VACUUM DRYER | VD-M Series

Professional Mixing Technologies

VD-M Series Vacuum Dryer Introduction

Mixer-type vacuum dryers offer effective drying at low temperatures along with homogeneous mixing. The spiral or twin-shaft mixer continuously moves the material, preventing accumulation on the surface and product burning. The system operates under vacuum and is heated with steam, thermal oil, or hot water; the temperature is precisely controlled. It is an ideal solution for heat-sensitive products in industries such as pharmaceuticals, chemicals, food, and ceramics. These high-efficiency systems provide energy savings while maintaining product quality. Thanks to the CIP (Clean-In-Place) feature, the cleaning process is quick and hygienic. These features support continuity of production processes and process safety.

Working Capacity	100–15000 [L]
Total Volume	137–19300 [L]
Feed Inlet	50–7250 [mm]
Discharge Valve	25–4000 [mm]
Working Temperature	25–150 [°C]
Pressure	-1–0.4 [Bar]
Speed Range	10–57 [RPM]
Motor Power	1.5–90 [kW]
Materials	AISI 304, AISI 316, AISI 316L, etc.
Industries	Pharmaceutical, Chemical, Food, etc.

Innovative Mixing and Drying Technologies

Professional Mixing Technologies

FEATURES

Vacuum Drying System
Enables low-temperature drying to preserve sensitive materials.

Integrated Mixing Mechanism
Provides uniform drying by actively circulating materials for balanced heat and moisture dispersion.

Precise Processing
Minimizes heat exposure to protect sensitive compounds from thermal damage and oxidation, preserving product quality and nutritional value.

Heat-Jacketed Design
Delivers efficient and uniform heat through a surrounding jacket, eliminating direct contact with the product and reducing the risk of burning or contamination.

APPLICATIONS

Pharmaceuticals
Drying and homogenizing heat-sensitive APIs and excipients.

Food Industry
Precise and gentle drying of aromas, extracts, and nutrient-rich powders.

Chemicals
Solvent removal and mixing of specialty and fine chemicals.

Biotechnology
Handles bio-based or sensitive materials under mild conditions to preserve their structure and functionality.

ADVANTAGES

- **Reduced Drying Temperature**
  It enables the precise drying of heat-sensitive products without degradation.
- **Faster Moisture Removal Under Vacuum**
  Vacuum lowers boiling point, enabling quicker and more efficient drying.
- **Homogeneous and Precise Drying**
  Ensures even moisture removal without damaging product texture or structure.
- **Minimal Oxidation**
  Drying in a sealed vacuum environment minimizes exposure to oxygen.
- **Steam Sterilization Option**
  Built-in option for sterilization ensures compliance with hygiene standards.
- **Easy Access and Cleaning**
  Top and side access simplify operation, loading, and cleaning processes.

CFD studies

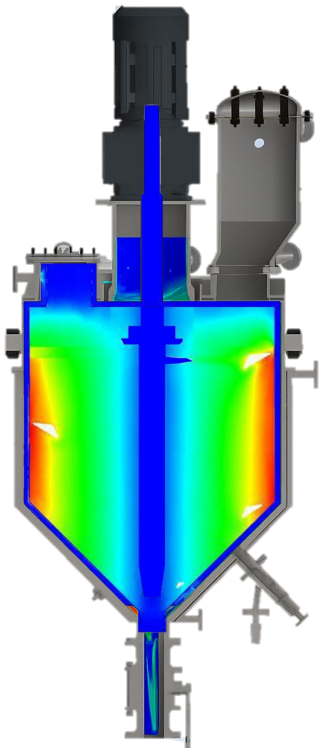
Computational Fluid Dynamics (CFD)

CFD simulations provide detailed analysis of fluid behavior inside real tanks and mixer setups in a virtual environment. This allows process performance to be verified and optimized before physical trials. With years of field experience, Mechanimix uses advanced CFD tools to increase equipment efficiency, improve mixing patterns, and eliminate dead zones, thereby achieving reliable and homogeneous drying results.

