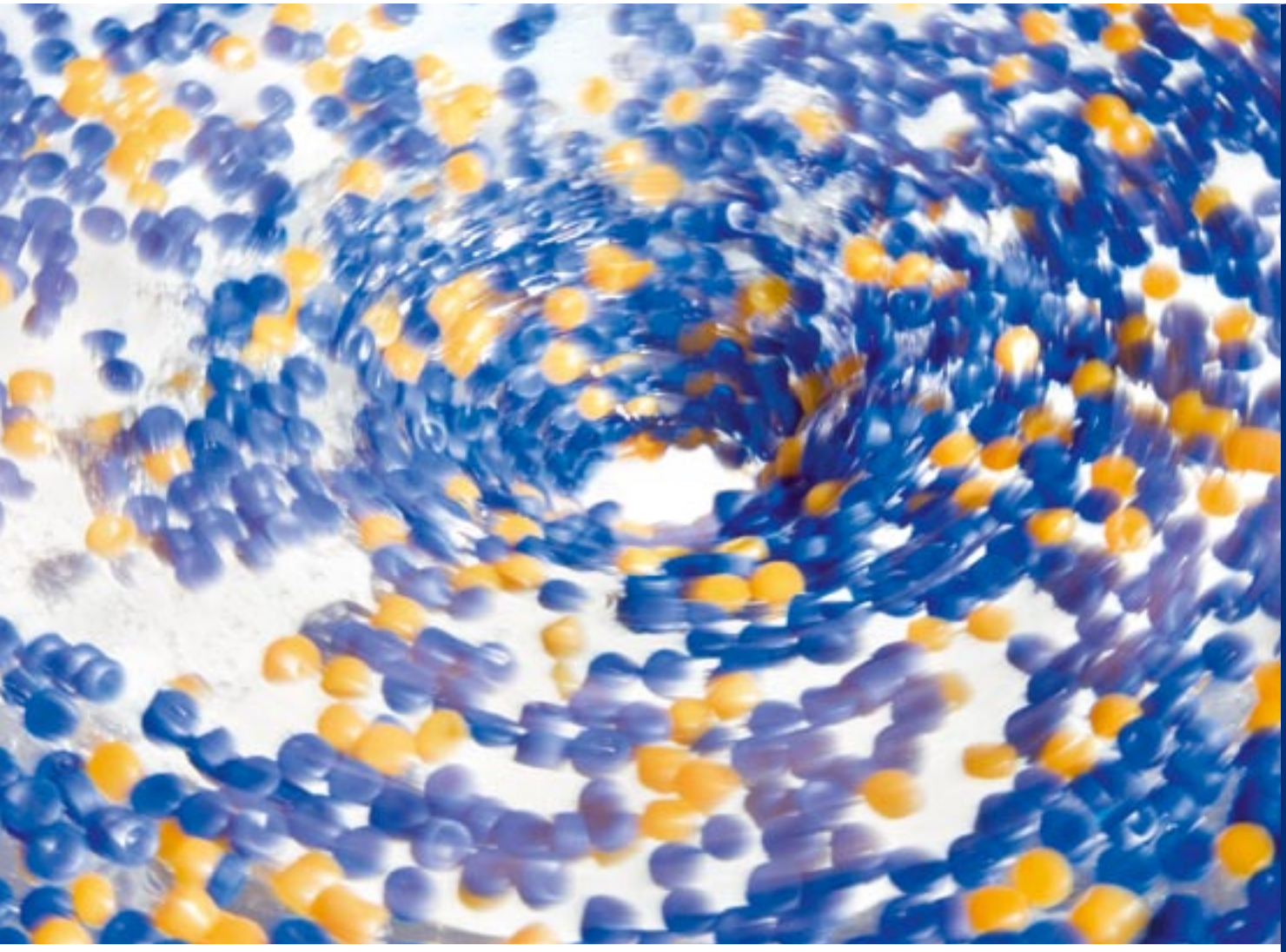
ZEPPELIN®

All specialists under one roof

Hydraulic Conveying Systems made by Zeppelin

Innovative technology for a gentle transport of bulk solids



Conveying Technology

A century of experience gained through your tasks

The industry sector of the Zeppelin Group is among the leading manufacturers of plants for storing, conveying, blending, and dosing of premium bulk solids. Thanks to our world-wide activities and locations in all important industrial centers we can always provide our clients with the latest, most innovative and reliable technology to ensure maximum economic success.

