

## Blending and Homogenization Silos

Economic solutions 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 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.

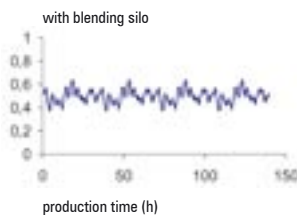
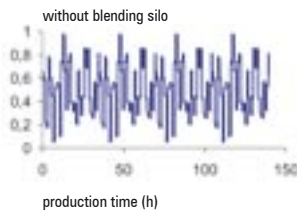


Pulling all the strings: the central office for the industry sector is located in Friedrichshafen, Germany. Here, in the world's largest Technology Center for pellets and powders, tests are carried out on an industrial scale. The test results are available to all subsidiaries, therefore allowing our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



## Innovative blender technology guarantees premium product quality

The graphs below show fluctuations in production processes with the use of a homogenization silo and without.



In times of constantly increasing requirements with regard to the product quality of plastic pellets, blending and homogenization are becoming more and more important. Zeppelin has therefore developed various blender concepts offering economic and reliable solutions for almost any application and allowing producers of plastics, masterbatches or recycled plastics to obtain an optimum blending efficiency and minimum fluctuations in product quality.

The blenders can be easily integrated into your production process. By using aluminium or stainless steel Zeppelin blenders tailored to your individual requirements, you will upgrade your product, ensure a constantly high product quality, reduce production time and save energy and costs - daily!

### The advantages of Zeppelin blending and homogenization silos at a glance:

#### Reduced energy consumption:

Energy costs money, so why wasting it? Clever engineering and optimum design may lead to a reduced energy consumption. Simply compare the energy required for homogenizing one ton of product in different blender types and you will soon realize why Zeppelin is among the international leaders!

#### Saving time:

With Zeppelin blenders the desired blending quality can usually be achieved through a single circulation. Your advantage: your production process will be accelerated and the output will increase. Several recirculations are only necessary in case of severe fluctuations in production or extremely high requirements to the blending efficiency – a process which has a considerable impact on your operating costs.



Blending pipes and blending chamber of a Zeppelin Multi-Pipe Blender with integrated aeration ring for degassing on the left

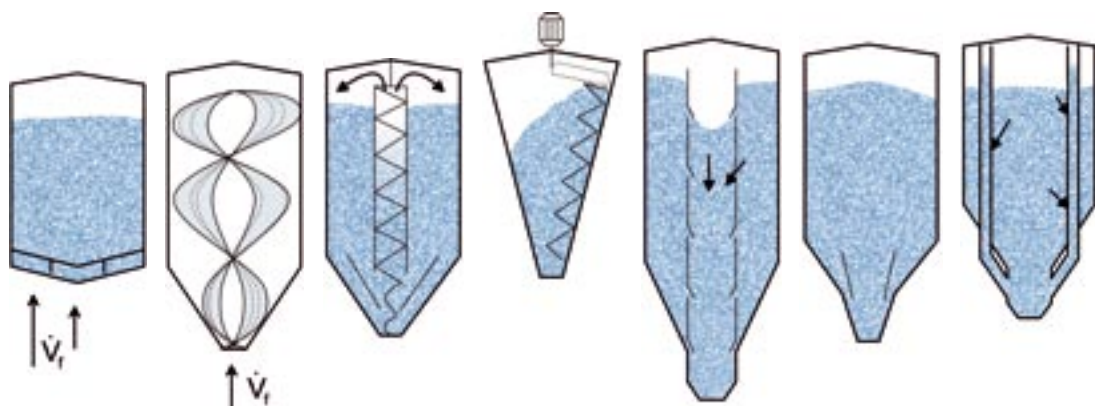
**Lower total investment:**

Investment in high-quality Zeppelin blenders means money well spent due to low energy consumption and top quality blending. Therefore Zeppelin is the best choice, not only because of the lower operating costs but also because of the reduced size or amount of blenders required thanks to the excellent results of Zeppelin blenders.

