

## Conveying Systems made by Zeppelin

The right solution for every application





## 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, Brazil and Saudi Arabia, production partners in 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.

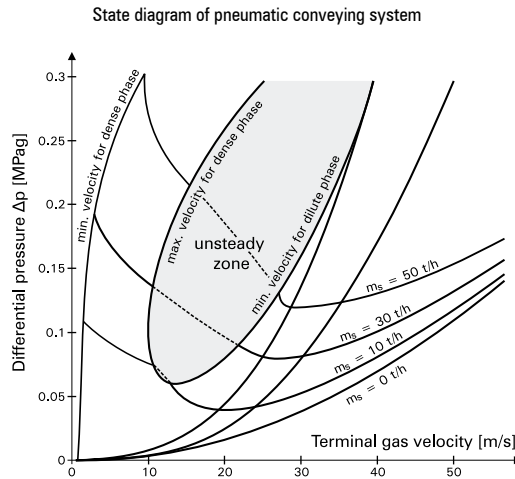


## The optimum conveying process for your individual requirements

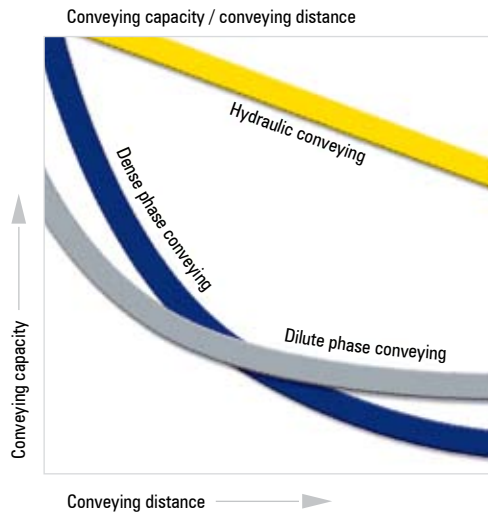
Achieving highest process reliability, maximum profitability as well as a corresponding product quality for the bulk solids transport is what you expect from your plant. Zeppelin is used to offering the highest possible customer value – and to advise you accordingly right from the beginning. Depending on the customer's requirements, basically two types of conveying systems are used in the production of bulk solids, in logistics terminals, or for feeding the processing machines:

- **Pneumatic conveying (dense or dilute phase):** conveying of the product with gas or air.
- **Hydraulic conveying:** conveying of the product with water.

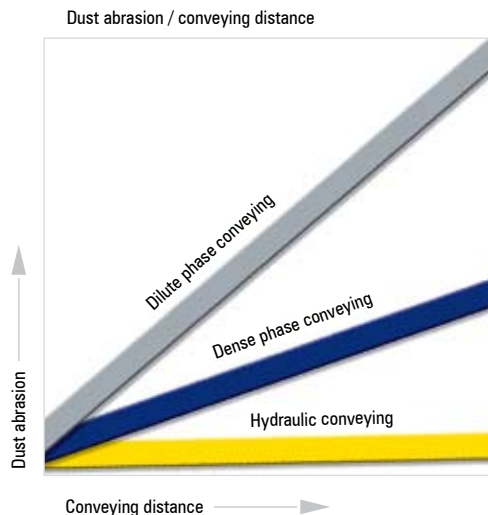
The choice of the appropriate conveying system depends on many different criteria: the characteristics of your bulk solids (such as grain size, abrasion sensitivity), the plant parameters (such as the conveying distances), the concept of the complete plant (such as planning of autonomous silo farms) as well as the costs for investment and operation all have to be taken into consideration. Combinations are also possible e.g. dilute phase conveying for long distances followed by purification and finally use of the product gentle dense phase conveying.



The individual state diagrams are used for the design of the respective pneumatic conveying system.



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



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

## Applications

This table can be used to facilitate your choice of criteria. Furthermore, it shows typical values of the different conveying methods.

Conveying process	Type of product			Conveying data				
	Fine powder	Grit, coarse grained powders	Pellets	Conveying distance**	Conveying capacity**	Conveying velocity	Load	Conveying pressure (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 by-pass				< 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

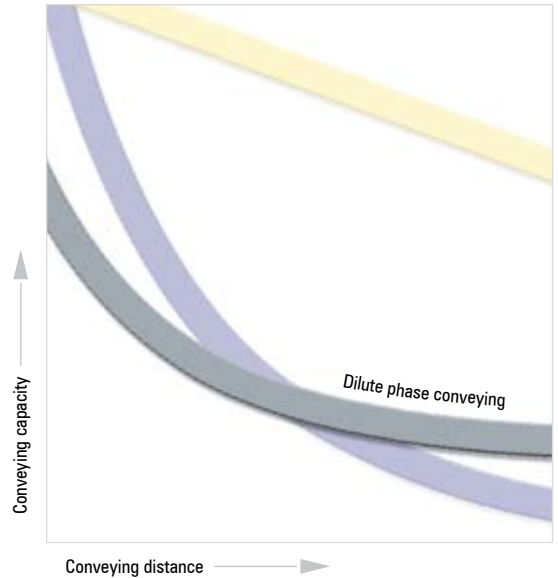
\* Data indicated in solid concentration

