

Micronization MILLING



# FPS never

always

## Values



### Experience

Over the years we grew as one of the largest manufacturers in micronization and containment equipment.

This growth is the result of our ability to listen and understand in depth your process and your needs.

### Reliability

You can trust the advice and the assistance of our experts: serving you is our mantra.

## Challenges



### Flexibility

In a high quality and fast changing industry, we remain flexible during project execution, to respond to new requests from our customers.

### Efficiency

Cost and time management is of paramount importance for projects, allowing for fast project execution.

## Innovation



### Performance

Our performance is the satisfaction our customers have when running our systems at the highest level, day in and day out. We live for that.

### Technology

The solutions we supply are driven by our relentless efforts to deeply understand the needs of our customers and their pharmaceutical environment.

Our numbers: **+1500** Installations **+40** Countries

# stops!

at your side

## Processes

### High Containment

Rigid isolator systems for sterile or HPAPI processing are fully integrated with the process to be protected. Well proven solutions are combined with innovative ones, maintaining safety as our first priority.



### Micronization

Fluid energy mills are more and more chosen for size reduction of new or established molecules. Derived from optimized experience and specific energy calculation, our jet mills are cutting-edge solutions for pharmaceutical needs..

### Hybrid tech

Our processes can be combined together or with other machineries, giving end users the integration required for each specific application.

## Customer support

### Spare parts

FPS strongly suggests to anticipate the purchase of spare parts and avoid that a small issue becomes a big problem. Original spare parts maintain the performance of your FPS containment systems, ensuring safety and reliability, minimizing down time and maximizing productivity. Thanks to the expertise of our team, we are able to provide customized spare parts lists to plan the periodic replacement of wear parts, managing the entire life cycle of the spare parts.

## Service

### After sales

Fps supports his customers during all the life cycle of their equipment.

We offer tailor-made assistance packages designed to constantly support our customers to get the maximum performance of their systems.

FPS firmly believes in Preventative Maintenance Programs and works closely with each customer to customize the final scope. These packages also include priority for on-site maintenance visits and a special discount for spare parts.

served **+350** Customers **+20** Years presence



# Spiral Jet Mills



With **Spiral Jet Mill** technology the size reduction is achieved by collisions between particles of the substance, previously accelerated by high-speed jet streams. Target PSD is generally down to  $D_{90} < 3\mu\text{m}$ .

#### Benefits:

- Easy Cleaning for Validation (to avoid cross contamination)
- No moving mechanical parts (no lubrication, high reduction in metallic contamination)
- No Heat Generation
- Constant Temperature

#### Working principles:

- High pressure gas (typically Air or Nitrogen), from 2 up to 12 barg
- Product particles acceleration in the milling chamber
- Particle to particle collision for product fragmentation
- Static classification.

The Jet Mill series are complete with dedicated feeding systems (volumetric or gravimetric) and final powder collection and filtration units. The equipment may be easily integrated into FPS isolators to allow the process of high active or sterile products.

There are three typical fields of applications: **R&D/Laboratory**, **Pilot Plant** and **Production Plant**.

## R&D/ Laboratory



In R&D quantities are very small. FPS designed the smallest jet mill in the world (10mg batch).

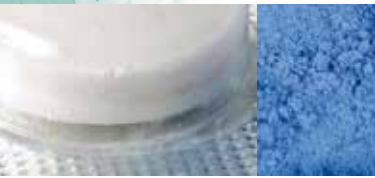
**LABOMILL-0**  
**LABOMILL-1**

## Pilot Plant



PilotMill series is designed for development laboratories and small production units. It's fully scalable.

**PILOTMILL-1**  
**PILOTMILL-2**  
**PILOTMILL-3**  
**PILOTMILL-4**  
**PILOTMILL-5**  
**PILOTMILL-6**



### PILOTMILL-5

PILOTMILL-5 is a JETMILL for Pilot Plant application, the batch sizes is from 100g to 100kg



