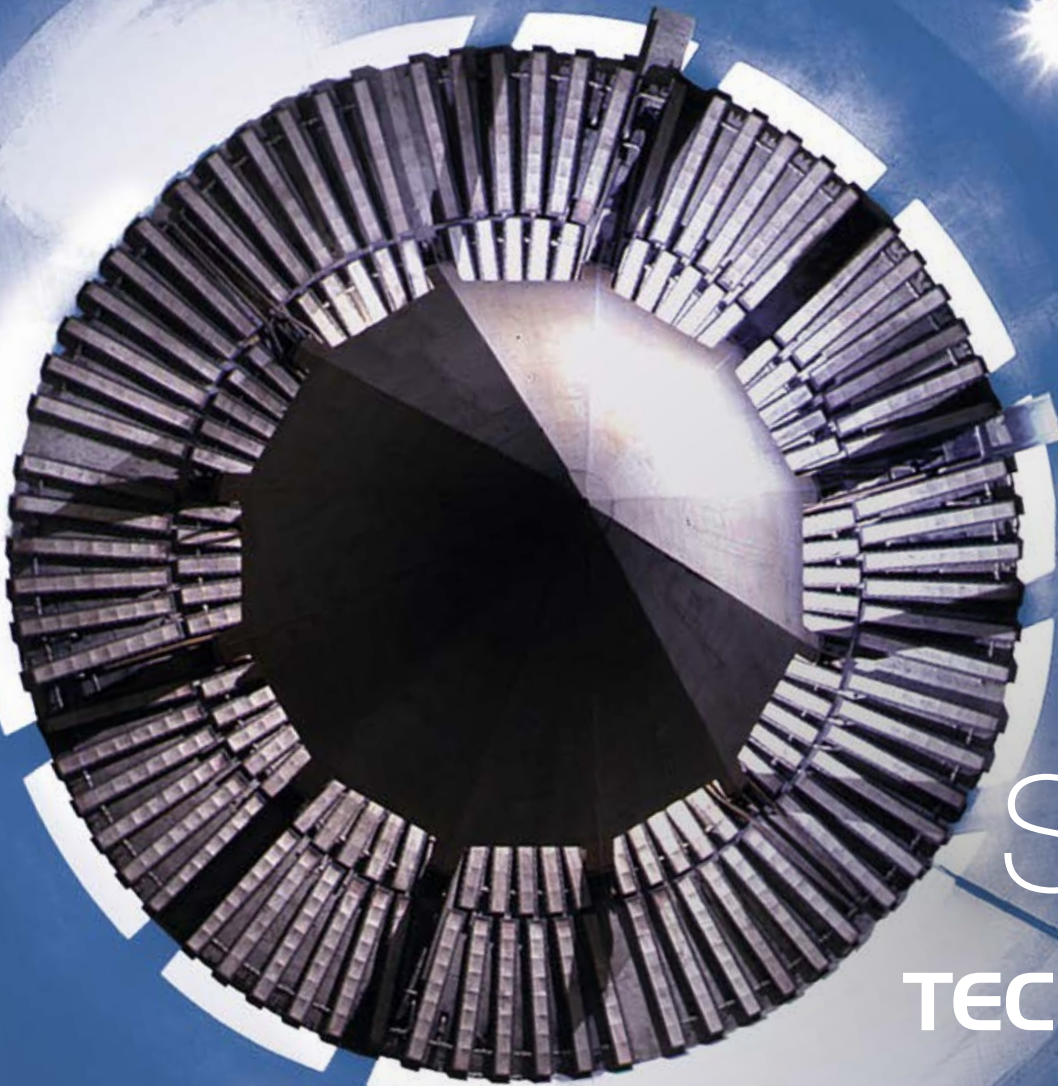




CLAUDIUS PETERS



Silo TECHNIK

We know how

silo technik

About

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Since its founding in 1906, Claudius Peters has become one of the world's most respected engineering houses and an innovative world leader. Its German engineering excellence continues to set benchmarks for the design, manufacture and commissioning of materials handling and processing systems for the gypsum, cement, coal, alumina, steel and bulk-handling industries.

From conception and installation through to commissioning and after-sales support, Claudius Peters provides world-class service to the world's biggest bulk materials producers.

The company is part of the Claudius Peters Group GmbH, headquartered in Buxtehude near Hamburg, Germany, with regional offices in the Americas, Asia and Europe.



Claudius Peters' headquarters, Buxtehude, Germany.

Technology you can trust

With more than 3,000 silo systems sold worldwide, Claudius Peters is a major contributor to the current international standards for silo design.

In addition, the Claudius Peters Technikum (Technical Center) is a state-of-the-art testing and research facility, where the analysis of bulk solids determines the design of Claudius Peters equipment and processes.

Developed by Claudius Peters, the expansion chamber principle, along with its patented optional inspection chamber for storage silos and overflow pipes for mixing silos, have become standards in world silo technology.

More than
13,000 bulk solid
samples entered
into our database



Typical Claudius Peters steel silo.



Typical Claudius Peters concrete silo.



Claudius Peters Technikum.