\*\* Depending on the conveying capacities or conveying distance

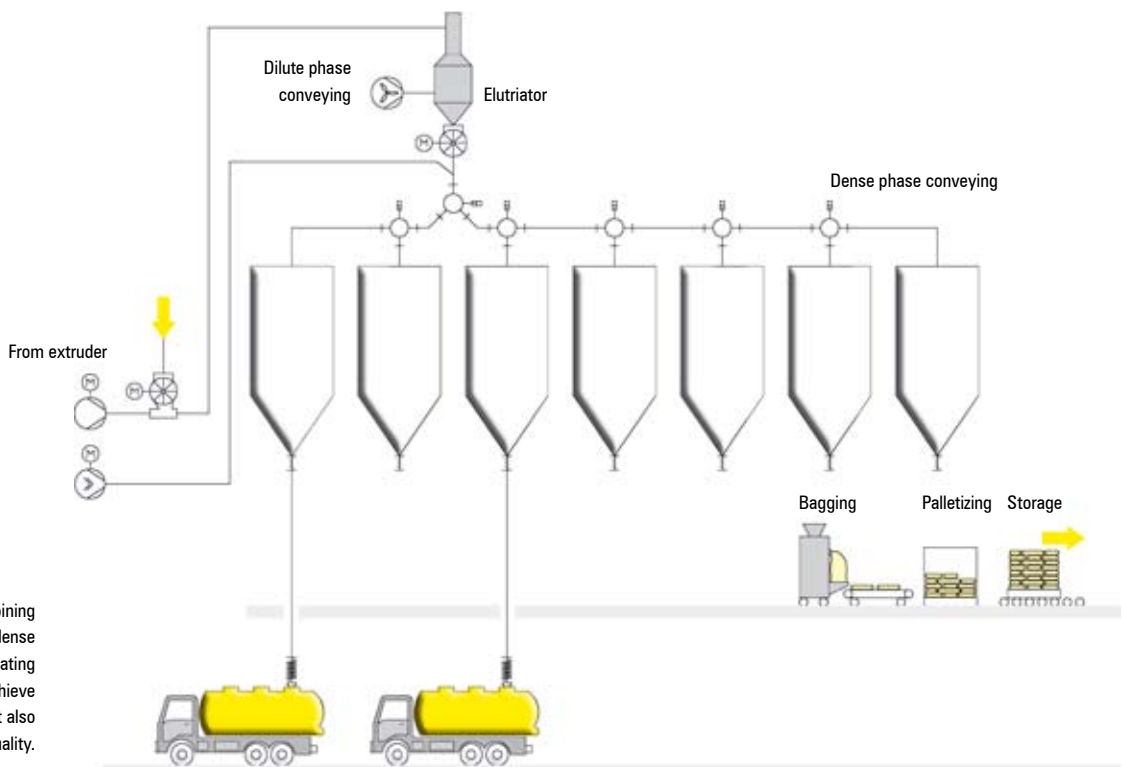


## Pneumatic dilute phase conveying: universal use for maximum flexibility

The pneumatic dilute phase conveying process (standard or high-pressure dilute phase conveying) is mainly characterized by the system's high flexibility, e.g. in case of varying conveying quantities. This type of conveying system is very simple compared to other conveying processes and can be used for short or long conveying distances. The necessary components are simple and require low maintenance. A further advantage of the dilute phase conveying is a reduction of total investment costs: lower pipe forces mean less costly pipe supports.



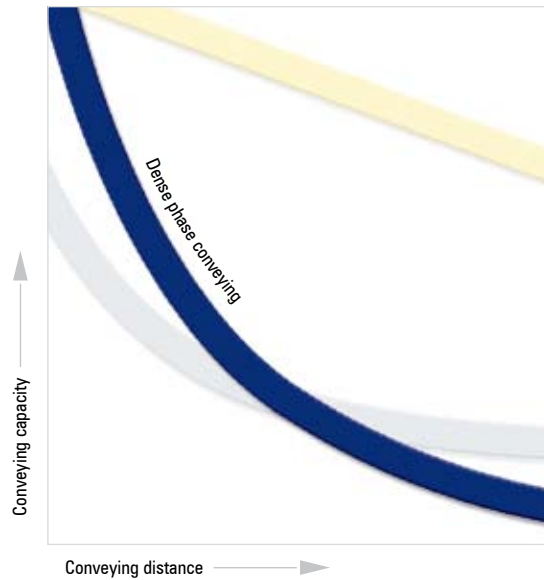
**Typical velocity:** 15 – 35 m/s  
**Typical load:** < 20



A clever solution: By combining the dilute phase and dense phase conveying and integrating an elutriator we not only achieve maximum profitability but also high product quality.

