Clinker Storage Systems
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The AUMUND Group Equipment for the Cement Industry is being applied worldwide in more than 10,000 plants.

Design, implementation and modernisation of clinker storage installations, customised as per requirement, achieve maximum customer benefit.

- Adapted to the customer’s specific requirements, all transport processes are constantly optimised based on innovations and the latest technical know-how.

- Combining economic and ecological aspects including future demands, balanced solutions are considered.

- High safety standards in all functions and under all conditions have been proven world-wide in technology, quality and reliability.

To receive an optimum overall conveying and storage layout, early involvement of AUMUND’s experienced layout engineers is recommended.
Circular Storage Hall without Central Column

Storing capacity from 50,000 to 250,000 t

These circular storage halls consist of a pretensioned reinforced concrete cylinder with a diameter of 40 to 80 m and a height from 10 to 25 m. A cone-shaped roof structure is arranged above the concrete cylinder. The roof is a self-supporting steel frame covered with trapezoidal plates. Special sealing elements at the joints of the trapezoidal plates make the roof structure dust-tight. For compensation of thermal stresses, the roof structure is arranged on special sliding bearings which are installed in the upper edge of the concrete cylinder.

The roof structure supports the headhouse with the drive station of the pan conveyor and the filter systems for dedusting of the storage hall. The diameter and height of the headhouse are determined to suit the dimensions of these systems. For all circular storage hall diameters, the main dimensions of the roof structure and headhouse are standardised. The storing capacity of these circular storage halls ranges from 50,000 to 250,000 t. Larger capacities can also be realized. Due to the reduced system height and the large diameter, it is also possible to build these circular storage halls on soils with a low bearing capacity. A minimum of approx. 500 kN/m² is required.

The material is discharged to two to four discharge tunnels, depending on the storage hall diameter. A discharge rate of approx. 85% is achieved.

During the loading process, the clinker segregates and forms cones according to the particle size. A homogenous clinker mixture is, however, an essential condition for the performance of cement mills. Therefore, it is recommended to systematically shift the silo discharge gates in order to blend the different particle sizes in the silo. In addition, regular shifting of the discharge openings ensures that the stored clinker level in the silo lowers uniformly, thus avoiding early discharge of fresh clinker.
Cylindrical Concrete or Steel Silos

Storing capacity from 30,000 to 60,000 t

These silos are made of reinforced concrete or prefabricated special steel. Due to the comparatively small basis, a high discharge rate of approx. 75% is reached by means of one discharging conveyor only. This implies that the complete material stored in the silo can be extracted to a large extent by gravity discharge, without using mobile evacuation systems.

After several years, a total residue discharge of the silos should be effected, as the material particles lying on the floor tend to consolidate and form a steep cone. Therefore, it is recommended to equip all silos with lockable entrance doors.

With clinker cooler problems, extremely high clinker temperatures exceeding 400 °C must be expected. For these high temperatures, clinker silos are preferably made of steel; otherwise the choice of steel or concrete depends on economical aspects. In certain regions steel plate silos can be produced at more favourable prices.

In general, the storing capacity of these silos ranges from 30,000 to 60,000 t. The largest cylindrical concrete silo designed by AUMUND has a diameter of 45 m and offers a storing capacity of 80,000 t. In view of the chosen diameter, the roof had to be designed as a self-supporting steel framed structure with trapezoidal cladding – a design standard which is also applied for the large circular storage halls without a central column.

For automatic silo operation, a reliable level control system is of primary importance. A proven solution is the combination of an electro-mechanical silo pilot system to measure the material level in the silo. Several rope probes monitor the maximum filling level and several rod probes arranged in the area of the loading chute activate the emergency shutdown of the conveyor lines.
### Silo group for different clinker types

- **80,000 t silo with steel roof**

- **Clinker silos in series**

- **Steel silos, 30,000 t each**

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<table>
<thead>
<tr>
<th>D (m)</th>
<th>H (m)</th>
<th>h (m)</th>
<th>Storing capacity (approx. t)</th>
<th>Discharge rate (%)</th>
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<td>36.30</td>
<td>12.10</td>
<td>60,000</td>
<td>75</td>
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</table>

Cylindrical silos made of concrete or steel with one discharge tunnel. Storing capacity in t with a bulk density of 1.5 t/m³.
Covered Stockpile with Central Column

Storing capacity from 50,000 to 190,000 t

The salient features of the covered stockpile with a central column are the low system height and the large diameter. The roof structure covers the material’s angle of repose and only a low, circular retaining wall is required.