Detail of Claudius Peters silo bottom.

methods of discharge

Identifying suitable discharge methods

World leaders
in advanced silo
technology

Through a central point:

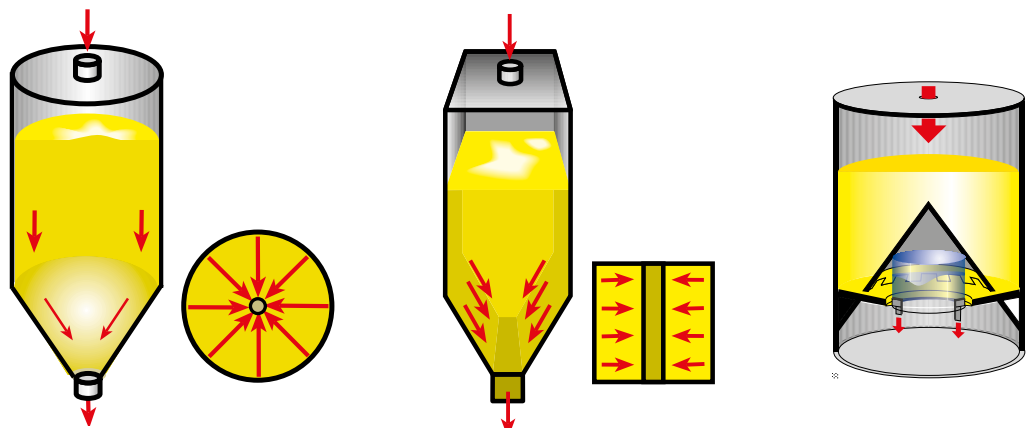
- Advantageous statics for construction
- Reduced flow profile up to funnel flow and arching
- Excellent solution for small silos
- Steep cone promotes mass flow

Through a straight line:

- Costly statics for construction
- Good flow profile due to flat flow behaviour
- Excellent solution for small silos
- Cone promotes mass flow

Out in a circular line::

- Advantageous statics for construction
- Good flow profile, flat flow behaviour by mounting a displacement cone
- Excellent solution for all silo sizes



Claudius Peters cement storage silo.

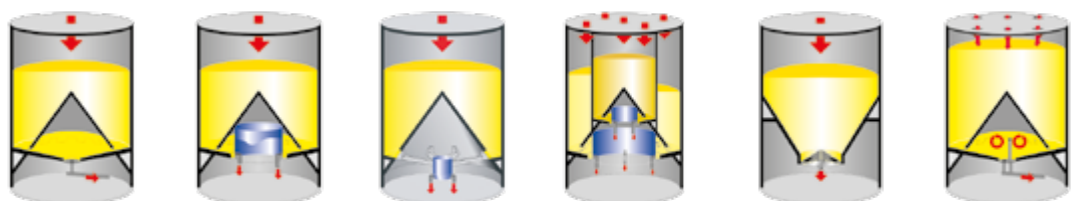
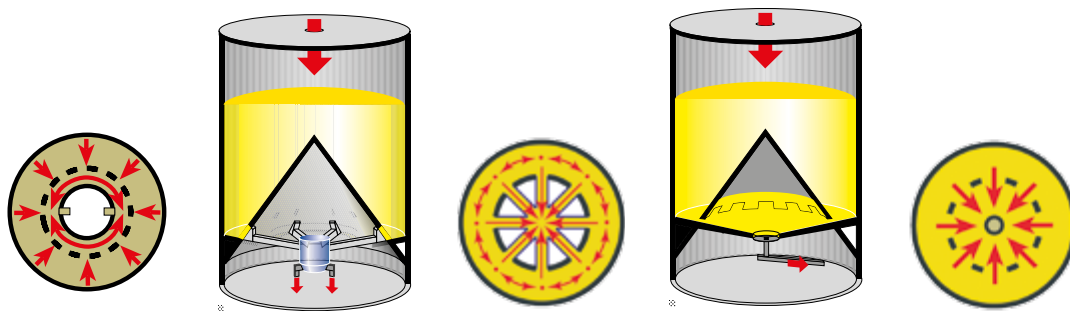
Selecting cone or chamber

Since the circular line discharge principle offers the most advantages, Claudius Peters' silo designs support this by incorporating either cone or chamber discharge methods in their construction.

Discharge in a cone design occurs through several small outlets, while the chamber design provides large surface outlets and a central discharge outlet. Both designs guarantee optimum aeration of the silo bottom.



Special, large diameter, silo base design.



Silo type	EC	IC	ME	MS	CC	MC
Outlets / number	P / 1	P / 2 – 4	P / 3 – 9	P / variable	P / 1 – 4	P / 1
Expansion / Inspection	+ / -	+ / +	- / -	variable / variable	- / -	+ / -
Filling level / \emptyset	1 - 3 : 1	1 - 3 : 1	1 - 3 : 1	1 - 3 : 1	1 - 3 : 1	up to ~ 3 : 1
Standard silo – \emptyset	10 - 30 m	10 - 30 m	10 - 30 m	as required > 30 m	4 - 14 m	10 - 30 m
Reclaim rate / Room utilizat.	> 99% / 95%	>99% / 91%	>99% / 88%	99% / 88%	>99% / 86%	99% / 95%
Mix. effect						10:1

P = pneumatic

expansion chamber

The largest possible storage volume

Industry-changing
'cone in a cylinder'
silo technology

Expansion chamber technology is synonymous with Claudius Peters – the company that originally invented it. The process of developing this revolutionary silo technology involved two key engineering challenges:

- **How to create a room inside a silo, separated from the material pressure of the main silo**
- **How to make adequate use of the conical chamber while maintaining optimum flow conditions**

