

*Conical part of spray drying chamber with the integrated fluid bed in a CDI Dryer*



*Conical part of CDP Dryer with powder outlet duct from the integrated fluid bed*



*MSD™ Dryer with removable insulating panels*



### Preheating

Prior to atomization, the product is pre-concentrated and possibly preheated. The feed must remain liquid and the viscosity kept sufficiently low to allow for proper atomization. However, a higher concentration of dry matter in the feed to the dryer results in reduced energy consumption of the overall process and the powder achieves a higher density.

### Atomization

Niro spray dryers are equipped with a rotary atomizer or high-pressure nozzles. For maximum operational flexibility some dryers can be designed for nozzle as well as rotary atomization. This allows the plant operator to choose the best atomization system for specific products. Niro air dispersers are designed to fit Niro atomizers and to ensure maximum contact between particles and drying air whilst preventing wet particles reaching the chamber wall.

### The Chamber

The spray drying chamber is sized for the required capacity, and the design is chosen to match the type of atomization used and the product to be dried. Some chambers are equipped with static, integrated fluid beds for better energy utilisation and gentler product treatment at lower temperatures.

### Product Separation

The drying chambers have a conical base where the first separation of powder and drying air takes place. The remaining dust from the drying air is removed in a cyclone and/or bag filter. Conventional spray dryers work with cyclones, which are still in use for some applications. However, most modern spray dryers are equipped with a bag filter, which can be cleaned in place – the SANICIP™. From this bag filter, the powder fraction can be recycled to the process, giving insignificant powder loss.



*Powder layer on the belt of the FILTERMAT® Spray Dryer (FMD)*

### Fines

The powder fraction from the SANICIP™ bag filter or the cyclone is recycled to the process, where it can be used for agglomeration. If agglomeration is not required, the fines can be conveyed to the VIBRO-FLUIDIZER®



*Stationary fluid bed with combined back mix and ring formed plug flow section with product outlet into the vibrating sieve.  
Spray dryer type:  
Integrated Filter Dryer - IFD™*

### **All-in-One Unit**

The latest development for the industry is the Niro Integrated Filter Dryer, IFD™, where spray drying, second-stage drying, powder cooling, and powder separation are all integrated in a single unit. This compact design represents a new and unique principle of spray drying: Once again Niro has taken the lead.

*Filters integrated in the IFD™ spray dryer reduce plant space requirements*



### *Dairy Data*

THE IFD™ DRYER  
REQUIRES 5% LESS  
ELECTRIC ENERGY  
AND 15% LESS  
BUILDING SPACE



Niro VIBRO-FLUIDIZER®

# After Treatment

## *Secondary drying and cooling of powder*

After treatment includes secondary drying and cooling and forms an essential part of powder production.

### **Fluid Bed Dryers**

Secondary drying at reduced temperature in a fluid bed gives a gentler treatment than can be obtained through full drying in one step in the spray dryer. Secondary drying takes place in an integrated static fluid bed

built into the bottom of the spray drying chamber. But secondary drying can also take place in an external fluid bed dryer, the VIBRO-FLUIDIZER®, giving great flexibility in dryer configuration.



*Internal view of a Niro  
VIBRO-FLUIDIZER®*



**BUBBLE  
PLATE™**  
- air distribution plates

### **Niro BUBBLE PLATE™**

The art of the fluid bed technique is the ability to control an even air distribution in the powder layer. No lumps, no channelling, constant powder layer, and complete emptying of the fluid bed are essential in operation. The unique Niro BUBBLE PLATE™ is sanitary, thanks to its smooth surface and the fabrication technique of the holes. Furthermore, it ensures complete emptying of the fluid bed.

### **Powder Cooling**

The VIBRO-FLUIDIZER® gives a lenient product transport and cooling. Cooling usually takes place in the second part of the fluid bed, but the entire bed can be designed for cooling, depending on the product to be treated. If cooling is the only issue, a pneumatic cooling system can be used instead of the VIBRO-FLUIDIZER®. This costs less to acquire, but is more expensive to operate. Pneumatic conveying and cooling is used only for products where the physical structure is of minor importance.