**Process integration:**

Based on the know-how of Zeppelin's process engineers all our blenders can be equipped with aeration or degassing equipment so that, in addition to blending, further operations such as degassing, cooling, heating, inerting or drying can be realized.

Selection chart for blenders



powders with good flowability $50 \mu\text{m} < x < 500 \mu\text{m}$	+	o	+	+	+	+	(+)
pellets with good flowability $200 \mu\text{m} < x < 2000 \mu\text{m}$	o	o	o	o	+	+	+
powders with poor flowability	-	+	+	(+)	+	+	-
maximum blender capacity (m <sup>3</sup> )	1000 (3000)	200	100	30 (60)	300	1.500	3000
type of energy application	pneumatic	pneumatic	mechanical	mechanical	gravimetric	gravimetric	gravimetric
specific power consumption (kWh/t)	1-2	2-7	2-10	2-10	1-2	1-3	<1

+ = suitable      (+) = suitable to a limited extent      - = not suitable      o = not efficient

## Zeppelin blending silos – used daily by successful customers

The Zeppelin program comprises five different blender types. Each blender can be rapidly tailored to the customer's individual requirements and in accordance with the product properties while always ensuring maximum reliability. Whatever the task, it is our business to provide you with the best possible solution.

### 2. Blending time – desired homogeneity ratio

This aspect is a decisive factor in obtaining rapid optimum blending results and consequently cost-efficient processes. The required data too can be determined during tests in our Technology Center or taken from our central database.

### Selection criteria

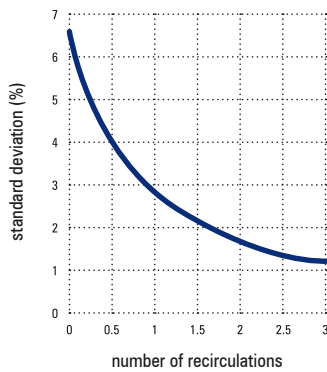
#### 1. Product characteristics and flow behavior

Knowledge of the product properties is essential for a reliable design of the blender for mass flow in order to achieve optimum blending results. The relevant properties are determined during tests in the Zeppelin Technology Center.

#### 3. Cleaning

Quick and easy cleaning of the blender is important in case of frequent change of products or colors. Ensuring that no residues remain in the blender is of utmost importance in order to avoid complete batches from being contaminated and no longer fulfill quality requirements.

Standard deviation as a function  
of the blending time



Plant with aluminium Multi-  
Channel Blenders with a capacity  
of 2850 m<sup>3</sup>



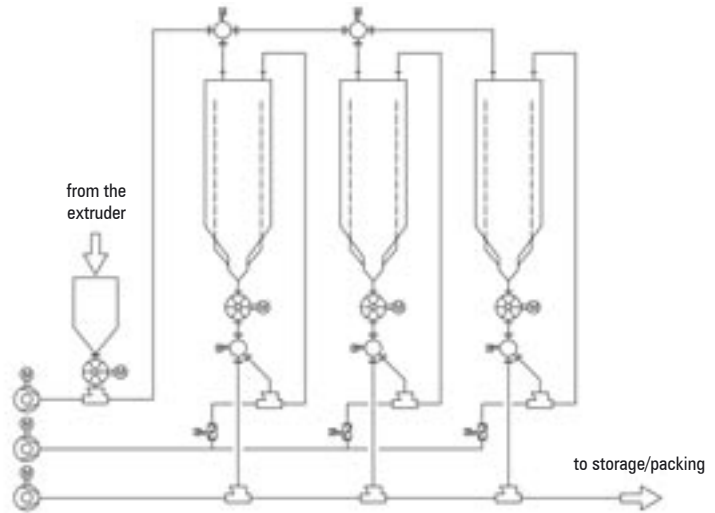
#### 4. Operating mode

Continuous or discontinuous operation – this decision depends on your production process. Zeppelin provides you with the most economic solution – whether for continuous filling of a new product into the blender with simultaneous discharge or for batch-wise filling and complete discharge.