Examples of CFD Analyses for Vacuum Dryer

CFD Post A – Velocity Gradient Map

In this simulation, the velocity profile inside the conical dryer during the mixer's operation is shown with a color-coded scale. Blue areas represent regions with low fluid velocity, while green and yellow areas indicate higher velocity zones influenced by the impeller movement. The velocity distribution inside the tank demonstrates effective mixing and minimal dead zones. This homogeneous velocity field indicates that the product moves and mixes evenly inside the tank. This is critically important for ensuring efficient drying and preserving product quality.

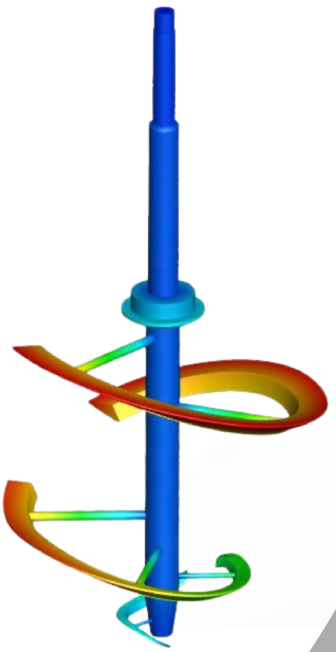


CFD Post A

CFD Post B – Homogeneous Mixing of the Material to be Dried

In the CFD simulations, the color distribution in the image shows the precise distribution of the material's physical properties during the homogenization process. The red color in the center of the tank represents the regions with the highest mixing intensity, caused by turbulence forces near the center. On the other hand, the blue or green colors at the tank edges indicate areas where flow and mixing intensity decrease.

Mechanimix engineers have utilized detailed CFD analyses to design their systems so that homogenization occurs evenly and efficiently throughout all tank regions — even at the edges.



CFD Post B

The Latest Innovations in Mixing and Drying

Professional Mixing Technologies

Efficient Mixing Mechanism

At Mechanimix, we understand that effective mixing is the heart of successful vacuum drying. Our advanced mixers ensure every particle moves seamlessly, delivering faster, more uniform drying — even for the most challenging materials.

- **Smart Blade Design & Gentle Motion**
  Specially engineered blades with low-shear, slow rotation create a strong, uniform flow that prevents material buildup on vessel walls and ensures consistent drying.
- **Optimized Drying Process & Energy Savings**
  Three-dimensional material circulation accelerates drying cycles, reduces energy consumption, and improves product uniformity—especially crucial for heat-sensitive or sticky materials.
- **Enhanced Mass & Heat Transfer for Consistent Results**
  The mixing mechanism boosts solvent removal speed and ensures stable, repeatable outcomes, leading to higher product quality and minimal product loss.

Particle Movement During the VD-M Series Process

Ultrasonic Vibration System

Sticky or heat-sensitive materials causing wall buildup? Mechanimix's ultrasonic vibration technology offers a non-contact, high-tech solution that keeps your product flowing and your process running smoothly.

- **External Ultrasonic Energy Transfer**
  A custom-designed transducer sends high-frequency sound waves into the vessel wall, creating micro-vibrations that keep product gently moving.
- **No Wall Build-Up, No Product Loss**
  These vibrations prevent material from sticking to walls, especially helpful for sticky, hygroscopic, or sensitive materials.
- **Gentle, Non-Invasive, Continuous Operation**
  Unlike mechanical scraping, ultrasonic motion is non-intrusive and preserves product quality while improving discharge.

Benefits include

- Minimized product buildup on vessel walls
- Faster and more complete discharge of the dried product
- Reduced cleaning time and lower risk of cross-contamination
- Greater process consistency for sensitive or high-viscosity materials
- Improved hygiene and regulatory compliance for pharmaceutical or food-grade applications