As the direct successor of Count Ferdinand von Zeppelin who turned the human dream of flying into reality by building his legendary airships over a century ago, we are used to looking ahead. Constantly innovating, striving for perfection and maximum functionality in our products has turned us into the company that Zeppelin is known as today: the technology leader for handling premium bulk solids.

On site world-wide - always near our customers. Production plants in Germany, Belgium and Brazil, production partners in Saudi Arabia, Thailand and China as well as subsidiaries and representations all over the world enable Zeppelin to serve its customers with speed, flexibility and the utmost closeness to them. More than 200 engineers – including specialists in chemical engineering – guarantee innovative and economic construction of plants.

Zeppelin has been the leader in the international market of silo construction for decades. Thanks to our own modern manufacturing and the international experience of our assembly staff and service engineers we guarantee quality of the highest level.

Competence in bulk solids handling – you can rely on Zeppelin

The industrial Zeppelin Group and its various divisions are focused on the requirements of their customer groups. All activities have, however, one thing in common: the economic handling of premium bulk solids.

Silo plants for the plastic, food, and chemical industries integrated in one logistics concept: from consultation and design to manufacture, assembly and after-sales service.
Turn-key plants for the plastics processing and chemical industry as well as for rubber producers and tiremakers.
Conveying components for any application: for powders or pellets, for high or low pressures, for products with good or poor flowability, for standard or special applications.
Silogistic: turn-key plants for plastics producers, engineering companies and forwarders. Zeppelin is the world-wide leader in the planning and construction of logistic centers and manufacturing plants.

Pulling all the strings: the central office for the industry sector is located in Friedrichshafen, Germany. Here, in the world's largest Technology Center for pellets and powders, tests are carried out on an industrial scale. The test results are available to all subsidiaries, therefore allowing our clients to always be on the safe side – no matter where their plant is located.

Conveying with water: The gentle alternative for bulk solids

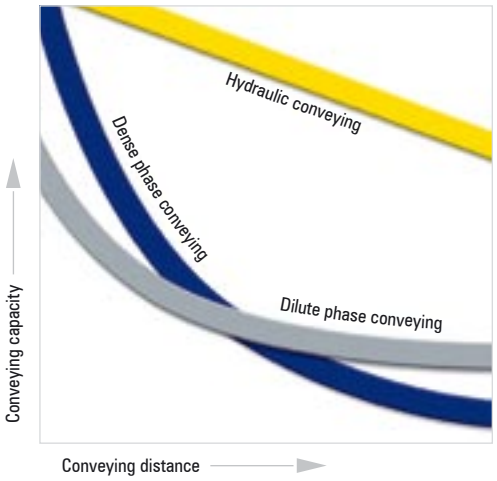
As system supplier for conveying systems, Zeppelin has specialized in reliable, efficient and above all process safe equipment for the transport of premium bulk solids. Depending on the task, pneumatic or hydraulic conveying is used.

Hydraulic conveying is becoming more and more important as pneumatic conveying technologies (dense or dilute phase conveying) are reaching their physical and economical limits for long conveying distances, high capacities and particularly stringent requirements to product purity.

Hydraulic conveying, which had been used in the past for the transport of coal, is now experiencing a comeback in the petrochemical industry. This is mostly due to the constantly increasing conveying capacities and requirements to product quality, thus a minimum product abrasion during conveying.

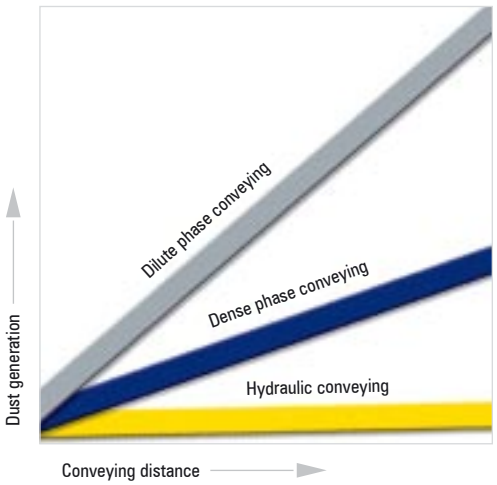
As the leader in bulk solids technology, Zeppelin has developed field-proven technologies and systems in accordance with the high requirements of the industry. These innovations ensure gentle conveying and above all operating efficiency and process reliability.

