SPXFLOW

# Upgrading of Anhydro Spray Drying Plants

## FOR EXTRA CAPACITY AND ENERGY SAVINGS

Anhydro®

SPX Flow Technology Danmark A/S is an international engineering company with a consistent goal to provide our customers with the optimal processing technology and the highest plant performance standards.

We have specialized in supplying the optimal design and engineering with respect to production performance, flexibility, energy efficiency and environmental protection.

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, centers 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.

# Re-Energizing Your Existing Investments

The dairy and food industries are competing harder than ever before to sustain and expand their positions in competitive markets. Many dairy and food manufacturers are looking to modernise their powder production plant in order to provide products with specific functional properties in response to ever more demanding market requirements.

## REBUILDING AND MODERNISING EXISTING PLANT

Spray drying technology has made significant advances in recent years to support the needs of the dairy and food industries. The latest equipment offers a wide range of benefits in terms of throughput, efficiency and powder quality that are essential to maintaining market share and earnings.

The cost and lead-time of a new plant may make this option less attractive for manufacturers looking to minimize capital outlay, maximize return on investment, and secure fast time to market. By partnering with SPX FLOW, however, you can achieve all of the benefits of a new plant faster and at a significantly lower cost by rebuilding and modernizing your existing Anhydro spray drying equipment.

## OPERATIONAL BENEFITS

Rebuilding and modernising your existing plant offers a number of decisive benefits:

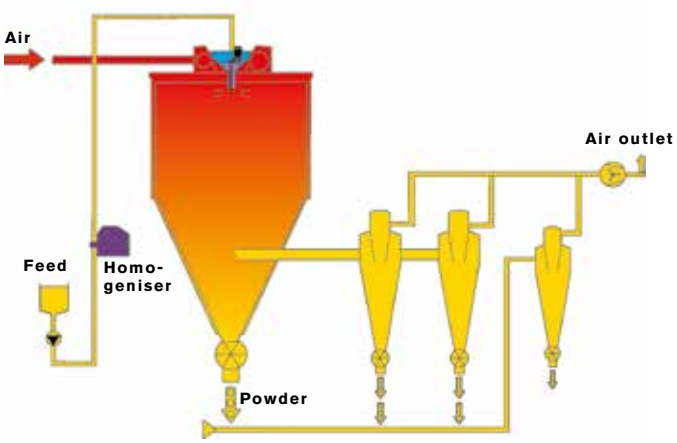
- Lower unit costs through increased powder rate and lower energy consumption
- A wider range of opportunities through the ability to produce a greater variety of products
- New earnings opportunities with higher quality, premium-priced products
- Reduced downtime by installing CIP (Cleaning-In-Place) systems
- Reduced operational costs through lower maintenance requirements
- Higher efficiency and less waste through automated plant control

## FASTER RETURN ON INVESTMENT

Rebuilding and modernising your existing plant to standards that will secure your competitive position well into the future will more than likely turn out to be a solution that is both faster and less expensive than investing in an entirely new plant. You will achieve:

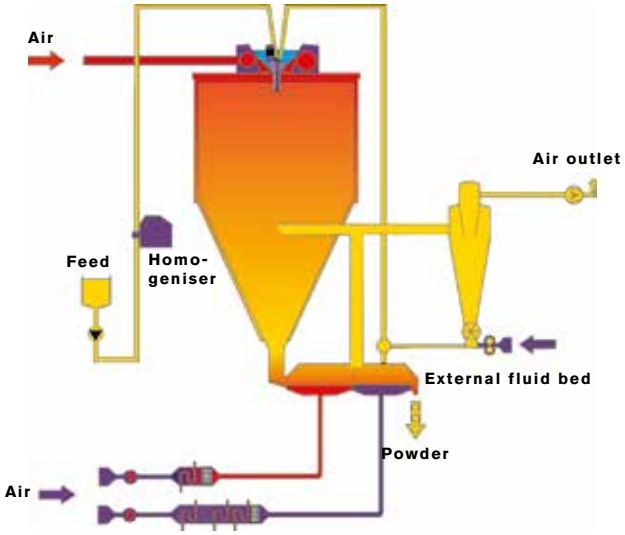
- Lower capital outlay
- Minimum production losses through faster implementation
- Shorter pay-back time
- Greater return on investment

