and control the system operation. The PLC allows various operating parameters to be set by using PID loops. The PID Set Points can be entered on the OIT and changed while processing your material to optimize the milling process. An automatic start/stop sequence is programmed to insure consistent, repeatable results, free from operator error.

The control cabinets are completely wired and contain all necessary components to effectively keep your system making a quality product. Equipment upstream and downstream of the mill are usually integrated into the control system.

- **Speed Control** - The Rotor and Classifier can each be controlled independently at specified speeds, insuring optimized milling and consistent particle size.

- **Air Flow Control** - A constant air flow rate is essential for maintaining proper particle size; therefore, the air flow is controlled independently.

- **Feed Control** - The speed of the feed metering device varies as a function of the rotor and/or classifier power so the system remains stable and operational at the maximum possible throughput.

- **Temperature Control** - The mill, inlet or outlet temperature can be monitored and controlled to heat or cool the material as it is processed.
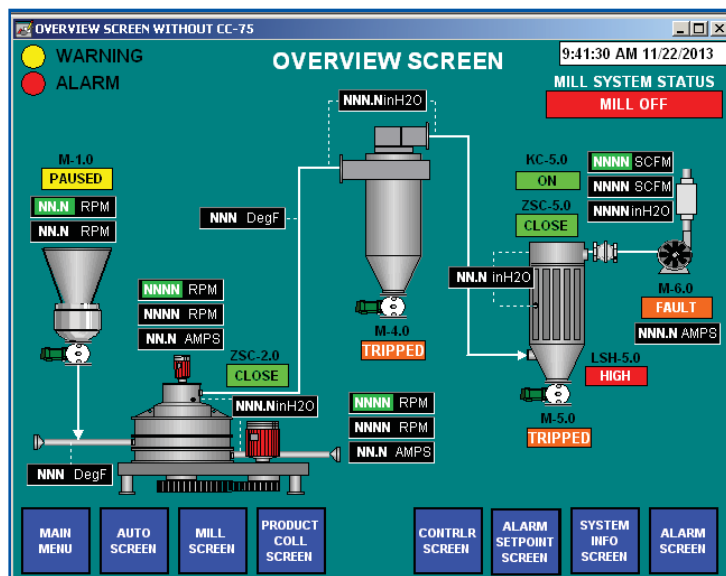
Typical Mikro ACM® - Air Classifying Mill with optional downstream cyclone
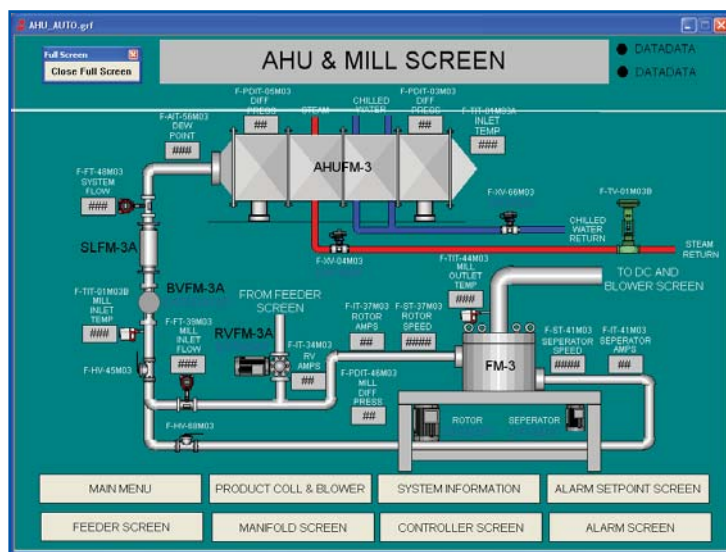
Mikro ACM® - Air Classifying Mill system with optional air handling unit for conditioning process air
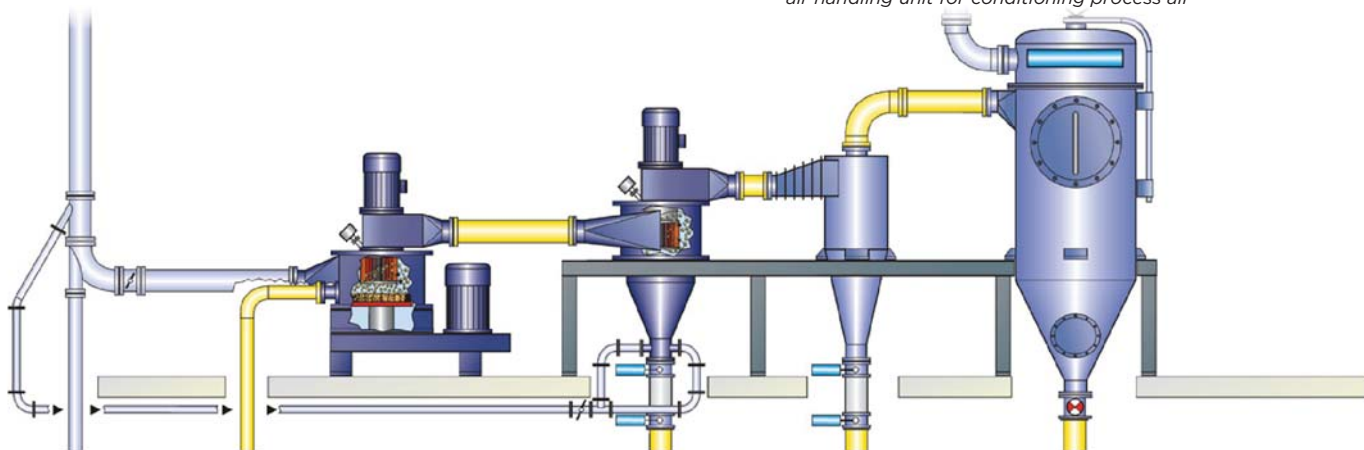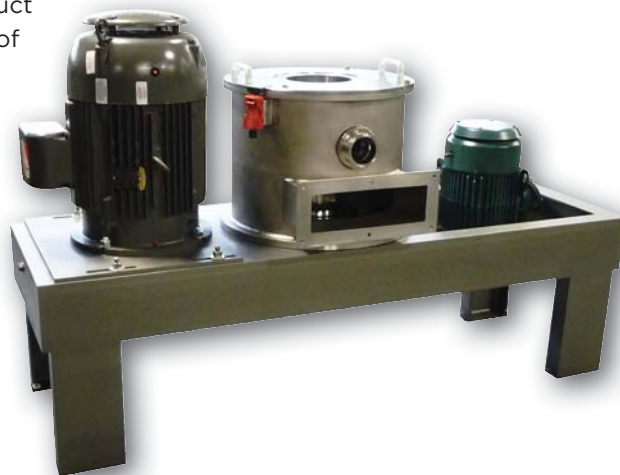
MIKRO ACM® - AIR CLASSIFYING MILL - MODEL EA (EASY ACCESS)