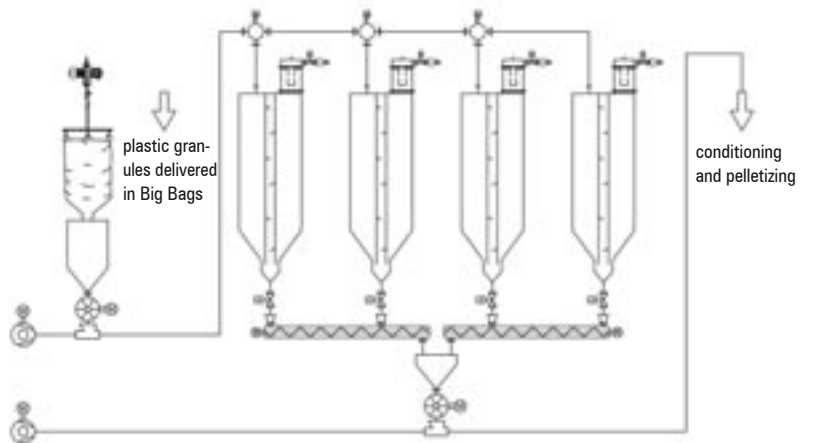
#### 5. Height to diameter ratio

Optimum blending results can only be obtained if the blender is designed in accordance with the appropriate height to diameter ratio. Benefit from the experience gained by Zeppelin's specialists: with such a technological lead, you may have to abstain from conventional blenders.

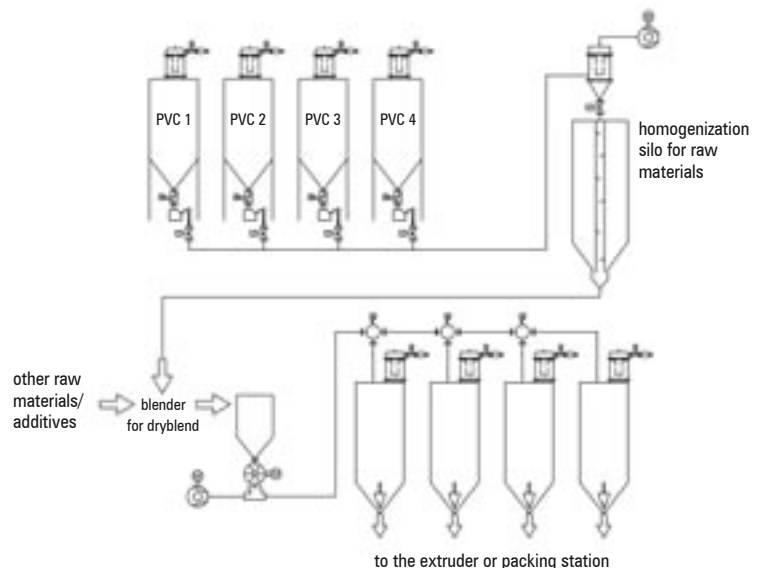
Typical use of blending silos in the manufacturing process of polyolefins



Typical use of blending silos in the recycling industry



Typical use of blending silos for the processing of PVC



## Zeppelin Multi-Flow Blender

### Applications

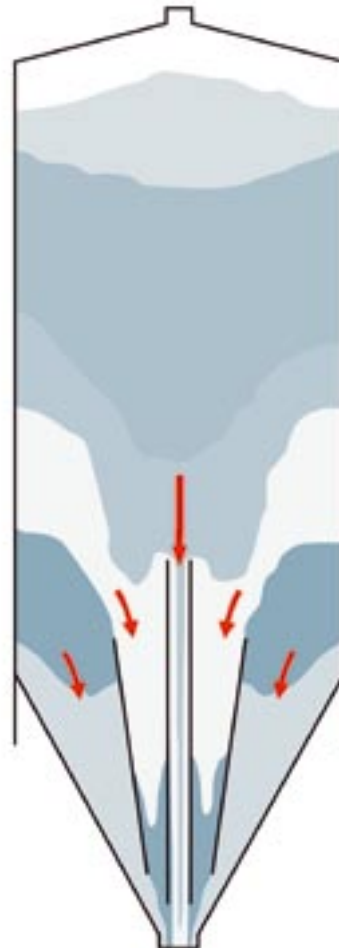
For bulk solids having easy to poor flowability i. e. pellets, powders, dryblends, compounds or recycling materials. Appropriate for continuous or discontinuous blending.

