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Your efficient partner for modern and effective bulk material handling

PLANT DESIGN - ENGINEERING - EPC-CONTRACTING

CEMENT - THERMAL POWER - MINERALS

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Silo systems.
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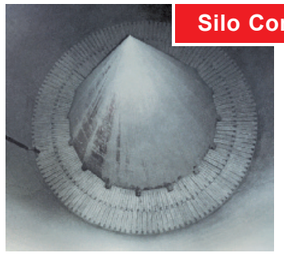

Silo Conversions

Economic
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Advanced
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Cement Carriers
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12/14/Silo conversions

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Silo conversions and modifications

for the Cement Industry

A HAVER & BOECKER Company

Introduction

The introduction of modern production techniques has brought about a change in the cement industry and silo engineering. Large numbers of different components like ground blast furnace slag, fly ash or limestone meal as well as finished products are produced.

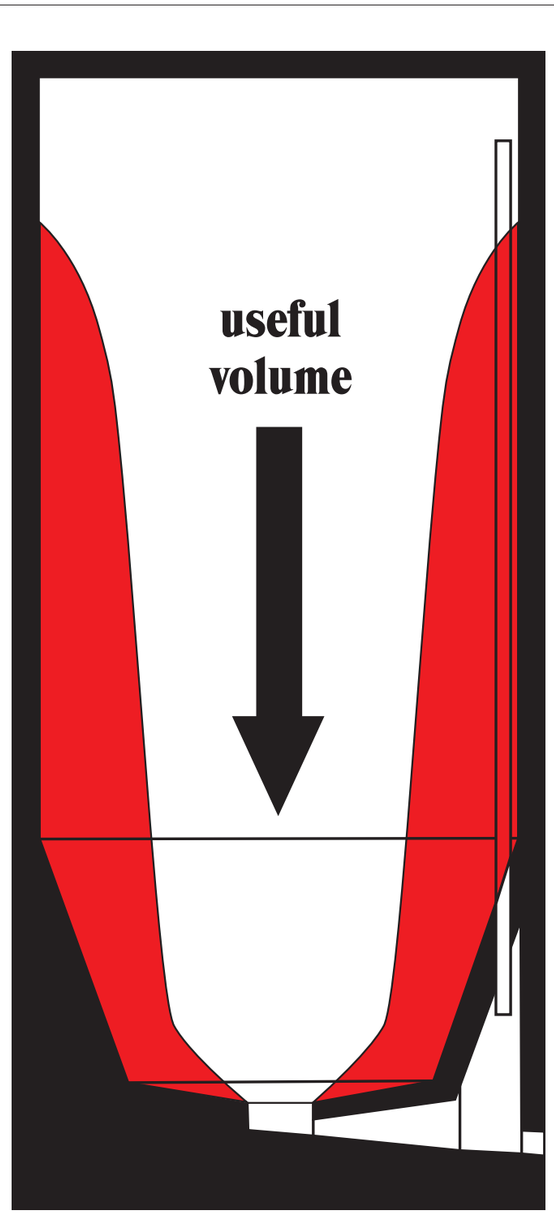
These circumstances are taken into account in new plants, for example, by building multi-compartment silos for cement dispatch. In existing lines, the silos often no longer match the current demand.

In addition, a longer operating period can often cause problems with the silo discharge or the cement quality is impaired due to seizures and lumps. In such cases, silo conversions can help.

Requirements for Silo Conversions

Modern discharge systems thus require the re-equipping of the existing cement silos. Before IBAU HAMBURG launched their central cone silo on the market in 1975, there had been various different methods of cement storage, with regional peculiarities playing a role to a certain extent.

The central cone silo has since become a worldwide standard. The most common problems with existing cement silos that do not have a modern IBAU discharge system are that a silo capacity is available only to a limited extent and/or that there are continuous discharge problems due to seizures and the formation of lumps. The cement quality is impaired, and a vast amount of energy is needed for fluidization.



Uneconomical silo design

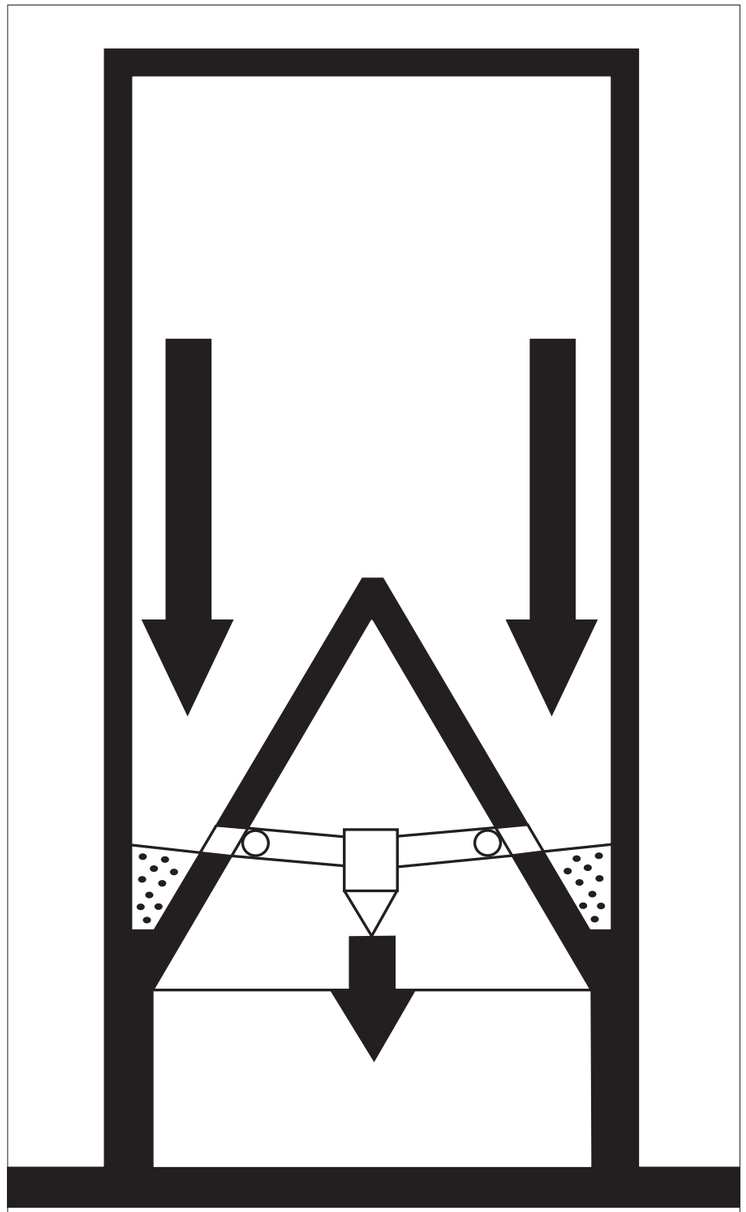
In many cases silos can only be operated with core flow, and sometimes even less than two thirds of the nominal silo volume is available.

In such cases the silos must be cleared manually and the solidified cement must be removed by digging it out. Work of this kind is dangerous and can even lead to death as some incidents in the past have shown.

In general, with poor silo availability, interruptions in cement loading with unnecessary waiting times right up to production stoppages are a major problem.

Consequently, cement buyers will favor competitors that do not have problems of this kind.

