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# FIMA SUSPENSION DRYER



fms-dde (07026)

## Overview advantages



### One Apparatus

For several process steps, no loss by product transfer

### No Cross Contamination

By provable efficient CIP systems a fully automatic cleaning can be validated

### High Containment

Absolutely tight and safe system, no contamination of the operator and environment

### Total Discharge

Maximum yield, possibility to combine with any product handling system in all OEL levels

### Multipurpose

Operation in versatile applications due to high process flexibility.

### Reliability

Fully automated and safe system, validatable process steps with individual recipe parameters.



### Compact Design

Little required space for basic machine. Auxiliary components in module unit design

### Sterile Design

Sterilisable equipment components, usage of double mechanical seals

### Online Monitoring

PAT Systems which enable continuous control of product temperature, drying gas and exhaust gas. Process monitoring by camera systems and endoscope. Product sampling

### No Particle Destruction

Gentle drying methods, discharge without mechanical internals

### High Process Flexibility

Best applicable drying option can be freely chosen. Combination of Counter-Pulse Drying and Vacuum Drying

## FSD (FIMA SUSPENSION DRYER)

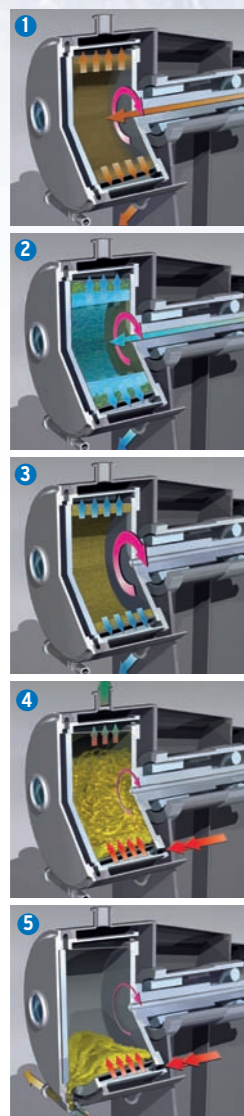
## Process Steps

From Suspension to dry Product

## Counter-Pulse Technology

Filtration of extremely difficult Products

Efficient Drying with improved Product Quality



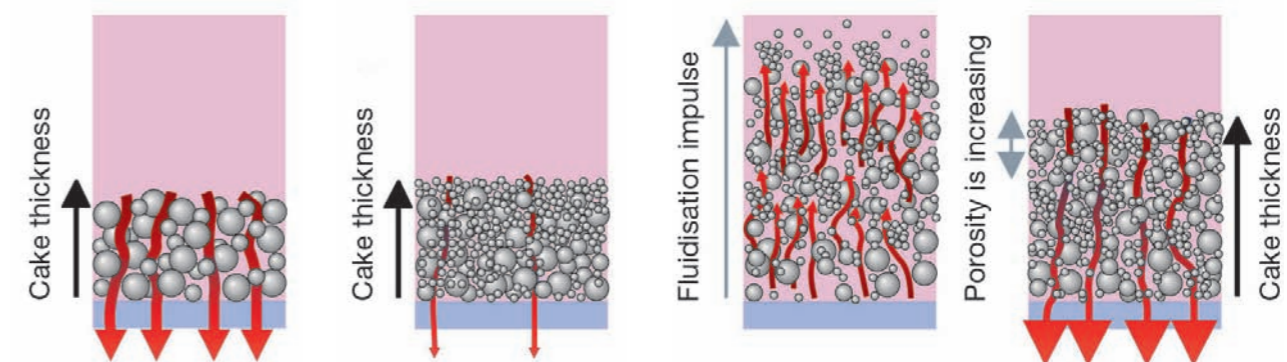
- 1. Filling:** Suspension is filled into the rotating filtering basket process monitored through the feed pipe. Thereby a homogeneous filter cake structure is achieved. The filtrate is drained out through the metal filter screen.
- 2. Washing:** Analogue to filling process the washing medium is lead into the filter drum through the feed pipe. Thereby rotational speeds can be freely selected. Due to the homogeneous cake structure every part of the solid cake is washed equally well. This procedure can be repeated arbitrarily often.
- 3. Spinning:** Spinning off the filtrate is performed with freely selectable rotation speeds. The spinning step is controlled by fluid accumulation per time or alternatively by a predefined spinning time. If materials are difficult to separate dewatering performance can be increased by over pressure in the centrifuge basket.
- 4. Drying:** The humid product cake is permanently loosened by Counter-Pulse method with low rotational speed by gas impulses against centrifugal forces. The porosity will be increased, hot drying gas is flowing through the product ring. Drying is supported by blowing in hot drying gas through the feed pipe. With this combination the product ring will be dried fast, gentle and free of lumps. With the classic fluidised bed method the humid product cake is dislodged part by part at low rotational speed by pressure gas blasts. Product concentrates as loose bulk material in the filter basket. Heated drying gas is pulsatively blown in from below into the processing room. The bulk material is thereby displaced into a fluidised bed, which is permanently shifted by rotating the filtering basket continuously.
- 5. Discharging:** After the drying step the filter basket will be opened. The dried product will be discharged by slow rotation of the conically shaped filter drum. This process is supported by gentle pulsation of propellant gas. Product can be conducted both gravimetrically as well as pneumatically.