The Model EA is the latest addition to the Mikro product line of milling equipment. The Model EA design can be supplied with either independent or coaxial drives.

These mills are designed for applications requiring frequent product changeover. The Model EA is designed for ease of access, removal of components and ease of cleaning the internal surfaces of the mill.

The Model EA mill operates and performs the same as the original Mikro ACM® - Air Classifying Mill, however the internal components are designed to be removed quickly and easily. The mill is designed with an internal liner assembly which stands on its own in the grinding chamber and is not mechanically secured. The shroud & baffle, liner assembly, classifier and rotor can be easily removed to open the entire chamber area for inspection and cleaning.

MIKRO ACM® - AIR CLASSIFYING MILL - MODEL E

The Model E is unique in that it has an external coarse recycle system which extracts oversize material and returns it to the grinding chamber for additional processing. The feed design of the Model E introduces product from under the main rotor; ensuring that 100% of the feed material comes in contact with the impact rotor for optimal grinding efficiency.

The Model E can also be used for grit reduction applications when tight particle top size control is required, such as in the case of Carbon Black, Iron Oxides, and Clays.

The processing of light density materials may become problematic as the lighter material will float in the classifier zone and will not easily be recycled to the impact zone of the mill. The external recirculation system of the Model E and the bottom feed ensure that all product is returned to the grinding chamber for more efficient size reduction.

Cohesive materials can in some instances stick and build up in the standard Mikro ACM® - Air Classifying Mill, due to the expanded surface area of shroud and baffle assembly and the reduced tangential air velocity. The Model E has no internal shroud and baffle and therefore no internal components to assist in accumulation of product. Also the internal airflow is allowed to develop maximum velocity thereby keeping the mill chamber walls free from accumulation.