Equipment	Batch	Productivity	Gas consumption @ 7 barg	Gas consumption @ 12 barg	Gas consumption 100 psig	Gas consumption 175 psig
LABOMILL-0	10mg–100mg	#	0.67 Nm <sup>3</sup> /h	1.15 Nm <sup>3</sup> /h	0,42 SCFM	0,72 SCFM
LABOMILL-1/PILOTMILL-1	0,1g–100g	3g/h – 80g/h	5.0 Nm <sup>3</sup> /h	8.6 Nm <sup>3</sup> /h	3,1 SCFM	5,4 SCFM
PILOTMILL-2	1g–3kg	5g/h – 1kg/h	11.6 Nm <sup>3</sup> /h	19.8 Nm <sup>3</sup> /h	7,2 SCFM	12,3 SCFM
PILOTMILL-3	3g – 10kg	50g/h – 5kg/h	14.4 Nm <sup>3</sup> /h	24.7 Nm <sup>3</sup> /h	9,0 SCFM	15,4 SCFM
PILOTMILL-4	5g–60kg	100g/h – 18kg/h	22.0 Nm <sup>3</sup> /h	37.8 Nm <sup>3</sup> /h	13,7 SCFM	23,6 SCFM
PILOTMILL-5	100g–100kg	0,2kg/h – 30kg/h	46.5 Nm <sup>3</sup> /h	79.7 Nm <sup>3</sup> /h	29,0 SCFM	49,7 SCFM
PilotMill-6	500g–250kg	0.25kg/h – 50kg/h	61.6 Nm <sup>3</sup> /h	105.6 Nm <sup>3</sup> /h	38,4 SCFM	65,8 SCFM
ProMILL-8	2kg–1000kg	0.5kg/h – 80kg/h	119 Nm <sup>3</sup> /h	205 Nm <sup>3</sup> /h	74 SCFM	128 SCFM
ProMILL-12	5kg–2500kg	5kg/h – 200kg/h	249 Nm <sup>3</sup> /h	427 Nm <sup>3</sup> /h	155 SCFM	266 SCFM
ProMILL-16	20kg–5000kg	10kg/h – 400kg/h	444 Nm <sup>3</sup> /h	761 Nm <sup>3</sup> /h	277 SCFM	474 SCFM
ProMILL-20	50kg–10000kg	20kg/h – 800kg/h	725 Nm <sup>3</sup> /h	1240 Nm <sup>3</sup> /h	452 SCFM	773 SCFM

## Production Plant



The ProMill series is engineered for the large volumes of production facilities, where flexibility, efficiency, and cleanability are key.

- ProMILL-8**
- ProMILL-12**
- ProMILL-16**
- ProMILL-20**



# QMills



**QMill** technology is an alternative to mechanical mills like PinMills and hammer mills. QMills produce a finer particle that mechanical mills and can work with coarser particles than a standard spiral jet mill. Also sometimes called “Loop Mill”, the QMill stands between mechanical mill and standard spiral jet mill. Because it is a jet mill all feeding and product separation components of a QMill can be also used with a spiral jet mill like FPS PilotMills and ProMills for a very cost effective set up. All connections of components are cGMP compliant and assure quick and easy assembly and disassembly. The number of components is reduced to a minimum to speed up cleaning and validation activities. Benefits:

- Fluid jet mill
- Larger starting PSD
- Final PSD down to 20  $\mu$ m
- Micronization of plastic type materials
- High throughput
- Interchangeable milling chamber with spiral jet mills.

The QMill series are complete with dedicated feeding systems (volumetric or gravimetric) and final powder collection and filtration units. The equipment may be easily integrated into FPS isolators to allow the process of highly potent or sterile products.

There are three typical fields of applications: **R&D/Laboratory**, **Pilot Plant** and **Production Plant**.

Equipment	Batch	Productivity	Gas consumption @ 7 barg	Gas consumption @ 12 barg	Gas consumption 100 psig	Gas consumption 175 psig
QMILL-2	1g – 3kg	0.01 – 1 kg/h	11.4 Nm <sup>3</sup> /h	19.5 Nm <sup>3</sup> /h	7,1 SCFM	12,2 SCFM
QMILL-6	100g – 100kg	0.2 – 30 kg/h	42.8 Nm <sup>3</sup> /h	73.4 Nm <sup>3</sup> /h	26,7 SCFM	45,7 SCFM
QMILL-8	1kg – 500kg	0.5 – 50 kg/h	67 Nm <sup>3</sup> /h	115 Nm <sup>3</sup> /h	42 SCFM	72 SCFM
QMILL-10	5kg – 2500kg	2 – 150 kg/h	188 Nm <sup>3</sup> /h	322 Nm <sup>3</sup> /h	117 SCFM	201 SCFM
QMILL-14	10kg – 5000kg	5 – 300 kg/h	401 Nm <sup>3</sup> /h	687 Nm <sup>3</sup> /h	250 SCFM	428 SCFM

## R&D

## Pilot plant

## Production plant



The R&D QMill is engineered for R&D labs where micronization is required on small quantities (from 1g to a few kgs).

### QMILL-2

The Pilot QMill series is for small production batch sizes (from 100g to hundreds of kg).

### QMILL-6 - QMILL-8



The Production QMill series is engineered for production facilities, where large volumes must be processed with high efficiency operation.

### QMILL-10

### QMILL-14



# Mechanical Mills



**PINMILL-50**

**Mechanical Mills** are designed to reduce agglomerates of pharmaceutical, chemical and food products down to fine size. The systems include hygienic design mill housing with interchangeable rotor and stator.