During filling and washing a top layer with a high level of fines can be formed with products with large practical size distribution due to different particle speeds. This topping decreases filtration rate considerably or even can cause that filtering and washing is not possible. Using Counter-Pulse technology such kinds of products can be processed too.

Thereby gas is shot in at ultrasonic speed in opposite direction to centrifugal force into the single filtering segments. This increases a porosity at this location and a light cake displacement. The filter cake ring permanently persists. Filtration resistance decreases and filtrate i.e. wash fluid can pass filter cake easier.

The same technology can also be applied with drying. Warm drying gas is shot into segmented chambers of the filter drum by drying nozzles. Drying efficiency is improved in many respects against conventional methods.

- Because the interior of the basket is closed, drying gas must pass the product ring two times – when shooting in from outside to inside and when leaving filtering barrel from inside to outside. Hence gas is employed more efficient.
- Product ring is partially lifted, which leads to porosity increase. Particle surface is significantly enlarged and diffusion ways decrease.
- By permanent light displacement of the product ring gaps are avoided in the first place, that lead to bypass flow of drying gas.
- Even products that intend to agglomeration are discharged as fine fluffy powder.



## Variation and Combination

High Flexibility

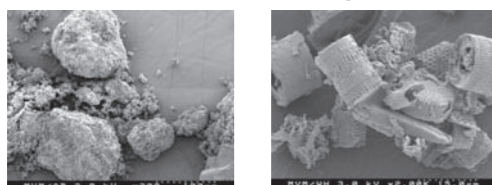
Intermediates and final products are differing in particle size, particle size distribution, crystal shape, crystal hardness and other chemical and physical characteristics. In order to cover a wide product range for production high demands are made on the process equipment. FIMA SUSPENSION DRYER are designed to select always the best filtration and drying procedure according to the product and process requirements.

The well proven Counter-Pulse Technology is always the standard program.

Other available variations and combinations with the Counter-Pulse technology are:

### Fixed bed drying:

The drying gas will be injected into the process chamber and dehumidifies the cake while flowing through it from the inside to the outside. This procedure can be selected permanently or in intervals. Due to the increased porosity the evaporation rate of the solvent will be higher and the drying of the product more efficient. This method allows a safe drying of the product without lumping.



### Vacuum Drying:

In order to supply the necessary heat to the process area, hot steam will be injected through the spray nozzles. The steam applies to the rotating filter drum and is condensing. The result is a very efficient and uniform heat transfer to the entire area. The filter cake remains with the appropriate choice of speed in the drum as a ring. In combination with the Counter-Pulse the cake will be porous, homogeneous and there are no lumps. The solvent will evaporate much better under vacuum as the capillaries become wider. Due to the short swirling of the cake due to the gas impulse, the particles will be relocated permanently. So areas of humid particles will be exposed to the drying gas and the complete batch will be dried much more efficient than with conventional vacuum dryers.



## Cleaning and Safety

Absolute Protection by closed System

Lacking hygiene can cause health risk due to product contamination to machines in products close to pharmaceuticals. Thus, the FIMA SUSPENSION DRYER design is optimized regarding simplest cleaning and inspection.

### Features

- Automated cleaning that can be validated in closed condition
- Clean room installation
- Easy and simple access to product contacting machine parts
- High surface finish quality of product contacting surfaces
- Use of materials and gaskets according to EN 10204 – 3.1 / 3.2 and FDA 21 CFR
- Avoiding potential contamination sources
- Cleaning method can be checked by Riboflavin test.

### Cleaning

The cleaning of the FIMA SUSPENSION DRYER is performed in closed condition by fully automatic CIP cleaning systems and partly flooding the processing room effectively within a short time. During rotation high shear forces are generated. This effect will clean the filtering basket and machine housing free of residual materials. Thus product changes can be performed rapidly and easily.