### **VIBRO-FLUIDIZER®**

Partly dried dairy powders from a spray dryer can be difficult to fluidize. Most external fluid bed dryers are therefore designed as vibrating units to ease fluidization. The VIBRO-FLUIDIZER® is used for second-stage drying, third-stage drying, and powder cooling. Coating of particle surfaces with e.g. lecithin can also be done in the VIBRO-FLUIDIZER®. The entire fluid bed complies with even the strictest sanitary criteria.

#### *Dairy Data*

THE NUMBER OF  
HOLES IN THE  
PERFORATED PLATE  
OF A 31.5 m<sup>2</sup>  
VIBRO-FLUIDIZER®  
EXCEEDS 50,000



*T-profiles used for  
the sanitary  
VIBRO-FLUIDIZER®*



*Top of 100 m<sup>3</sup> milk powder silos.  
Silos are equipped with automatic self-cleaning filters*



*Bottom of powder silos. Pipelines connected for vacuum conveying product to bag filling machines*

# Powder Handling

## *Retaining Powder Properties*

**Conveying, storage, and packing require great care in order to maintain the physical properties acquired during drying.**

### **The Product**

#### **Determines the Solution**

If the powder produced is e.g. an ordinary skim milk powder, it can be conveyed by conventional methods, including pneumatic transport. If the product is an agglomerated powder, mechanical treatment must be minimised in order to maintain product structure. Niro specialises in supplying lenient powder handling and, where needed, vacuum transport systems.

### **Powder Storage and Packing**

Storage and packing systems are also available from Niro. Avalon Engineering, another member of the GEA Group, supplies bagging-off lines from small, semi-automated systems to large, fully automated lines filling and palletizing up to twelve 25 kg-bags per minute, or 18 tons per hour.



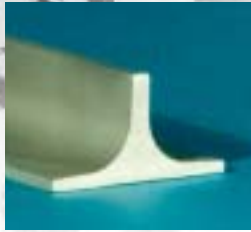
*Automatic Avalon carousel bagging-off equipment*



*Bag heat sealing and belt transport*



*Robot bag palletizer*



*T-profiles used for welding where 3A Standard radii requirements must be met*



*Reverse jet nozzle for SANICIP™ CIP-able bag filter and IFD™ dryer*



*Retractable CIP-nozzle*

# Sanitary Design

*for maximum plant hygiene*

Recognising hygiene as a safety issue, sanitary designs are based on the *Niro Sanitary Code*. This code is updated continually. It draws from official standards agreed during the past 50 years as well as codes issued by organisations all over the world such as 3A Standard (USA), IDF, and the EU Hygiene and Foodstuffs Directive (93/43/EEC).

## ■ Liquid Handling

Liquid processing is always done in ways to minimize bacteria growth. Preheating uses waste heat from the plant, always with strict attention to hygiene.

## ■ Evaporation

To eliminate heat contact surfaces, Niro has developed new preheaters and a special pasteurizer with direct steam injection and a regenerative section. This swirl heater provides fast and efficient heating for product heat treatment - for specific classifications - prior to evaporation. All this allows

for a 20-hour production cycle between cleaning avoiding the risk of bacteria growth such as thermophiles and their spores.

For efficient CIP of the evaporator Niro has introduced a "hydro cyclone", which collects and discharges impurities that would otherwise block the distribution plates above the calandria during CIP.

## ■ Spray Drying

The spray dryer is equipped with appropriate drying air filtration and

*Dismantable insulation panels*



*Retractable CIP-nozzle mounted on a VIBRO-FLUIDIZER®*



# Safety Precautions

*as built-in features*

**The design of a spray drying plant must address more than optimum product quality. It must also observe maximum safety for plant and people.**

Dried dairy products have a potential risk of fire and explosion. Based on own statistics collected over the last 40 years, we are convinced that explosions can only be ignited by an open flame or a large smouldering lump of powder. Fires most commonly start by self-ignition of powder deposits, and only 4-5% of fires turn into explosions.

