

#### INTERNATIONAL DAIRY FEDERATION - GERMAN NATIONAL COMMITTEE





IDF World Dairy Summit United Dairy World 2009 BERLIN 20-24 SEPTEMBER

# **CIP** filter

# Solutions for milk dryer plants





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- Optimization with CFD
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### Intensiv-Filter at a glance

#### Intensiv-Filter Gruppe

Intensiv-Filter GmbH & Co. KG Intensiv-Filter Austria GmbH Filtres Intensiv S.a.r.I. Intensiv-Filter (UK) Ltd. Intensiv-Filter do Brasil Ltda. Intensiv-Filter Korea Ltd. Intensiv-Filter India Pvt. Ltd. Infastaub Bad Homburg, Deutschland Solidux Billerbeck, Deutschland

#### More than 400 employees worldwide

#### www.intensiv-filter.com

Velbert-Langenberg, Deutschland Grieskirchen, Österreich Bouzonville, Frankreich West Midlands, England Sao Paulo, Brasilien Seoul, Korea Pune, Indien small and nuisance filter < 30.000 m<sup>3</sup>/h sound insulation



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### Intensiv-Filter at a glance

#### Performance

- system suppliers for plants in the area of dust removal technology and product recovery
- Product range covers process bag filter up to 2 mio m<sup>3</sup>/h, nuisance filter, roundfilter, CIP filter, coolers and vents
- planning, engineering, own manufacturing, installation, commissioning and service
- tailor-made filtermedia

Food

Cement, lime, gypsum Steel, iron, Non-ferrous metal Chemistry Glass

Energy

Disposal





### **Intensiv-Filter at a glance**

#### **Mission Statement:**

Environmentally compatible customer solutions for more profitability

# Our filtering installations protect the environment:

- With dust removal installations for better and safer conditions in emission protection.
- With filtering installations for the protection of the resources in product recovery.
- With an economical and energy-efficient filtering technology for the benefit of our customers









### Filter with CIP-technology

#### Filter with CIP-technology are

- designed for a dry filtration process and cyclical washing
- filter that are cleaned automatically and without removal of the filter bags
- suitable for a wide range of air volume flows
- apply in the
  - food industry
  - chemical industry
  - pharmaceutical industry
- for processes when
  - product changes frequently
  - product ageing is expected
  - risks of any product contamination is valid







# Filter with CIP-technology



Filtering installations for the food industry since1978

CIP filter with and without cylones is standard since 1993





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### Filter with CIP-technology HISTORY OF FILTER TECHNOLOGY







Round Filter with tangential inflow until 2001

Round Filter with radial inflow until 2007

Round Filter with radial inflow and according to Atex instructions 2008





### Filter with CIP-technology

Drying of milk with a spray dryer



- Production of powdery products
- Residual water is evaporated in spray dryers
- Powder is conveyed from the spray drier into the fluid bed
- Exhaust air is dedusted in a downstream CIP Filter

- 1 Spray dryer
- 2 CIP Filter
- 3 External fluidised bed





### Filter with CIP-technology

- 1 Housing
- 2 Clean gas chamber
- 3 Clean gas outlet
- 4 Bag bottom plate
- 5 Raw gas inlet
- 6 Raw gas baffle plate
- 7 Filter bags
- 8 Raw gas chamber
- 9 Filter cone
- 10 Product discharge







### Filter with CIP-technology

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Schematic representation of the cleaning procedure with water in an "Intensiv-Filter" with CIP equipment

Cleaning of:

- Housing walls
- Filter bags
- Components

Additional functions

- Disinfection
- Neutralisation
- Washing with other auxiliary agents, e.g. protein solvents

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- 1 Drying with hot air from spray dryer exhaust
- 1 Washing nozzle groups
- 2 Washing fluid
- 3 Filter bags





### Filter with CIP-technology

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#### **Hygienic standard**



#### **Optimized bag bottom plate**

New design for increased requirements







### Filter with CIP-technology

#### **Advantages**

- Prevention of product loss
- Hygienic impeccable production of food
- Qualified for the procuction of alternating products
- Fully automatic cleaning
- Space saving installation (cyclone not required)
- Economic (tdue to short payback period)





### **Optimization with CFD**

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#### Analysis of the flow distribution in a CIP filter

- Flow distribution in the inlet and on the baffle plate
- Flow distribution in the raw gas chamber
- Flow distribution inside the bag package
- Through and up flow in the bags