The central column is provided with slot-shaped outlet openings (stockpile) and supports the simple roof structure, consisting of the steel frame and the trapezoidal cladding. The platform above the central column is designed to receive the conveyor bridge with conveying equipment and the filter system.

A discharge rate of 40 % to 60 % is reached by installing one to three discharge tunnels. For total residue discharge, mobile evacuation systems will be required.

The standard storage diameters range from 70 to 110 m. Storing capacities of 50,000 to 190,000 t can thus be reached.

A special storing facility with a capacity of 230,000 t could be created by combining two storage halls. An essential condition for this project was the load distribution on a surface of 90 m x 126 m. Due to the bad soil with a relatively bad specific soil bearing capacity, special measures were required in order to avoid damage from differential settlement. The bridge structure was thus supported on special bearings and the roof fitted with a jacking system for repeated adjustment.

The two central columns with a diameter of 12 m provide a storing capacity of 4,500 t special clinker each. The storage hall is equipped with three discharge tunnels, ensuring a discharge rate of approx. 60 %.

The large roof surface of this storage hall offers another advantage: the cooling effect on the stored clinker.

<table>
<thead>
<tr>
<th>D m</th>
<th>H m</th>
<th>Storing capacity t</th>
<th>m³</th>
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<td>80</td>
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<td>90</td>
<td>33.3</td>
<td>106,100</td>
<td>70,700</td>
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<td>100</td>
<td>36.7</td>
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<tr>
<td>110</td>
<td>40.1</td>
<td>190,500</td>
<td>127,000</td>
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</table>

Discharge rate approx. 60 %. For total residue discharge, auxiliary equipment.

<table>
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<th>Preferred sizes</th>
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<tr>
<td>D m</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>70</td>
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<td>80</td>
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<td>90</td>
</tr>
<tr>
<td>100</td>
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<tr>
<td>110</td>
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</table>

Discharge rate 100 %

In case of irregular filling, a reduced output factor of 0.9 will have to be considered.

Storing capacity in t, with a bulk density of 1.5 t/m³.
Total and automatic residue discharge

The actual live capacity secured with gravity discharge only amounts to a maximum of 85 %, presuming an optimum geometry of the storage facility. The discharge rate of covered stockpiles, although equipped with several reclaim tunnels, is even less.

Total and automatic residue discharge of this storage type is achieved with the automatic discharge system MOLEX® and just one discharge tunnel.

The MOLEX® mainly consists of a scraper chain installed in a bridge structure either turning around the central column or, if the stock is built without a central column, on a support base above the central discharge. The scraper chain drags the clinker which cannot be discharged by gravity to the central discharge hopper. PLC controlled drive systems drive the radial movement of the bridge truss and the scraper chain.

The opposite sketches explain the working principle of the total residue discharge system. The clinker is first discharged by gravity through the central discharge and additional openings in the reclaim tunnel. A level sensor installed in the central hopper monitors the lack of clinker and activates the scraper chain of the MOLEX®. When the scraper blades have cleared the clinker piled against the bridge truss, the travel units for radial movement of the MOLEX® are started.

The power absorbed at the scraper chain drive controls the radial travel movement of the MOLEX® and allows clearing the stock without manual intervention being required.

