

## Anhydro Spray Drying Plants for the Dairy Industry



## A Question of Accuracy, Efficiency, and Flexibility

Spray drying is a highly cost-effective method of obtaining powder from heat-sensitive liquids such as milk and whey while retaining valuable nutrients, aromas, and flavours.

Spray drying is a continuous process, which converts almost any pumpable liquid into a free flowing powder. The liquid, which can be pre-heated in order to reduce energy consumption in the drying process itself, is sprayed via an atomizer into a drying chamber, in which it is evaporated. The solids content is further processed in an integrated and/or external fluid bed.

SPX FLOW, Inc. (NYSE:FLOW) is a leading manufacturer of innovative flow technologies, many of which help define the industry standard in the market segments they serve. From its headquarters in Charlotte, North Carolina, it operates a sales and support network, centres of manufacturing excellence, and advanced engineering facilities, throughout the world. Its cutting-edge flow components and process equipment portfolio includes a wide range of pumps, valves, heat exchangers, mixers, homogenisers, separators, filters, UHT, and drying technology that meet many application needs. Its expert engineering capability also makes it a premium supplier of customized solutions and complete, turn-key packages to meet the most exacting of installation demands.

Incorporating many leading brands, SPX FLOW has a long history of serving the food and beverage, power and energy, and industrial market sectors. Its designs and engineered solutions help customers drive efficiency and productivity, increase quality and reliability, and meet the latest regulatory demands. In-depth understanding of applications and processes, state-of-the-art Innovation Centers, and advanced pilot/testing technology further assist in optimizing processes and reducing timescales to reliably meet production targets.

To learn more about SPX FLOW capabilities, its latest technology innovations and complete service offerings, please visit [www.spxflow.com](http://www.spxflow.com).

## Spray Drying

### CRITICAL CUSTOMER DEMANDS

Plant solutions for dairies looking for long-term competitive leadership and profitability need to meet a long line of decisive demands. These include:

- Constant product quality and uniformity with consistent powder moisture content and particle size distribution.
- High yield at lowest possible cost.
- The ability to utilize the same plant for a number of different applications.
- Traceability and compliance with food regulations.
- New product developments with short time to market.

### BENEFITS

The Anhydro spray drying plants are available in a wide range of sizes and configurations. All are based on experience gained from long-term partnerships with dairies all over the world in order to provide competitive solutions for critical demands:

- Total control over a wide range of parameters such as moisture content, particle structure, particle size and distribution, solubility, mixability, and wettability, and retention of natural aromas and flavours.
- Energy-efficient components, continuous and rapid drying, ease of operation, and process automation deliver maximum process yield at the lowest possible cost.
- Top-quality and reliable components for prolonged service life together with efficient and straightforward CIP (cleaning-in-place) mean maximum uptime.
- Automated process control enables end-to-end traceability in compliance with contemporary food standards and regulations.
- Plant designs based on experience with many different applications ensure versatility for a variety of applications.

# Atomization and Drying

## ANHYDRO ATOMIZERS

SPX FLOW offers two basic types of atomizers which disperse feed liquid into the hot air in the drying chamber:

- Centrifugal atomizers, which accelerate and atomize the liquid feed using centrifugal force in a rotating disk. They are suitable for most dairy applications, especially crystallized products.
- Nozzle atomizers, which force the liquid feed through a nozzle under high pressure or using compressed air. Nozzle atomization is used in particular when a coarse powder with narrow particle size distribution is required.



Atomizer  
CC 400



Nozzle atomizer

## Typical Product Applications

**With the Anhydro spray drying equipment you can produce a wide range of dairy powders.**

### Infant Formula

Qualities such as easy dosing, good reconstititional properties, dustless powders, and high nutritional values are obtainable.



### Milk Powder

Drying of milk into powders, where aromas, flavours, and colouring as well as protein, fat, carbohydrate, vitamins, minerals, etc. are retained.



### Concentrated Whey

As a by-product of cheese-making, whey can be processed to make a wide range of value-added products, e.g. whey protein concentrate.



### Ingredients

Tee and coffee creamer, chocolate milk, and buttermilk.



## ANHYDRO SPRAY DRYERS

Two drying principles are relevant for the dairy industry. The Anhydro Conical Spray Dryer (CSD) with air outlet at the base of the chamber, and the Anhydro Triple-A Spray Dryer with air outlet at the top of the chamber.