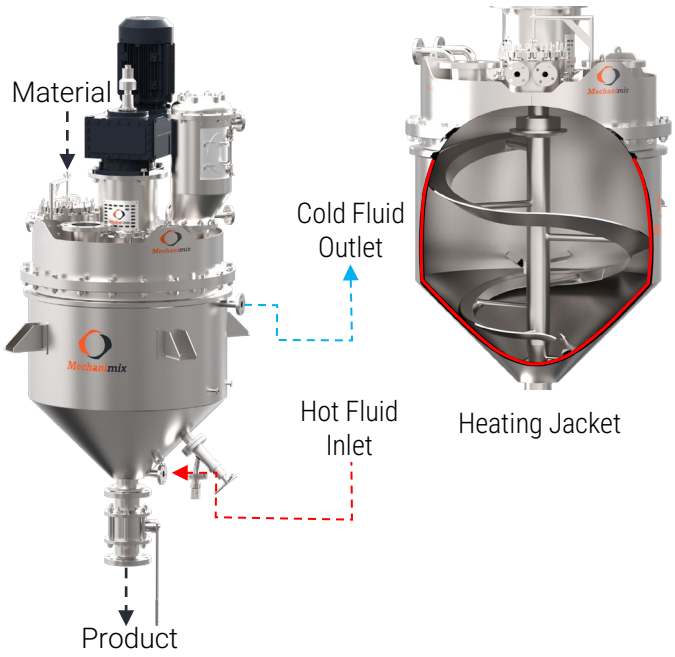
Professional Mixing and Vacuum Drying Technologies

Professional Mixing Technologies

HEATING MECHANISM

Successful and controlled heat is the key to effective vacuum drying. Mechanimix uses indirectly heated jacketed vessels to provide safe, uniform, and energy-efficient temperature control.

- **Heat Jacket**
  A double jacket surrounds the vessel, circulating heat-transfer media (steam, oil, water, or molten salt) to evenly heat the product.
- **Precise and Safe Heating**
  Ideal for sensitive materials, this system prevents local overheating and ensures safe temperature control.
- **Efficient Energy Use and Uniform Performance**
  Indirect, enclosed heating minimizes energy loss and provides uniform drying conditions throughout the process.



Spray Nozzle System

Spray nozzles in Mechanimix vacuum dryers are designed for dual functionality: efficient atomization of liquid feed for rapid drying, and high-pressure cleaning for fast, hygienic CIP (Cleaning-In-Place) operations. This combination ensures both top drying performance and minimal downtime.

- **Spraying for Maximum Surface Contact**
  Thanks to the effective range and wide coverage angles of the nozzle designs, liquid contact is easily achieved on all surfaces inside the tank.
- **Homogeneous Dispersion Across Drying Chamber**
  Uniform mist distribution ensures consistent drying and prevents wet spots or clumping.

Static Nozzle System

CIP Spray Nozzles

- **Strategic Placement for 360° Coverage**
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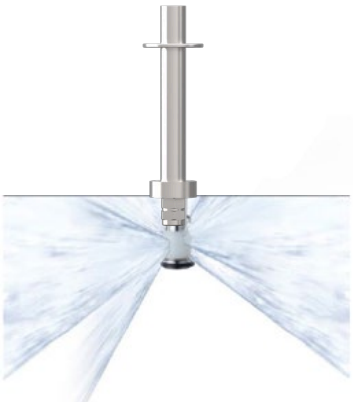
  Spray nozzles are positioned to reach every inner surface of the vessel, ensuring complete internal cleaning without blind spots.
- **High-Pressure Cleaning Without Disassembly**
  Cleans the system thoroughly without the need to open or take apart the vessel — saving time and reducing manual effort.
- **Hygienic & Time-Efficient Process**
  Ideal for pharmaceutical and food industries, where cleanliness is critical. Speeds up cleaning, reduces downtime, and supports GMP compliance.



360° Dynamic Nozzle System

Advanced Mixing Equipment Features

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A cooling device is installed in the gearbox

