



MÖJJ ENGINEERING SYSTEMS LTD.

**DRYERS**

Excellence Through Innovation

# EXPERIENCE

## Over 36 Years of Drying Experience



## Over 1500 Dryer Installations Worldwide

- SPRAY DRYERS
- FLUID BED DRYERS
- FLASH DRYERS
- AGITATED FLASH DRYERS
- ROTARY DRYERS
- CONDUCTION DRYERS
- AGITATED THIN FILM DRYERS
- VACCUM DRYERS

Excellence through Innovation

# FRONTRUNNER IN SPRAY DRYERS

## SPRAY DRYERS

This is a single step drying operation in which liquid feed solutions, emulsions, dispersions or slurries are directly converted to free flowing powder or granules.

Spray Dryers are custom designed to achieve product characteristics. Proper atomization methods and air flow patterns are selected to achieve this.

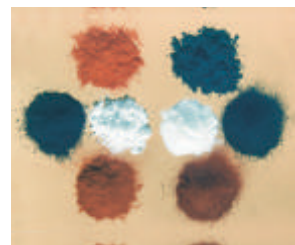


## ROTARY DISC ATOMIZATION

A high speed rotating disc is used for atomizing the liquid feed. The disc throws the liquid outward or tangentially at high velocities forming fine droplets / mist. Instant drying takes place in contact with hot air forming free flowing dry powder.

Discs designs include straight / curved vanes, pin wheels, multilayer discs in diameters of 60mm, 100mm, 160mm, 250mm & 350mm for different capacities.

For high temperature applications special bearing cooling arrangements are provided.



# FRONTRUNNER IN SPRAY DRYERS

## NOZZLE ATOMIZATION

Feed Solution or Slurry at high pressure is atomized through a nozzle into fine droplets and then dried instantaneously. Various types of air flow patterns are possible with nozzle atomization systems. Nozzle type spray dryers are used to produce material in the granular, non-dusty form or powder form as required.

Depending on the desired physical properties of end product, the choice of co-current, counter current or mixed air flow is selected.



SINGLE-FLUID NOZZLE,  
CO-CURRENT MODE



TWO-FLUID NOZZLE,  
FOUNTAIN MODE



## FEATURES

- Wide range of materials can be dried.
- Options of both single fluid / two fluid nozzles.
- Easy to operate and user friendly.
- Compact layout.
- Automatic / Remote nozzle change over with steam / air flushing.
- PLC / DCS
- CIP
- Explosion proof designs



# CUSTOMIZED DRYING

## FLUIDISED SPRAY DRYERS CUM GRANULATORS

Spray Dryers with Integrated Fluid Beds are ideally used to meet special particle size, dispersibility and bulk density requirements. The spray comes in contact with fluidized dried particles and agglomerates. External fluidized bed systems are provided for finish drying, de-dusting, and product cooling.



INTEGRATED FLUID BED DRYER

### APPLICATIONS

- Suitable for production of granular, non dusting, instantised or hygroscopic products.
- Plant evaporation capacities from 100 Kg / hr onwards.
- Design available for explosive / hazardous products.
- Energy efficient operation



EXTERNAL FLUID BED DRYER



### CLOSED LOOP SPRAY DRYERS

When the product to be dried is oxidisable or laden with flammable / explosive solvents, nitrogen purged closed loop systems are preferred. These are typically used in Pharma Industry.

### ADVANTAGES

- Ideal for solvent laden, flammable / explosive product to be dried.
- Inert gas drying avoids oxidising of material.
- Recovery of costly solvents
- Special nitrogen purged atomizers to achieve desired product particle size and bulk density.
- Solvent recovery of upto 98.5%

# RELIABLE TECHNOLOGY IN CONDUCTION DRYERS

## CONDUCTION DRYERS

This range of dryers employ the conduction mode of drying. These dryers ensure low temperature gentle drying of the product. Conduction dryers are designed taking into consideration the wet and dry product flow characteristics, lump crust formation tendency and thermal sensitivity. These could be indirect with tubes or jacket.



