HAVER & BOECKER

HAVER CEMENT
DESIGNING PREMIUM PROCESSES

PERFECTING YOUR FLOW

HAVER & BOECKER

“Concentrating the expertise of our technology brands, providing our knowledge of technology, industries and processes, and adding the complete project management package from just one single source will energize our customers to make higher quality cement at a reduced operating expense level. The cement plant of the future will set new global standards for the optimum production of cement in terms of quality, cleanliness and profitability.”

Wolfgang Bednarz, General Manager, HAVER Cement

PROCESSING STORAGE MIXING FILLING PACKING PALLETIZING LOADING AUTOMATION

W.S. TYLER · IBAU HAMBURG · sommer · Feige FILLING · HAVER & BOECKER · BEHN+BATES · NEWTEC BAG PALLETIZING

CONTENT









HAVER & BOECKER

THE CEMENT PLANT OF THE FUTURE

Introduction

HAVER & BOECKER is a family-owned and run, medium-sized company headquartered in Oelde/Germany. As the company's global division for the cement market, Haver Cement is focused on designing premium cement processes by combining all technologies from silo inlet to final dispatch as well as the complete limestone quarry operations. In order to offer its customers process chains without any compromises, Haver Cement assembles nothing but the best technology brands; all owned 100 % by HAVER & BOECKER.

These are:

- **HAVER & BOECKER/ W.S. Tyler:**
  While HAVER & BOECKER started to process minerals in 1930, W.S. Tyler got a head start in 1872. With technology centers in Germany, Brazil and Canada, both technology brands combine a wealth of knowledge in screening, washing and pelletizing. This allows for an optimal combination of technologies to design new plant concepts and processes for the cement limestone quarry operations world-wide.

- **IBAU HAMBURG** (storage systems):
  Founded in 1975, IBAU is an engineering house located directly at the rim of the harbor in Hamburg. IBAU offers complete solutions for cement handling and storage as well as mixing and blending solutions. Signature IBAU Technologies are the cone silo, multi-compartment silos, ship unloaders and the design of cement carrying ships.

- **HAVER & BOECKER:**
  Carl Haver and his cousin Eduard Boecker founded the company in 1887. In the mid 20's the company began to build packing machines for cement. HAVER & BOECKER shaped the packing technology market when it introduced the world-renowned ROTO-PACKER® in the 1960's. At the end of the 1990's HAVER & BOECKER introduced the SEAL technology, capable of welding paper valve bags completely shut after the filling process. The latest innovation to the cement market is the ADAMS® technology, the first in the world capable of filling cement into plastic bags for better logistics and continuous production.

- **NEWTEC BAG PALLETIZING** (palletizing + loading): As the first international offspring of the original inventor of the palletizer, NEWTEC expanded their diverse line of palletizing systems to include automatic truck loading systems, railcar loading and fully flexible bag loading systems.

- **HAVER Automation**: Founded only last year, HAVER Automation intends to bring Industry 4.0 to the cement industry. HAVER Automation focuses on designing complete cement plant operating and logistics systems using the latest technologies such as cloud computing.

- **HAVER Engineering**: As a by-institute of the Mining University in Freiberg/Germany, HAVER Engineering Development focuses on the design of new working processes within the cement industry. Whether in the quarry or in the packaging plant, HAVER Engineering analyzes procedures and systems, provides basic and further training, and designs build-operate-transfer (BOT) models for interested customers.

HAVER Cement's strategic orientation is to combine all of these premium technology building blocks to tailor-made solutions for cement producers around the world. Wolfgang Bednarz, Head of HAVER Cement, explains his vision as follows: "We believe that concentrating the expertise of our technology brands, providing our knowledge of technology, industries and processes, and adding the complete project management package from just one single source will energize our customers to make higher quality cement at a reduced operating expense level. The cement plant of the future will set new global standards for the optimum production of cement in terms of quality, cleanliness and profitability."

Florian Festge, Managing Partner at HAVER & BOECKER, has a focused vision: "Our cement plant of the future is a highly efficient process, which will empower our customers to gain an even better image, higher customer satisfaction, increased market share and maximized profits. In history, time and time again, quality has always won over price. This holds true today more than ever. Premium technology may be more expensive at the outset. To compensate for this, we will offer all the required financing. However, in the long run a premium built cement plant focused on automating the latest technology will always win over cheap solutions in product quality, operational expenses and human satisfaction."

Florian Festge is determined: "We want to make a significant contribution to shaping and forming this industry that has been so very good to us and which we love. The cement plant of the future will do exactly that!"

www.haverboecker.com

PROCESSING TECHNOLOGY

HAVER & BOECKER

NIAGARA

"Tomorrow's quarry will minimize raw material costs by making a variety of products rather than just limestone. It will be more resourceful by transforming former waste into usable material."