HOSOKAWA MILLING TECHNOLOGIES

Hosokawa Micron Powder Systems offers a wide range of equipment for coarse granulation to ultra-fine size reduction.

- Coarse Granulation to Ultra-fine Grinding
- Lab Scale to Large Production Models
- Air Classification Mills
- Jet Mills: Opposed Gun, Fluidized & Spiral
- Hammer & Screen Mills
- Pin & Universal Mills
- Pre-Crushers & Granulators
- Ball & Media Mills
- Attrition Mills
- Wet & Dry Grinding
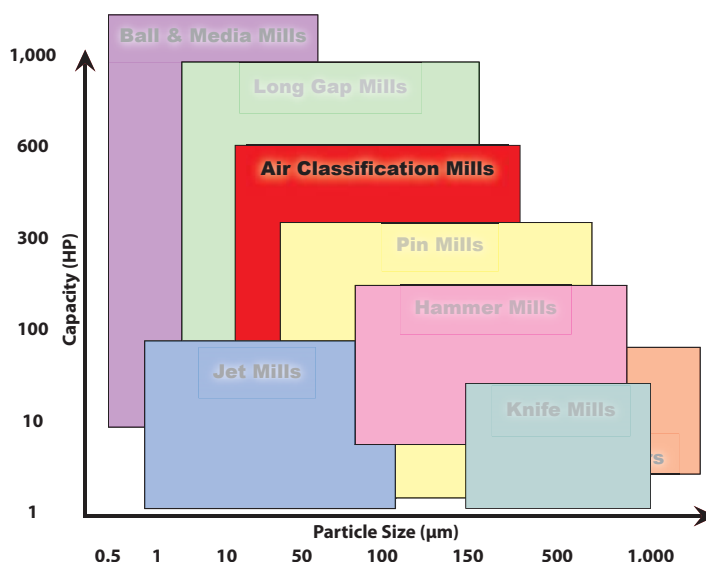
SR SIZE REDUCTION EQUIPMENT
- Mikro ACM® - Air Classifying Mill
- Mikro Pulverizer® Hammer & Screen Mill
- Mikro® UMP – Universal Milling System
- Mikro LGM® - Long Gap Mill
- Mikro Atomizer® - Air Classifying Mill
- Alpine® AFG – Fluidized Bed Jet Mill
- Alpine® AS – Spiral Jet Mill
- Alpine® UPZ – Pin Mill
- Alpine® SO – Ball Mill

CL CLASSIFICATION & SEPARATION
- Majac® Acucut Air Classifier
- Mikro® Classifier
- Micron Separator
- Alpine® ATP Turboplex Classifier
- Alpine® ASP Stratoplex Classifier
- Alpine® TTSP Tandem Classifier

m/b MIXING, BLENDING & DRYING
- Vrieco-Nauta™ Conical Screw Mixer
- Micron Drymeister Flash Dryer
- Vrieco-Nauta™ Cyclomix
- Vrieco-Nauta™ Vacuum Dryer
- Vrieco-Nauta™ Active Freeze Dryer
- Micron Nobilta™

CI CONTAINMENT, FILLING & WEIGHING AND ISOLATION TECHNOLOGY
- Stott Rigid Wall Isolators
- Stott Hygienic Filling & Weighing Systems
- Stott Flexible Isolators
- Vitalair Downflow Booths

### PA LABORATORY & ANALYTICAL EQUIPMENT
- Micron Air Jet Sieve MAJSb
- Mikro Air Jet Sieve™ MAJSx
- Mikro® LPM Laboratory Pin Mill
- Micron Powder Characteristics Tester PT-X
- Micron Viblette Wet Sieve VBL
- Micron Peneto PNT - N

SERVICES
- Hosokawa Brand Parts
- Engineering & System Design
- Custom Toll Processing
- Test Center & Analytical Laboratory
- On-site Service & Maintenance
- Pre-Owned Equipment Sales
- Equipment Validation & Surveying
- Educational Programs & Training