A further positive aspect complementing the automatic residue discharge is the blending of coarse and fine-grained clinker particles obtained when operating the storage with the MOLEX®, thus allowing the grinding mill to be fed with an almost consistent mixture.
Circular storage hall with earth cone

Storage Hall with Earth Cone

Essential increase of storing capacity

The storing capacity of longitudinal and circular clinker storage halls can be essentially increased by the installation of an earth cone. In addition, the discharge rate is considerably improved by this measure. The earth cone is usually provided with an inclination of 40° to 45°. Untreated surfaces simply blasted out of the rock did not prove to be reliable in practice. Despite a low groundwater level, it has to be considered that surface water may penetrate into the earth cone through fissures and gaps. Therefore, the surface of the cone has to be covered with a concrete or steel shell. It is also recommended to install a drainage system in order to ensure that water accumulations can flow off.

For the roof and headhouse, a steel frame with trapezoidal cladding is preferred, as for circular storage halls without a central column.

Clinker discharge from the earth cone is effected through central discharge openings. For safety reasons, at least three silo discharge devices should be provided. These clinker storage halls can also be equipped with a central column, which is then used for storing special clinker. A rotating feed chute is required for feeding the central tower as well as for the symmetrical feeding of the main storage hall.

<table>
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<th>h (m)</th>
<th>T (m)</th>
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<th>Storing capacity (m³)</th>
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Minimising dust generation without the use of dust filters

To reclaim the clinker, discharge systems which can be operated without the use of dust filters, are the preferred equipment for all kinds of clinker storage facilities.

The gravity discharge gate, combined with a pan conveyor reclaiming the clinker at low speed minimises dust generation. The conveying capacity is defined by the adjustable discharge cross section and the pan conveyor speed. Frequency controlled drive units allow adapting the conveying capacity to operational requirements.

Deep-Drawn Pan Conveyors are the ideal equipment to combine with the gravity discharge system. With an optimum plant planning the Deep-Drawn Pan Conveyor allows for direct feeding of the mill hoppers in the grinding section.

Dust Suppression

In order to avoid dust emissions from the clinker storage hall, negative pressure needs to be created in the feeding area. For this purpose, the filter system must be designed for an operating temperature of 100 °C. The air volume required depends on the storage diameter and the clinker temperature, which essentially influences the buoyant forces.

About 12,000 m³/h are required for small cylindrical silos and up to 60,000 m³/h or more for large-sized circular storage halls.

Vent hopper and compact filter systems proved to be a space sparing solution. A favourable load distribution is achieved if two filters are served by one blower.
Conversions and Refurbishments

- Upgrading of existing plant components
- Targeting increased efficiency
- Higher output
- Improved availability

With our expert team of engineers planning selective modernisation measures, we pay special attention to the upgrading of existing plant components, targeting increased efficiency, higher output rates and improved availability.

Upgrading of your materials handling and storage equipment to state-of-the-art technology is achieved through a tailor-made refurbishment process under optimum utilisation of time and budget.

Most of the existing components are re-used in the refurbishment process to save cost.

Engineered conversions and refurbishments for increased efficiency and output are performed on AUMUND equipment as well as on the equipment of other manufacturers.
After Sales Service

Customer Proximity around the World
At AUMUND, service does not end at the sale of the equipment. It's the beginning of a long-term partnership. AUMUND offers you a full range of services – from commissioning to the delivery of quality spare and wear parts to customized preventive maintenance programs and equipment upgrading. The benefits for you: Maximum equipment efficiency at lower operating cost.

Commissioning and Field Service
Today, presence “on the spot” is an absolute “must”. Therefore, our commissioning and service engineers operate from support centers on all continents to guarantee immediate and competent support.

Spare and Wear Parts
A comprehensive range of genuine spare parts is available for our entire product range from stocks in Germany, Hong Kong, Brazil and the USA. Our product specialists provide assistance and respond instantly.

Retrofits & Modernisation
Aged and worn equipment? Capacity increase needed? Too high operating cost? AUMUND “just as new” retrofits are economical and tailor-made solutions for improving your existing equipment at reasonable cost.