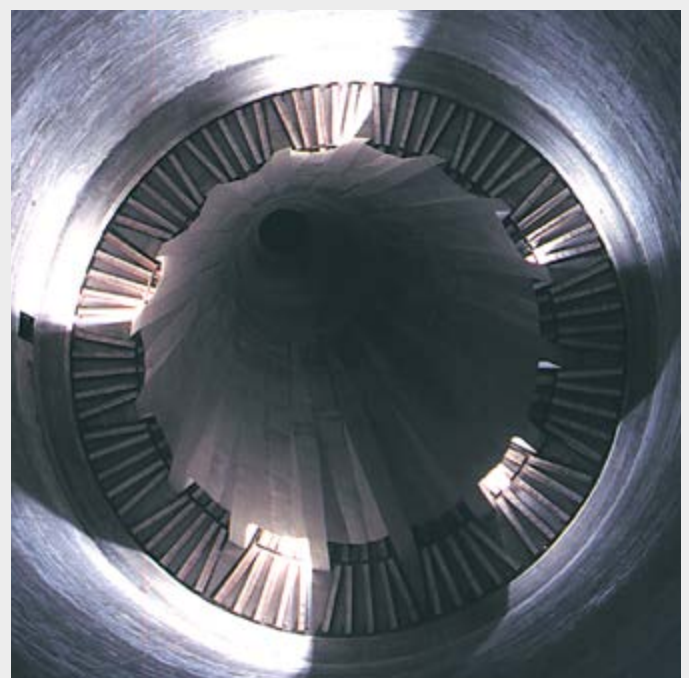
This system, which now forms the basis for all types of Claudius Peters silos, involves a discharge system in which the displacement cone, with its concrete or steel structure, moves the bulk solids close to the silo wall, thereby augmenting 'first in/first out' operation.

Claudius Peters product range offers:

- **High flow capacities with minimal residual product**
- **Use of the chamber as additional material storage**
- **Only a few outlets are required**
- **Significant reduction in investment and maintenance costs for control systems, dosing and shut-off equipment**



Expansion chamber under construction.



Completed expansion chamber.

The principle

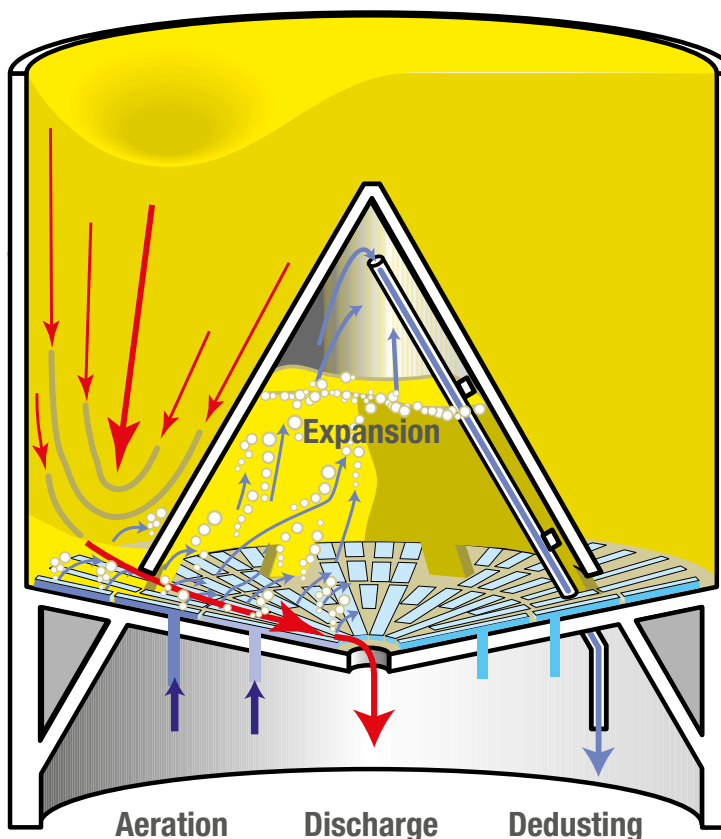
To achieve a free and unobstructed material flow, almost 40% of the area around the cone base is used as an opening. The complete silo bottom is covered with open aeroslides, radially arranged and aerated in sections.

A control system to ensure cost-effective operation

A controlled air supply causes the pressurized bulk material to flow from the main silo room into the inner cone area. Short flow distances minimize areas of dead, unmoved material.

To re-establish normal pressure conditions, excess air is allowed to escape into the upper chamber area, where it is dedusted. This is important in ensuring a uniform discharge as well as even, pulsation-free material flow for subsequent loading or packing. Compared to fully aerated material, partially de-aerated material ensures a low velocity and as a result, a highly reduced wear rate for the conveyors.

Cost-effective operation that delivers uniform discharge



EC storage silo

With expansion chamber

Highest usable
storage volume in
the market

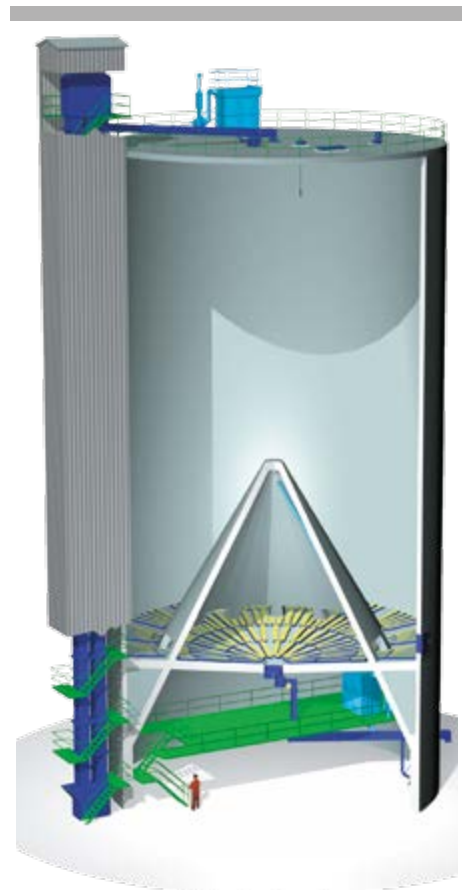
Utilizing the advantages of expansion chamber technology, the EC storage silo type makes use of the complete expansion area for additional storage of bulk solids, resulting in a reduction of building height and therefore building costs.