## One-Stage Spray Dryer



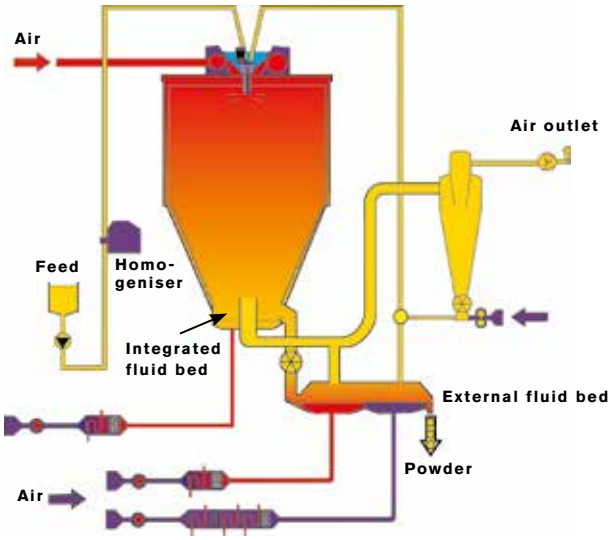

Power rate: approx. 900 kg/h (1,984 lb/h)
Steam consumption per kg water evaporation: approx.
2 kg/h (4.4 lb/h)

## Two-Stage Spray Dryer




Power rate: approx. 1,160 kg/h (2,557 lb/h)
Steam consumption per kg water evaporation: approx.
1.8 kg/h (4 lb/h)

## Three-Stage Spray Dryer




Power rate: approx. 1,400 kg/h (3,086 lb/h)
Steam consumption per kg water evaporation: approx.
1.6 kg/h (3.5 lb/h)

Anhydro spray dryer

# Upgrade Options

There are numerous opportunities for improvements in most existing drying plant in order to ensure compliance with new environmental regulations, recover heat, increase drying capacity, reduce cleaning downtime etc. The best result depends, however, on choosing the solution that best meets your needs with regard to capacity, product quality, operating cost, payback time, return on investment etc.

## BAG FILTER

Environmental considerations often dictate the installing of a bag filter. Today, a bag filter is normally installed after the cyclones in order to reduce costs and collect residual powder, reducing emissions after the filter to 10 mg/Nm$^3$ (see Fig. 1).

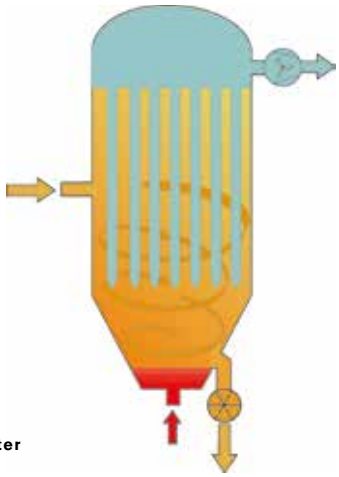



**Fig. 1: Bag filter**

## RECUPERATOR BETWEEN EXHAUST AIR AND INLET AIR

A textile filter ensures exhaust air of a purity that enables the utilisation of a heat recovery system using finned tube heat exchangers in a liquid coupled recuperator system.

## RECUPERATOR BETWEEN COMBUSTION AIR AND INLET AIR

The combustion air has a purity that enables the utilisation of a heat recovery system using finned tube heat exchangers in a liquid coupled recuperator system (see Fig. 2).