## Pneumatic dense phase conveying: gentle to the product – for high requirements

For high demands regarding the pellet quality, the pneumatic dense phase conveying is normally used. This system is recommended especially for products susceptible to abrasion. The dense phase conveying is more complex than the dilute phase conveying, is operated with higher pressures (up to typically 3.5 bar) and it requires more complex components regarding design and layout. However, the dense phase conveying is often the better solution for short conveying distances.



**Typical velocity:** 3 – 10 m/s  
**Typical load:** < 80



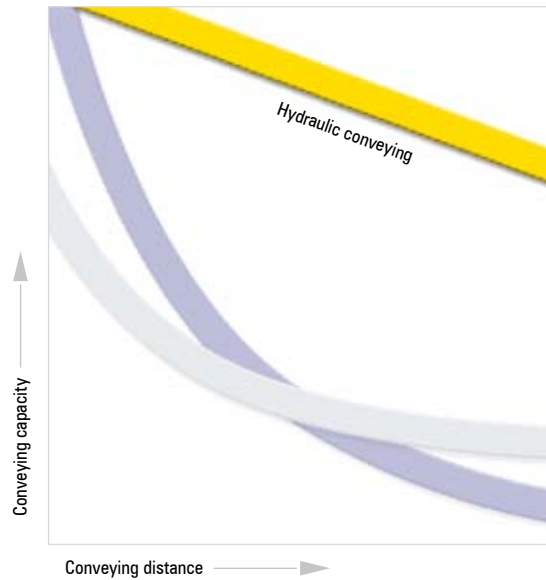
A conveying method that is gentle to the product – whenever necessary. With the dense phase conveying even high requirements regarding the product purity will be fulfilled.



# Hydraulic conveying: for long distances – and maximum product quality

For hydraulic conveying, water is used as conveying medium instead of gas. This conveying method is especially advantageous in case of long conveying distances or extremely high purity demands and the complex system has a lower energy consumption for the conveying. Furthermore, smaller pipe diameters can be used even for high conveying capacities, resulting in minimal pipe forces and low sound emissions.

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

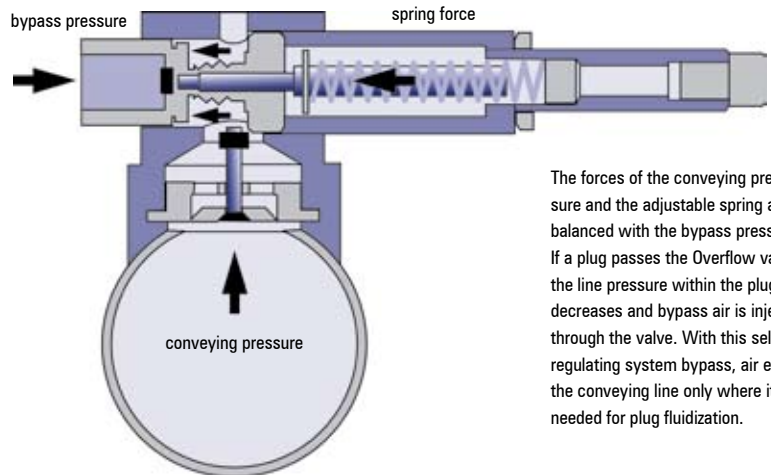


Long conveying distances – an extremely demanding product: a hydraulic conveying system was built for the transport of Polycarbonate.