The sloped silo bottom reaches over the whole silo diameter and is entirely covered with radially arranged open aeroslides. To facilitate better material activation, aeration of the main silo and the chamber are kept separate. Further separation into smaller sections guarantees that the air is always fed where it is needed, resulting in reduced operating costs.

The aerated bulk solid flows directly from the main silo through the large cone openings into the expansion chamber where it is partially de-aerated and then transported to the central discharge. A constant material level in the expansion chamber ensures a consistent, even material discharge. As a result the EC storage silo offers the best space utilization by far, as well as low purchasing costs and a rapid return on investment.

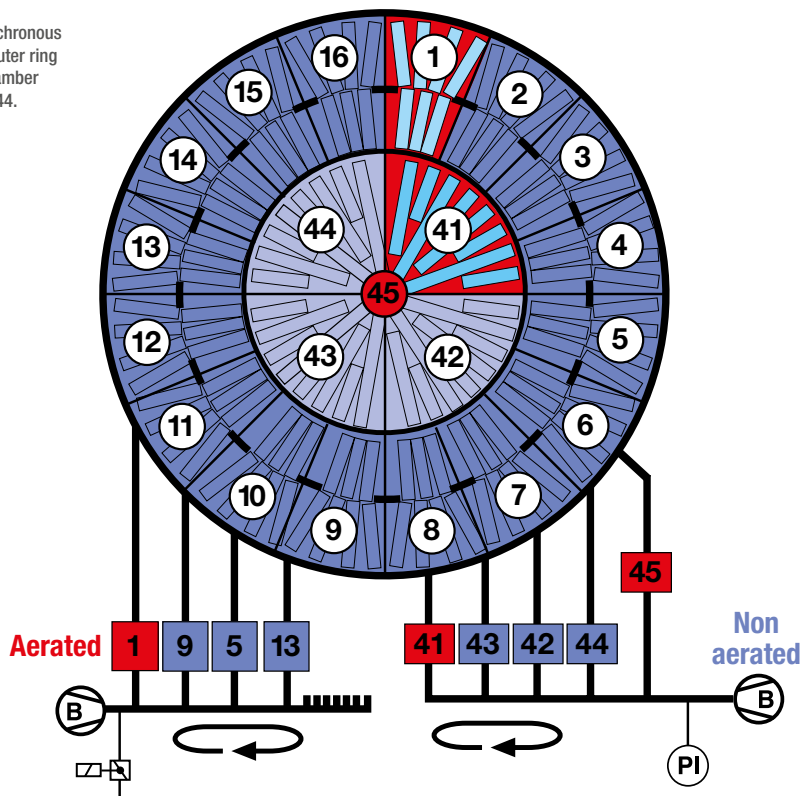


EC storage silo, Kantvik, Finland.



Cross section of inspection chamber silo.

Rotating synchronous
aeration of outer ring
1-16 and chamber
sections 41-44.



Central discharge.



Expansion chamber interior.



Expansion chamber exterior.

EC storage silo features:

- Capacities of 2,500t to 60,000t
- Diameters of 10m to 30m
- Discharge capacities up to 1,000t/h
- Reclaim rate >99%
- Energy consumption approx. 0.03kWh/t of discharged bulk solid
- Expansion chamber ensuring continuous material discharge
- First in/first out principle
- Additional storage space
- Only one outlet necessary
- In-chamber de-dusting
- Low discharge speeds
- Reduced wear in the discharge equipment

IC storage silo

With inspection chamber

'Chamber in chamber' principle offers easy maintenance

The IC storage silo combines the proven expansion chamber principle with an accessible inspection chamber.

A 'chamber-in-chamber' principle allows the expansion chamber to be used for maintenance work as well as storage. It also enables rapid access to the outlet area for easy maintenance, with the inspection chamber being used to house the exhaust air filter system and other plant components.

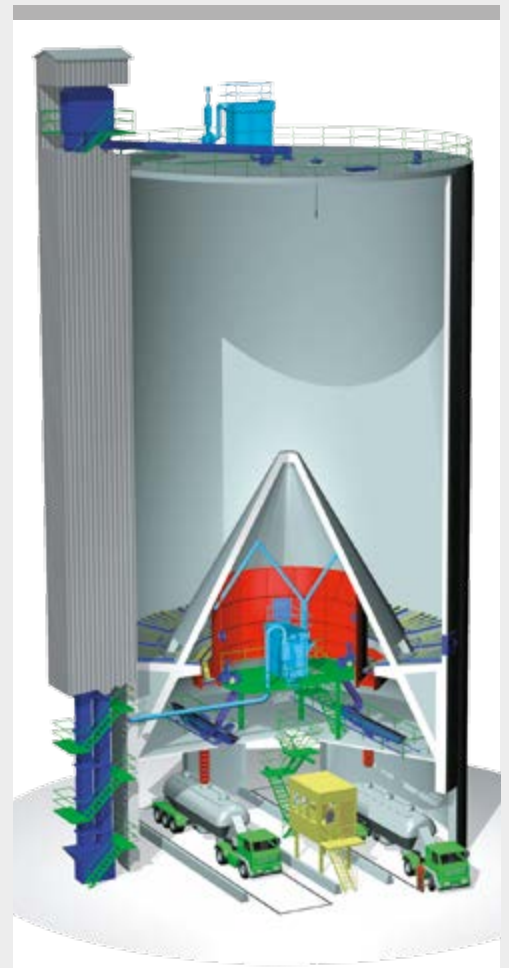
As with the EC silo type, the inspection chamber design incorporates an annular expansion chamber and a ring channel equipped with circumferentially arranged aeroslides slanted to the discharge. Additional discharge arrangements can easily be installed at any time.