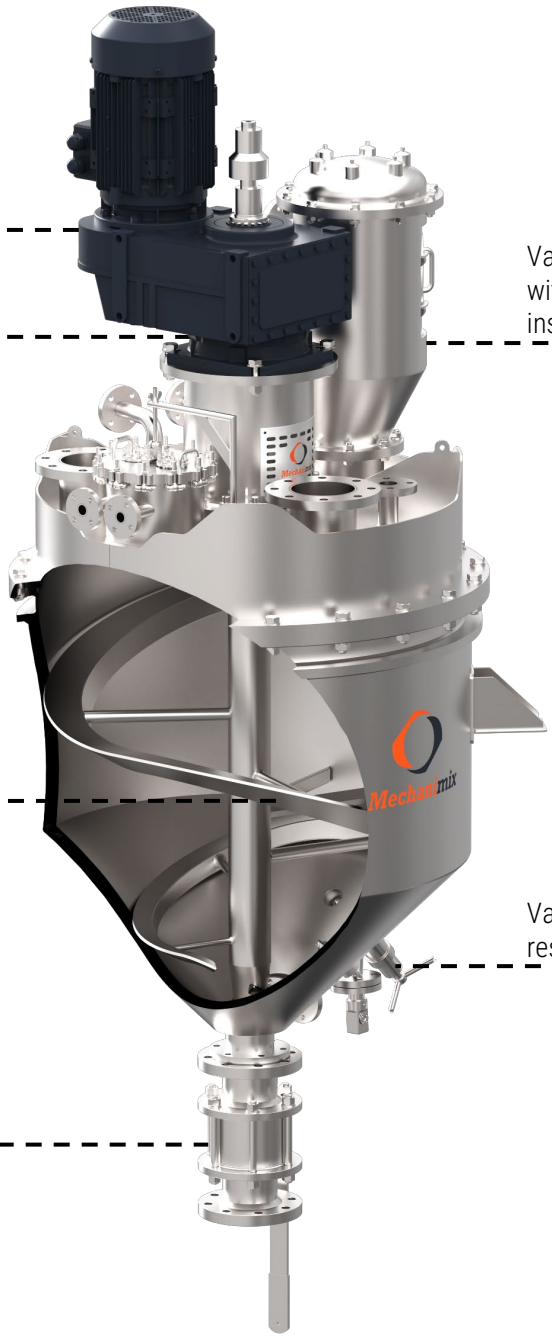
The mixing tool is placed and driven just on top

Vapour filter heatable, equipped with Clever-Cut®-designed inspection door on demand

The tank is resistant to vacuum and pressure and can be heated with steam, thermal oil, or water. It can also be supplied with insulation upon request.

Mixing chamber and mixing tool are fully welded and polished.

mixing tool: fully temperature controlled on demand, outstanding mixing quality, and high discharge capacity.



Vacuum and pressure-resistant sampling valve.

Segment ball valve designed to eliminate dead space, capable of withstanding both vacuum and pressure conditions.

Mixing tool heated

The loading and inspection hatch is designed for easy use

Various Filter Applications

Conical Vacuum Dryer – Technical Configurations

Type	VD-M375	VD-M560	VD-M750	VD-M940
Effective Volume [L]	375	560	750	940
Total Volume [L]	500	745	1000	1250
Feed Inlet [mm]	150	225	300	375
Discharge Valve [mm]	85	127	170	212
Weight [Kg]	1350	2000	2700	3735
Discharge Type	Manual	Automatic	Automatic	Automatic
Control System	Manual	Semi-Automatic	PLC	HMI + PLC
Lump Breaking Agitator	✗	✗	✓	✓
Liftable Cover	✗	✗	✓	✓
Liquid Addition	✗	✗	✓	✓
Solids Sampler	✓	✓	✓	✓
Automated Drum Loading and Unloading System	✗	✓	✓	✓
CIP - Clean-In-Place Spray Nozzles	✓	✓	✓	✓
Explosion-proof EX	✗	✗	✓	✓
Vacuum System	✓	✓	✓	✓
Hot Water or Hot Oil Temperature Control Systems	✗	✗	✗	✓

- The features listed under "Design Options" (e.g., Lump Breaking Agitator, XP Electrics, etc.) are configurable based on customer requirements. ✓ indicates the feature is included, ✗ indicates it is not included by default, and availability may vary depending on the specific model configuration or customization.
- Technical specs like volume, dimensions, and weight are based on standard designs and may vary with customization. Mechanimix uses its expertise to design and build conical vacuum dryers of any size and complexity, fully tailored to your process needs. We go beyond standard models to offer custom solutions.

Industrial Vacuum Dryer Technologies

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The vacuum dryer (100–15000 L) dries sensitive materials safely and homogeneously under controlled temperature and pressure; it is especially suitable for the pharmaceutical, food, and chemical industries.

Mechanimix offers a range of industrial vacuum dryers with versatile models delivering optimal drying solutions for various industries.