Alternatively, central cone silos can be converted to multi-cell silos for the storage of various cements. Such concepts are designed for silo diameters above 18 m. Furthermore, conversions of grain silos and oil tanks have also been completed for cement storage in port terminals.



IBAU-Central cone for complete discharge

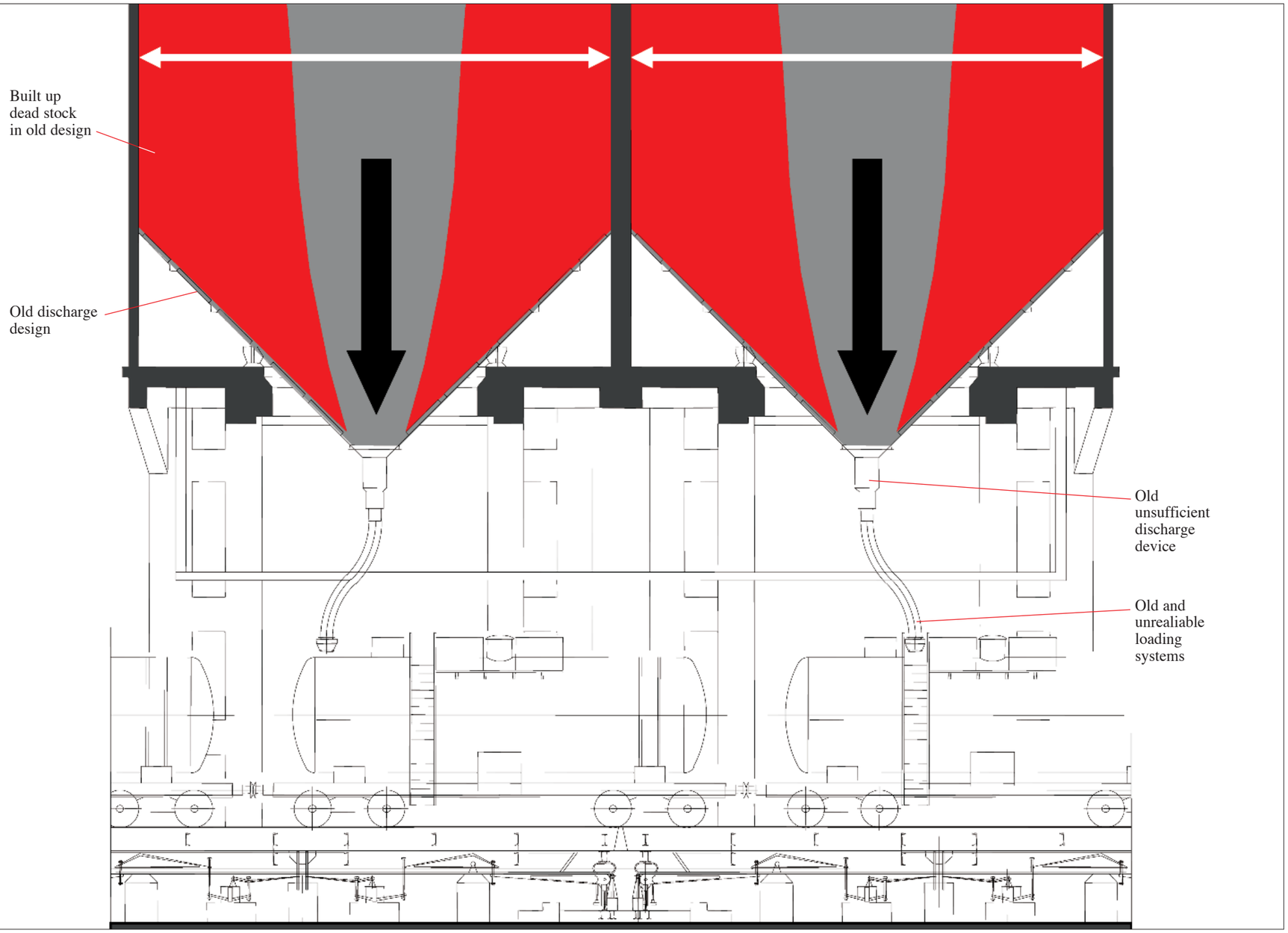
The Most Important Conversion Concepts

First of all, the building substance and silo static must be checked in order to convert or modernize the discharge system of an existing silo. Cracks in the walls, which can be caused by tension peaks during eccentric unloading for example, must be analyzed very precisely before any silo conversion can be considered.

The possible conversion designs result from specific requirements, planned investment amounts, incorporation in the plant as a whole, silo size or the space conditions in the silo and the expense of removing the piled concrete for the existing silo base.

If the technical conditions are given, the installation of a central cone in the flat-based silos is also possible for silos with a diameter larger than 12 m. Where the accumulated concrete is hard to remove and eccentric silo discharges exist, other solutions such as the installation of a double pitch roof are preferred.

As far as smaller silos are concerned, it might not be necessary to make any alterations at all. Steel bases with prefabricated aeration units can be used for base sections with a diameter of 5 m and a central discharge.



Typical cement silos before conversion

Silos with Concentric Discharge

The most common conversion design is the installation of a central cone in an existing flat based silo.

A typical example is the conversion of cement silos for HOLCIM (Romania) in the Alesd plant, where IBAU HAMBURG has converted a large number of cement silos and a fly ash silo in several stages.

The silos with a diameter of 15.7 m each were equipped with new aeration bases and were fitted with a central cone using steel construction.

Subsequent conversions of IBAU central cone silos have in recent years been carried out for a large number of customers.

These include silo conversions for Duna Drava Cement in Hungary, Lafarge Mykolaiv Cement in Ukraine, Fabrica Cementa Novi Popovac in Serbia and Rüdersdorfer Zement in Rudniki, Poland.