**To maintain maximum safety, Niro focuses on:**

## ■ Warning

All process parameters that present a risk are monitored and protected by temperature and pressure alarms.

New detection systems can be used to monitor CO contents in the outlet air.

## ■ Prevention

To minimize the risk of fire, we aim to avoid powder deposits and eliminate hot surfaces in the dryer. Fire extinguishing systems are integral parts of the design and are supplied to prevent explosions by extinguishing fires quickly and safely. Niro recommends that plants are kept free of dust outside the dryer to avoid the risk of dust explosions in the working areas.

## ■ Protection

All dryers are provided with explosion venting connected with ducts to the outside. Other protection systems may be incorporated as well.

Our main goal is to encourage and assist our customers to implement maximum protection of personnel and minimal equipment damage in case of an accident. Niro stays updated on the newest standards and directives world-wide.

CIP facilities. All surfaces in contact with the product comply with the above standards and materials are FDA approved. All equipment is designed for proper drainage during CIP.

All drying plants are designed with smooth surfaces avoiding hollow spaces. Furthermore, they are equipped with CIP nozzles whenever appropriate. The SANICIP™ bag filter enables wet cleaning, which ensures proper cleaning of bags and housing.

For the ultimate in hygiene – customers have confidence in Niro.

Sanitary sound attenuator *SOUNDCIP*™



### *Dairy Data*

1 mm OF DUST ON THE FLOOR OF A 5 x 5 x 5 m ROOM WILL, IF SUSPENDED, CORRESPOND TO 100 g/m<sup>3</sup>. MILK POWDER EXPLODES AT 60 g/m<sup>3</sup>, IF IGNITED



# Customer Services

*Reliable operation*



*Rotary atomizer*

## After Sales

Our spare parts programme has one focus: Maximum uptime for our customers. We carry a large stock of essential parts and offer service programmes for key components as well as full service contracts with visits by experienced staff from local Niro offices all over the world.

## Process Adaption

The food and dairy industry is dynamic with market demands and raw materials changing over time. Although a new investment may not be needed, plant operators may benefit from a visit from one of our product specialists for process modification and optimisation.

## Laboratory and Test Station

Our in-house laboratory and pilot plant facilities enable customers to have their products tested assisted by Niro product specialists. We also co-operate direct with customers to develop new products and refine existing processes under established confidentiality agreements.



*Multi Stage Dryer at the Niro Test Station, Denmark*

**More than just plants – Niro supplies performance.**

**With the term “reliable operation” Niro provides a range of services to keep plants up and running.**

## Plant Retrofits

Plants operating continuously for many years require more than just maintenance. To keep plants on stream and up-to-date, Niro has a special task force of experienced engineers who, on request, will evaluate existing systems and quote for their rebuilding as an alternative to investing in a completely new plant.



*Retractable CIP-cleaning nozzle*



*Sanitary rotary valve*





# Financing

The decision to invest in a spray dryer or a complete plant is a complex one. Niro offers project financing assistance to customers planning to invest in industrial processing plants.

## Accessing Funds

Niro is able to access funds and/or guarantees to make it possible for customers to implement their projects, especially in markets where access to investment capital is limited.

Our financing experts have a widespread network of contacts with banks and multi- and bilateral financial institutions in most parts of the world.

## All-Round Expertise

With in-house project-financing experience as well as industry and technology know-how, Niro is the unique partner at any stage of the planning, design, and delivery of an industrial processing plant. An expertise that makes it obvious that if you want the best in dairy processing, look to a market leader – look to Niro.



# DAIRY

## Process Technology for Dairy and Dairy-Like Products

*Niro is a world leader in industrial processing, with evaporation, spray drying, freeze drying, and fluid bed processing as core technologies. Today, Niro stands for an international group of companies which forms the Process Engineering Division of the GEA Group.*



Process Engineering  
Division

A company of mg technologies group

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