### Inspection

For inspecting the FIMA SUSPENSION DRYER the process room and associated components can be opened simply and rapidly. All product contacted surfaces and as well as all rotating parts therefore are easily accessible. Demounting of machinery parts for inspection or cleaning is not necessary.



The cleaning result can be reviewed and qualified by SWAP tests.

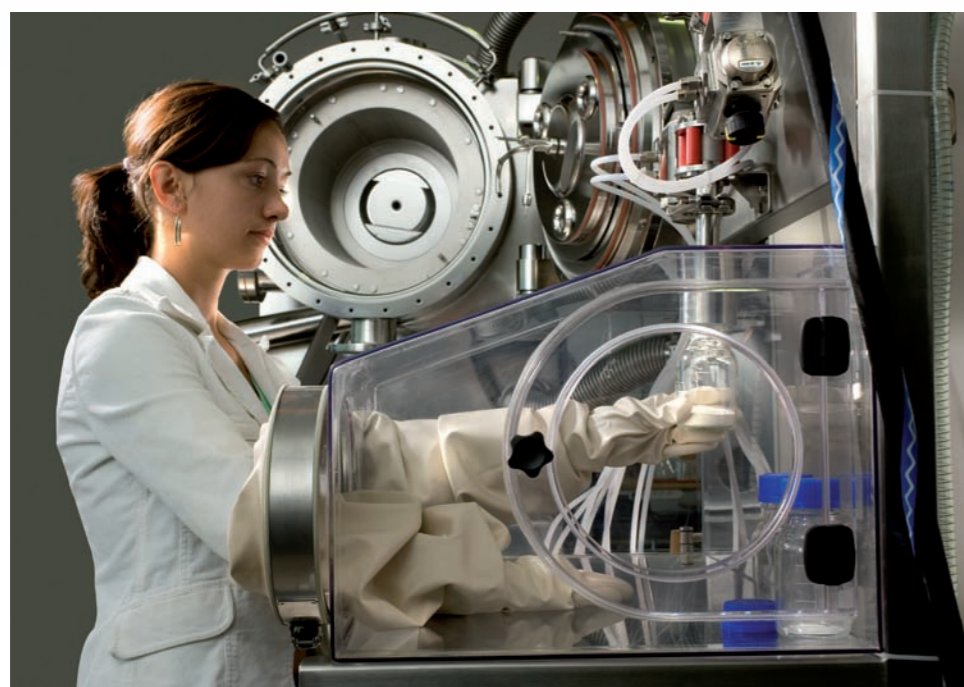
## Sterile Version

Solutions for highest Purity

To enable the usage of the centrifuge dryer in sterile agent productions a sterile version of the **FIMA SUSPENSION DRYER** is available. Hereto e.g. special sealing systems are used that were especially designed for operation in sterile processes.

### Features

- Hermetically closed enclosures
- Pressure resistant enclosure for vapour sterilisation
- Avoiding dead rooms and gaps
- Avoiding screw connections
- Fully automated control systems
- SIP systems that can be fully automated and validated
- Sterilisable components
- Special sealing systems



## Plant Automation

Reliable Validation of your Facilities

In pharmaceutical productions very high additional requirements are demanded regarding qualification / validation of machinery controls.

### Controls:

The control of the basic machine and also of the peripheral equipment needs to be adapted to operator requirements individually: Many functions of the FIMA SUSPENSION DRYER and gas loop are tailored to customer requirements and desires.

### Features:

- Considering the operator specifications at visualisation of the facility on operation terminal screen
- Complete recipe management within centrifuge control is possible
- Simple to complex communication with superior process control systems with different communication interfaces
- Control terminal can be installed in explosion protection zones
- Controls can be executed as stand alone versions or as sub-systems of complex control systems of the customer.

### Quality management:

By a comprehensive quality management it is ensured that customer defined criteria for design and production are considered and verifiably met by a systematic clearly defined project realisation. This is approved by documentation compliant with cGMP/ GAMP which is an important part of our scope of services to pharmaceutical industry.



## Chemical Industry

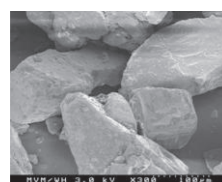
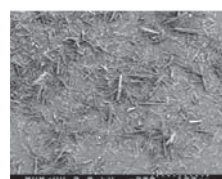
Robust and economical Solutions

## Pharmaceutical Industry, Fine Chemicals and Biotechnology

Multiple Applications with best References

The FIMA SUSPENSION DRYER CD (chemical design) has been developed especially for applications in the basic chemical industry. Also this design allows all combinations on filtration and drying as previously described. The characteristics are a robust and economical design.