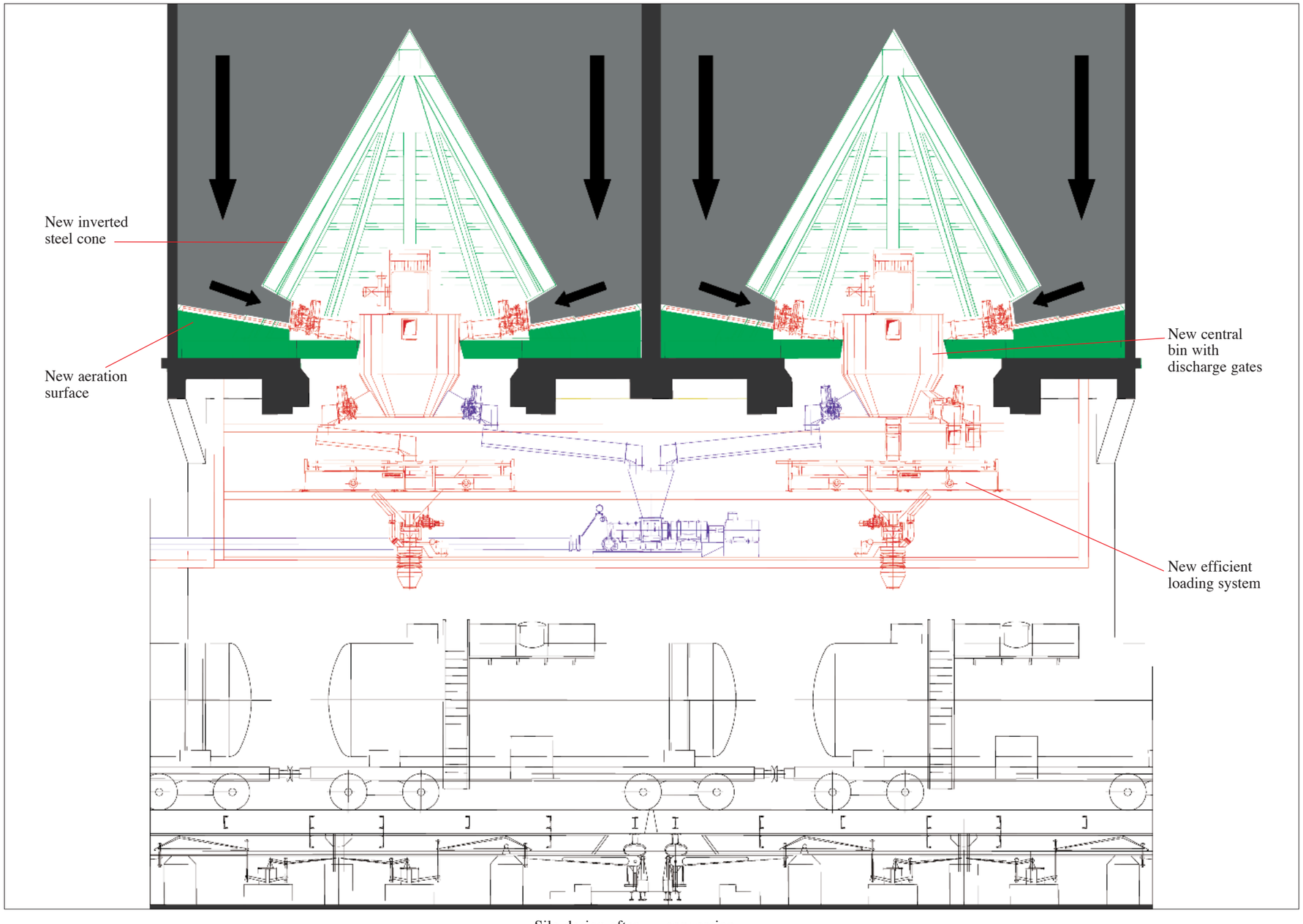
Via PSP Engineering IBAU received an order to convert a cement and a slag silo at Rugby Cement in Detmarovice, Czech Republic. The silos with a diameter of 12 m and a storage volume of 1800 m^3 each were designed with an identical construction.

At the Lengfurt plant of HeidelbergCement eight cement silos with a diameter of 8 m were converted with new aeration units with a central discharge. This silo base is closely connected with aeration units in which the pipelines are integrated. This leads to very small residual quantities when operating the silo. The conversions were realized in pairs in four construction sections to interrupt the silo operation and cement loading as little as possible.

A large number of silos ranging from a diameter of 8 to 12 m have aeration units in a steel discharge cone. The simplest way of modernizing the discharge system is usually to disconnect the existing cone in the lower segment and to replace it by a flat base. At Lafarge Cement in Westbury, UK, a respective prefabricated silo base with aeration segments for a cement loading silo was used.

Silos with Eccentric Discharge

In the case of silos with an eccentric discharge, the central cone version and the version with a silo cone are rarely/never used. The number of versions here is much higher than that with concentric discharges. With the increasing size of the silo, suppression installations are also used. In silos with a diameter of 10 m and a silo base version such as that at Garadagh Cement in Azerbaijan, which is part of the HOLCIM Group, the cement is transported over a 45° inclination and aeration gullies to two transverse gullies, and from there to two discharges. Conversion to another discharge version or the installation of depressure systems is too complex for silos of this kind. That is why only a new aeration system can be used.



Silo design after conversion

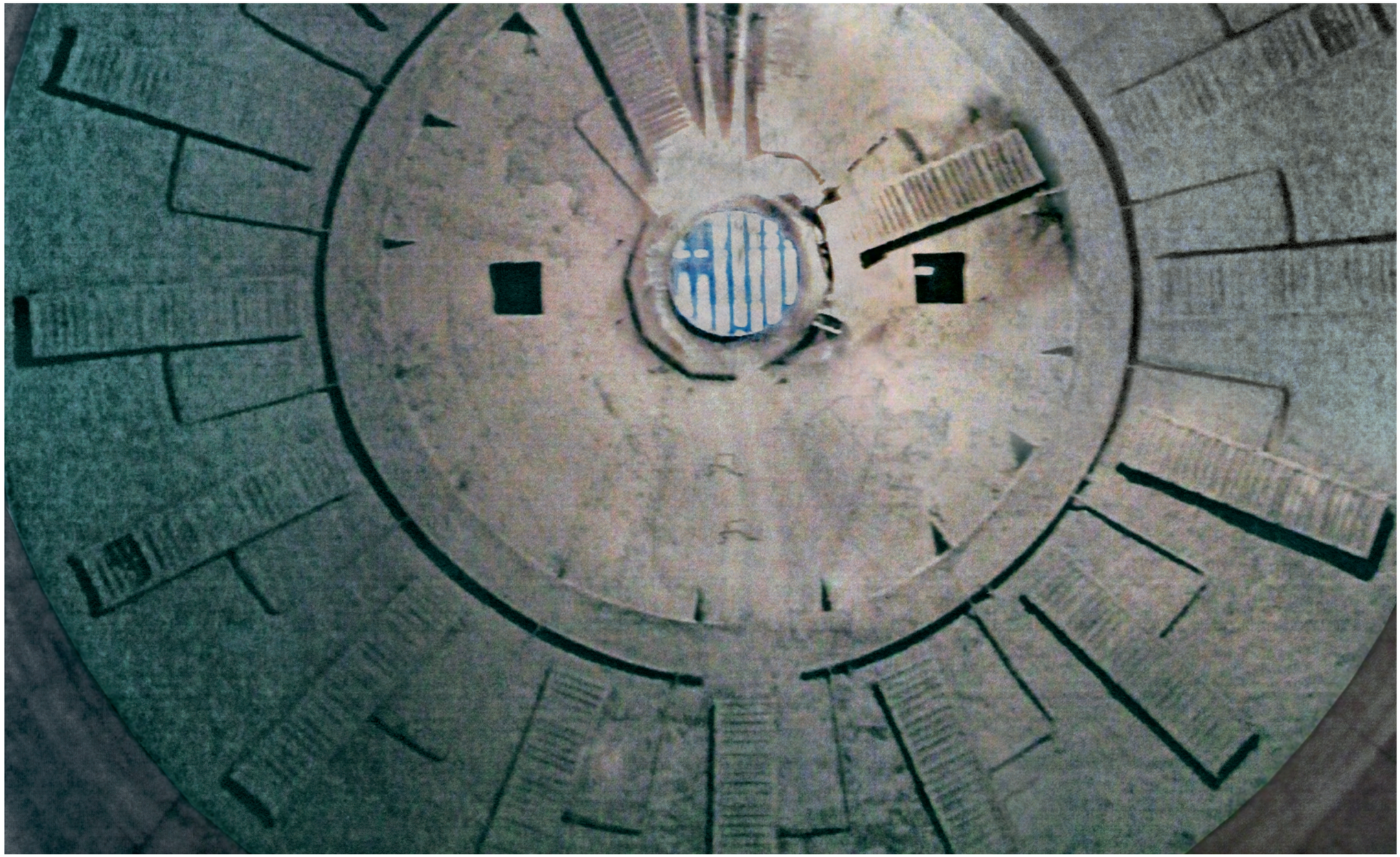
At the Czech cement manufacturer Ceskomoravsky Cement, which is part of the HeidelbergCement Group, six cement silos with a diameter of 12.4 m each were converted at the Kraluv Dvur plant. Here too, the silo base has a 45° inclination and two gully transverse transports for both discharge openings. Double pitch roofs as relief chambers are located above the gully transverse transports. The silo discharge with a maximum of 300 t/h is transported from the openings via flow control gates into a downstream collecting gully which is for three silo units each.