Dr.-Ing. Metodi Zlatev, Head of the Sales & Project department

HAVER & BOECKER

NIAGARA

1. INCREASING PRODUCTION, REDUCING WASTE AND CUTTING COSTS IN THE QUARRY

1.1 Introduction

HAVER & BOECKER has made up its mind. The company located in Oelde/Germany wants to shape the future of the cement industry. Its objective is to begin designing the cement plant of the future.

First stop – Mineral Processing. The basis for quality and cost of the cement starts here. Process-engineering research in the cement industry has always aimed at

- Reducing energy consumption in cement production
- Optimizing quality and uniformity of produced cement, and
- Minimizing emissions from the cement-production process [1, 2]

The starting point for all these goals is naturally the starting point of the complete process. HAVER & BOECKER as well as its technology brand W.S. Tyler suggest redesigning the limestone quarry with a special focus on:

- Extending the range of sellable product by installing specialized technology in the immediate vicinity of the cement plant
- Improving the efficiency of material extraction from natural deposits

1.2 The cement plant of the future

makes more products while transforming waste into sellable goods. Limestone sedimentary rock is needed not only for cement production, but is also an important raw material in the building materials, agriculture, water management, steel, glass, fertilizers and paper industries. Stone products are currently produced at and shipped from self-contained facilities (e.g. pre-crushing and gravel plants) in the vicinity of the natural deposits [3]. The concept of additionally using the cement plants' material deposits more intensively is therefore an obvious step in improving the efficiency of natural deposit exploitation. The cement plant of the future focuses on making use of existing overcapacities in the cement plants' material deposits, and transforming frequently encountered deposit types which are not suitable for cement production to sellable products by removing impurities. In both cases after the primary and/or secondary crushing stages, a portion of the mineral can be used for producing various stone products such as crushed stone and/or gravel (see Figure 1, Cluster I).

1.2.1 Adding to the product line – mortars

Even today, most cement producers outside of Europe are not seizing the opportunity of adding mortars to their cement product line. Mortars are relatively simple to make and achieve a significantly higher price per ton compared to pure cement. The cement plant of the future is equipped to optimally process limestone for the correct mortar additives. Limestone grit, e.g. of the 0.1/1.2 mm fractions, is an optimum raw material for further processing into typical fine-sand fractions that are needed for the production of blended cement or of rendering and dry mortar. Downstream from the raw-meal mill the limestone grit is sifted (removal of the ultrafine particulates fraction <0.09 mm from the material flow) in a classifier and then is fed to the mechanical fines screens for separation into fractions. Fractions of d < 2 mm can be used as

