

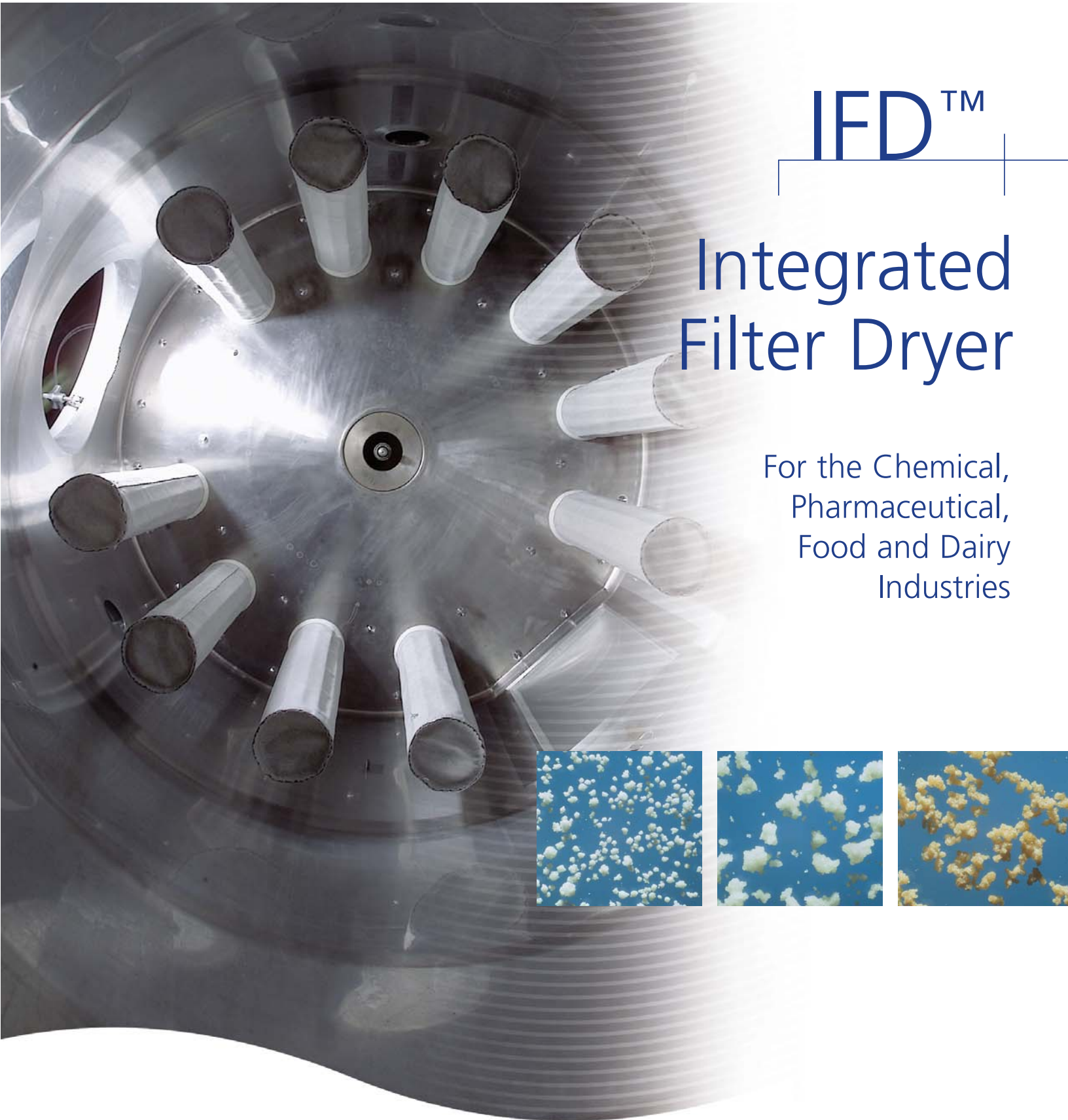


Niro Inc.