### **Optimization with CFD**

- Very uniform flow distribution inside the bag package
- Symmetrical flow distribution on the baffle plate
- Uniform flow distribution inside the bags
- Up flow in the bags







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### **Explosion protection**

- An explosion is a reaction on oxidation or decay with a sudden increase of temperature, pressure or both together .(DIN EN 1127-1:1997).
- A sudden volume expansion of gases appear and enormous energy is released on small space.
- Following terms apply in dependence of the expanding speed
  - deflagration (0.1 to 1 m/s)
  - explosion (1 to 1,000 m/s)
  - detonation (ex 1,000 m/s)



- Comparison: sonic velocity is about 333 m/s





### **Explosion protection**

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# Explosion pressure shock resistant design with explosion suppression

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- Explosion pressure shock resistant for the reduced explosion pressure (0.4...1 bar)
- A special extinguishing agent is introduced into the filter in the case of explosion suppression
- The signal for the activation of the extinguishing agent container is transmitted via highly sensitive pressure sensors or/and Infrared detectors
- Decoupling about extinguishing agent block
- 1 Extinguishing agent block
- 2 Extinguishing agent container
- 3 Pressure sensor

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### **Explosion protection**

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# Explosion pressure shock resistant design with explosion pressure discharge



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- Explosion pressure shock resistant for the reduced explosion pressure (0.4...1 bar)
- The explosion is dissipated in a controlled manner through the use of burst discs
- Keep free the discharge surfaces by effective bag retain system (Developed with DEKRA Exam)
- Decoupling about extinguishing agent block
- 1 Clean gas area, no explosion spread (dust concentration under explosion limit)
- 2 Burst discs
- 3 Spread of pressure and flame (safety zone surrounding in front of pressure relief devices)
- 4 Spread of pressure and flame





### References



Gas volume	150,000	m³/h a.c
Raw gas dust content	20	g /m³
Residual dust content	< 10	mg/m³ n.c. dry
Filter surface area	1,290	m²







Gas volume	148,000	m³/h a.c.
Raw gas dust content	20	g /m³
Residual dust content	< 10	mg/m³ n.c. dry
Filter surface area	914	m²





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### References

Installation of the world's largest spray-drying plant with a volume of 600,000m<sup>3</sup>/h in New Zealand



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### **CIP filter vs. Cyclone**

Basic data	<ul> <li>Costs baby food: 4.00 EUR/kg</li> <li>Air flow: 150,000 m<sup>3</sup>/h</li> <li>Fan efficiency: 0.75</li> <li>Operating hours: 6,000 h/a</li> <li>Cyclone: Residual dust content 200 mg/m<sup>3</sup> n. c.</li> <li>Bag filter: Residual dust content 10 mg/m<sup>3</sup> n. c.</li> <li>Operating costs: ca. 0,05 EUR/kWh</li> </ul>	
Investment cost	CIP filter ca. EUR 1,200,000	
Additional return and reduction of operating costs	<ul> <li>Additional return due to recovered product: (200 mg/m<sup>3</sup> - 10 mg/m<sup>3</sup>) · 150,000 m<sup>3</sup>/h · 6,000 h/a · 4,00 EUR/kg · <sup>1kg</sup>/<sub>10<sup>6</sup> mg</sub> = EUR 684,000 per anno</li> </ul>	
	<ul> <li>Additional savings due to ca. 1,000 PA less pressure drop: Reduced electric power consumption of the fan <u>air flow pressure drop</u> fan efficiency         · 150,000 m³/h · 1,000 Pa <u>3,600 · 1,000 · 0.75</u> = 56 kW         </li> </ul>	
	<ul> <li>Reduction of operating costs: 56 kW · 0.05 EUR/kWh · 6,000 h/a = EUR 16,800 per anno</li> <li>Total savings: EUR 700,800 per anno</li> </ul>	



### Summary

# Intensiv-Filter has over 25 years of experience with CIP Filters in the milk and food industry

- ✓ Down time for cleaning is minimized due to automatic cleaning process
- ✓ Recovery of powder losses up to 99 %

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- ✓ No contamination of powders
- ✓ Substantial saving of space
- ✓ No clogging of cyclones
- $\checkmark$  Very high safety of operating and production
- $\checkmark$  Energy reduction up to 30% by replacing cyclones into CIP filters
- ✓ Suitable for hygroscopic powders and powders with high free fat content
- ✓ Economical (very short payback period)



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