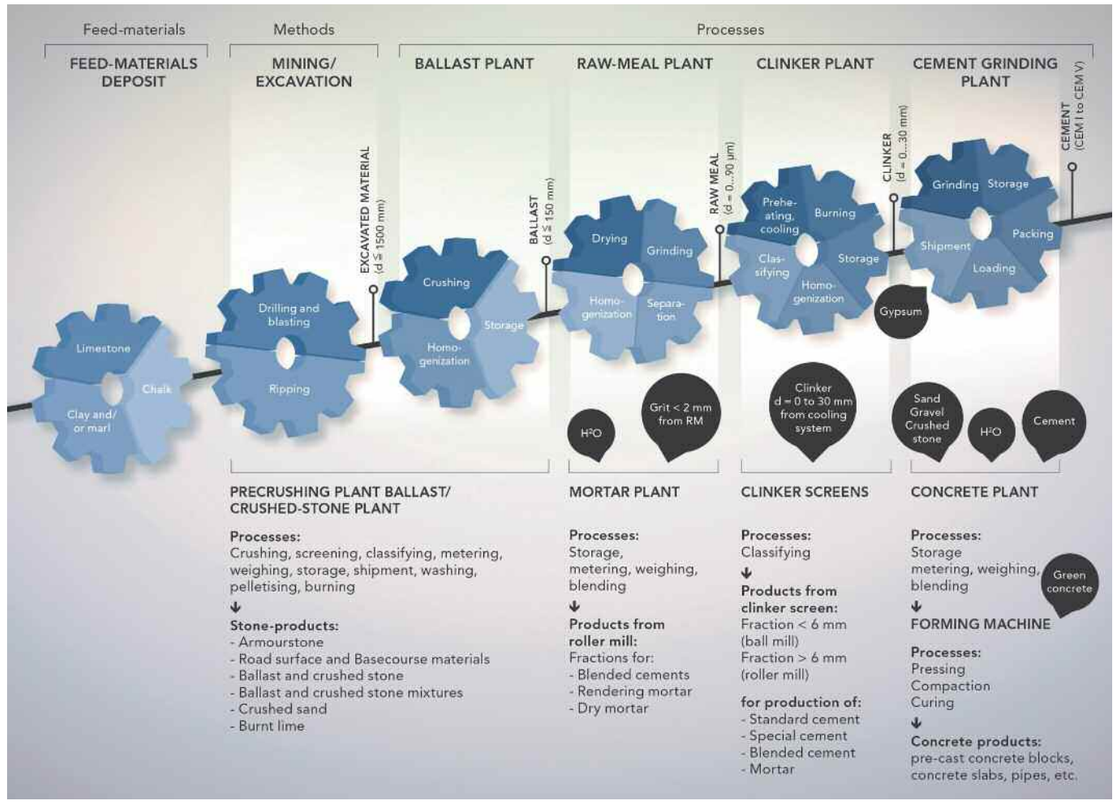


Figure 1

dry mortar, cement additives, and for flue-gas desulphurization. It has become apparent in practical application that the use of the Fine-Line Screening Technology (pic 1) makes it possible to produce limestone grit for dry mortar production at high throughput rates and with precise cut sizes (also see Figure 1, Cluster II).

Pic 1

1.2.2 Adding to the product line – burnt-lime production

An additional application for limestone is the production of burnt lime. Burnt lime (CaO) is a powder produced by burning limestone at approx. 800 °C. Burnt lime reacts with heat to form slaked lime ($Ca(OH)_2$) when water is added. Burnt and slaked lime are used by a broad range of industries. For example it is used as an additive for the production of mortar in the construction industry, as agricultural lime in the fertilizer industry, and for desulphurization of "hot metal" (unrefined iron from the blast furnace) in the steel industry. Slaked lime can also be used as an alternative to limestone in fluegas desulphurization in power-generating plants [1, 2, 3]. The cement quarry of the future will be outfitted with the required technology to produce burnt lime when and where feasible in order to increase revenues, which will offset the cement production costs.

1.2.3 Transforming waste into sellable products by removing impurities

How can we turn waste into sellable product? The cement quarry of the future answers the question. It utilizes the Hydro-Clean Technology. The Hydro Clean was designed to wash minerals using high pressure (pic 2). This combines the highest cleaning power possible with the lowest possible water consumption. The


Pic 2

start-up of a low-wear, energy-efficient and resource-conserving high pressure washing facility for the supply of high-quality limestone fractions for further processing using the Hydro-Clean Technology. The high pressure washer was used for cleaning of the heavily fouled deposit material and achieved extremely good cleaning results with a water consumption of only 1.5 m³ per metric ton. It is then removed from the washing chamber via a frequency-controlled extraction belt. The material's exposure period can be modified to match the bonding (e.g. bond form, bond type and bond strength) between the contaminant and the product itself by altering the speed of the extraction belt. This makes it possible to react flexibly to fluctuations in deposit material, and thus ensuring constant uniform cleaning for prolonged periods of operation. A wet screen for production of the 0/5, 5/30 and 30/70 fractions was also used in the material preparation plant, in addition to the installed high pressure washing system. After washing the coarser 30/70 fraction is routed to the burnt-lime kiln while the finer fractions (0/5 and 5/30) are used for producing dry mortar. The resulting washing water is then cleaned by a water-treatment plant and again fed back into the washing process. Loam yielded in this process is routed as a corrective to a clinker production plant.

1.3 The cement plant of the future reduces costs

1.3.1 Saving costs using a Niagara pre-crushing plant

Most limestone quarries world-wide use a grizzly scalping screen. Some do not pre-treat the material prior to entering the primary crusher at all. This results in the unnecessary processing of materials, creates bottle necks within the crusher and jeopardizes the product quality for the subsequent processing steps. Using the Niagara Scalping System, ROM material can be pre-sized prior to entering the crusher, creating a final product at the very first step of the process. The Niagara Scalper utilizes an eccentric shaft supported by a total of four bearings. This technology guarantees a continuous vibration under all operating circumstances. This keeps the screen surface openings clean and guarantees full removal of all fines, which in return allows for reduced crusher wear and an increased overall system performance. Common grizzly screens offer neither of these advantages. The scope of supply includes not only the Niagara Scalping Screen System and armourstone plant, but also all conveying equipment, temporary-storage and dust silos, structural planning and complete installation. An example of flexible

Pic 3

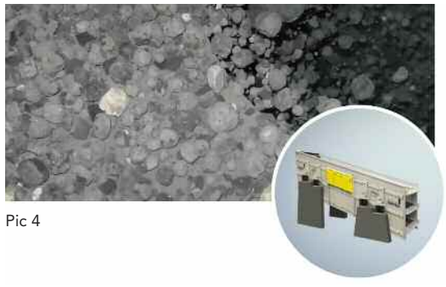
production is provided by the armourstone facility, on which the 4 to 40 kg and 10 to 60 kg weight classes can be produced separately or simultaneously as needed by means of two "Niagara" type heavy-duty mechanical screens. Due to optimal project planning, implementation time for the complete plant from start to commissioning was only some twelve months. The cement plant of the future includes the Niagara Scalping System-based pre-crushing plant (pic 3) to optimize product quality and operating costs.