A system similar to that at Ceskomoravsky was converted at the Eclépens plant at HOLCIM in Switzerland, but the gully inclination there was 15° and the discharge capacity was up to 400 t/h. IBAU has received an order for a further conversion of this type at the Beli Izvor plant (Holcim Bulgaria). Here, the silo diameter is 15 m with a discharge

capacity of 200 t/h. Another silo base design involves only one transverse gully and two eccentric discharges such as that at the San Sebastian plant of Cementos Caribe. There, four cement silos were modified and equipped with new aeration systems. Above the transverse gully there is a double pitch roof as relief chamber. The downstream cement transport includes collecting screws and bucket elevators.

IBAU HAMBURG, the Specialist for Silo Conversions

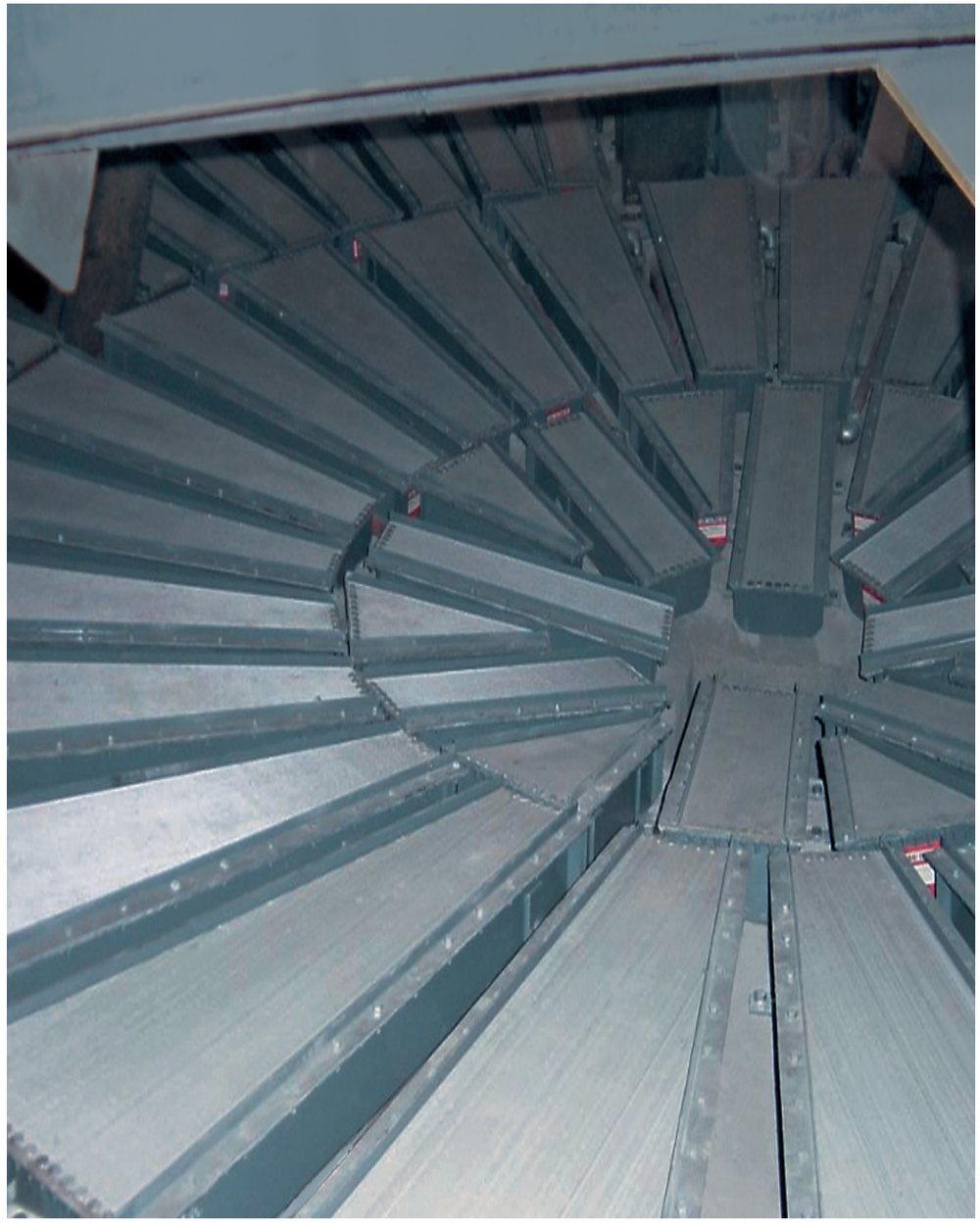
IBAU HAMBURG has become an expert in the conversion and modification of silos for the cement industry. Only in the past ten years more than 250 conversions have been realized. System expertise is the basis for simple, flexible and economic solutions. Even during the project planning and layout stages customers benefit from engineering services and consultation opportunities. The development of system solutions together with the customers has a long tradition at IBAU HAMBURG; it is a key component of customer service. Engineering from one single source is a guarantee for unproblematic interaction of all components within the system.