Conveying capacity / conveying distance



As pneumatic conveyors' physical capacities are limited, more and more hydraulic conveying systems are being used to meet the constantly increasing conveying requirements.

Dust generation / conveying distance



By selecting the appropriate conveying process the amount of abrasion can be largely reduced.

Typical conveying parameters

Typical velocity: 1.5 – 3 m/s
Solids concentration: < 40%

Field-proven technologies for maximum customer value

Zeppelin has developed technologies and innovative patented concepts which – unlike traditional hydraulic conveying systems – fully exploit the benefits of hydraulic conveying. Zeppelin is the number one systems supplier when it comes to product purity and operating efficiency. Find out for yourself!

Advantages of hydraulic conveying:

- minimum abrasion of product
- nearly unlimited conveying distances and capacities
- energy savings of 60 - 80%
- low noise emission
- small pipe diameters even for high capacities

Special advantages of the Zeppelin design:

- The hydraulic conveying pump does not come in contact with the solids flow.
- The patented technology allows gentle feeding into the conveying system without mechanical stress on the product.
- One pump is sufficient for the circulation as its efficiency is not influenced by the solids.
- Accurate plant design based on tests at the Zeppelin Technology Center.

Conveying process	Type of product			Conveying data				
	Fine powder	Granular, coarse powders	Pellets	Conveying distance**	Conveying capacity**	Conveying velocity	Solid to air ratio	Conveying pressures (recommended)
Dilute phase conveying	■	■	■	< 1,500 m	< 150 t/h	15 - 35 m/s	< 20 kg/kg	< 3.5 bar
Dense phase conveying		■	■	< 1,000 m	< 100 t/h	3 - 10 m/s	< 80 kg/kg	< 8 bar
Dense phase conveying with bypass	■	□		< 300 m	< 30 t/h	3 - 10 m/s	< 30 kg/kg	< 8 bar
Hydraulic conveying	□	□	■	< 5,000 m	< 100 t/h	1.5 - 3.0 m/s	< 40%*	< 8 bar