1.3.2 Saving costs by screening clinker downstream

A further example on the road to the cement plant of the future is the downstream screening of clinker with separate grinding project. The starting point for these ideas was the generation of clinker fines as a result of the rapid cooling setting properties of the cement. The cooled clinker is then routed via conveying systems to the clinker storage facility. The cooling and conveying process resulting from the system causes a clinker fines fraction < 5 mm of up to 30 %.

1.3.3 Saving costs grinding clinker

Ball mills have proven their capabilities for clinker grinding for many years. Single-stage grinding using vertical and horizontal mills and high pressure roller mills has also become popular in recent years. These mills are suitable for the production of standard grades of cement. In granulometric terms, special grades can still be produced to a higher quality by using ball mills. For this and for a number of other market-specific reasons, the cement plant of the future will still contain both alternatives and possible even combination of these mill types. Both ball and vertical roller mills will continue to be state-of-the-art for clinker grinding in upcoming years. Based on an energy analysis, it would therefore appear rational to comminute various clinker fractions in separate grinding machines. The future cement plant will divide clinker into a coarse and a fine fraction by means of classification using a Niagara mechanical screen (pic 4). To obtain energy benefits, the coarse fraction is routed to a roller mill for further grinding, and the fine fraction to a ball mill. Thereby achieving an overall increase in specific


Pic 4

throughput rate with a simultaneous improvement in the energy-efficiency of the grinding process. The energy savings attained via separate grinding can be as much as 10 %. Further advantages include quieter operation and low wear to the vertical roller mill. For the cement plant this innovative solution allows the highly flexible adaptation to the future demands for standard, special, and blended cement products as well as for dry mortar.

1.4 Conclusion

The cement plant of the future starts in the quarry. The cement quarry of the future will increase the variety of products than ever before, turning waste into sellable product and it will be more cost-effective than ever before. The slogan is "let us make more with less". More intensive networking between cement and concrete production and further processing systems could also be advantageous (see Figure 1, Cluster I and Cluster IV). Locating concrete production and processing in the vicinity of a cement plant could reduce storage and transportation costs and increase the diversity of products available for regional sales. Let the future begin.

STORAGE TECHNOLOGY

IBAU HAMBURG

"Tomorrow's silo will not only ensure consistent product flow, but will evolve into a work of art offering new functions aside from just storing material."

Mario Raemmele, Sales Director

2. IBAU'S SILO OF TOMORROW - GENERATING THE PERFECT FLOW, EVOLVING INTO A WORK OF ART AND PROVIDING NEW FUNCTIONS

Some 40 years ago, the IBAU Central cone silo revolutionized the design of the silo. Forty years is a long time in the assessment of IBAU HAMBURG, an EPC Engineering house located in Hamburg and owned 100% by HAVER & BOECKER. Convinced it is time to "play it again, Sam", 'IBAU has decided to evolutionize the silo. This article provides insights into what the cement producer's demand is today and how silo technology can significantly contribute to their success.

2.1 Introduction

In the mid 70s, the existing silo solutions for large capacity silos with a diameter of more than 10 m used the same process of aerating the entire silo floor in order to generate flow. The pneumatic discharge equipment of the time was not capable of completely emptying such silos. As a result, the material in the center provided core flow, but the material close to silo walls simply stuck. The results were poor silo flows and reclaim rates paired with high power consumptions for the compressed air.

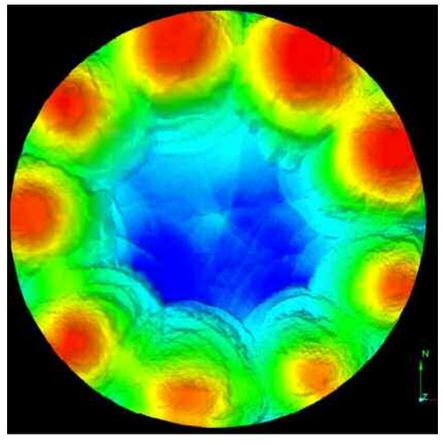
With the introduction of the IBAU Central cone silo (pic 5) the situation completely changed and improved. There are more than 10,000 of these silos in operation by various customers around the world.