IFD™

Integrated Filter Dryer

For the Chemical,
Pharmaceutical,
Food and Dairy
Industries

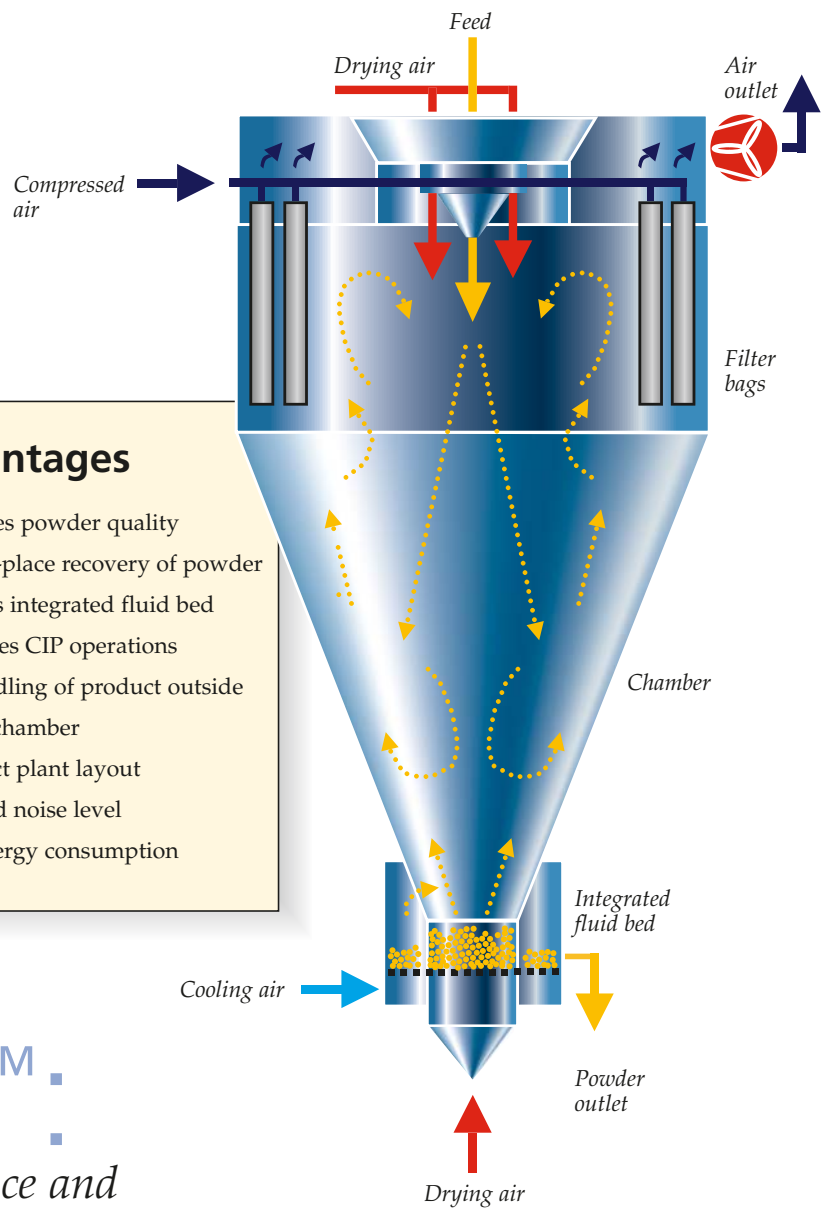




Integrated Filter Dryer operating at the Niro Test Station.

Advantages

- Improves powder quality
- Total in-place recovery of powder
- Features integrated fluid bed
- Simplifies CIP operations
- No handling of product outside drying chamber
- Compact plant layout
- Reduced noise level
- Less energy consumption



IFD™: Improved Performance and In-Place Powder Recovery

Niro has developed a new design concept involving particulate air filters placed inside the drying chamber of spray dryers with integrated fluid beds.