# Bypass systems as an option for powders

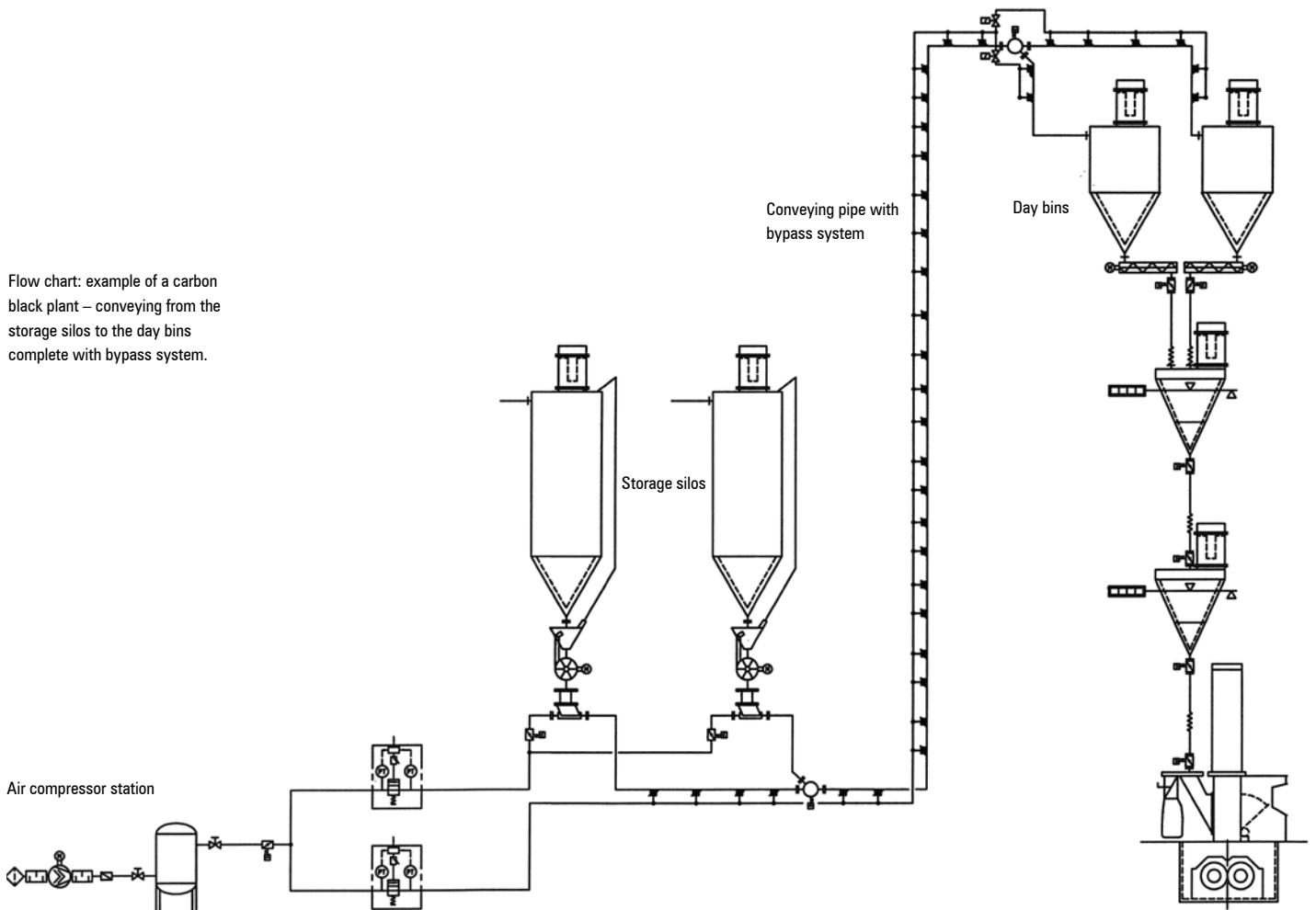
Two special bypass systems (Overflow and Airfloat) allow the use of the gentle dense phase conveying even for fine powders. The bypass systems blow secondary air through valves into the conveying pipes at exactly defined intervals. This process ensures trouble-free dense phase conveying, a method which is preferably used for granulated carbon black or silica due to the low rate of particle destruction.



The forces of the conveying pressure and the adjustable spring are balanced with the bypass pressure. If a plug passes the Overflow valve, the line pressure within the plug decreases and bypass air is injected through the valve. With this self-regulating system bypass air enters the conveying line only where it is needed for plug fluidization.

**Typical velocity:** 3 – 10 m/s  
**Solid concentration:** < 30%

Flow chart: example of a carbon black plant – conveying from the storage silos to the day bins complete with bypass system.



## First-class components for first-class systems

**The reliability of a complete system depends on the quality of its components – therefore, Zeppelin develops and produces the most important components in-house. This is the only way to guarantee process reliability for the whole plant.**

You not only get field-proven products but also components designed to fit perfectly into the system – for any application: for powders or pellets, for high or low pressures, for products with good or poor flowability, for standard or special applications (e.g. pipe cleaning systems). A broad range of products full of innovative and economic ideas.



Diverter valves in a modular system – for simple as well as the most demanding applications.



High and medium pressure rotary feeders for feeding the product into the conveying systems.

Innovative technology for purification of the product: from the drum sieve via the elutriator to the cyclone.



## The Zeppelin Technology Center: research and development for your success

**With our test facility network – unique in size, possibilities and performance – we offer another element which will contribute to your success: factual information on your product to help you select the best possible components or plant design.**

Our Technology Centers are built on an industrial scale to meet our customers' wide range of demands. Two separate test facilities are available at present: one for pellets and one for powders. We can provide you with tailored answers to your individual tasks, from trials on an industrial scale to special configurations that can be quickly installed.

Research facilities such as Zeppelin's Technology Center help our clients gain the market edge.



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