The IBAU Cone silo was a revolution. Now the company wants to do it again. This time IBAU HAMBURG will not be revolutionizing, but evolutionizing Silo Technology. IBAU is dreaming big and setting the course for the future:

"Tomorrow's silo will ensure perfect flow, evolve into a work of art and offer new functions aside from just storing cement."

2.2 Ensuring Perfect Flow

In tomorrow's silo the central cone will continue to be the key in creating the perfect flow. The cone provides a material displacement function, allowing an optimal flow profile in the silo and forms a ring space on the silo bottom. The ring space is divided into individual aeration sections and the material transport distance from the silo walls to the discharge openings is significantly reduced. Furthermore the central cone has advantages for the silo construction and allows various multi-compartment concepts. The discharge equipment (pic 6) as well as packers and other equipment can be located under the central cone, depending on the silo diameter, so that the silo space is fully used.



Picture 7 shows a controlled material discharge in an IBAU Central cone silo with 30 m diameter, measured by 3D-laser scanning technology. The technology not only illustrates how a mass flow in a silo can be achieved, it also demonstrates how uniform the flow from the different discharge sections is. The company is using such measures to optimize its silo technology and to incorporate the knowledge in its "Safety First"-silo concepts /1/.

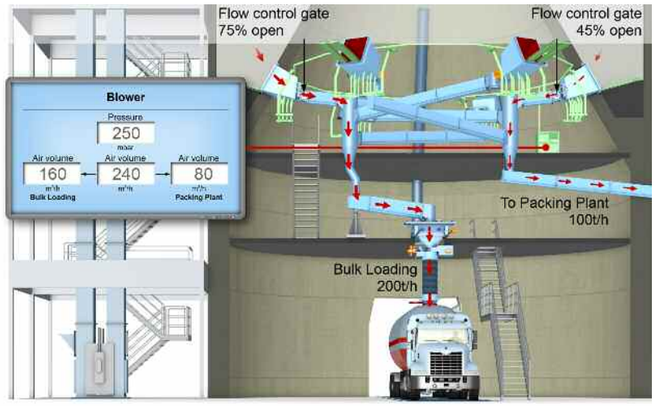
Today, materials handling and storage systems use significantly improved efficient pneumatic and mechanical materials handling equipment compared to forty years ago when the cone silo was invented. An example of a combined pneumatic-mechanical type of equipment is the IBAU Screw pump (pic 8). These pumps are used to feed bulk material into pneumatic conveying lines, pulsation-free and with a variable material feed between 0 and 100%. Two features distinguish this pump: easy and quiet running, even under no-load conditions and the easy removal and refitting of the screw without disturbing the bearing seats. IBAU HAMBURG has equipped more cement silos with extraction systems than any other supplier and has always set the standards for this technology.

Generating perfect flow in a silo for the future will however no longer be restricted to the flow of the product, but will encompass the flow of the complete system including the energy it requires to operate. Focusing solely on the mechanical parameters of the extraction components is no longer enough. A time in which we use nature to generate our power and drive around in hybrid and electric automobiles also calls for the setting of a new standard when it comes to silo design. The Silo of Tomorrow will make the complete extraction process highly efficient. It will meet today's requirements of cement producers in minimizing the

Pic 5

Pic 6

Pic 8



Pic 9

energy requirements. In order to accomplish this, IBAU designed the ground-breaking Gdischarge system. The idea behind the Gdischarge is to optimize the energy requirement for large cement silos with an advanced discharge control system focused on minimizing energy consumption. Using specially designed blower and compressor technology, the consequent limitation of the differential pressure for the silo bottom aeration significantly reduces the power required for the generation of the compressed air.

Using Gdischarge, it is no longer necessary to use screw or rotary lobe compressors for the silo extraction system. Instead, positive displacement roots blowers are able to achieve the required overpressure much more economically. No compromises have been made to the IBAU Central cone technology which is characterized by a number of separate discharge outlets. All system components such as fans and metering devices are designed for maximum discharge capacity and optimized by the Gdischarge system for the required discharge situation. This means that during operation the air volume flow of the blower is automatically adjusted via a controller. Alternative discharge requirements for downstream conveying to varying numbers of trucks, railcars, mixer and packing plants can be integrated in the control procedure.

Picture 9 illustrates how the aeration air can be adjusted in silo systems with several downstream loading and transport facilities. A frequency converter for the blower and a pressure sensor at the blower form a control unit, which is linked to an intelligent controller (BB). This controller regulates the opening and closing of the flow-control gates for the silo discharge to achieve the necessary discharge rate and adjusts the motor speed of the blower depending on the back pressure in the flow line. Target and actual pressure in the flow line regulate the air quantity of the blower. The blowers being used allow a very wide control range from 25% to 100%. It goes without saying that these blowers are robust and durable, very easy to service and maintain and provide complete oil-free aeration air.