- Material of construction for non product contacted parts is carbon steel, painted
- Material of construction for product contacted parts is stainless steel or Hastelloy
- Shaft seal design with the well proven lip seal cartridges



Typical applications are e.g. the production of basic chemical products, coloured pigments and toner.

Also with these applications permanently higher requirements to product quality are requested. Due to higher occupational safety requirements the focus is turned to closed filtration and drying systems.

The FIMA SUSPENSION DRYER CD can be equipped optionally with PAT – instrumentation for real time – recording too. The required product quality can be achieved and monitored during the entire production process.



**FIMA SUSPENSION DRYER SD (sterile design) can be applied for production of**

- Pharmaceutical agents
- Special chemicals
- Biotechnologically manufactured products

Other applications appear at isolation of oxidation sensitive products which require a secure process that must be executed at any stage of process chain under granted and total exclusion of oxygen.

In fine and special chemical technology permanently higher requirements to product quality are requested. Also here trend are up-to-date centrifugal i.e. dryer systems isolating different high grade substances securely and reliably.

**FIMA SUSPENSION DRYER is especially suitable for the following products**

- High Potency Compounds
- Pharmaceutical output stages
- Highly toxic products
- Agents for infusion solutions
- Agents for hypodermic application methods
- Agents that have to be manufactured in sterile environment
- Products sensitive to oxygen

### PAT – Instrumentation

To ensure secure verifiable process control as well as required product quality across the entire production process, the FIMA SUSPENSION DRYER can be equipped optionally with PAT – Instrumentation for real time – recording.

During processes product temperature as well as residual humidity is permanently measured and recorded. Furthermore products can be sampled at any time. With the help of an endoscope and a video camera insight in processing room is possible at any time.

Video camera  
Endoskop

Product sampling  
Temperature sensor

NIR

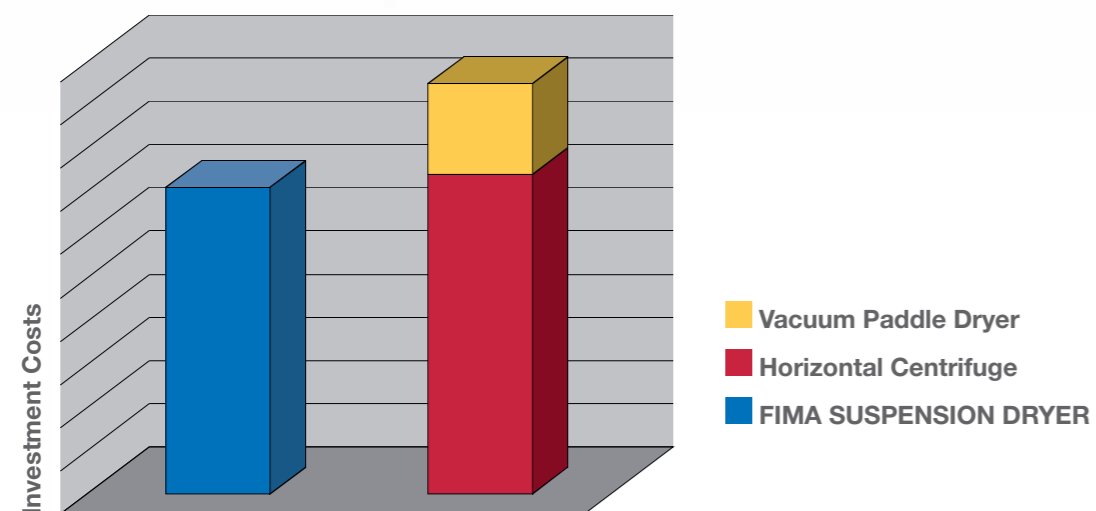


## Capital Investment

FIMA SUSPENSION DRYER, the most reliable Solution

In many applications the liquid solid separation and drying in a filter dryer cannot be performed due to product characteristics. The typical equipment will be then the combination of a filtering centrifuge with a vacuum paddle dryer or the FIMA SUSPENSION DRYER.

The following graphic shows the comparison of capital investment of the two process solutions. The numbers were calculated based on product trials with pilot units and scale-up estimations. The inverting filter centrifuge was operated with the thin layer filtration method. The product was sticky and intended to agglomerate. Both process equipment achieve the same capacity per year.