Preventive Maintenance
Knowing beforehand that service will be needed allows you to schedule downtime and save money with timely repairs. Repairs or retrofits can be accurately anticipated allowing for the downtime to be at the most convenient times and at the lowest possible cost.

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THE AUMUND GROUP

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**GERMANY**
AUMUND Fördertechnik GmbH
Saalhoffer Str. 17
47495 Rheinberg
Phone: +49 - 2843 - 72 0
Fax: +49 - 2843 - 6 02 70
info@aumund.de
www.aumund.com

AUMUND Logistic GmbH
Saalhoffer Str. 17
47495 Rheinberg
Phone: +49 - 2843 - 72 0
Fax: +49 - 2843 - 7 24 73
logistic@aumund.de
www.aumund.com

SCHADE Lagertechnik GmbH
Bruchstraße 1
45883 Gelsenkirchen
Phone: +49 - 209 - 50 31 60
Fax: +49 - 209 - 50 31 62 88
sales@schade-lagertechnik.com
www.schade-lagertechnik.com

**THE NETHERLANDS**
AUMUND Holding B.V.
Wilhelminapark 40
5911 EE Venlo
Phone: +31 - 77 - 320 01 11
Fax: +31 - 77 - 320 07 28
info@aumund-holding.nl

**SWITZERLAND**
AUMUND AG
Arthur Str. 3
6301 Zug
Phone: +41 - 41 - 710 10 82
Fax: +41 - 41 - 710 42 02
info@aumund.ch

**RUSSIA**
AUMUND Representative Office
German-Russian House, Office 44
ul. Malaja Pirogovskaja 5
119435 Moscow / Russia
Phone: +7 - 495 - 287 90 02
Fax: +7 - 495 - 287 90 06
info@aumund.ru

SCHADE Representative Office
German-Russian House, Office 44
ul. Malaja Pirogovskaja 5
119435 Moscow / Russia
Phone: +7 - 495 - 287 90 03
Fax: +7 - 495 - 287 90 06
info@aumund.ru

**FRANCE**
AUMUND France S.A.R.L.
43, rue de Trévise · F 75009 Paris
Phone: +33 - 1 - 42 46 72 72
Fax: +33 - 1 - 42 46 72 74
aumund@aumund.fr

**BRAZIL**
AUMUND Ltda.
Avenida Eng. Luis Carlos Berrini 716 - 4 andar · conj. 41
04571-000 - São Paulo / SP
Phone: +55 - 11 - 287 90 02
Fax: +55 - 11 - 287 90 06
aumund@aumund.com.br

**INDIA**
AUMUND Engineering Private Ltd.
2nd Floor, Lakshmi Neela Rite Choice Chambers - 9, Bazulla Road,
T. Nagar Chennai - 600 017
Phone: +91 - 44 - 4390 63 00
Fax: +91 - 44 - 2815 60 46
aumund@venil.com

**HONG KONG SAR**
AUMUND Asia (H.K.) Limited
Unit 3B & 5, 30/F.
148 Electric Road
Kowloon City
Hong Kong
Phone: +852 - 3695 - 43 33
Fax: +852 - 3695 - 43 11
info@aumund-asia.com

**USA**
AUMUND Corporation
1701 Barrett Lakes Blvd
Barrett Lakes Center I
Suite 450
Kennesaw, GA 30144
Phone: +1 - 770 - 226 - 95 78
Fax: +1 - 770 - 953 - 48 44
sales@aumundusa.com

**P.R. CHINA**
AUMUND Machinery Trading (Beijing) Co. Ltd.
Rm. 7-8, 22-F, East Ocean Centre
No. 24 Jianguomenwai Avenue
Chaoyang District
Beijing 100004
Phone: +86 - 10 - 65 15 58 13 / 14
Fax: +86 - 10 - 65 15 58 15
aumund@aumund.cn
AUMUND GROUP

Your partner for all requirements regarding material handling and storage.
We design, engineer, manufacture, erect and service reliable equipment.
Reputation and competence proven by more than 10 000 installations in over 100 countries.