The aerated bulk material flows from the main silo via the expansion chamber to the discharge points. Expansion of the material, de-dusting of the exhaust air and monitoring of the material levels are all carried out concurrently.

Compared to other types, the IC storage silo offers low maintenance, minimal equipment and a compact building structure.

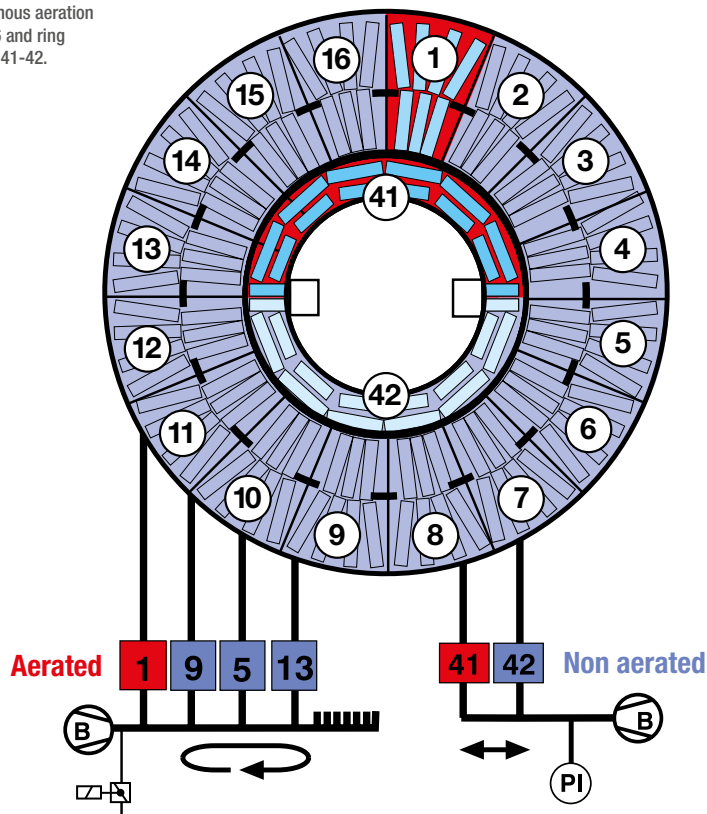


IC storage silo, Saudi Arabia.



Cross section of inspection chamber silo.

Rotating synchronous aeration
of outer ring 1-16 and ring
channel sections 41-42.



Ring channel.



Ring channel inspection.



Inspection chamber.

IC storage silo features:

- Capacities of 2,500t to 60,000t
- Diameters of 10m to 30m
- Discharge capacities up to 1,000t/h
- Reclaim rate >99%
- Energy consumption approx. 0.03kWh/t of discharged bulk solid
- Expansion chamber promoting continuous material discharge
- First in/first out principle
- Additional storage space
- Only 2-4 outlets required
- Dedusting in the chamber
- Lower material velocity reduces wear and tear at the discharge outlet
- Inspection chamber
- Inspection can be carried out while silo is full
- Compact construction integrating exhaust air filter system in the inner area of the chamber

ME storage silo

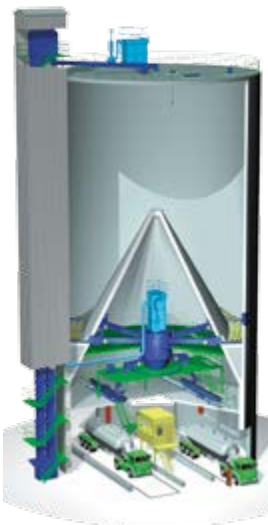
With multi-extraction

Bulk solids can be extracted simultaneously at different points

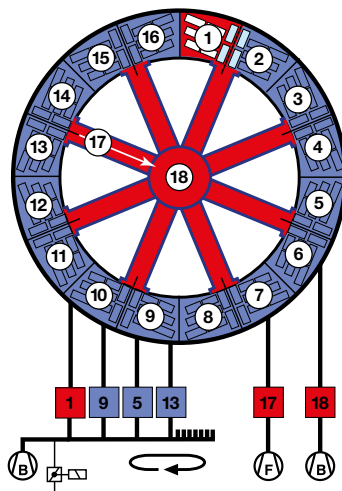
Another alternative for bulk solid storage is the ME silo type which applies the concept of multi-extraction.

This silo is also equipped with a displacement cone which covers the silo bottom almost entirely. Unlike the EC silo type, this design has a large number of outlets. The silo bottom located between the silo wall and cone is completely covered by circumferentially arranged open aeroslides. The outlets are divided into small, slanted sections to optimize air usage.

From the outlets, the material flows via closed aeroslides into a centrally installed collecting bin, inside which excess air pressure is relieved. Dust from the aeration air is then returned into the system before the material is distributed to bagging and loading stations.



Cross section of ME silo.



Rotating aeration of bottom section 1-16.
Permanent aeration of aeroslide 17 and collecting bin 18.

ME storage silo features:

- Capacities of 2,500t to 60,000t
- Diameters of 10m to 30m
- Discharge capacities up to 1,000t/h
- Residual discharge >99%
- Energy consumption approx. 0.04kWh/t of discharged bulk solid
- Displacement cone promoting use as room for aggregates and filters
- First in/first out principle
- Facilitating many outlets (3-9)
- Collecting bin/pot for de-dusting and buffering the material



Silo discharge.



Collecting bin, feeding.



Collecting bin, discharge.

CC storage silo

The Conventional Cone (CC) silo, especially suited to small silo units, is basically a conventional cone silo where the lower section of the cone is cut and replaced by an aerated CC standard bottom.