### INDIRECT STEAM TUBE ROTARY DRYER

Indirect Steam Tube Rotary Dryer comprises of tubes fixed to a rotating shell. Steam passes through the tubes. The wet material present in the rotary shell is lifted by means of lifters and showered. The product is dried by means of the indirect contact with steam. The entire shell is supported on rollers and rotated by means of tyres & girth gear.

A Sealing arrangement is provided to avoid air leakage and product losses.

### ADVANTAGES

Rugged construction | Continuous operation | Gentle drying of material  
Thermally efficient | Low operating & maintenance cost

## ROTARY TUBE BUNDLE DRYERS

A Tube Bundle is like a heat exchanger, rotated in a stationary insulated housing. Lifters provided on the tube bundle lift the material and shower them on the hot tube bundle surface. Steam is passed from one end of Tube Bundle for drying and condensate is removed from the other end

### ADVANTAGES

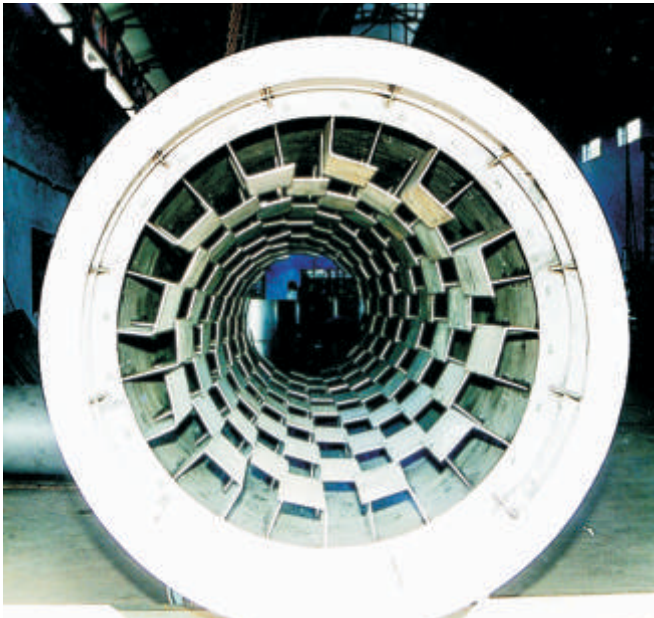
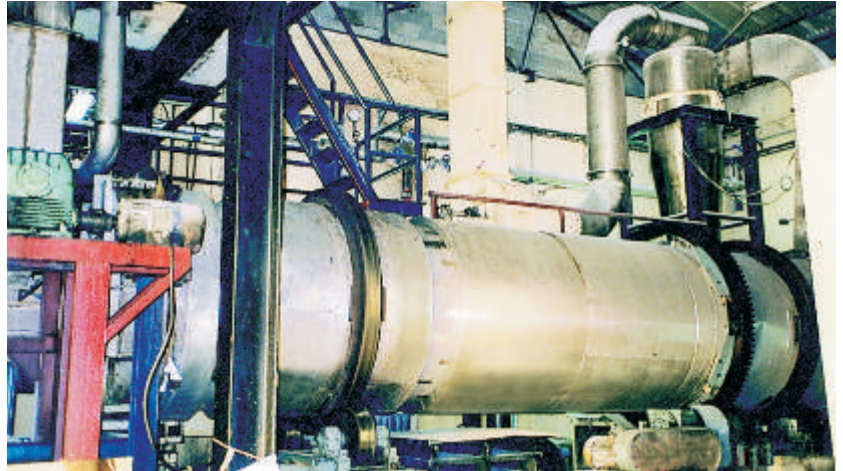
- Gentle drying.
- No breaking of material.
- High heat economy.
- Continuous operation.



# REVOLUTIONARY ROTARY DRYERS

## ROTARY DRYERS

Rotary Dryers are work horses. They are rugged and robust in which the solids to be dried are showered in a hot stream of air and dried during travel through the dryer.



## DIRECT ROTARY DRYER

Direct Rotary Dryer comprises of a rotating inclined shell through which a hot stream of air flows. The wet material present in the rotary shell is lifted by means of spiral flights and showered in hot flowing air. Due to this direct contact, the product is dried.

Rotary Dryers are available with co-current or counter current air flow patterns depending on the properties of individual products to be dried.

The internals are designed to ensure uniform distribution over the entire cross section.