### Each type offers the following options:

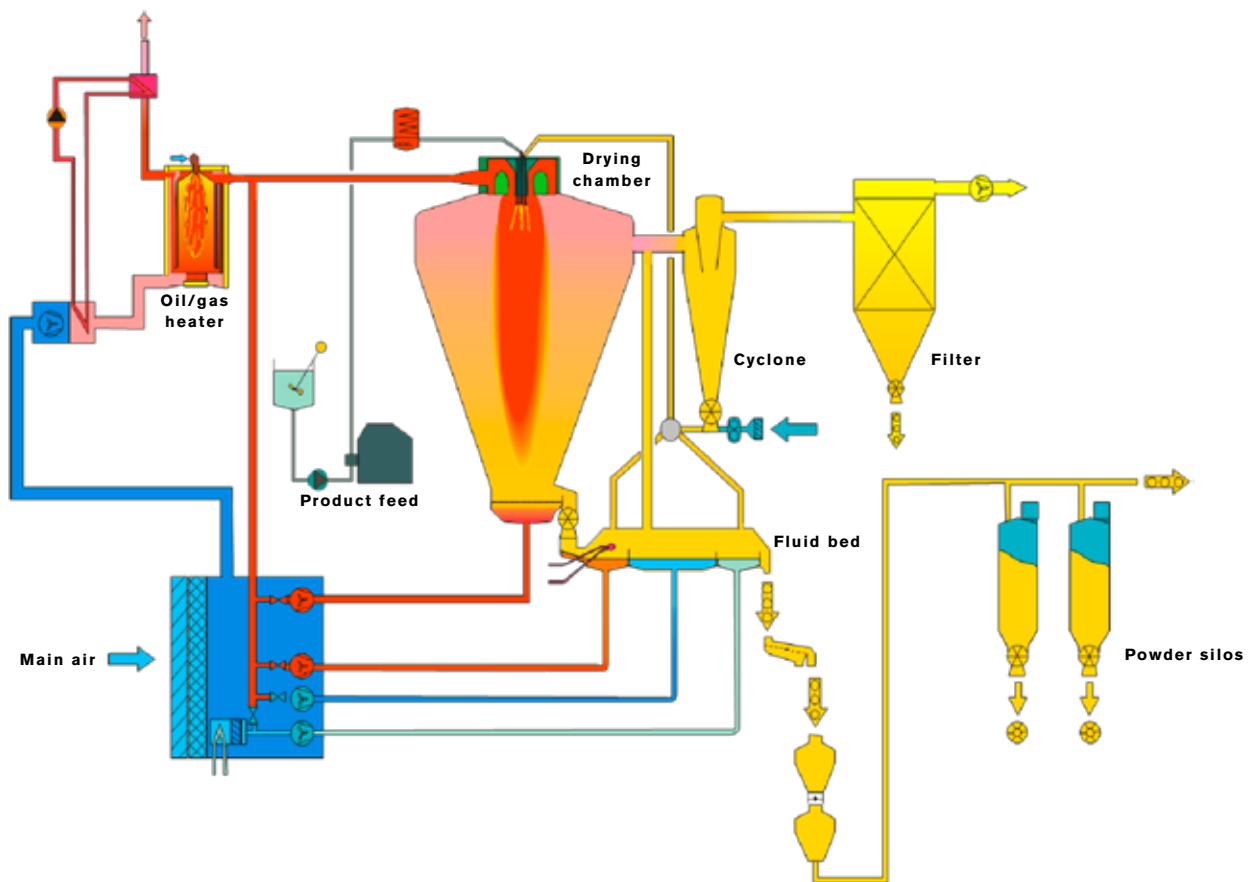
- Single-stage spray dryers with product outlet at the base.
- Two-stage spray dryers sending product to an external fluid bed dryer and/or cooler.
- Multi-stage spray dryers sending product to an integrated fluid bed, and then into an external fluid bed dryer and/or cooler.



A section of a dairy drying system - a drying chamber cone and a bag filter bottom

## FINES RE-INJECTION

Fines are led back from the cyclones and/or bag filters to the atomization zone or integrated fluid bed for agglomeration.



A typical dairy flow diagram using Anhydro Triple-A Spray Dryer

## Gentle and Efficient Finishing

Temperature and residence time in the spray drying chamber are important parameters affecting powder consistency and the retention of nutrients, flavours, and aromas.

After-drying of powder is typically used for heat-sensitive products and for obtaining a free-flowing powder.

### FLUID BEDS

An integrated or external fluid bed can be used for after-drying and/or cooling of powder leaving the drying chamber with relatively high moisture content. Use of a fluid bed enables adjustment of process parameters in order to achieve a superior overall drying economy and powder quality. An external fluid bed is also ideal for other kinds of powder treatment such as mixing, agglomeration, dust binding, and instantising.