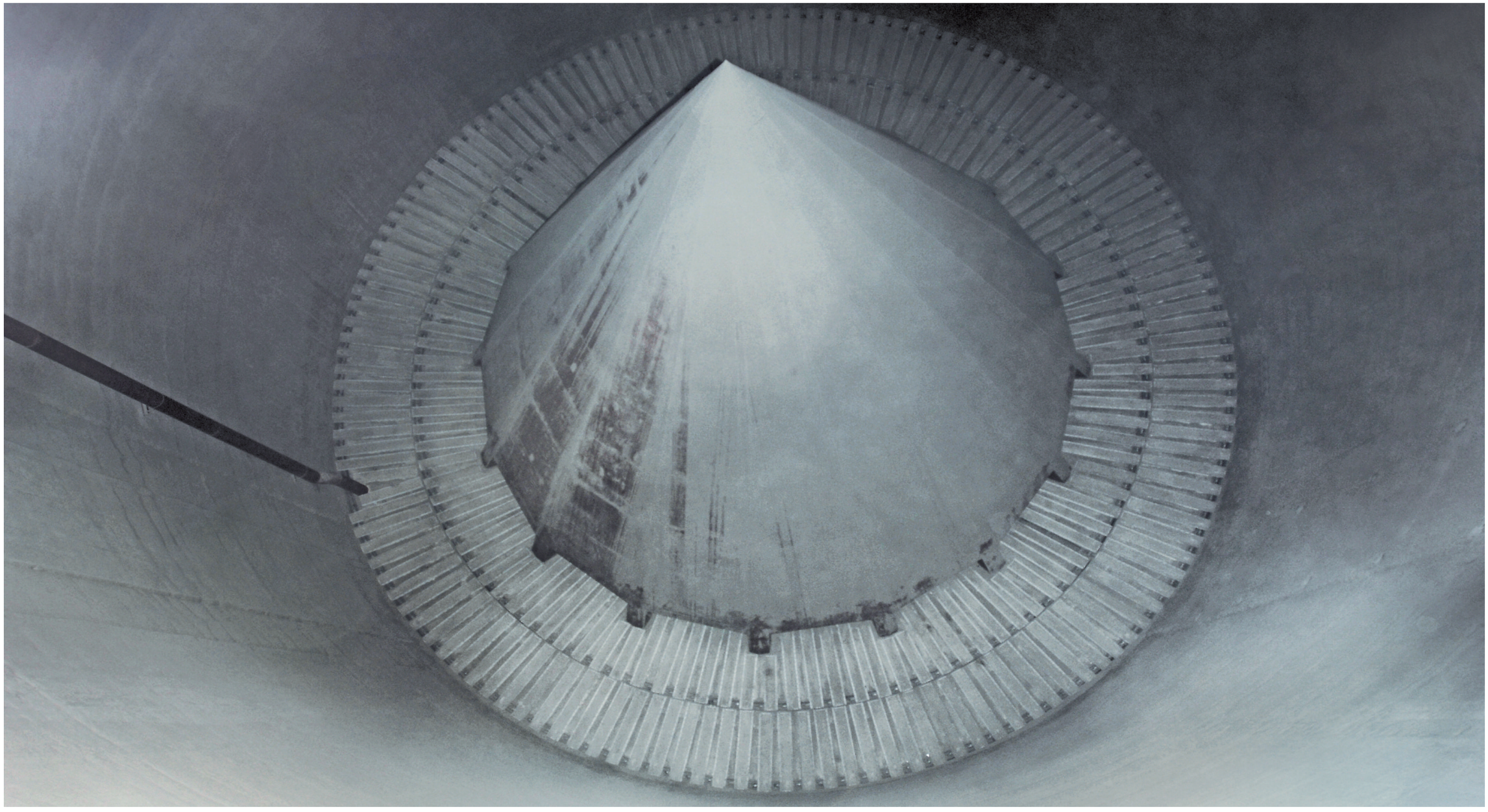
Silo floor with central outlet before modification

Modification of a silo floor with steel cone and central outlet

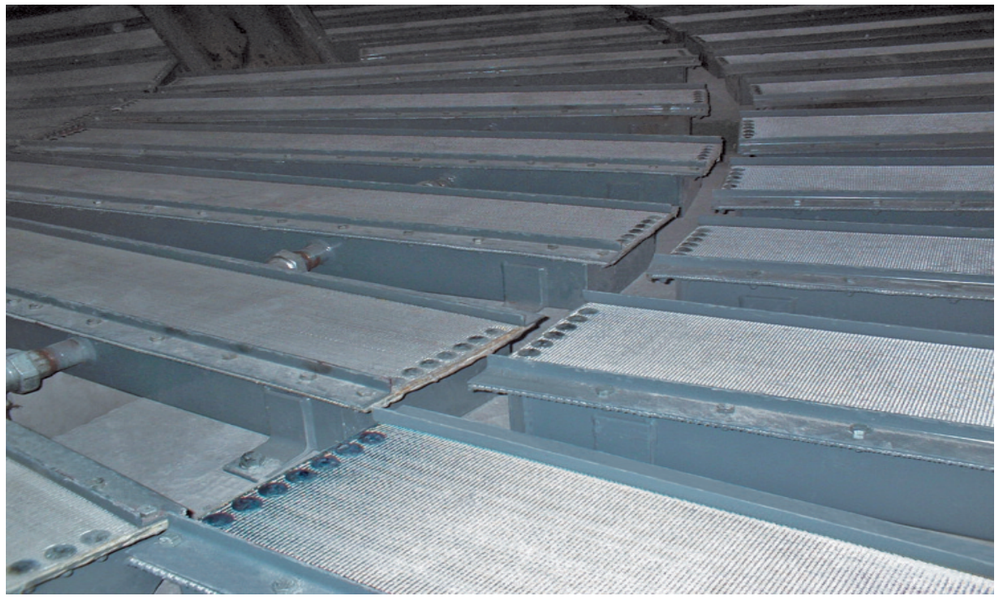
Floor aeration panels outside the steel cone



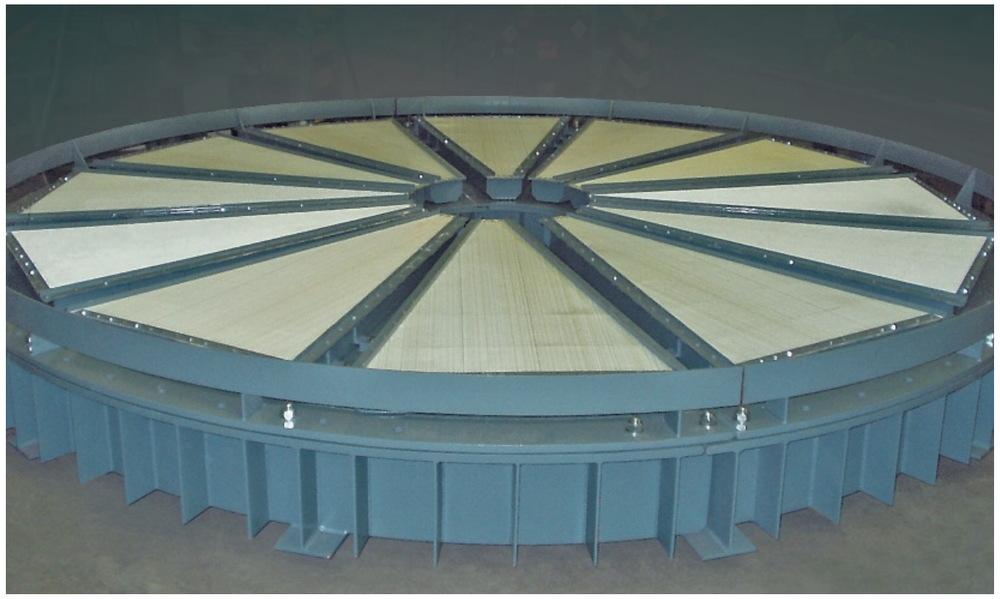
Floor aeration panels under the steel cone



Top view into a silo after modification



Silo aeration panels during assembly



Pre-assembled silo bottom

After the first complete discharge

Pre-assembled bottom after first complete discharge

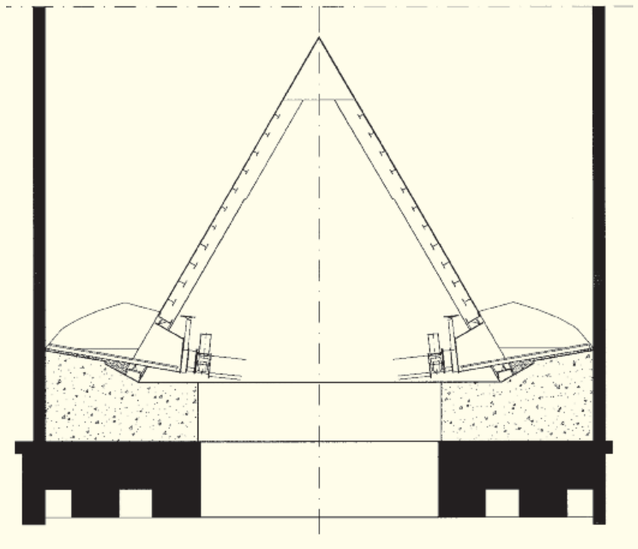
Converted silo station for Lafarge Cement, Mykolaiv, Ukraine