The entire shell is supported on rollers and rotated by means of tyres and girth gear or by means of a friction drive. Sealing arrangement is also provided so as to have a minimum air leakage and product loss.

## DIRECT ROTARY COOLERS

Direct Rotary Coolers are used for cooling product to the desired temperature before packing. The product is showered in an air stream by internal lifters. Ambient de-humidified air is used for cooling.

## ADVANTAGES

Ideally suited for large capacity application and uneven particle size distribution Continuous operation and versatile application | Low operating & maintenance cost.

# STATE-OF-THE-ART FLUID BED DRYERS

## FLUID BED DRYERS CUM COOLERS

Fluid bed dryers are offered for free flowing granular powders. These are static equipment having benefits of high Heat Transfer coefficient. Cooling is possible just by extension of the Fluid Bed.



## VIBRATORY FLUID BED DRYERS

Vibratory Fluid bed dryers are used for granular / crystalline powders which are difficult to fluidize. Air fluidization is supplemented by mechanical vibrations to achieve uniform bed distribution on the perforated plate.

The dryer offers better control on fluidisation, residence time, product moisture and dust levels.

Explosion proof designs



## CLOSED LOOP FLUID BED DRYERS

- Inertised drying of free flowing Agro chemical cake with ethyl acetate solvent.
- Reduces risk of oxidization of product.



## ADVANTAGES

Adjustable residence times to suit each individual product | Uniform product temperature possible  
Drying and cooling in a single step

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# WINNING TECHNOLOGY IN FLASH DRYERS



## FLASH DRYERS

Flash Dryers are used for drying wet cakes, crystals or granular products. These are long ducts carrying air at a high velocity and the material is dried while it is pneumatically conveyed along with hot air.

## ADVANTAGES

- Continuous operation & single step drying of free flowing powders, crystals.
- Unique feeding devices for taking care of uneven feed moistures.
- Less floor space.

## CAGE MILL FLASH DRYERS

For materials where size reduction is desired along with drying Flash dryers with Cage Mills are ideally suited. Materials in the nature of lumps, semi-hardcakes can easily be dried.



## AGITATED FLASH DRYERS

Are used when the material to be dried is sticky in nature, thixotropic and requires longer drying time.

Closed Loop design with inert gas for solvent recovery.

## ADVANTAGES

Continuous operation & single step drying | Disintegration of dry hard product lumps or crusts  
Particle size control | Recycling of hot gases

# VACCUM DRYERS

## VACCUM DRYERS

Vaccum dryers are used to facilitate rapid and low temperature drying of heat sensitive products without raising their temperature.

### ROTARY VACUUM DRYERS/COOLERS

These Dryers are horizontal cylindrical jacketed chambers and are equipped with a central shaft to which paddles or ribbons and scrappers can be attached for agitation and mixing.

Vacuum in drying chamber allows drying of material at low temperature.

For recovery of solvent condensers and receivers are provided.

#### ADVANTAGES

- Low temperature agitated vacuum drying
- Ideal for heat sensitive products which can be agitated.
- Minimum space required.
- Recovery of Solvent

## ADVANTAGES

- Low temperature gentle drying.
- Ideal for heat sensitive products.
- Minimum space required.
- Solvent Recovery



## AIR BROOM

Air broom is made of pipe having multiple nozzles. This broom pipe is rotating inside the Drying Chamber at low rpm through gear box and motor.

Dehumidified air is passing through the pipe for air brooming through nozzles to remove the deposition from chamber shell.

# CLEANING IN PLACE

## CLEANING IN PLACE (CIP)

Cleaning in Place, as a packaged system, can be added on to the Drying system where frequent cleaning of dryer chamber or the complete plant is required. Cleaning can be with manual or automatic sequential operation.

### ADVANTAGES

Quick product changeover | Economical use of wash water | Uniform and consistent washing

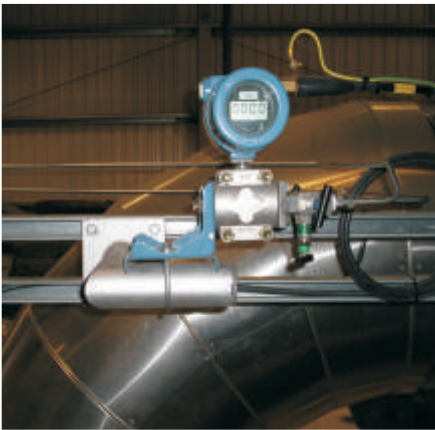


### SAFETY

Drying Systems are also offered incorporating special safety features like Pressure / Vacuum relief device, Rupture Vents, Fire Fighting features, Explosion Isolation Barriers etc.

