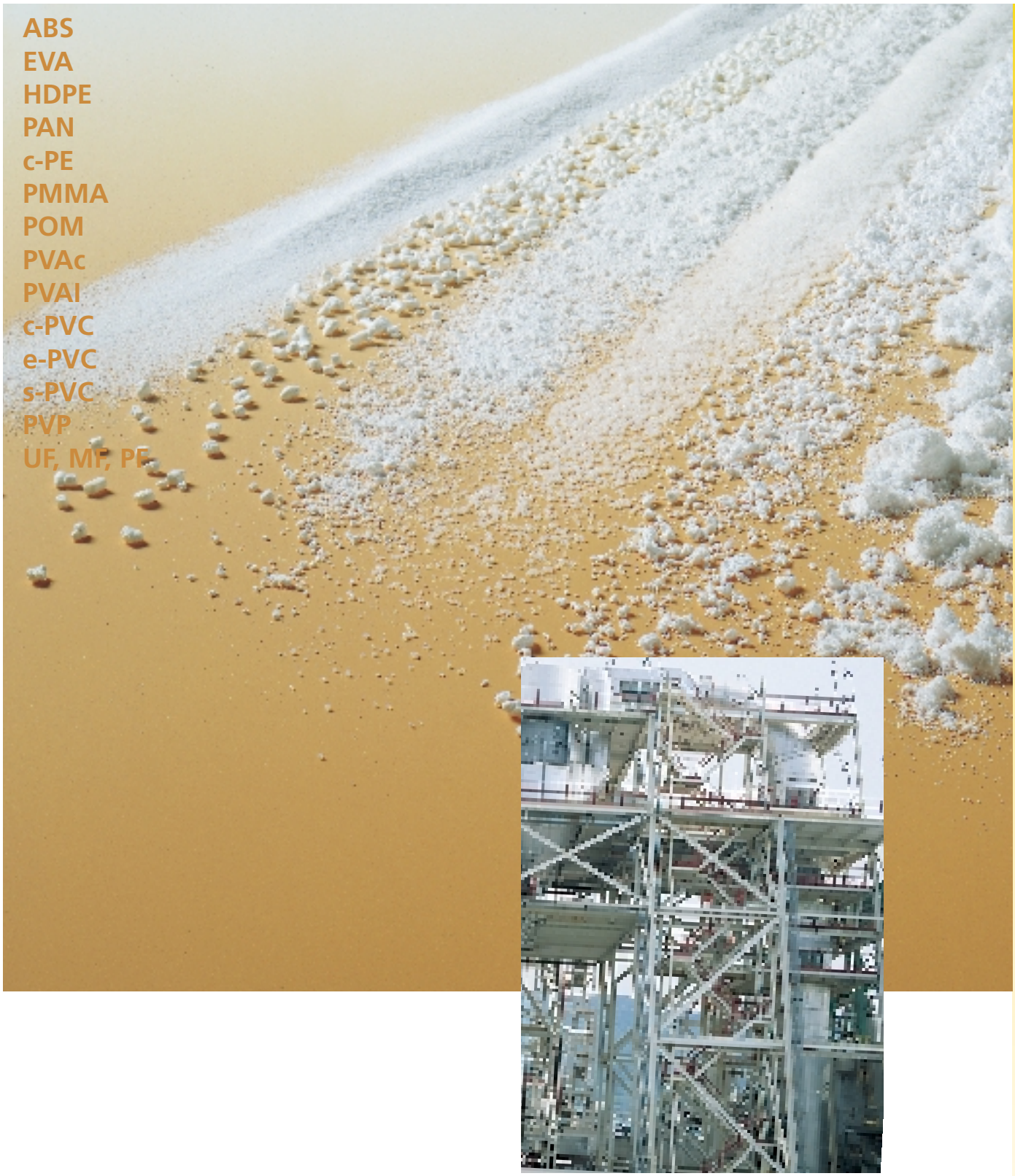
GEA
Powder Technology
Division

Niro

Polymer Drying



CONTACT FLUIDIZER™
63 m^2 for s-PVC.