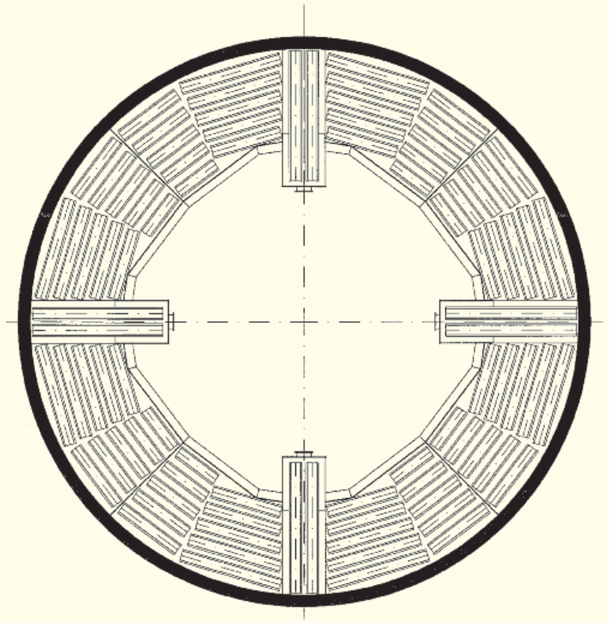
High efficient SIMPLEX truck loading system

Silo type: I BAU central cone

Silo modification into a classic I BAU central cone silo

This silo modification is intended to be used for existing silos with a center discharge and a diameter of > 12 m and with existing partial flat bottoms. At least 4 or more silo outlets and 8 or more aeration sections are planned, depending on the silo diameter. The discharge and the aeration take place in intervals.



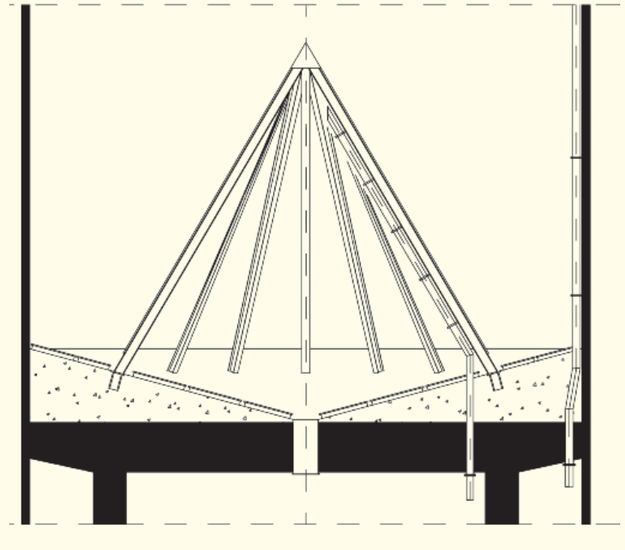


Advantages:

- easy modification work
- small aeration surfaces
- very high degree of silo emptying
- low power consumption
- high working reliability (many silo outlets)

These modifications were e. g. supplied for:

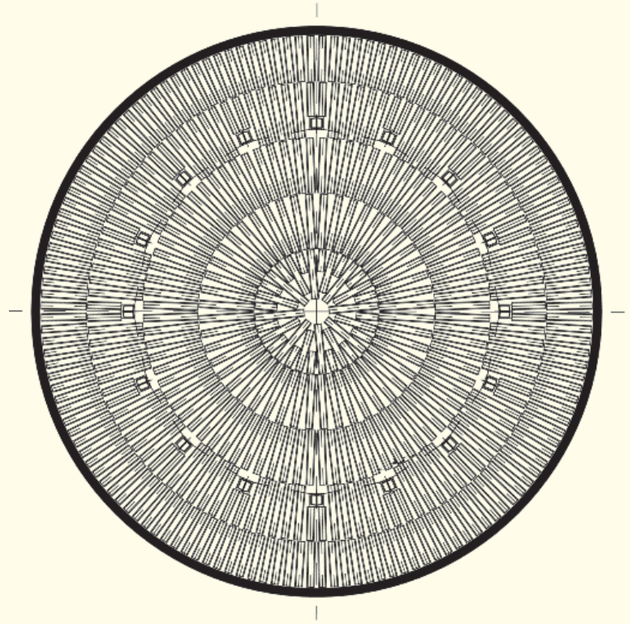
- PJSC Sukholozhsk Cement, Russia
- Duna-Drava Cement, Beremend, Hungary



Silo type: Depressure chamber

Silo modification into a depressure chamber

This silo modification is intended to be used for existing silos with a continuous flat bottom, a center discharge and a diameter of > 12 m. The flat inclined bottom below the depressure chamber and outside of the depressure chamber is divided into aeration sections, which are aerated in intervals.



Advantages:

- easy modification work
- good degree of silo emptying

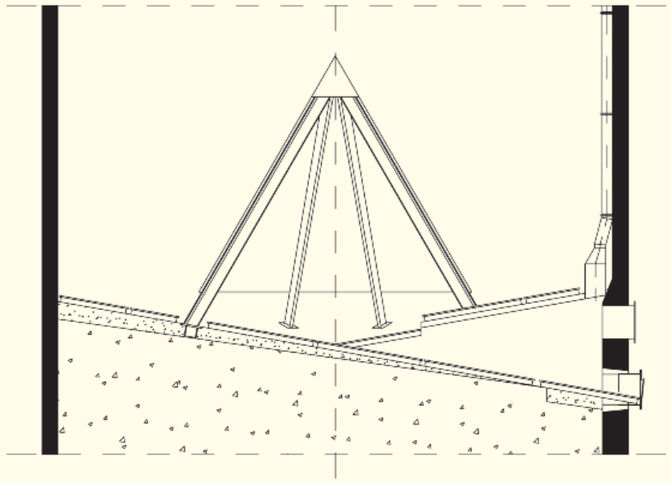
These modifications were e. g. supplied for:

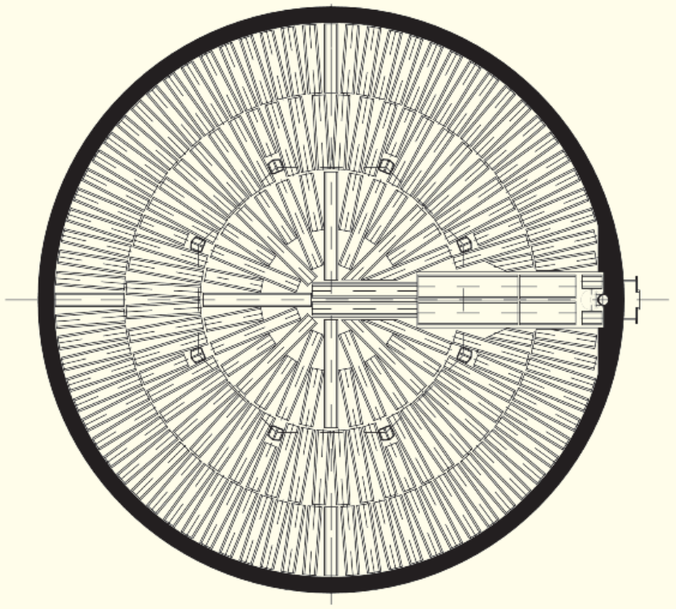
- Holcim, Alesd, Romania
- HeidelbergCement, Burglengenfeld, Germany
- Lafarge, Malogoszcz, Poland
- HeidelbergCement, Zlatna Panega, Bulgaria

Silo type: Depressure chamber with side discharger

Silo modification into a depressure chamber with silo side discharge

This silo modification is intended to be used for existing silos with flat bottoms, a side discharge and a diameter of > 12 m. The flat inclined bottom below the depressure chamber and outside of the depressure chamber is divided into aeration sections, which are aerated in intervals.