In the last couple of years large-scale tests have been made at the silo plants of several clients to identify how the new system compares with existing silo extraction systems. The results were better than expected and the savings increase with the discharge rate. Up to 25% of the energy consumption can be reduced, which results in amortization rates of 3-5 years for the new equipment. Another aspect is the reduced wear within the system due to a reduction in the air quantities and velocities, which results in a reduction of the maintenance costs of the system. Furthermore, the filter loads are also reduced. Another positive effect is that faster loading operations for trucks and railcars can be achieved due to less aeration air in the cement.

Last but not least a very positive effect is achieved on the formation of flow funnels in the silo. Because of the reduced silo aeration pressure and aeration air quantities, the flow funnels in the silo are smaller in diameter and the core funnels do not touch the silo walls so that the horizontal pressures on the silo walls are more homogenous within the silo and peak loads are reduced.

Pic 10

2.3 Evolving into a Work of Art

"Our customers, especially the privately held companies, are often owned, chaired or managed by very forward-looking people. They do not just want to make cement, but change the course of the world", finds Reiner Meyer, managing director of IBAU HAMBURG. If cement producers want to brand their image by conveying their message to their markets, customers, employees and their local regions, what bill board is better suited for that task than their very own silo? It is big, tall and stands out as a land mark. It can be formed and it can be shaped according to the desires of the big dreamers. Cement producing pioneers are doing exactly that. They are using their silos to express themselves, their goals and their way of thinking. As a result, they are turning formerly dull and unexciting silo structures into works of art. See Picture 10 as an example.

2.4 Providing New Functions

The silo of Tomorrow will also offer new functions, unthought-of forty years ago. Take the CEMENTA Silo in Sweden, shown in Picture 11. Believe it or not, but at the top of the silo, the customer used the space to create a large conference space. Considered the highest board room in Malmö, it not only offers the features of a meeting room, but also offers an unprecedented view. Making works of art and placing a conference room at the top of a silo may not be everyone's cup of tea, but one thing all cement producers are facing is the constant threat of margin loss due to over capacity. The modern cement producer is looking for new business options, when the markets for standard cements signal a decline.

Such options can include the production of special cements and dry mortars. There are hardly any limits to the properties and applications of

Pic 11

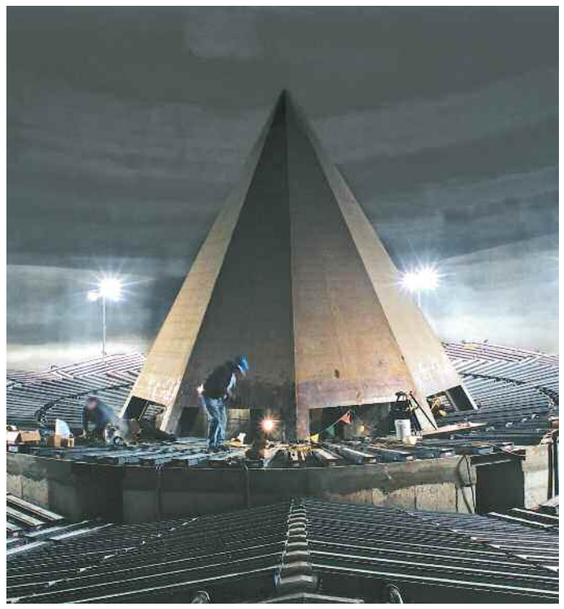
mineral factory-mixed mortars. Weather protection, heat protection, noise protection, fire protection, leveling and finishing of floors, interior climate, living comfort and the aesthetics of the building are all crucially affected by the contents of the mortar. A new trend is eco-friendly dry mortars. Accordingly the market for these products is now growing especially in emerging markets in the Far East, Middle East and Latin America.

Premixed dry mortar plants comprise sand preparation, storage and feeding equipment, material metering, weighing and mixing systems and dispatch facilities, which usually include a packing plant. There are concepts for tower mixing plants and in-line mixing plants. Tower mixing plants (pic 12), which are characterized by a vertical plant configuration and favorable material flow have been used by IBAU HAMBURG for some years in premix dry mortar plants as well as blended cement plants and there are a large number of existing IBAU reference sites in these two industries. Depending on the annual throughput of such plants either multicell concrete storage silos or steel storage silos are used. For the premix dry mortar industry the steel design is more usual.

Pic 12

All of this means that the silo of tomorrow will be equipped with more functions than just the storage of cement. They will be designed to store, convey and mix cement, sand, adhesives and other products. Building new plants is not always necessary. Proven added value is possible from the inspection and optimization of existing plants and equipment to eliminate bottlenecks such as blocked silo volumes and to improve the capacity utilization of the plants (pic 13).