MIKRO ACM®
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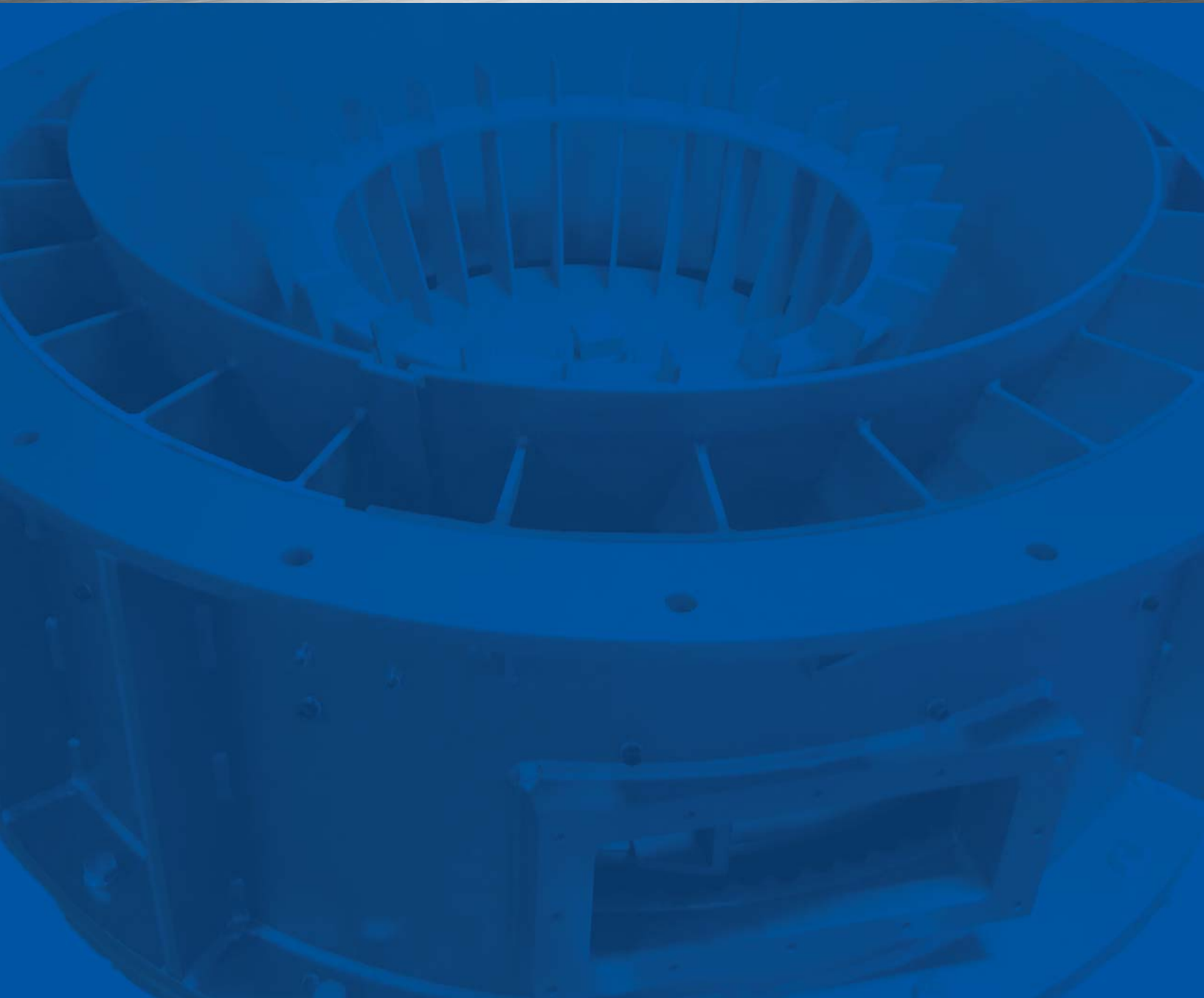
Hosokawa Micron Powder Systems, located in Summit, New Jersey is a member of the Hosokawa Micron Group. We are a leading provider of equipment and systems for Size Reduction, Classification, Mixing/ Blending, Drying, Particle Analysis, Compaction, Granulation as well as a full line of laboratory and analytical equipment. We also provide Contract Manufacturing, Complete Aftermarket Services and OEM parts, Equipment Leasing, Refurbishing, Product Development Services and Educational Programming. We serve the Chemical, Mineral, Food, Pharmaceutical, Cosmetic and Plastics processing industries.

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04-2014