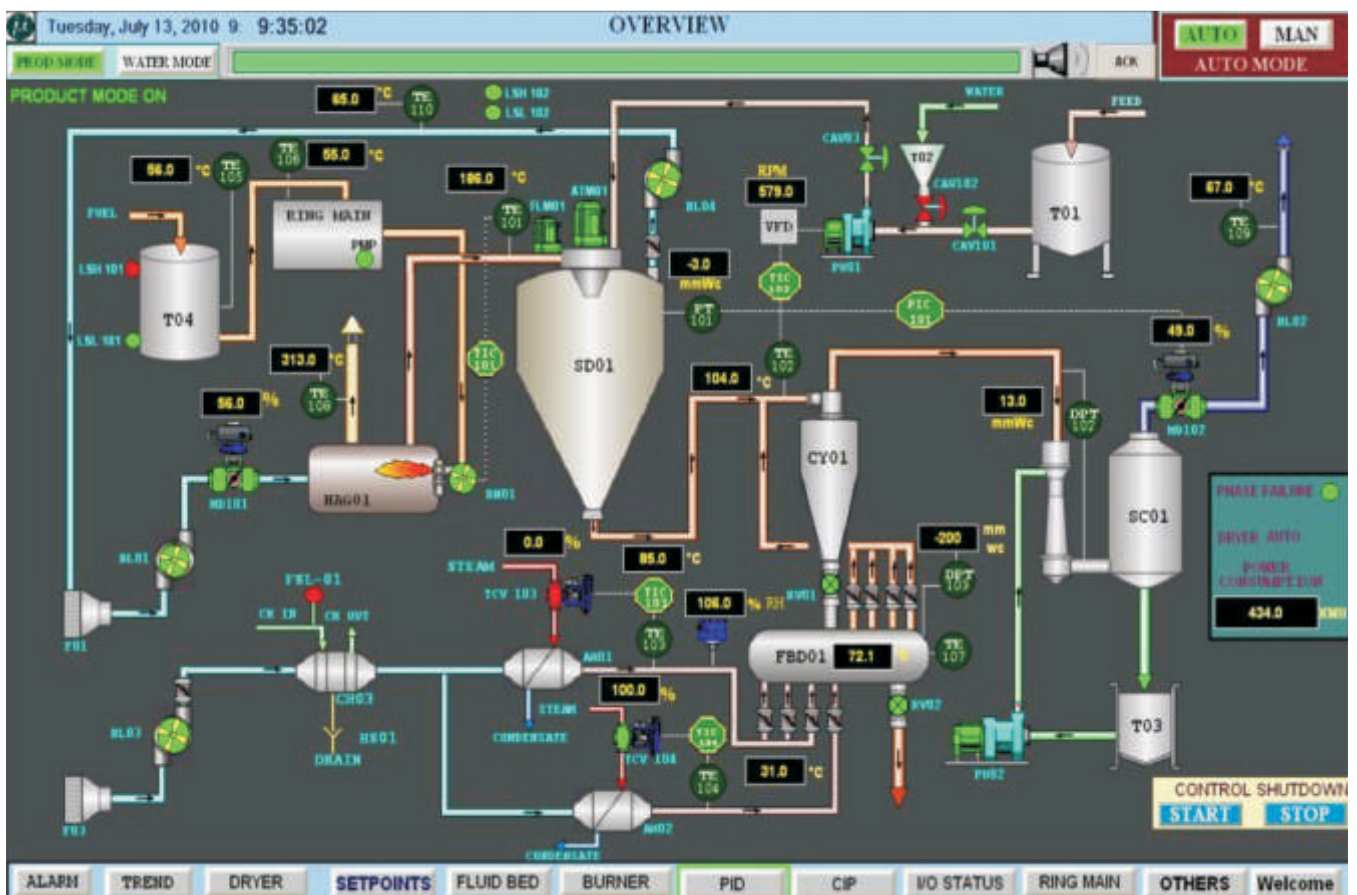
Depending on the product characteristics and operating conditions of the dryer, the system components can be custom designed to withstand the permissible over-pressure requirements.