For such retrofits, modernizations and conversions and for spare parts services the use of high quality components almost always pays off. Paying specific attention to small, but critical components such as flow-control gates, mobile loaders and loading chutes makes the big difference. The IBAU Mobile loader (pic 14) has become synonymous with reliable, quick and dust-free bulk loading of road and rail tankers. The IBAU Flow-control gate has become a standard silo discharge device, due to its reliability and innovative design. The basic type is available with different actuators to allow an accurate material flow.



Pic 13

Pic 14

2.5 Outlook

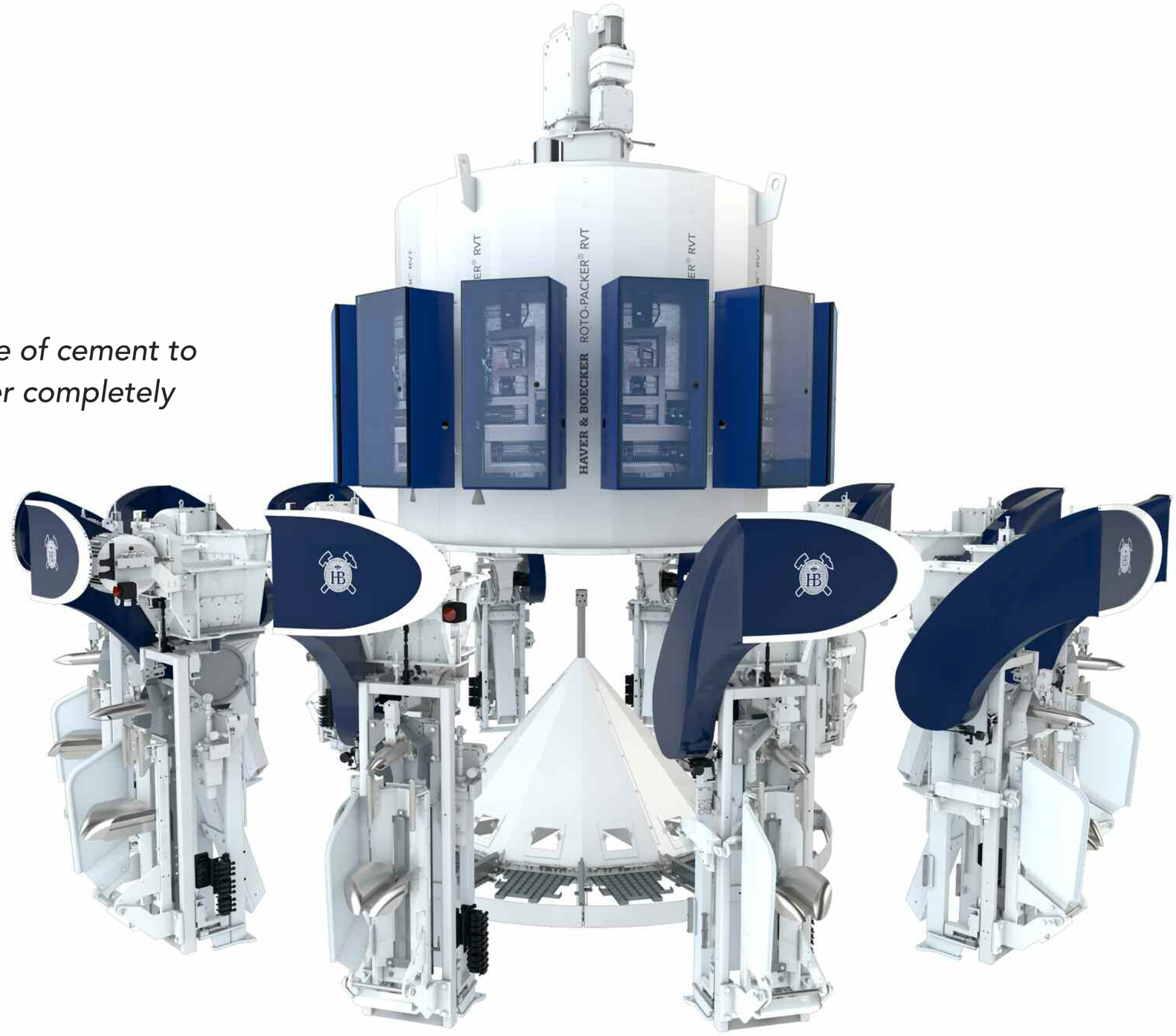
The last few years may not have been the easiest era in the cement business. Declining prices due to over capacity have made us realize that we must adapt our business to new times. However, if we view the challenges we are facing as an opportunity, we can use the current situation to change the world. If we use modern technology paired with a different outlook on our industry, we can make cement cleaner and more efficient than ever before. We will no longer have to flee into rural areas to make our cement, but can produce cement for people amongst people. Doing that, will transform the image of cement from a dirty, polluting and energy inefficient consumable to a clean and efficient building block of society. IBAU's Silo of Tomorrow will significantly contribute to this goal be ensuring that material, processes and energy will flow perfectly. IBAU's Silo of Tomorrow will be designed in an artful manner so that it will blend into its environment. Finally, IBAU's Silo of Tomorrow will provide new functions to make a broader range of cement-based products, thus reducing the costs to make cement. The future of cement will be bright, if we make it bright.