■ Preferred process □ Appropriate process

* Data indicated in solid concentration

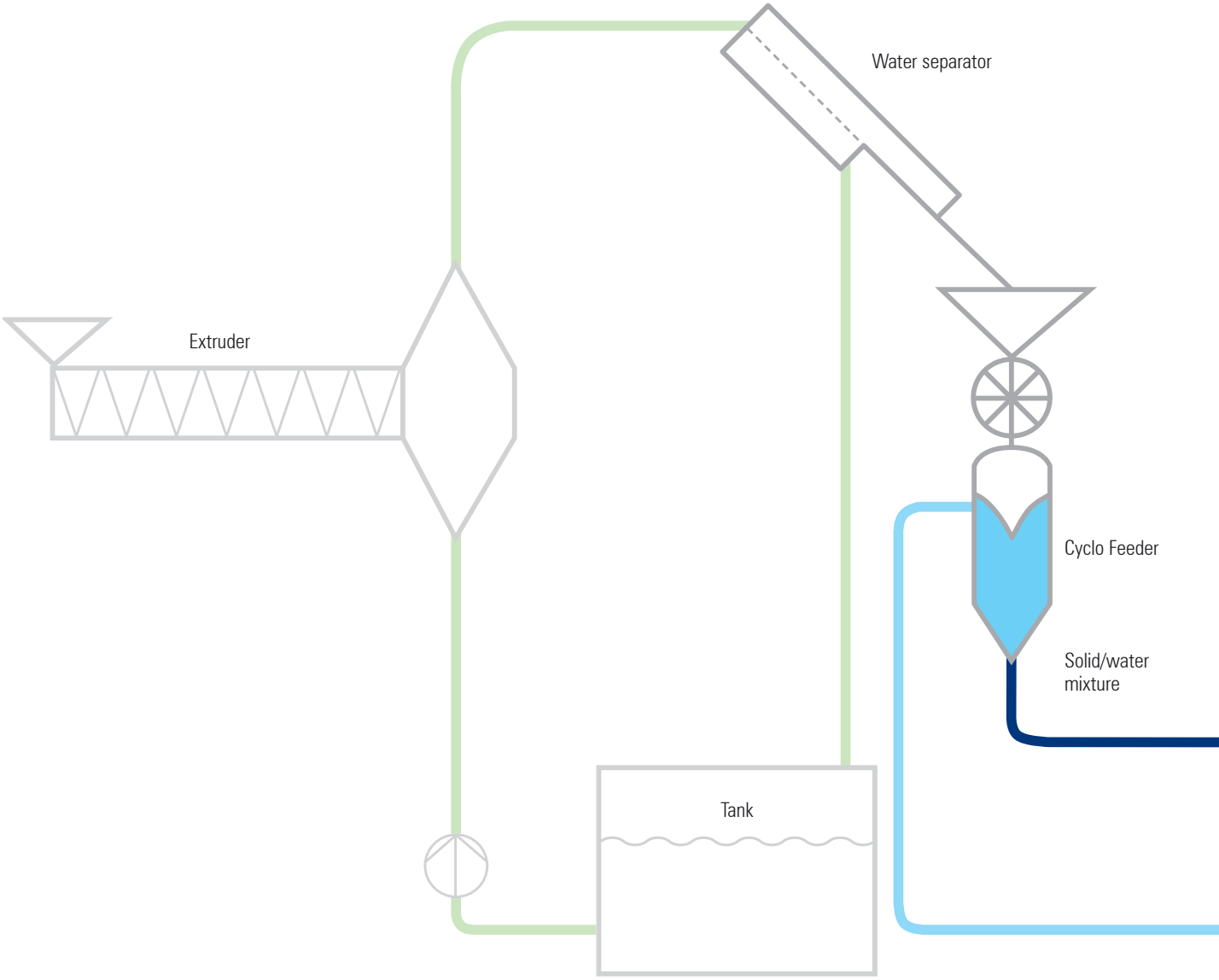
** Depending on the conveying capacities or conveying distance

Innovative ideas for maximum process reliability

You can expect gentle feeding of the product into the process, the best-suitable temperature control of the conveying medium, high-duty filters and innovative drying systems from all our plants. Zeppelin designs plants that meet your high requirements and are characterized by their utmost process reliability based on tests performed at the Zeppelin Technology Center.

Feeding of the product using the patented Cyclo Feeder
Zeppelin's clever concept feeds the product into the process without any contact to the mechanical components. Pellets with a low density which usually swim on top of the water stream can also be fed into the conveying pipe using the Cyclo Feeder.