# CONTROLS & INSTRUMENTATION



The performance, safety and efficiency of a drying system depends upon accurate monitoring & control of the operating parameters and control logic.

Manual / semi-automatic or fully automatic control modes can be incorporated - Microprocessor based single loop feedback / cascade controls ; Programmable Logic Control (PLC) with man machine interface / Personal computer or Distributed Control system (DCS) interface to match the client's control philosophy.



# RESEARCH AND DEVELOPMENT

R & D Center recognized by Dept. of Sciences & Technology, Govt. of India houses facilities for laboratory testing of materials on Pilot plants.

## THE LABORATORY HOUSES PILOT PLANTS FOR

Spray Dryer | Agitated Flash Dryer | Fluid Bed Dryer | Integrated Fluidised Bed Spray Dryer  
Air De-humidification unit | Automated Controls & Instrumentation



Multistage spray dryer  
[ Various design of atomizer wheels ]  
Vibratory fluid bed dryer

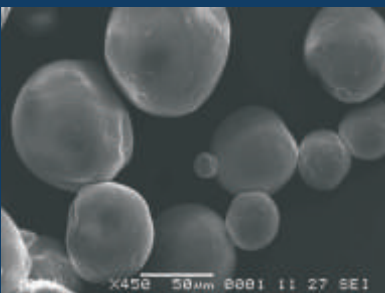


Agitated Flash Dryer  
[ Options of various designs of  
Attritors ]



Agitated Thin Film Dryer

## Image Analysis of Spray Dried Products Comparison of Samples



Mojj pilot plant sample analysis

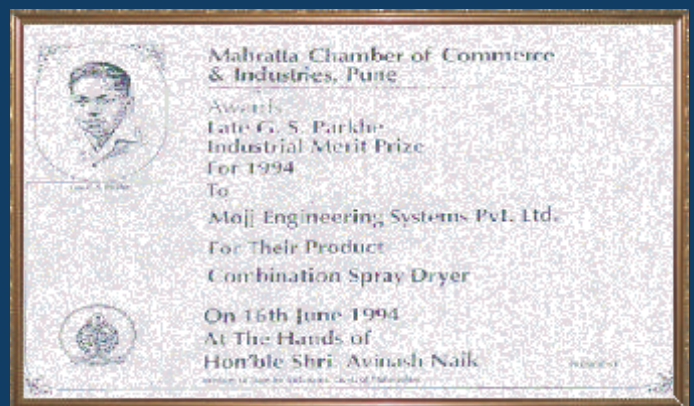


External Lab sample analysis

Laboratory testing on material is conducted by well trained & dedicated professionals to establish characteristics and generate data for sizing, scale up & repeatability. The above services are offered to customers.

### ACCOLADES

Recognition for us, in the field of dryers, has come by way of the prestigious Parkhe Award instituted by the chamber of Commerce for innovative design, development and commercialization of the Combination Spray Dryer.



## ARENA OF SITE ACTIVITIES



- Large dryers can be built / assembled at site from shop fabricated components.
- Trained / skilled technical fabrication professionals.
- Experience of erection at various locations and altitudes.
- Timely completion using advanced modern tools.



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# USER INDUSTRIES

## CHEMICAL PROCESS INDUSTRIES

Aluminium hydroxide  
Sodium Sulphate  
Aluminium Flouride  
Organic Metals  
Formaldehyde Resins  
Organic Metals  
Fine Chemicals  
Wood Preservatives  
Polymer Emulsions  
Potassium Flouride  
Ligno Sulphonates  
Dicalcium Phosphate  
Managenese Sulphate  
Mangnese Corbonate  
Polystyrene Beads  
Metal Salts  
Vinyl Polymer  
Vinyl Sulphone

