Jet Mill Buying Guide

1. How Does a Jet Mill Work?

A mechanical mill is based on impact force, where rotating blades strike the material with high speed to break it down. Compared to a mechanical mill, a jet mill grinds dry solids by utilizing the high kinetic energy generated from compressed gas. This causes high-speed collisions and severe friction between particles within the grinding chamber.

2. Types of Jet Mills

According to the different structure or working mode, jet mills can be categorized into three types: spiral jet mill, loop jet mill, fluidized bed jet mill.

2.1 Spiral Jet Mill

The spiral jet mill is simple in design, consisting of a flat cylindrical grinding chamber with several nozzles arranged tangentially in the peripheral wall, a pneumatic feed injector and a feed funnel.

2.2 Loop Jet Mill

The loop jet mill is designed with an inverted trapezoidal shape, which forces the circulating particles to concentrate at the nozzles. These rapidly moving particles collide and rub against each other, breaking

down into very fine particles.

2.3 Fluidized Bed Jet Mill

Driven by the high-speed air, the particles in a fluidized bed jet mill are accelerated and collide at the intersection point of the nozzle jets, thereby achieving the purpose of micronization.

3. Key Factors to Consider When Buying a Jet Mill

Be clear about your needs when you decide to purchase a jet mill. In general, you need to consider the following points.

3.1 Material Compatibility

Here are some key considerations for material compatibility in jet mills:

3.1.1 Moisture

The material needs to be dry which is at least less than 5% moisture content. Some material is easy to absorb moisture or water from the surrounding environment that cause clumping.

3.1.2 Infeed size

The material is required to enter the jet mill in powder or granular. If the material is over-sized or lumpy, it is not suitable for direct entry into the jet mill. In this case it is recommended to pre-grind the material first.

3.1.3 Ductility

Ductility is the ability of a material to deform plastically without fracturing and retain the new shape when the load is removed. It is difficult to grind thermoplastics with traditional milling method at ambient temperatures.

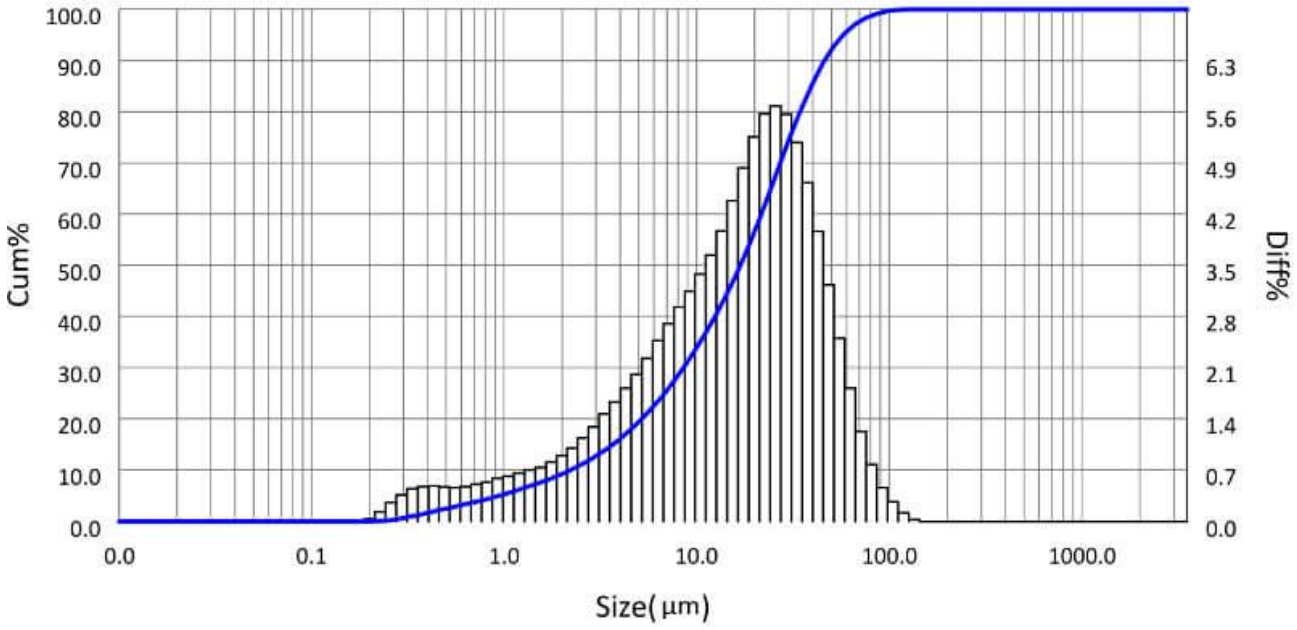
3.1.4 Abrasiveness

Materials with higher hardness, such as silicon carbide or alumina, are typically more abrasive than

softer materials like talc or gypsum. This will lead to the equipment's surface wearing out more easily.