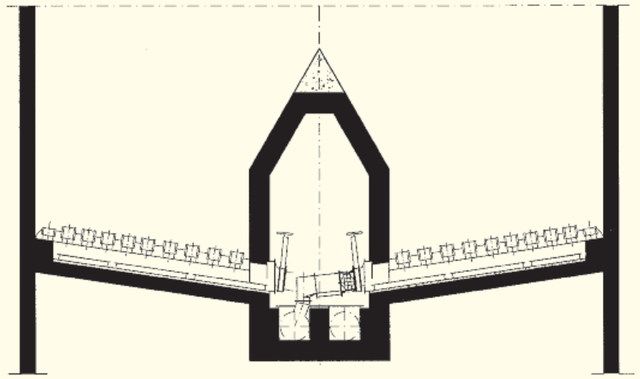


Advantages:

- relatively easy modification work
- good degree of silo emptying

These modifications were e. g. supplied for:

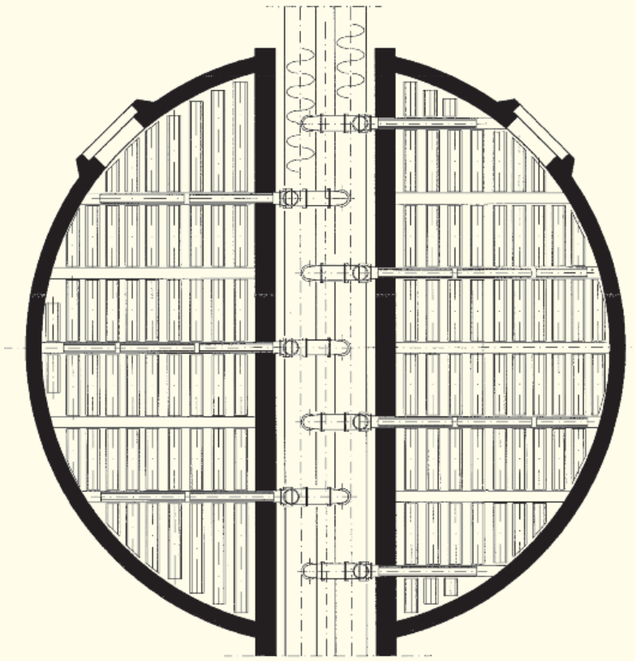
- Lafarge, Le Cric, Reunion
- Duna-Drava Cement, Vac, Hungary (18 silos)



Silo type: Tunnel discharge

Silo modification for silos with existing closed tunnel

This silo modification is intended to be used for existing silos with a continuous closed tunnel. The modification takes place with a minimum of change of the concrete surfaces. The existing silo outlets in the tunnel area are used. For each silo outlet 2 aeration sections are assigned. The discharge and the aeration are taking place in intervals.



Advantages:

- very easy modification work
- good degree of silo emptying
- high working reliability (many silo outlets)

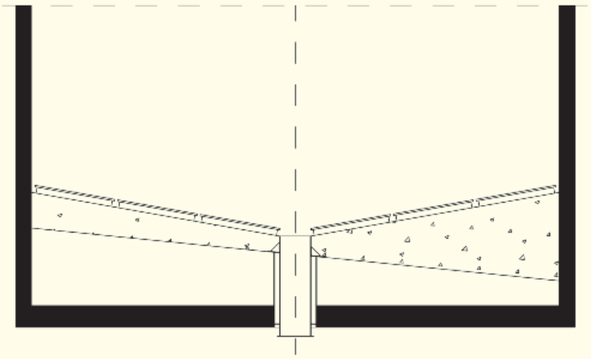
These modifications were e. g. supplied for:

- Cemex, Pertigalete, Venezuela
- Dyckerhoff, Lengerich, Germany
- HeidelbergCement, Pula, Croatia
- Irish Cement, Limerick, Ireland

Silo type: Flat bottom

Silo modification without depressure chamber

This silo modification is intended to be used for existing silos with a center discharge and a diameter of < 10 m. The flat inclined bottom is divided into aeration sections, which are aerated in intervals.

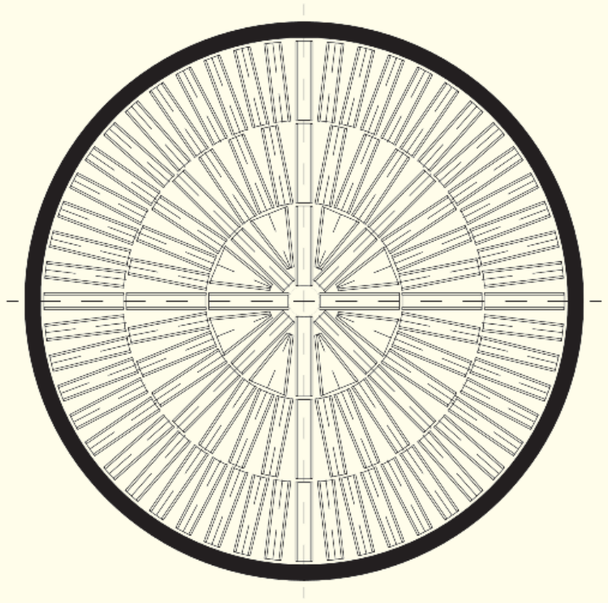


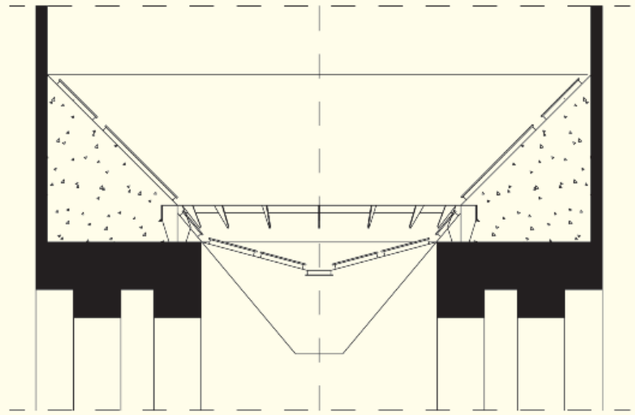
Advantages:

- very easy modification work
- good degree of silo emptying

These modifications were e. g. supplied for:

- HeidelbergCement, Lengfurt, Germany (8 silos)
- Ciment de Bizerte, Bizerte, Tunisia
- Dyckerhoff, Beckum, Germany