## FOOD STUFF

Whole / Skimmed Milk  
Fruit Pulp & Juices  
Tea and Coffee Extract  
Lactose  
Whole Egg Powder  
Chilli  
Instant coffee powder  
Cheese  
Cassein  
Food Colours / Flavours  
Cereals  
Salts  
Proteins

## DYESTUFF & AUXILLARIES

Reactive Dyes  
Dispersing Agents  
Acid Dyes  
Direct Dyes  
Organic Pigments  
Detergents  
Tinopal  
Disperse Dyes  
Inorganic Pigments  
Optical Brightner  
Leather Chemicals  
Basic Chromium Sulphate  
Sodium Lauryl Sulphates  
Olefin Sulphonate

## NATURAL PRODUCTS

Herbal Extracts  
Yeast  
Hydrolised Protein  
Alovera  
Spirulina Algae  
Enzymes  
Cellulose  
Acetates  
Animal Feed / Waste

## PHARMACEUTICAL

Pharma Base  
Bulk Drugs  
Manitol USP  
Applied Pharma Ingredient  
Pharma Intermediates  
Clinical Dextran  
Sodium-2-Ethyl Hexonate

## CARBOHYDRATES

Starch  
Gum  
Maize / Wheat  
Gluten  
Wheat Flour  
Soya Flour  
Sorbitol  
Maltodextrine  
Glucose / Dextrose

## PESTICIDES, FUNGICIDES, HERBICIDES

Sulphur Derivatives  
Mancozeb  
Urea Formldehyde  
Melamine Formaldehyde

## CERAMICS & MINERALS

Kaolin  
Silica  
Enamels  
Sand  
Coal  
Limestone  
Ferrites  
Zirconium Silicate  
Metal Oxides  
Tableware  
Activated Earths  
Mica  
Alumina  
Tile Slip  
Insulators  
Technical Ceramics

# Mojj Philosophy

We believe and recognize the basic fact that each customer has his own specific and not so specific needs to be catered to, requirements to be met and problems to be solved. We therefore strive in giving our services suited to these specific and peculiar needs of our customer. This calls for understanding these needs and transferring them into an engineering solution. No aspect of a plant is too minor to be ignored and no process requirement too complex to be met.

<b>Range of Products</b>	<b>Dryers</b> <ul style="list-style-type: none"><li>• Spray</li><li>• Fluid Bed</li><li>• Flash</li><li>• Rotary</li><li>• Conduction</li></ul>	<b>Evaporators</b> <ul style="list-style-type: none"><li>• Falling Film</li><li>• Forced Circulation</li><li>• Scraped Surface</li><li>• Wiped Film</li><li>• Natural Circulation</li></ul>	<b>Bio-Technology</b> <ul style="list-style-type: none"><li>• Fermentation and Distillation</li><li>• Composting</li><li>• Pre-Clarifiers</li></ul>
	<b>Mixers</b> <ul style="list-style-type: none"><li>• Top Entry</li><li>• Side Entry</li><li>• Blenders</li><li>• Blungers</li></ul>	<b>Turnkey plants</b> <ul style="list-style-type: none"><li>• Non Dairy Creamer</li><li>• Powder Milk</li><li>• Starch</li><li>• Detergents</li></ul>	<b>Pollution Control</b> <ul style="list-style-type: none"><li>• Flue Gas Spray Scrubber</li><li>• Wet Scrubber</li><li>• Incinerators</li><li>• Bag Filters</li><li>• Thermal oxidiser through Anguil USA</li></ul>



MÖJJ ENGINEERING  
SYSTEMS LTD.

## MOJJ Engineering Systems Ltd.

81-B /15, M. I. D. C. Bhosari, Pune - 411 026 (India).

Tel: + 91-20-27120360 / 27122837.

### Email

[dryer@mojjpune.com](mailto:dryer@mojjpune.com) | [evaporator@mojjpune.com](mailto:evaporator@mojjpune.com) | [distillery@mojjpune.com](mailto:distillery@mojjpune.com)

### Website

[www.mojjpune.com](http://www.mojjpune.com)

### Branch offices At

New Delhi | Ahmedabad | Bangalore | Chennai

### Works (India)

Unit I : Bhosari, Pune | Unit II : Ranjangaon, Pune | Unit III : Markal (Alandi), Pune | Unit IV : Vatva, Ahmedabad

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