### Description of apparatus

The Zeppelin Multi-Flow Blending Hopper generates various flow velocities of the bulk solids in the hopper and cylindrical blender section. This results in different residence times which provide the blending effect. The most efficient ratio of height to diameter for blending is less than 2.5. Multi-Flow Blending Hoppers can be welded into silos during fabrication or flange connected or welded onto existing silos. Vertical flat ribs supporting the hopper facilitate cleaning.

### Advantages

- quick and easy method to retrofit existing silos
- good blending results thanks to wide residence time distribution and mass flow
- no additional supports in the blender facilitates cleaning of the blending hopper
- economic solution for blending of bulk solids
- reduced overall height thanks to the internal blending chamber
- blender free from residues after discharge
- the operation can be combined with degassing



Flanged Multi-Flow Blending Hopper for retrofitting existing silos

# Zeppelin Centro-Blend

## Applications

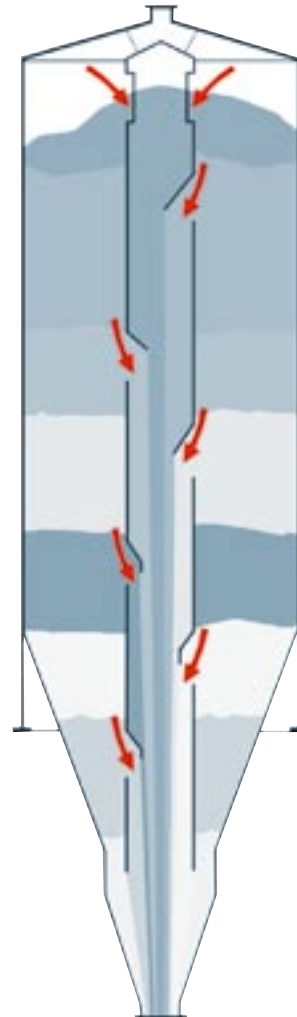
For bulk solids having easy to poor flow-ability such as plastic powders, recycling materials, pellets, free-flowing elastomers. Appropriate for continuous and discontinuous blending. Standard capacities: 7 - 300 m<sup>3</sup>

## Description of apparatus

Bulk solids are simultaneously withdrawn through intake openings at various levels in the central pipe and directed to the blending chamber. Different size deflector plates are welded above the intake openings ensuring that equal quantities are withdrawn from all layers. The product in the blending pipe is added to the product from the annular space in the blending chamber.

## Advantages

- no product residues and dead zones due to the plane surfaces of the deflector plates
- consistent design for mass flow
- easy integration into the chemical production process



Left: Interior view of a Centro-Blend and its central blending pipe

Right: View of the blending pipe from bottom to top



# Zeppelin Multi-Pipe and Multi-Channel Blenders

## Applications

For dry bulk solids with good flowability and particle sizes above approx. 0.5 mm, especially pellets. Appropriate for continuous and discontinuous blending.