Compact design means that this type of silo bottom needs less fluidization equipment and as a result less energy compared to a conventional silo. It guarantees excellent discharge characteristics, even for materials which do not fluidize very well. Other bulk materials, like gypsum, quicklime and lime hydrate can also be stored and discharged with the CC silo.

The CC silo bottom can be used to convert existing conventional cone silos to produce significantly improved discharge characteristics, or be easily applied to new installations. A CC silo bottom with a standard 3.5 metre diameter can support silos of up to 8 metres diameter, with 5.5 metre and 7.5 metre options available if higher capacities are needed.

With the CC silo configuration, sectors are alternately aerated at pre-set times, ensuring almost complete discharge of the silo.

This process does not affect the filling procedure. Aeroslides arranged on the silo bottom support discharge by fluidizing the stored material. Fluidized material then flows along the inclined aeroslide to the outlets via gravity. Sector size is optimized to maintain flow and eliminate the possibility of bridging.

CC storage silo features:

- High material flow
- Excellent reclaim rate
- Reduction in required equipment and energy
- Suitable for small silo units
- Quick and easy on-site erection through pre-installed silo bottom
- Reduced building height for new installations at the same storage volume



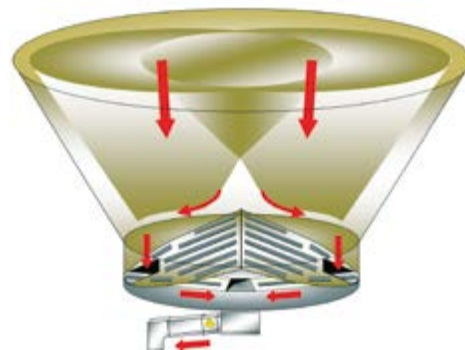
Erection of the CC silo.



Cross section of CC silo.



Storage CC silo after completion, Austria.



Aeration in a CC silo.

multi-storage silos

Maximum efficiency in loading, packing and mixing

Store a range of different materials simultaneously

Multi-storage silos, mainly used in cement works and cement terminals, offer various storage possibilities whilst using all available space within the silo.

In addition to cement, raw meal and gypsum it is also possible to separately store additives such as slag, fly ash or mixed cements and to have these materials ready for use at all times. When connected to mixing, packing and loading systems, this silo type is a highly versatile solution to storage problems.

Working closely with its clients, Claudius Peters draws on many decades of experience to provide tailor-made systems that deliver the right technology in timely and cost-effective ways.



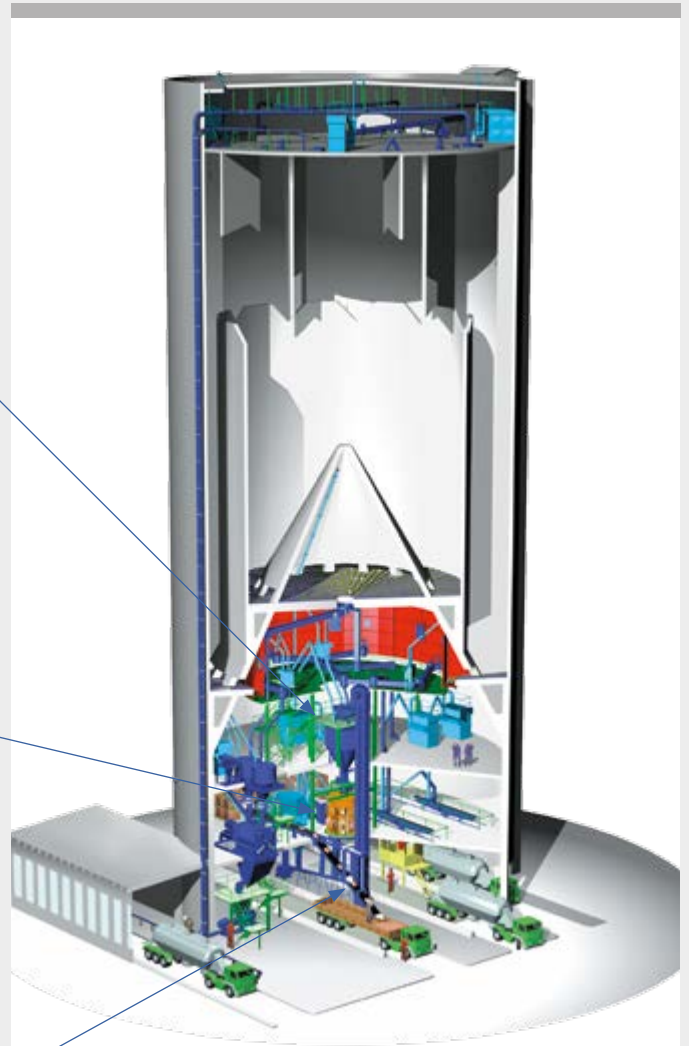
Loading technology.



Bagging technology.



Mixing cement systems.



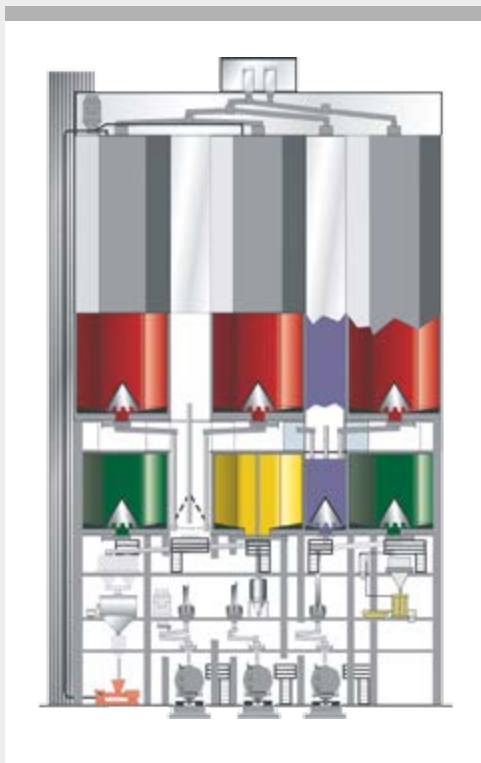
Cross section of multi-storage silo.