Niro is a Member of the GEA Group

GEA, with head office in Bochum, Germany, is a global engineering group specialising in the design and supply of plant incorporating thermal, energy, and air treatment technologies.

The Niro organisation, founded in 1933, consists of 40 companies world-wide and forms the Powder Technology Division of GEA. The Niro drying technology centre in Copenhagen, Denmark, is responsible for equipment design, and product and process development. Niro plants are supplied for the production of products in powder, agglomerate, and granular form. The drying of polymers is a special area of expertise.

Niro has supplied over 5000 industrial dryers including more than 500 (since 1950) for polymers. The polymer industry therefore benefits both from Niro's direct product expertise and from the transfer of value added technology from other drying applications.

The Niro organisation is strongly customer and product focused. New dryers are designed to individual requirements based upon pilot plant testing and industrial plant experience. Offices around the world provide a dedicated local customer service. The main facilities for polymer test drying are in Copenhagen (Denmark), Columbia, Maryland (USA), and Tokyo (Japan), where a wide range of pilot plants and some industrial size units are available.

Dryer Types

The main types of polymer dryers supplied by Niro are shown on the opposite page together with specific characteristics and product applications.

When polymer drying involves wet powders (particles already created as a result of slurry polymerisation or precipitation), water or organic volatiles are removed in flash and/or fluid bed dryers (figures 1 and 2).

When polymer drying involves formation and drying of particles of specific size and structure (polymers from emulsion and solution processes), spray dryers are used, often combined with fluid bed post-drying and cooling (figures 3, 4, and 5).

When processing involves molten polymers, spray congealing is adopted in plant designs that resemble spray dryers.

Dryer Cleaning
Dryers are designed for continuous operation, with scheduled shutdowns for cleaning and grade changes. Automatic Cleaning-In-Place (CIP) systems can be incorporated in all dryers when required.

Dryer Capacities
Scale-up of polymer dryers presents no problems. Both present day and expected future process stream rates can be handled in single dryer units. Current dry product rates already exceed 35 tonnes an hour for slurry polymers, and 5 tonnes an hour for emulsion polymers.

Energy Savings
Contact heating (heating elements) can be incorporated in fluid beds to great advantage. Heat recovery and partial recirculation of the drying medium reduce energy consumption in spray and flash dryers.

Residual VOCs
Stripping of Volatile Organic Compounds from dry polymers is a growing requirement, and could well become a general processing standard due to concern about the release of VOCs during handling, storage and fabrication. Both integrated and separate stripping stages can be included in the dryer design.

Turnaround Time
Emptying, cleaning, and start-up times depend upon the dryer type, but special design features are incorporated into Niro dryers to minimise the turnaround time.

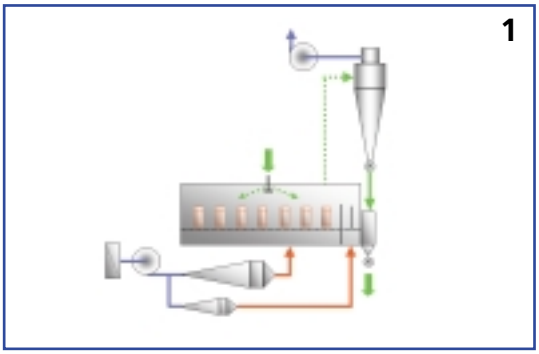
TALL FORM DRYER™
with 180 two-fluid nozzles
for e-PVC.