## Description of apparatus

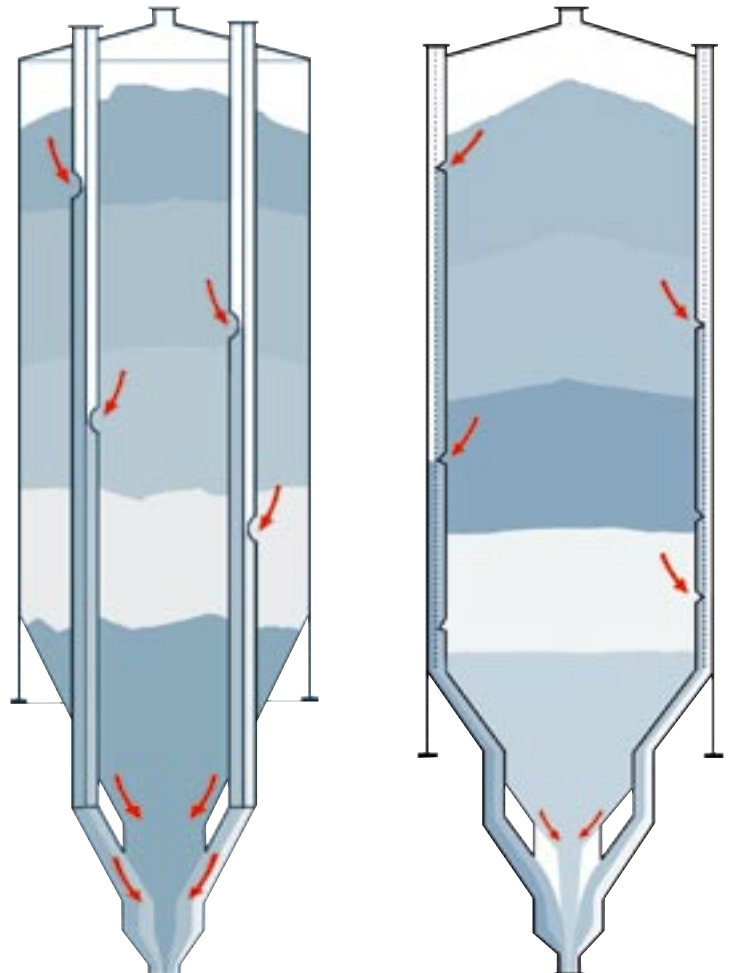
Bulk solids are withdrawn by vertically running blending pipes inside the blending silo from 18 different levels at the same time and fed into the blending chamber. Inside the blending chamber, the 18 partial product streams are mixed with the product from the central outlet of the blender before being discharged. To achieve this result, 6 blending pipes with 3 compartments each are used. This procedure guarantees that the final product at the blender outlet is a blend of the complete silo content.

## Advantages

- homogenization of batches
- applicable for different filling levels down to approx. 25%
- a blending hopper designed for mass flow ensures a good and reproducible homogenizing effect
- easy integration into the production process
- a single cycle is often sufficient for many applications in continuous operation
- discharge free from residues
- the operation can be combined with degassing

## Additional advantages of the Multi-Channel Blender

- blending pipes are welded to the silo shell
- additional supports for the blending pipes are not required



# Zeppelin Fluidized Bed Blenders

## Applications

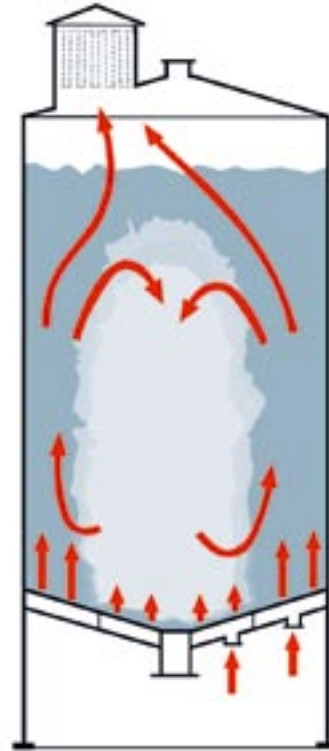
For blending fluidizable bulk solids with particle sizes below  $500 \mu\text{m}$ , especially powders. Appropriate in batch-wise operations.

## Description of apparatus

Fluidization of particles is achieved by fluidization gas (normally air) flowing through the bulk solids. The random motion of the particles leads to homogenization of bulk solids in fluidized beds. Horizontal homogenization can be intensified by varying aeration flow rates at the different air inlets, which leads to optimized blending results and reduced blending times.