As a global market leader for turnkey plants, Claudius Peters can produce multi-storage silo solutions for every conceivable need.

Silo terminals consisting of storage silos with mixing and blending technology, packing plant and loading systems are all operated and controlled by Claudius Peters state-of-the-art control systems, designed in-house by our experienced electrical engineers.



Batch-type mixer – HTC 6,300.



Multi-storage silo with mixing components.



Dispatch automation.



Polygon silo:

- Ideal for several small bulk solid quantities
- Simple, economic construction
- Easily expandable



Round silo:

- Ideal for large quantities of bulk solids
- Inner silo with outer ring silo
- Compact design

mixing technology

Claudius Peters mixing silo solutions enable plant operators to achieve low discharge variations within raw meal mixtures, improving product quality and optimizing a key part of the processing chain.

The more homogeneous the better

Economic kiln operation is largely dependent on the condition of the raw material, particularly in cement and other applications. From quarry to rotary kiln feeding, raw materials undergo a variety of processes before they are supplied to the clinker production process. The mixing silo is a crucial part of this process as it is the last quality-improving step within the processing chain before kiln feeding.

Achieving optimum mixture

Mixing effects and discharge variations, a silo's key performance indicators, are determined by the ratio of inlet and discharge variations of raw meal components.

Claudius Peters mixing technology is designed so that high levels of discharge variation can be controlled and reduced to achieve the optimum mixing effect.

In addition, combining Claudius Peters pre-blending bed technology with stackers and reclaimers as well as Claudius Peters mixing silos produces the optimum raw meal mixture.

The three steps of mixing silos:



■ Step 1: Multi-flow feeding

Utilizing the principle of 'the thinner the layer, the better the mixing effect', raw material is fed evenly over the whole silo area via a special distributor in the silo ceiling (multi-flow feeding). Thin layers of different raw material concentrations are produced.



■ Step 2: Gravity mixing in the main silo room

Due to special bottom aeration within the silo, the raw material travels in a funnel flow produced by gravity. The different layers are mixed by the material exchange to compensate long-term variations. An additional mixing effect is produced by rotating material discharge into the mixing chamber.



■ Step 3: Pneumatic mixing in the mixing chamber

Claudius Peters mixing silos are equipped with mixing chamber sections that can be aerated separately. In this way the segments can be supplied with air quantities that not only fluidize the raw meal but also mix it intensively, guaranteeing a low discharge variation.

MC mixing silo

Intimate mixing for optimum raw meal mix

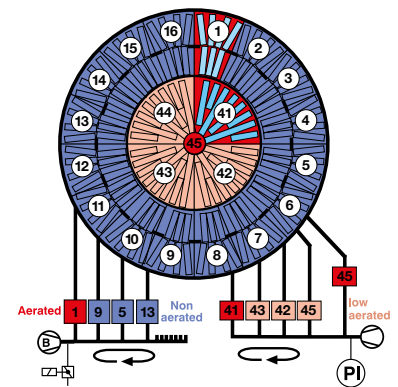
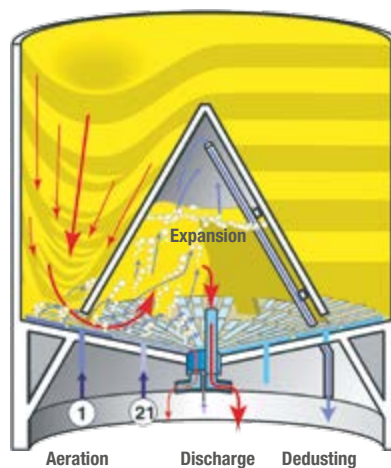
The Claudius Peters MC mixing silo is uniquely constructed to provide short travel paths and compact intense mixing areas within the chamber.

MC mixing silo features:

- Storage capacity of 2,500t to 60,000t
- Diameters of 10m to 30m
- Discharge capacities up to 1,000t/h
- Mixing effect up to 15:1
- Residual discharge >99%
- Lowest energy consumption
- Lowest discharge fluctuations possible
- Mixing / expansion chamber for continuous mixing operation
- Additional mixing step
- Additional storage room
- Avoidance of separation
- Intensive de-dusting in the chamber leading to reduced discharge velocity
- Wear reduction on the discharge devices
- Patented overflow pipe increasing the retention time of the material in the mixing chamber
- Increased mixing effect
- Reduced discharge fluctuations
- Low construction height
- Low investment costs
- Second discharge in the lowest point of the silo bottom, minimizing any residual product

The silo also incorporates the Claudius Peters patented overflow pipe, which increases the material mixing time while keeping air usage down to a minimum, ensuring perfect and economical homogenization.

Simultaneous
homogenization
and storage



Rotating synchronous aeration of outer ring 1-16 and chamber segments 41-44.



Silo system Rüdersdorf, Germany.



Multi-flow feeding.



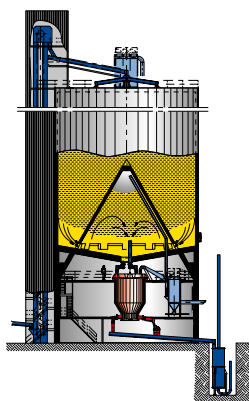
Patented overflow pipe.