The Multi-Stage Dryer MSD™ has been widely used in the food and dairy industries since Niro obtained the first patent in the early 1980s. The MSD™ plant has subsequently proved very environmentally friendly, being both safe and energy-efficient in operation. Fluidized spray drying is one of the most successful concepts of spray drying ever developed. It is used to produce a wide range of free-flowing powders, agglomerated, and granular dry materials of low dust content, many

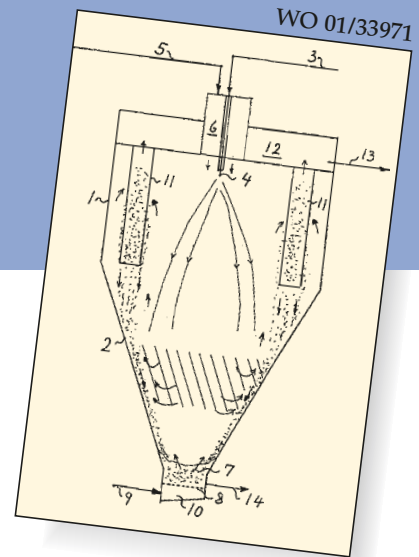
of which are difficult to produce on other spray dryer types.

The Integrated Filter Dryer - IFD™
Niro has further developed and refined the versatility and success of the MSD™ by introducing the CIP-able SANICIP™ bag filter. This combination is used in the new Integrated Filter Dryer — IFD™ — which features an integrated fluid bed and filter arrangement. The location of the filter assembly inside the drying chamber



Selected patents pending

- WO 01/33971 IFD™: Dairy products
- WO 01/03807 IFD™: Individual blow of filters
- WO 00/74836 IFD™: Total exhaust gas treatment
- WO 00/21642 Reverse air jet nozzle
- WO 98/00001 Filter CIP
- WO 97/14288 IFD™: Special filters



Integrated filters reduce space requirements. Whether using the SANICIP™ cleaning system or not, an integrated filter will enhance performance for a long range of products.

Reverse jet air nozzle

improves powder quality and gives total in-place powder recovery and cleaning capability. It also simplifies powder handling as it eliminates the need for external cyclones, bag filters, and fines recycling.

Prototype testing has shown that the location and operation of the internal filters enhance control over particle formation and therefore over the quality specification.

The compact design reduces the amount of equipment in contact with the product. Consequently, cleaning is easier making the IFD™ concept especially attractive to producers where hygiene is a first priority.

Advantages at a Glance

- The obvious advantages from the SANICIP™ filter with the well proven reverse jet air nozzle are used in the new dryer concept.
- CIP features cleaning of the bags from inside-out.
- The IFD™ concept creates a more compact dryer layout reducing floor area and building space requirements.
- Filter elements, located in the drying chamber, simplify powder handling and exhaust air cleaning and offer a high level of product containment.
- Integrated particulate filters can be installed in all sizes of spray dryers. Small scale units are available.
- Reduced pressure drop over the particulate air filters (and no cyclones) result in reduced energy consumption and noise level.
- The compact layout reduces the number of surfaces to be cleaned and makes it easier to switch products, thereby making it an attractive solution for the food and dairy industry.
- No fines recycling necessary for making an agglomerated product. This also results in a lower free fat content in the powder.

IFD™ Integrated Filter Dryer

Niro is a world leading engineering company specializing in industrial process equipment. Its core technologies are spray drying, freeze drying, fluid bed processing, evaporation, distillation, high-pressure homogenization, membrane filtration, tablet presses, powder packaging and handling, and particulate processing systems. For more information



about our products and services please access our web site www.niroinc.com.



Niro Worldwide HQ in Denmark



US center of excellence for chemical and pharmaceutical process equipment



US center of excellence for food and dairy process equipment



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