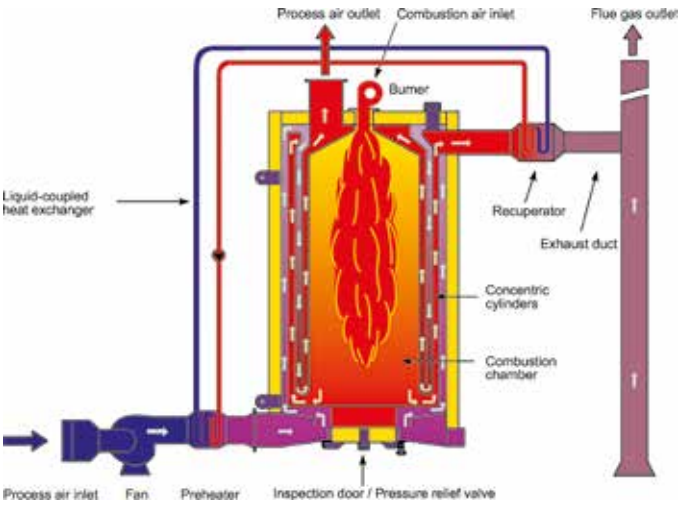



**Fig. 2: Recuperator system**

## INDIRECT OIL/GAS AIR HEATER

An older steam air heater can be converted into an indirect gas- or oil-fired air heater, thus eliminating the need for purchasing a new high-pressure steam boiler. This can also provide an increase in drying air temperature, resulting in a higher plant capacity (see Fig. 2).

The typical maximum inlet temperature with steam air heater is 190°C (374°F). This can be raised to 220°C (428°F) using indirect gas air heating, resulting in a plant capacity increase of some 30%.


**Anhydro spray bed dryer with a fluid bed**

## CONCENTRATE HEATER

A spiral type heater is frequently used for indirect heating of the concentrate. The product is heated by means of vacuum steam, thus avoiding the risk of overheating, and achieving long and continuous operation time. (see Fig. 3).

The installation of a concentrate heater in the feed line close to the atomiser, for example to heat the concentrate from approximately 45°C to 80°C (113°F to 176°F , means three advantages:

- Increase of 8 to 9% in drying capacity
- Pasteurising heat treatment
- Reduction of viscosity

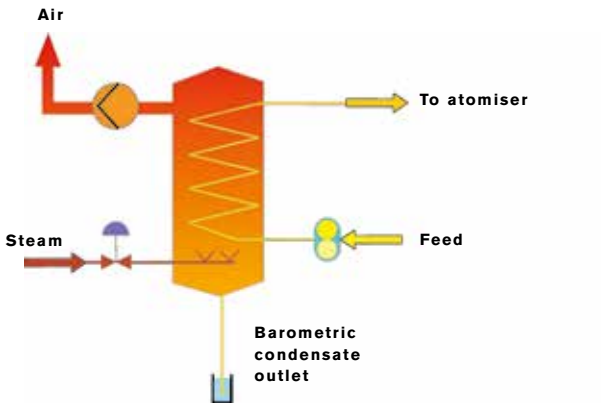



**Fig. 3: Spiral concentrate heater**

## CLEANING IN PLACE (CIP)

In addition to raising the efficiency and hygienic standard of a drying plant, an automated CIP system with built-in spray balls provides further manpower savings and reduced downtime.

**Anhydro spray bed dryer with a fluid bed**

# Case Story: Skim Milk Production - Before and After

| PRODUCT: SKIM MILK | DATA BEFORE UPGRADING | DATA AFTER UPGRADING |
|---|---|---|
| FEED TEMPERATURE | 40°C (104°F) | 40°C (104°F) |
| INLET TEMPERATURE | 180°C (356°F) | 180°C (356°F) |
| OUTLET TEMPERATURE | 95°C (203°F | 83°C (181°F) |
| AMOUNT OF AIR OUT TO CHAMBER | 33,290 kg/h (73,392 lb/h) | 35,970 kg/h (79,300 lb/h) |
| SOLIDS IN FEED | 45% | 48% |
| MOISTURE IN POWDER | 3.5% | 3.5% |
| POWDER RATE | 800 kg/h (1,763 lb/h) | 1,000 kg/h (2,204 lb/h) |