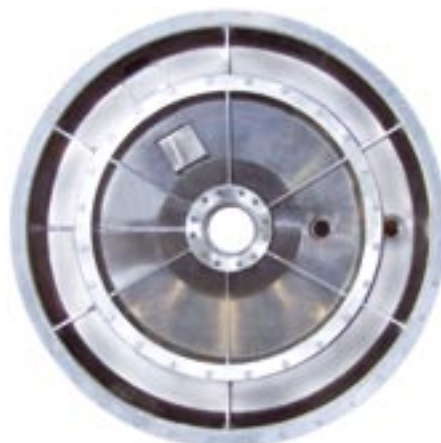
## Advantages

- appropriate for fluidizable powders
- gentle homogenization as the particles are subject to minimum external forces during fluidization
- appropriate for bulk solids susceptible to break and abrasion
- simultaneous degassing of the product
- homogenization of substantial quantities of powders at a minimum energy consumption



Left: Supporting structure of a fluidization bottom supporting the aeration cloth and division of the main airflow by two concentric zones

Right: Fluidization bottom with fixed fluidization cloths ensuring uniform aeration





## 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.**

Shear tests provide the basis for the design of storage and blending silos. The data obtained through these tests are used for the silo design for flow and for statics calculation.

Our Technology Center is equipped to solve your blending problem – with blending tests on an industrial scale or shear tests in our laboratories.



## Services

**A technology center must be versatile and equipped to meet the wide range of customers' demands and those of the industry. This means conveying pipelines made from different materials, and conveying distances, capacities and air supply should be modifiable over large pressure ranges.**

Different blender types are required for testing blending processes. The Zeppelin Technology Center can provide you with answers to all of these tasks and offers optimum testing conditions for any application.

### Capacities and operating data

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Storage and blending silos (3 - 35 m<sup>3</sup>):

Air compressor and air supply:

Conveying pipelines (material):

Bypass:

Conveying pipeline diameter (nominal width):

Conveying distances:

Flow rate:

Feeding systems:

Product separator:

Multi-Flow, Multi-Pipe, Centro-Blend

up to 8 bar and 10,000 m<sup>3</sup>/h

aluminium (roughened or smooth), stainless steel, polyethylene, rubber hoses

Overflow, Airfloat

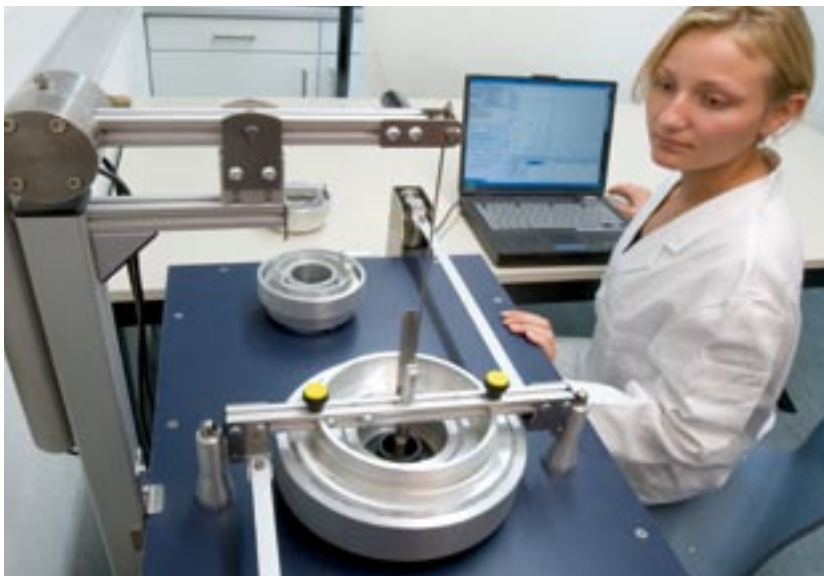
DN 60, 80, 100, 200, 250

20, 65, 100, 150, 225, 420 m

1 - 80 t/h

rotary feeders, pressure vessels, Pump Flow, Screw Flow, injectors

filters, cyclones, separators, drum sieves, special separators for streamers



Shear tests require much experience in the handling of bulk solids having very different properties. Wall friction and time consolidation are important characteristics for the design of silos in accordance with valid standards.