Main Types of Polymer Dryers

Fluid bed dryer with contact heating.
CONTACT FLUIDIZER™, **CFD**

Applications ABS, HDPE, MBS, PAN, POM, s-PVC, c-PVC, c-PE

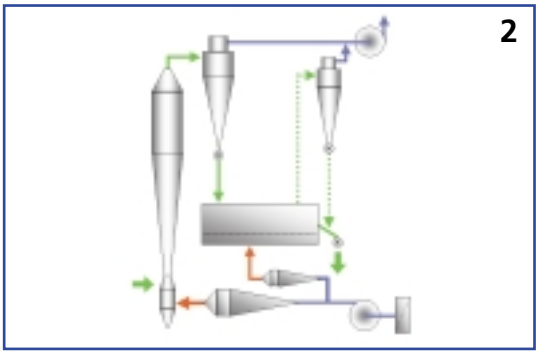
Characteristics
- Particulate feeds
- Low specific energy consumption
- Low product processing temperature
- Long product residence time, gentle drying
- Average particle size range 50-800 µm
- Two-stage drying, cross-current flow mode



FLash Dryer with Fluid Bed post Dryer, **FLD** + **FBD**

Applications ABS, MBS, PAN, s-PVC

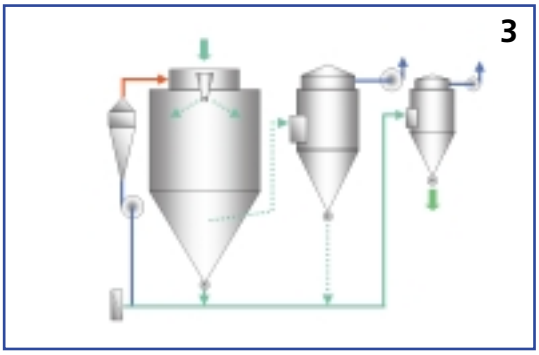
Characteristics
- Low specific energy consumption
- Short product residence time, rapid drying (FLD)
- Long product residence time, gentle drying (FBD)
- Average particle size range 50-800 µm
- Two-stage drying, co-current + cross current flow modes



Spray Dryer with Rotary atomizer, **SD-R**

Applications e-PVC, EVA, MF, PF, UF, PMMA, PVAc

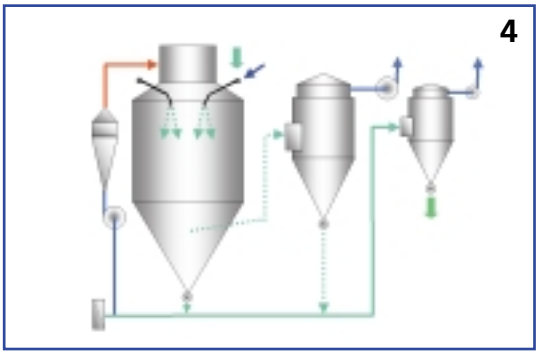
Characteristics
- Fluid feeds
- Single atomizer unit
- Average particle size range 30-125 µm
- Co-current flow mode
- Bag filter preferred powder collector



Spray dryer with pressure or two-fluid Nozzle atomizer(s),
TALL FORM DRYER™, **TFD-N** or **-2N**

Applications e-PVC, PMMA, PVP

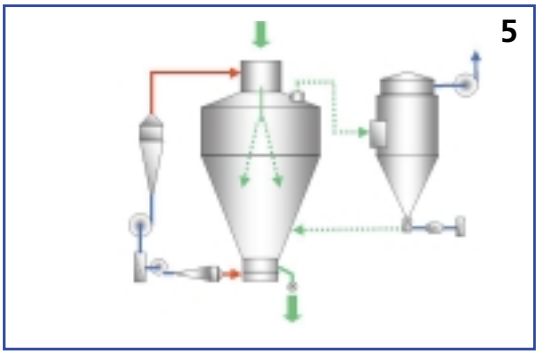
Characteristics
- Fluid feeds
- Multiple atomizer assembly
- Average particle size range 15-250 µm
- Co-current flow mode
- Bag filter preferred powder collector



Fluidized Spray Dryer with Rotary or Nozzle atomizer, **FSD**™, **FSD-R** or **-N**