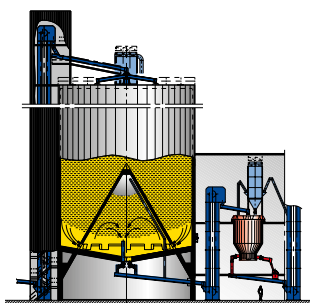
Silo discharge system.

MC mixing silo

Online calibration
ensures smooth
kiln-feeding



Mixing silo with flow control facility and airlift – pre-heater feeding arranged below.



Mixing silo with flow control facility – pre-heater feeding arranged alongside.

Continuous mixing with mixing chamber

With the MC mixing silo the expansion chamber can be used concurrently for homogenization and storage of the raw material.

Raw meal is fed to the silo via a multi-flow feeding system, with the number of feeding points being determined by the diameter of the silo. This ensures an optimum and even distribution of the bulk material into the silo. During operation, aerated material funnel-flows into the mixing chamber, which is made up of independent sections, each having varying air-flow characteristics. This produces the best mixing possible.

Discharge occurs mainly via the centrally arranged overflow pipe, which as well as increasing retention time, ensures that material cannot pass straight through without having been mixed intensively.

Automatic flow control gates at the outlet, combined with a flow control facility, ensures controlled kiln feeding. The MC silo is highly energy efficient. The mixing chamber, with its integrated over-flow pipe, ensures optimal mixing performance, simultaneously keeping discharge fluctuations as low as possible.

Flow control technology

Claudius Peters flow control technology enables maximum blend efficiency, optimum kiln operation and lower energy consumption.

Mixing silos are connected to a flow control facility which meters the raw meal to the pre-heater of the kiln. The system consists of a control bin, flow control gates and a continuous weighing device. During the continuous, pulsation free, pre-heater feeding (by airlift or bucket elevator), the raw meal metering device is calibrated online to ensure the requirements of the kiln are met without any feed interruption.

Single operation:

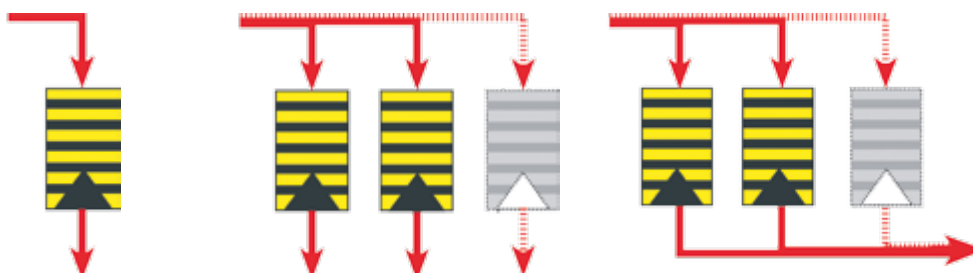
- Simultaneous feeding and discharge
- Cost-advantageous because only one system is used
- Mixing effects of up to 7:1

Half-parallel operation:

- Simultaneous feeding of several silos while discharging out of one silo
- Double availability guarantees full functionality, e.g. during inspection work
- Mixing effects of up to 10:1

Parallel operation:

- Simultaneous feeding and discharge of several silos is possible
- Double availability for a safe production process
- Mixing effects of up to 15:1



plant optimization

Boost plant efficiency and expand operation – a full range of proven modernization options from Claudius Peters.

Your perfect modernization partner

For modernizing or optimizing existing plants, Claudius Peters is your perfect partner, providing concepts and solutions that can be customized to even highly specific situations.

Modernizing or upgrading plant will bring appreciable increases in storage capacity as well as streamlining operations into an efficient, modern unit capable of up to 99% discharge.

Retrofitting and updating can increase the mixing effects of a silo by up to 50% whilst at the same time reducing energy consumption. It should be considered when a plant is being extended, or where there is the need for a higher discharge rate or for a silo to be used for other materials.

It should also be considered if there are signs that silos are no longer operating efficiently, with evidence of dead zones, coarse particle separation or a tendency to core flow.

Efficient mixing operations

An expansion chamber of prefabricated steel or concrete segments, installation of multi-flow feeding and process automation and covering the silo bottom with aeroslides will all help to maximize the efficiency of mixing operations.

Tailored modernization options to enhance processes and boost output



Modification of a grain terminal to a cement terminal.



Steel mixing expansion chamber, retrofitted in old silo.

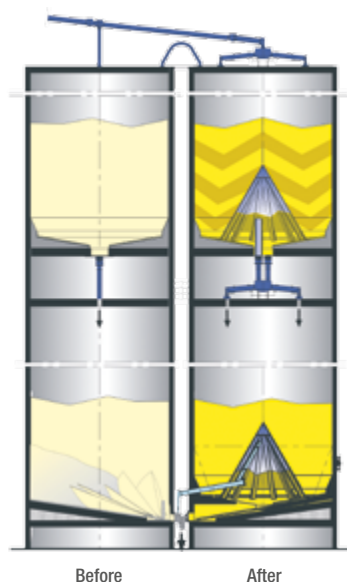
Before:

Two-storey silo (combined mixing and storage silo) of old design without expansion chamber.

After:

Two-storey silo after modernization with expansion chamber:

- Continuous mixing operation
- High discharge output
- High usable silo volume, thus >99% of the available storage capacity is used
- Reduction of energy consumption
- Pulsation-free operation



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CALCINING
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DISPATCH
DOSING
DRY BLENDING
DRYING
GRINDING
PACKING
PNEUMATIC CONVEYING
PULVERIZED FUEL SUPPLY
SILO SYSTEMS
STOCKYARD SYSTEMS
ALUMINA HANDLING SYSTEMS
MARINE POWDER HANDLING
TURNKEY PROJECTS

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We know how

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