Additional drying using one or more Anhydro fluid beds adds a number of advantages compared to single-stage spray drying e.g.:

- Energy savings due to a high temperature difference in the dryer.
- Improved product quality, in particular in heat-sensitive products, due to a more gentle drying process.
- Higher powder bulk density and lower air content due to lower drying temperature.
- Lower powder loss due to reduced powder content in the air.

### REWET AGGLOMERATION

Anhydro fluid beds are also used for rewet agglomeration for the production of coarse and stable agglomerates as well as adding atomized additives. Typical examples are the production of instant skim-milk and whole milk powders. Agglomeration results in better free-flowing properties, less dust, and improved solubility and wettability.



A section of a dairy drying system - a fluid bed and a crystallization conveyor



# Optimised Yield and Efficiency

Separation of powder from the hot air leaving the drying chamber increases yield by limiting powder losses, and ensures compliance with environmental legislation by reducing emissions. Efficient heat recovery is also a key factor in plant economy.

## CYCLONES

Powder from the drying chamber is fed to two or more high-efficient cyclones for primary separation from the drying air. With high separation efficiency the cyclones ensure minimal powder loss. Further cleaning of the drying air can be achieved by using a bag filter. This secures that the emissions will be within the limits of environmental regulations.

## BAG FILTERS

Anhydro CIP-cleanable bag filters to replace cyclones enable lower pressure loss and increased energy savings. The filter materials can handle relatively high air outlet temperatures, and the automatic cleaning system ensures a high and constant separation efficiency.

## HEAT RECOVERY

SPX FLOW can offer a number of heat recovery systems including conventional heat recovery system from air exhaust to air inlet.

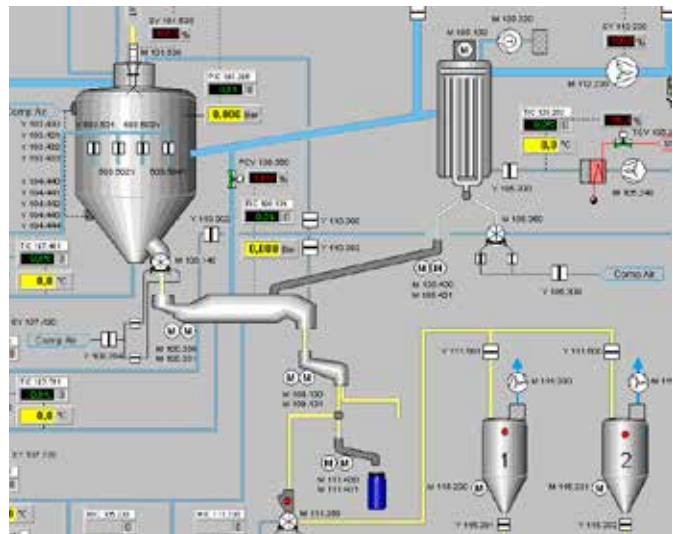
Today more and more systems are utilizing waste energies. Many of the systems like dehumidification system use heat pumps on different levels to optimise energy utilization and energy cost.

Each heat recovery system will be tailor-made to the actual purpose depending on products, capabilities, and energy cost levels for different energy sources, etc.

## PROCESS AUTOMATION AND CONTROL

Automated process control is essential in order to optimise key process settings such as feed rate, temperature, pressure, residence time, particle size, moisture content, bulk density, etc.

The Anhydro spray drying plant is controlled from numbers of operator stations, providing the operator with an end-to-end overview of all production parameters. Anhydro control systems also enable plant performance optimization, rapid troubleshooting, and real-time recording of critical process data providing complete traceability. Process data can be passed on to a local network or even to a remote computer via a dedicated dial-up line or the internet.



A screen-dump example of a typical spray drying plant

# Global Services for Individual Needs

## CUSTOMER FOCUS

SPX FLOW can assist in designing complete spray drying plant solutions and optimising process parameters as well as plant maintenance and spare parts services.

The SPX FLOW worldwide service organization is ready to provide any necessary spare parts at short notice. Our service technicians can help you rectify problems on site, thus reducing unscheduled downtime to a minimum.

SPX FLOW offers a number of service agreement options, depending on your individual needs, and our service engineers are always available to provide application and development support.

## INNOVATION CENTRE

SPX FLOW's state-of-the-art test facility close to Copenhagen in Denmark enables customers to perform confidential product development and trials together with knowledgeable SPX FLOW technologists on drying and evaporation equipment ranging from laboratory-scale testing to full-scale pilot production runs. Here it is possible to test applications and processes, thus ensuring fast time to market with optimised performance immediately after commissioning. Small plants are also available on a rental basis for in-house laboratory trials.



SPX FLOW innovation centre in Soeborg, Denmark

# Anhydro Spray Drying Plants for the Dairy Industry

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