The size reduction of the product is considered dependent upon:

- the product being processed, with its chemical and physical properties
- the rotational speed
- the product feed rate into the milling chamber that defines the quantity of product inside the milling chamber
- the process temperature
- the adopted tools (pins, knives, hammers, blades).

The milling system can operate in conjunction with a cryogenic exchanger which allows the reduction of the process temperature down to -100C.

FPS Mechanical Mills are: PINMILL-50, PINMILL-100, PINMILL-200, HAMMERMILL-100 AND HAMMERMILL-200.



**PINMILL**



Milling head complete with pin rotor and stator, operating at speed up to:

- 50m/s.
- 100m/s.
- 200m/s.

**HAMMERMILL**



HAMMERMILL-100 is a portable unit that can be used for the milling of pilot batches. Different screens can be provided.



# Multimilling Platform



## Multimilling Platform

FPS proposes an innovative interchangeable milling station for the execution of milling operations in research and pilot plants, with different technologies integrated into a single system.

The platform can include a combination of:

- Spiral JetMill like PILOTMILL-4, PILOTMILL-5 or PILOTMILL-6
- PINMILL-100
- Loop mill like the QMill-6
- Conical mill
- HAMMERMILL.

The system can be designed to be explosion proof and to process OEB4/5 products when combined with an FPS barrier isolator.

Benefits:

- space saver: footprint 2-4 times smaller
- faster processing: no product transfer
- faster cleaning: fewer parts to clean

The milling system can be operated in conjunction with a cryogenic exchanger which allows the reduction of process temperature down to -100°C.

### Stand alone



Hybrid tech

The platform can integrate different types of mill:  
Mechanical Mills,  
Spiral JetMills and  
QMILLS.

### In isolator

The same system can be integrated in isolator.



Hybrid tech



# Milling and Micronization Isolator

Due to high energy involved in process operations and size reduction down to few  $\mu\text{m}$ , Milling & Micronization performances may result in dust clouds, exposing operators and environment to HPAPI.

FPS provides efficient containment Solutions for:

- Conical mills
- HAMMER MILLS
- PIN MILLS
- Fluid energy mills (Jet Mills and QMILLS).

Isolators are designed for laboratory, pilot or production units.

Containment of cryogenic milling operations is also available. Glove ports or half suits isolator configurations are chosen depending on space availability and desired ergonomics.



*Hybrid tech*

**ProMILL-12 station in isolator**  
With integrated sampling

## Milling and Micronization Isolator series

Contained milling and Micronization System  
CPT=  $50\text{ng}/\text{m}^3$ .



*Hybrid tech*

Milling isolator in half-suit configuration for ProMILL-16



*Hybrid tech*

# MEC test center



The **MEC - Milling and Micronization Excellence Center** - is where you can try to crack your most difficult applications. Our PhD staff, our experience and the variety of systems available are the ideal conditions to design the best process to achieve the best results. It can also be used to get a head start and validate your process while your equipment is being manufactured.

Our ISO8 grade test suites allow the execution of short to medium duration micronization technical tests and can handle from laboratory, to pilot, to production quantities.

The center is equipped with state of-the-art equipment and instruments as well as some isolators to assure product and operator protection during activities to assess process optimization and validation.

Special configurations of micronization equipment can be arranged for dedicated testing on a large range of equipment:

- Spiral Jet Mills
- QMILLS (loop type)
- PIN MILLS
- HAMMER MILLS.

Additional services concerning the particle size reduction include:

- De-lumping
- Co-micronization
- Sieving – Blending
- Cryogenic Operations
- PSD Analysis

Two isolators are available for technical test on HPAPI with R&D and Lab Jet Mills, up to PilotMill-6 and Pin Mill-100 units. The isolators are complete with gravimetric feeder and PLC controls.

Rental units are available to execute tests at our customers premises.

## Technical data

<b>Rooms class</b>	ISO8
<b>Available Mills</b>	R&D, Pilot and Production Mills
<b>Batch size</b>	Minimum 0,2g - Maximum 100kg
<b>Working pressure</b>	From 2 up to 12barg
<b>Process gas</b>	Nitrogen / Air
<b>Feeders</b>	Volumetric type with double concave screws Vibrating channel Gravimetric type with double concave screws
<b>Cryogenic milling</b>	Down to -100° C
<b>Control system</b>	Manual
<b>Particle Size Analyzer</b>	Malvern Mastersizer 2000 and Beckman Coulter LS100Q available
<b>Thermal Analysis</b>	Differential Scanning Calorimeter from -90° up to 400°







**R&D  
and Test Center**

For technical trials on a wide range of particle reduction equipment and technologies.

**R&D and Test Center**

FPS experienced technicians assure the necessary technical support for the process development.





**FPS. Food and Pharma Systems S.r.l.**

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