A skim milk manufacturer decided to upgrade a two-stage 2CSD77 spray dryer into a three-stage 3CSD77 unit. The upgrade included:

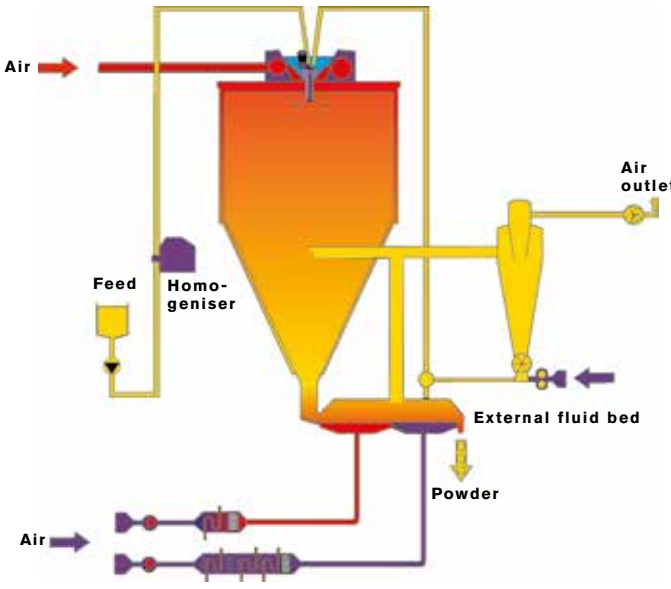
- Mew integrated fluid bed
- New complete air system for the fluid bed
- Capacity increase of suction fan by approximately 10%
- Modification of the cyclones to achieve greater quantity of air
- Fines return system

## SIGNIFICANT COST-BENEFITS AND NEW OPPORTUNITIES

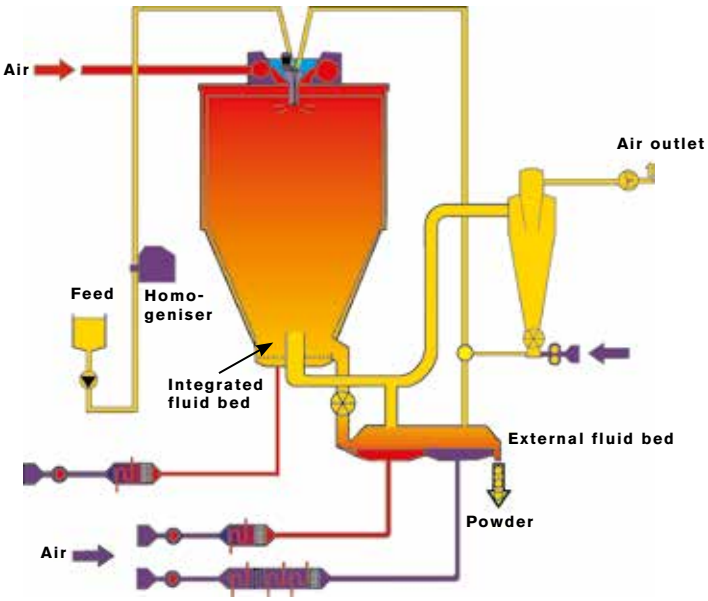
The described upgrade resulted in the following enhancements:

- Powder rate increase of 37% from 800 kg/h to 1,100 kg/h (1,763 lb/h to 2,204 lb/h).
- Energy saving if approximately 0.15 kW per kg finished powder
- Enhanced powder quality due to a significantly lower outlet temperature
- The opportunity to produce agglomerated powder due to the fines return system

**Original Two-Stage Spray Dryer**




**Upgrated Three-Stage Spray Dryer**



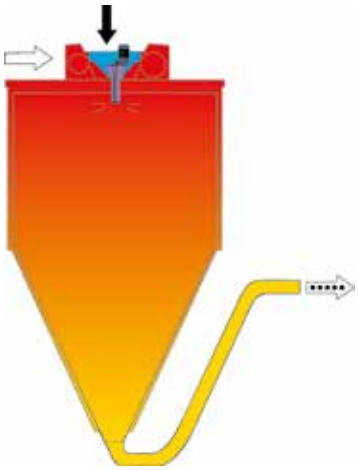
# Case Story: Skim Milk Production - Before and After