Silo type: Silo bottom with strongly inclined bottom

Silo modification without depressure chamber with strongly inclined bottom

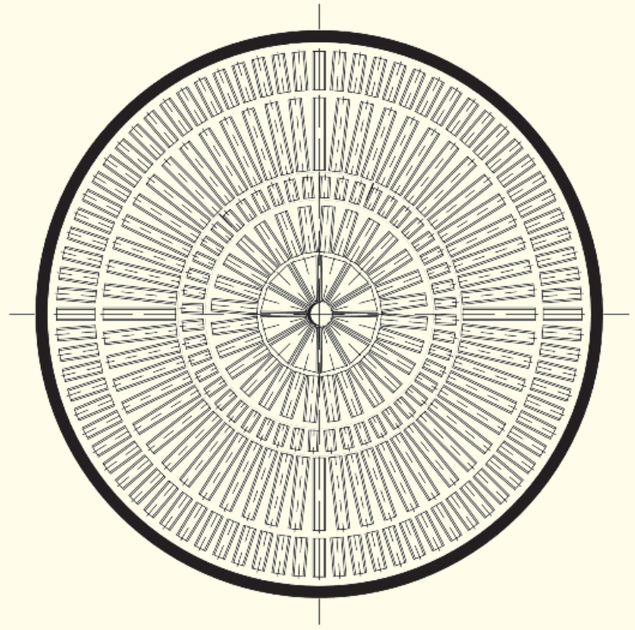
This silo modification is intended to be used for existing silos with a center discharge and a steel cone arranged on the concrete bottom. The steel cone is dismantled and replaced by a flat inclined bottom. This flat inclined bottom and the existing cone surfaces are divided into aeration sections, which are aerated in intervals.

Advantages:

- easy modification work
- acceptable degree of silo emptying

These modifications were e. g. supplied for:

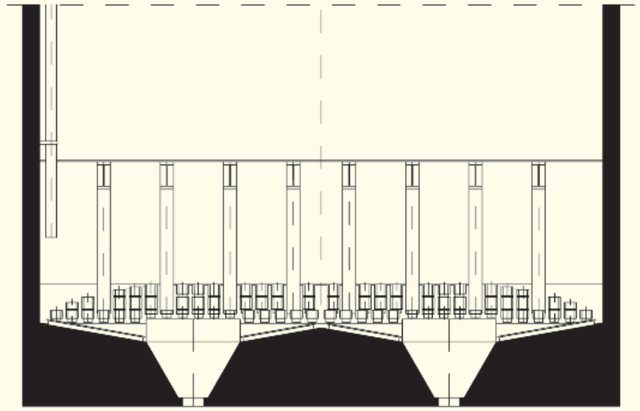
- Novoross Cement, Russia
- Lehigh Cement, Union Bridge, USA

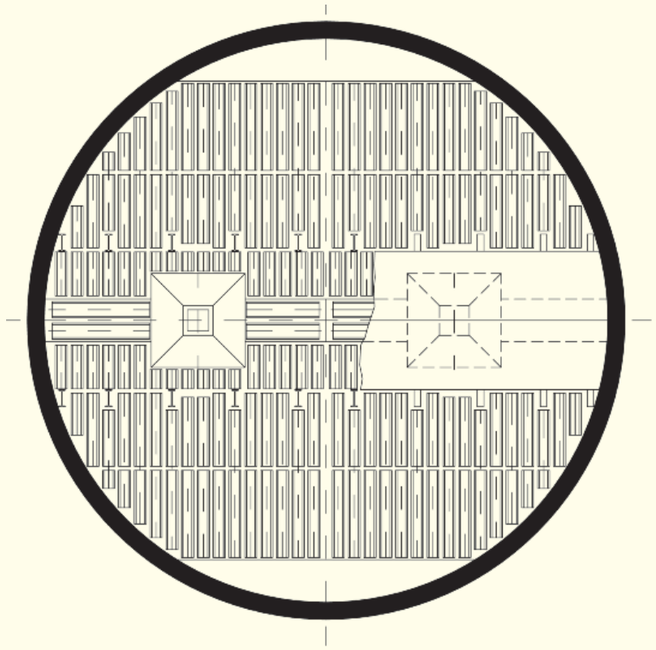


Silo type: Depressure hood

Silo modification with depressure hood

This silo modification is intended to be used for existing silos with continuous flat bottoms with two outlets and a diameter of 10 - 14 m. A depressure hood above the outlet is arranged from silo wall to silo wall. Inclined bottoms are created parallel to the depressure hood. The surfaces outside and inside of the depressure hood are divided into aeration sections, which are aerated in intervals.



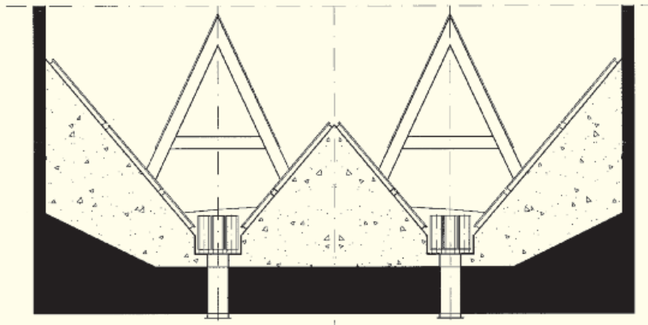


Advantages:

- relatively easy modification work
- acceptable degree of silo emptying
- good working reliability (2 silo outlets)

These modifications were e. g. supplied for:

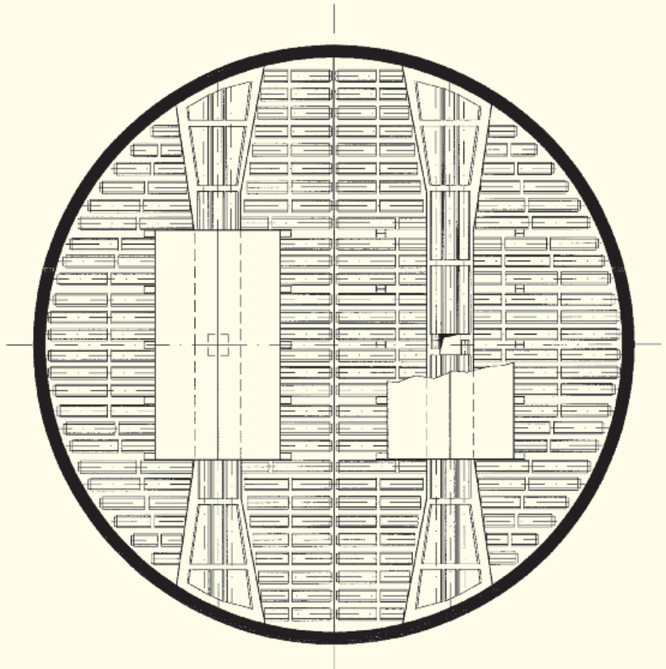
- Holcim, Cementos Caribe, Venezuela



Silo type: Double depressure hood

Silo modification with two depressure hoods

This silo modification is intended to be used for existing silos with several strongly inclined concrete surfaces and 2 resp. 4 silo outlets and a diameter of 10 - 14 m. Above the silo outlets, i. e. the concrete depressure hoods are arranged. The existing strongly inclined concrete surfaces are covered with aeration sections. The downstream concrete receives a new layer of concrete with flat inclined surfaces. The aeration takes place sectional in intervals.



Advantages:

- easy modification work
- short time of modification
- acceptable degree of silo emptying
- good working reliability (2 to 4 silo outlets)

These modifications were e. g. supplied for:

- Ceskomoravsky Cement, Kraluv Dvur, Czech Republic