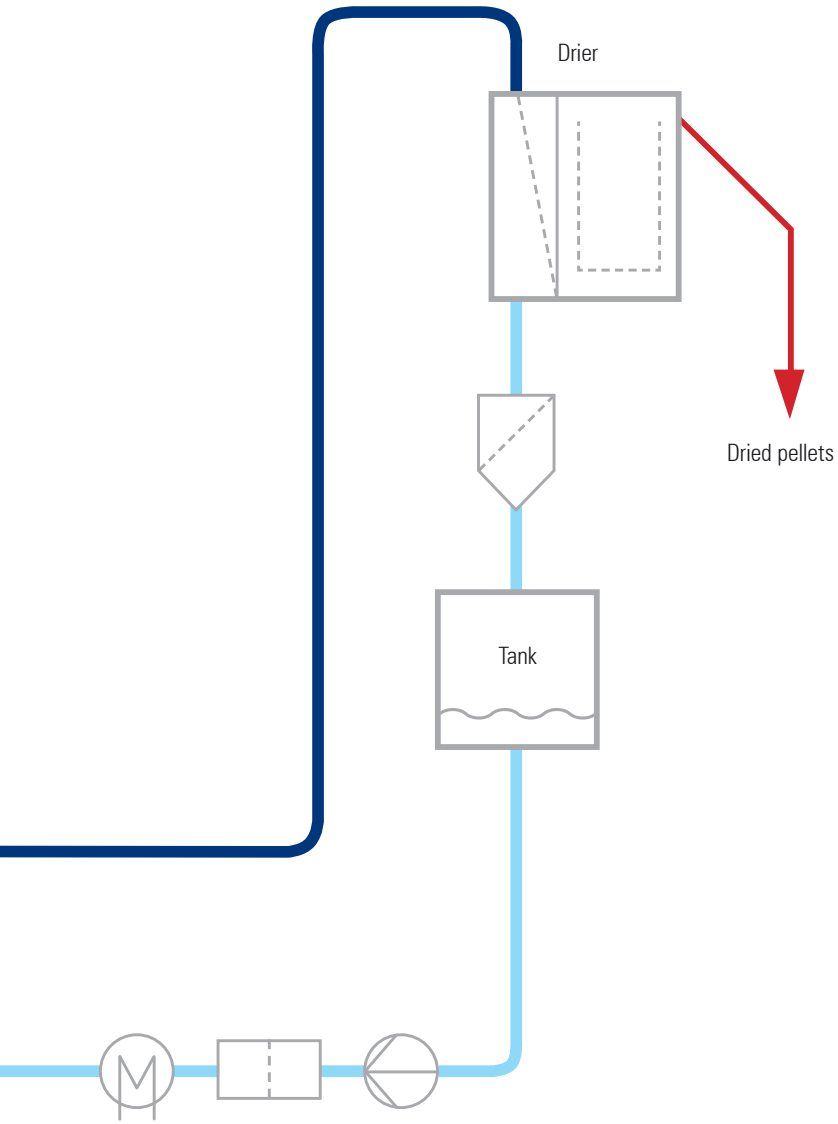
Precisely defined residence time of the product in the water
If the conveyed product remains too long under specific conditions in the hydraulic conveying pipe, its moisture content might increase resulting in an undesirable change of the product's properties. These time limits are precisely defined during tests in the Zeppelin Technology Center to ensure a safe and accurate design of the plant.



Underwater pelletizing

Water separator for the separation of liquids from solids: static or dynamic dewatering with a slotted screen.

Efficient separation and maximum reliability for continuous operation: the automatic reversible flow filter for separating fines and particulate material from the conveying medium.

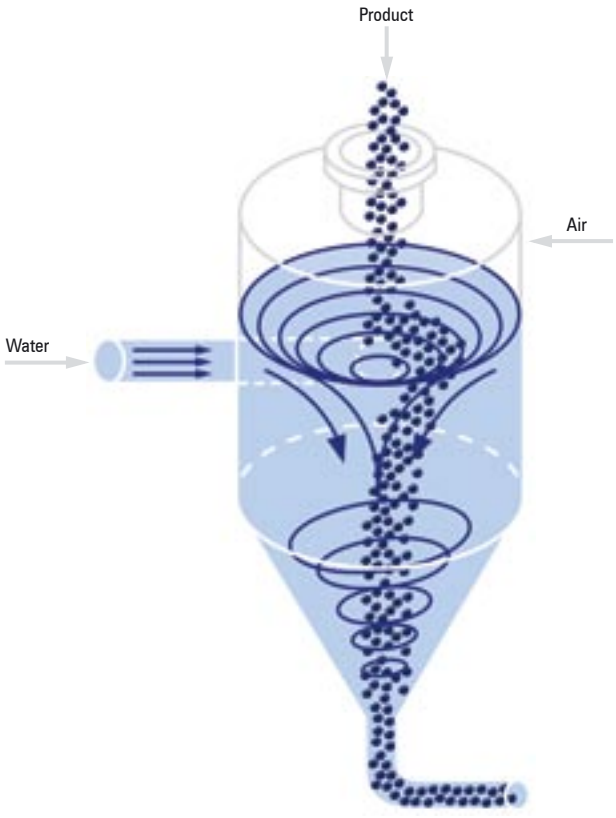


Hydraulic circulation

Optimum energy management

The temperature of the circulating water is maintained in accordance with the product properties to allow faster, thus low-cost, drying of the product after conveying.
The amount of energy used for tempering should therefore not be too extensive, and the temperature too high (could cause the product to dissolve). Complying with these parameters guarantees a maximum efficiency and, thus, profitability of the plant.