Depending on your existing equipment and specific requirements, you can choose between a number of modification options for adding stages and other features. These include:

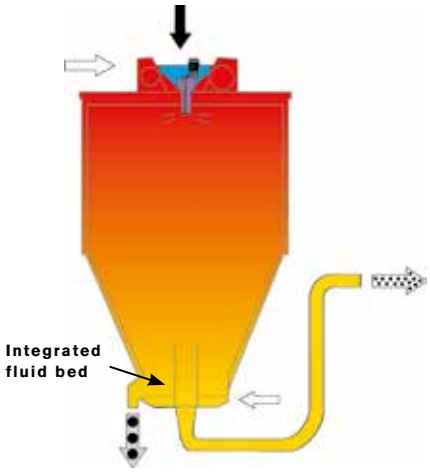
- Equipping of a one-stage conical spray dryer with an integrated fluid bed at the base of the existing dryer chamber, and/or an external fluid bed for final drying and/or cooling
- Extension of two-stage spray dryer to three stages by adding an extra fluid bed
- Reserving of the external fluid bed for cooling in order to ensure sufficient cooling of powders with high fat content.

The combination of spray dryer and fluid bed drying results in higher capacity, lower outlet temperatures, and a more flexible drying process.

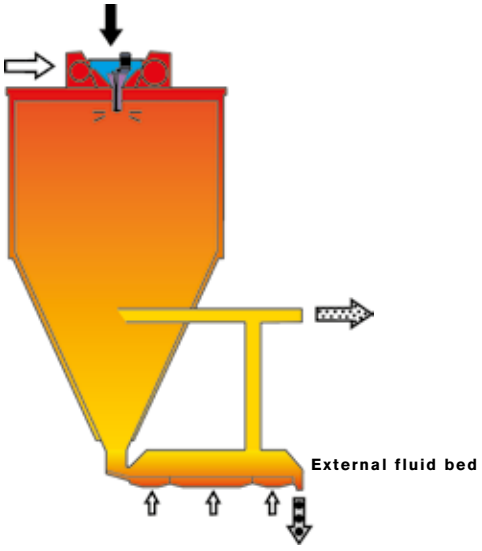
A fluid bed system offers the opportunity of an on-line lecithination process for the production of lecithinated whole milk powder. In addition, other ingredients can be sprayed into the powder layer in the fluid bed in order to achieve large and stable agglomerates.



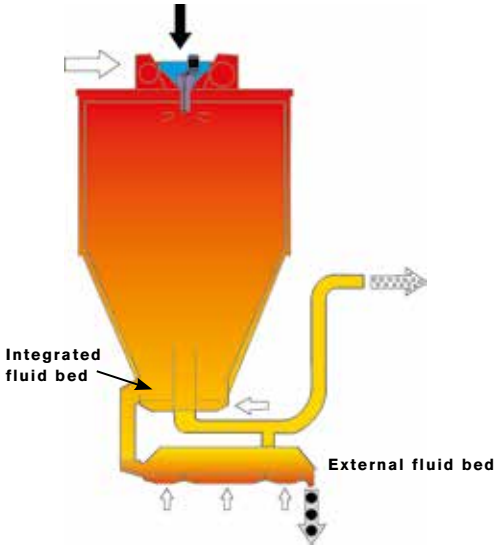
**One-stage Conical Spray Dryer, CSD**




**Two-stage Conical Spray Dryer, 2CSD**
**(with internal fluid bed)**




**Two-stage Conical Spray Dryer, 2CSD**
**(with external fluid bed)**




**Three-stage Conical Spray Dryer, 3CSD**
**(with internal and external fluid beds)**

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SPXFLOW

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