3.2 Desired Particle Size and Distribution

Particle size distribution is a critical parameter that influences the behavior and performance of materials in end-use applications. For example, calcium carbonate is required to reach d90: 2μm to improve the paper's brightness.



3.3 Capacity Requirements

The jet mill can be designed in laboratory scale, pilot scale, and production scale according to the objectives. The capacity of our jet mills can range from tens of grams to thousands of kilograms per hour. The selection depends on bulk density and characteristics of the material to be processed.

3.4 Jet Mill Design and Features

3.4.1 Construction Material and Lining

Stainless steel provides a non-reactive surface ideal for pharmaceutical, food, and chemical applications. For highly abrasive materials, ceramic lining construction is often employed due to its extreme hardness. In some cases, polymer coatings such as PTFE or polyurethane are used to reduce material buildup and prevent contamination from metal contact.

3.4.2 Nozzle Design and Configuration

Our nozzles are designed using the Laval nozzle principle as an acceleration device. The Laval nozzle is a significant phenomenon in aerodynamics. A jet engine is an example of a Laval nozzle, where compressible fluid is squeezed through the Laval nozzle. The greater the expansion of the ejected gas, the faster the speed. The well-designed nozzles are critical to affect the particle distribution in the process.

3.4.3 Ease of Cleaning and Maintenance

Our jet mills feature easy access to the grinding chamber, enabling fast disassembly and cleaning between batches. For applications requiring frequent cleaning, we offer tool-free dismantling options to ensure optimal hygiene. A CIP system allows automated cleaning with minimal manual intervention using validated procedures.

3.4.4 Integrated Classifier Options

An integrated classifier offers precise control over particle size, ensuring that only particles of the desired size are collected, while oversized particles are recirculated for further grinding. The rotor speed can be adjusted to fine-tune the cut point, allowing for the production of very fine powders with a narrow particle size distribution.

3.5 Energy Consumption and Efficiency

3.5.1 Energy Efficiency

Some trial tests are necessary to determine the optimal process parameters such as grinding pressure, feed rate and classifying speed. In addition, the motors and blowers should be selected or designed with energy-efficient products. During equipment commissioning, all technical indicators should be adjusted to the optimal operating range for the jet mill.

3.5.2 Air Consumption and Pressure Requirements

Jet mills typically consume a significant amount of compressed air, which is used to generate the high-velocity air streams needed to grind materials. Depending on the specific application, the air pressures range from 6 to 10 bar.

3.6 Safety Considerations

3.6.1 Explosion Protection and Inert Gas Milling

Many materials such as organic compounds, metals can form combustible dust during the process. All electrical components require ATEX certification to prevent potential risks. Proper grounding of all equipment parts prevents static electricity buildup. Inert gases, such as nitrogen or argon, are used to create an oxygen-free environment when dealing with combustible materials.

3.6.2 Dust Containment and Filtration

The jet mill should be fully enclosed to prevent the escape of dust during the milling process. All connections, inlets, and outlets should be tightly sealed. For handling particularly hazardous materials, glove boxes can be used around the mill to further prevent dust from escaping into the environment. A jet mill equipped with fabric filter bag captures fine dust particles to ensure air quality.

3.7 Cost Considerations

3.7.1 Initial Investment

The size of the jet mill you need depends on the production scale, with larger mills requiring more substantial investment. The cost of additional equipment, such as air compressor, air tank, and refrigerator air dryer, must also be considered.

3.7.2 Operation Costs

Energy costs will depend on the compressed air requirements and the efficiency of the air compressor. Besides, electricity is required to power the mill's other components, such as screw feeder and control panels.

3.7.3 Lifespan and Durability of the Mill

Regular maintenance can extend the lifespan, but heavy use will still result in a shorter operational life. Our jet mills can run for as long as 5-10 years under normal operation.