Applications PMMA, specialties

Characteristics
- Agglomerated products, no fines fraction
- Fines recycled within dryer
- Average particle size range 100-300 µm
- Two drying stages
- Mixed flow mode
- Bag filter preferred powder collector



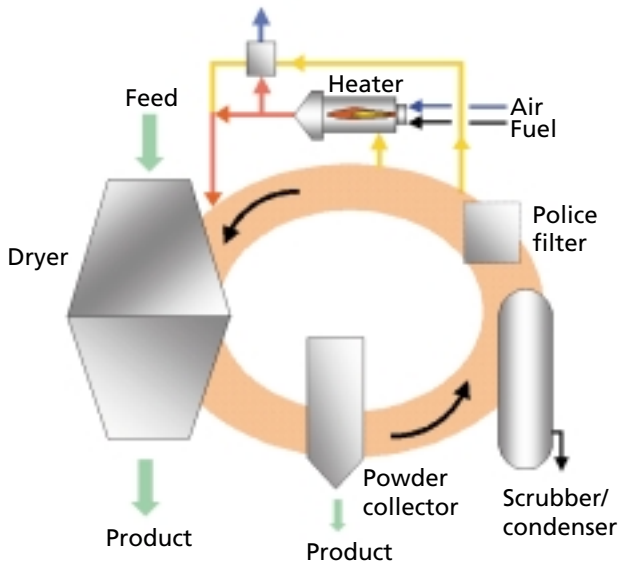
Operational Safety

Polymers in powder form are combustible and can form explosive mixtures in air. The selection of the safety concept is product specific and involves risk analysis procedures.

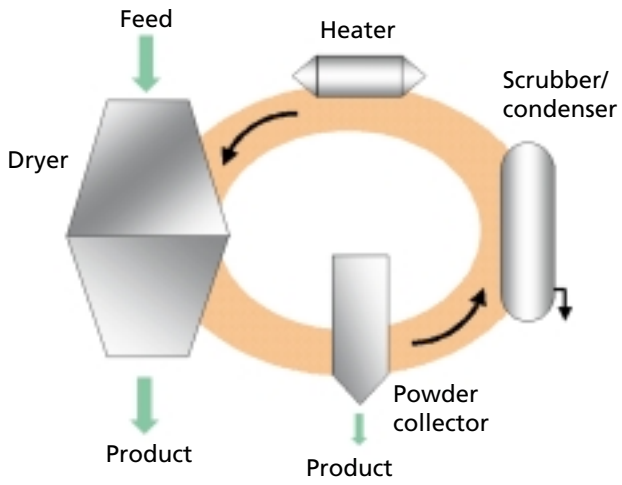
Water wet polymers can be dried using air as the drying medium. Plants are designed to eliminate possible ignition sources and operate under conditions that keep air-powder mixture concentrations low. Installation of explosion-relief or suppression systems operating in combination with automatic fire extinguishing arrangements provide additional safety protection. If a product grade presents a high powder explosion risk, drying can be safely carried out in self-inertizing recycle layouts. Inertizing is created by use of a special direct fired heater with venting of small volumes of exhaust drying air to maintain system equilibrium. This layout is ideal for preventing VOC emissions, since the small vent volume can be economically incinerated in an integrated heater system.

Solvent wet polymers are dried in closed cycle dryers operating with inert gas (nitrogen) as the drying medium.

Self Inertized System



Closed Cycle System



Environmental Protection

Dust Emissions
Cyclones operating alone or in combination with wet scrubbers meet emission requirements from flash and fluid bed dryers. Bag filters are required for spray dryers, since they are normally producing a smaller particle size.

VOC Emissions
Compliance with environmental regulations is often achieved by stripping of the wet feed. When this is insufficient or impractical, the exhaust air can be purified by adsorption or by catalytic or thermal incineration. If self-inertizing layouts are used for operational safety, incineration can be carried out in the direct fired heater incorporated in the layout (see above).

GEA Niro A/S
Powder Technology Division

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