## Pilot Plant Facility

Test and Process Optimization in Oberfischach / Germany or Osaka / Japan

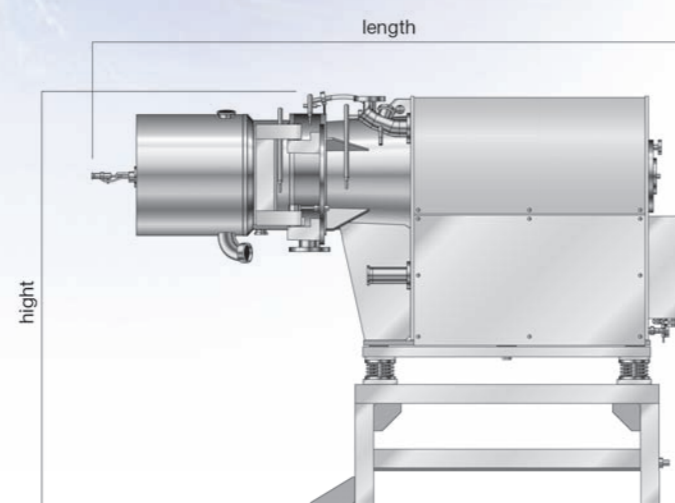
No product is like another one. No customer requirement is like another one. Based on our experience we know that each process machine is unique. Each customer has his own products being produced by individual employees in completely different environments. For this reason, in addition to our range of pilot equipment, we offer in our pilot facility extensive services for individual design and optimization.

### Direct advantages for our customers:

- Shorter implementation time for product by determination of the product suitability as well as the necessary process cycle
- Optimized adjustment of the process parameters in the production line by precise estimation of the cycle times
- Definition of efficient cleaning processes (CIP/WIP)

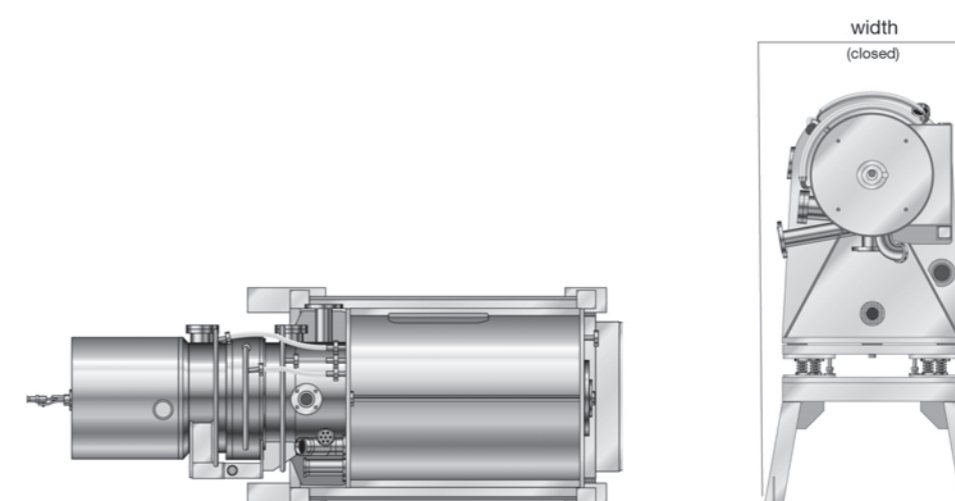


## Technical Data FSD (FIMA SUSPENSION DRYER)



Technical Data FIMA SUSPENSION DRYER	FSD S 400	FSD S 600	FSD S 800
Length (mm)	3200	3400	3900
Width, closed (mm)	1400	1600	1800
Height (mm)	1700	1900	2400
Weight, approx. (kg)	3500	4300	9500
Drum diameter (mm)	400	600	800
Filling volume, max. (l)	30	63	125
Filter area (m <sup>2</sup> )	0,38	0,85	1,26
C-factor (xg)	600	600	600
Rotating speed (1/min)	1640	1340	1160

Details are subject to change



Technical Data FIMA SUSPENSION DRYER	FSD S 1000	FSD S 1300	FSD S 1600
Length (mm)	4000	4100	4200
Width, closed (mm)	1800	2200	2800
Height (mm)	2500	2800	3100
Weight, approx. (kg)	11500	16000	21000
Drum diameter (mm)	1000	1300	1600
Filling volume, max. (l)	235	460	800
Filter area (m <sup>2</sup> )	1,89	2,86	4,02
C-factor (xg)	600	600	600
Rotating speed (1/min)	1040	910	820

Details are subject to change