## Zeppelin long-term quality means money well spent

**Smart investors opt for quality right from the start – because investments have to pay off in the long run**

In other words: the better the system design, the more professional the logistics service, and the higher the fabrication quality, the more profitable the silo system – and the higher your profits! In short: the sooner you get in touch with Zeppelin, the better!



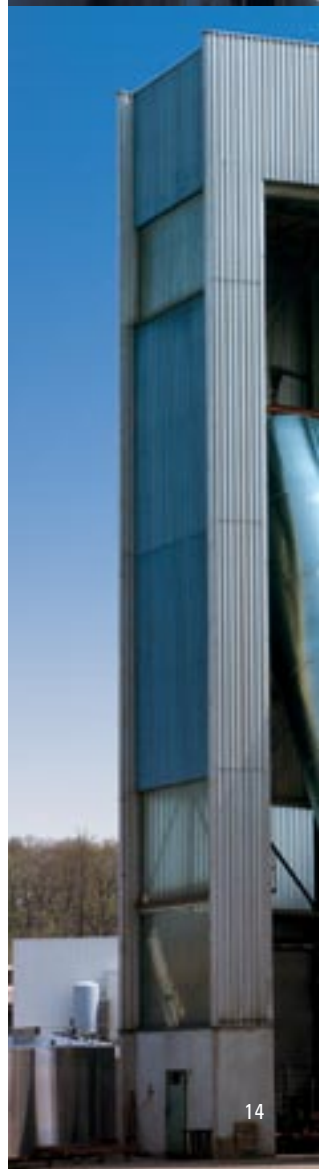
Patented technology e.g. special cone forming machines means a competitive advantage for us and first-class products for you. Innovative welding techniques (such as simultaneous double-sided welding) speed up the fabrication of your product and guarantee a minimum of weld seams in lasting Zeppelin quality.



Zeppelin uses only high-caliber professionals for its production, too. Our TÜV-certified welders undergo extensive in-house training in the interests of long-term product quality. This means an optimum surface finish of your silo, for optimum flow properties and maximum strength.



Fast, precise, powerful. The water jet cuts aluminium plates of up to 200 mm and steel plates of up to 150 mm with a pump pressure of 4100 bar.





## Quality management

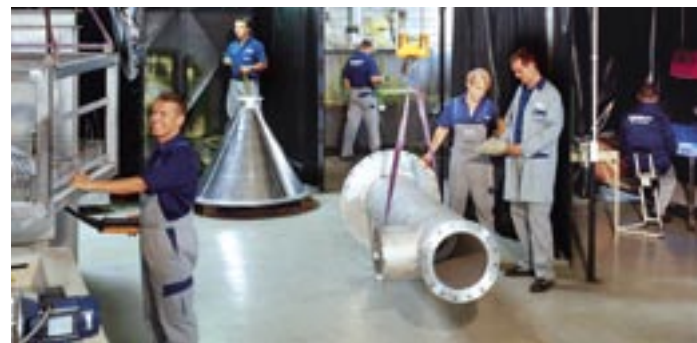
# With Zeppelin your company's future is assured

Quality management at Zeppelin is everything you would expect from such a first-class supplier. Not only does the customer benefit from it, but the entire industry as well: for example, it was our engineers who assisted the TÜV authorities in defining the DIN calculation regulations.

As an internationally active and successful industrial group, Zeppelin has all important and relevant licenses for welding and manufacturing techniques.



All quality tests (whether destructive or non-destructive) are carried out in the Zeppelin laboratories.



Vertical assembly of Zeppelin silos: a further guarantee for extreme precision and hence maximum stability. In the long term, this means satisfied and successful customers.



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All specialists under one roof

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