Cyclo Feeder: The vortex flow allows gentle feeding into the conveying pipe even for pellets with a low density.



Process reliability with an intelligent pump concept

The pump, which powers the hydraulic plant, is located outside of the product flow to ensure steady operation and gentle conveying of the product without having it pass through the pump. Possible clogging of the piping is avoided and a fully automatic stand-by pump ensures operation of the plant even in case of failures (e.g. defective pump).

Clean water in the hydraulic system at any time

Hydraulic conveying systems are operated as closed loop systems in order to save costs for the conveying medium. Therefore, high-duty filter units are required for separation of fines and suspended sediments which may remain in the water cycle. Zeppelin uses special filters located directly downstream the pump ensuring highest purity of the conveying water at any time.

Efficient drying

Once hydraulically conveyed, the product must be dried either by centrifugal or by fluidized-bed driers. Again, Zeppelin ensures profitable operation of the plant by tailoring it in accordance with the product properties.

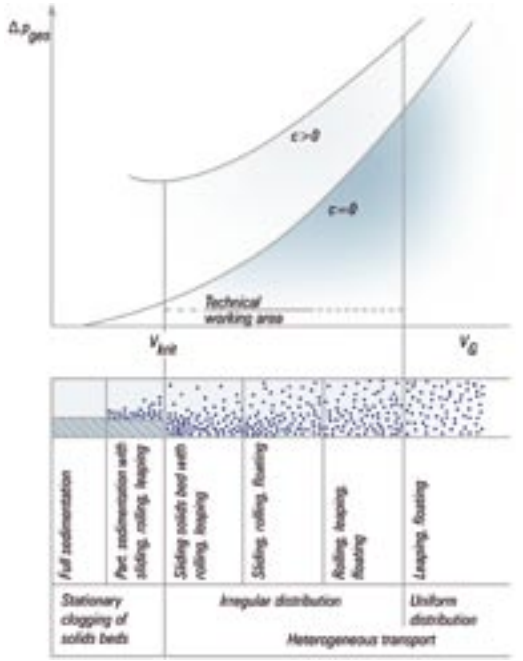
Individual plant design – verified in the Zeppelin Technology Center

Zeppelin owns a large-scale Development and Technology Center which focuses on the different technologies for the handling of bulk solids. In this facility, tests are carried out to determine the highest-possible operating parameters of your plants.

The Technology Center, which comprises Zeppelin's complete scope of services, provides key information necessary to your success: factual information on your product for an optimum design of your plants.

Our customers expect naturally maximum process reliability in order to form a sound basis for their investment decisions. Therefore, Zeppelin provides results which will leave no question open:

- competent result analysis by our specialists
- conclusive test reports and documentation
- determination of relevant design parameters



Our know-how for your success

The plastics industry is undergoing rapid change. Our customers constantly develop new or modified products with completely different characteristics. Only those who know everything about the bulk solids and their properties can ensure functional design and operation of plants. The Zeppelin Technology Center applies various methods to determine product properties in order to safely design silos, blenders, components and complete plants.

Zeppelin customers have their tests carried out at our modern testing facility. The results of all the tests are then not only submitted to our customers, but also stored in our central database for future reference. With the help of our experimental set-up and the test results, we can determine all significant parameters for the optimum design of your hydraulic conveying system. By using our testing facility, our customers also have access to our laboratories.

Services of our laboratories:

- shear tests with translational and ring shear testers
- determination of the bulk solids' density
- measurement of consolidation over time
- particle size analysis (by screening)
- residual dust content of pellets
- fluidization tests
- determination of friction coefficients
- determination of the separation efficiency
- wear tests
- moisture content

In order to determine the residual dust content in pellets, the electrostatic forces between the dust particles and the pellets must be eliminated. Elutriation processes with fractional separation have proven best-suitable for this task.

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