PACKING TECHNOLOGY

HAVER & BOECKER

“Tomorrow’s packer will elevate the image of cement to more than just a consumable. It will deliver completely clean and precisely weighed cement that is storable in any weather.”

Frank Ormeloh, Sales Manager



HAVER & BOECKER
CEMENT

3. HAVER & BOECKER'S PACKER OF TOMORROW WILL ELEVATE THE IMAGE OF CEMENT TO BEING MORE THAN JUST A CONSUMABLE.

As a cement producer what if there was a way for you to energize your brand power, upgrade your product display, increase your sales, and conquer market share while reducing operating expenses and driving up profits at the same time? Sounds like a bad late-night TV commercial? HAVER & BOECKER is convinced that all it takes for cement producers to get there is to take a new look at their most underestimated ally in the pursuit of success – the cement bag.

"Upcyling Deluxe is a company in Berlin focused on using recycled products and turning them into luxury articles. Customers visiting their websites can purchase wallets, cell phone covers, bags and backpacks made out of old and used cement bags. If they see value of the world's most used packaging, then for sure we should too", says Bernhard Pagenkemper, Chief Sales Officer of HAVER & BOECKER.

HAVER & BOECKER's goal sounds simple: The company aims to elevate the image of cement to more than just a consumable. This goal is fueled by the realization that the world is offering an abundant over-capacity for cement. As a result, prices in the industry are declining and cement producers are experiencing increased cost pressure. While in the past the main objective for cement producers, especially outside of Europe, was to maximize production, the future trend will be diversification and process optimization. "A way in which we can achieve both objectives – allowing our customers to be different while at the same time helping them optimize their process flow – is to focus on the cement bag and the way we fill it", asserts Pagenkemper.

In order to diversify the product and reduce the expense at which it is produced, the packer of tomorrow must fill the product in a completely clean manner, weigh it precisely, seal it and, if possible, deliver it in a way so that it may be stored outside in any weather. The technologies that will change the cement industry are the ROTO-LOCK, SEAL, ADAMS® and the RADIMAT®.

3.1 ROTO-LOCKing around the World

There are two perspectives when looking at the cleanliness of the filling process. On the one hand a dirty work environment is a threat to the health, safety and motivation of the operators. Anyone who has ever worked in the packaging process of a cement plant knows most buildings are very dim and extremely dusty. Placing bags on a rotating packer by hand is a challenge in itself in terms of keeping up with the machine. And no one requires the additional burden of standing ankle-deep in product spillage while wearing a dust mask.

A second perspective is the fact that all the spillage and dust that gets blown into the air does not end up in the bag. The product for which cement producers have spent a considerable amount of money, time and energy in the making is wasted. How can you improve the working environment significantly, while at the same time avoid wasting your very own product?

One primary source of spillage in high-performance rotating packing systems have always been the sliding plates, which link the impeller box and filling spout. Even when maintained regularly, sliding plates are a heavy wear item. As a result cement makes its way in between the plates, thus creating a passage for the cement to blow through during the filling process. Resetting the plates is a tedious process, which most operators and maintenance teams do not have time to do.

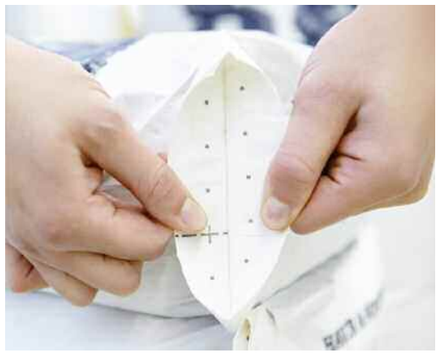
Pic 15

HAVER & BOECKER have developed a new solution for this very critical interface in every packer. ROTO-LOCK is the world's only dosing unit (pic 15) that replaces the traditional sliding plates with a rotating flow gate. It is a completely contained system. As a result it not only minimizes but eliminates spillage during the dosing process. Unlike the sliding plates, it requires no maintenance during the production process. The system is designed to ensure that the product ends up in the bag. The resulting cleanliness creates a new standard for the cement filling process. "We could not believe how clean the system works when we saw the first installation. We had high hopes, yet we did not expect such positive results. The filling process has now taken on new dimensions. After seeing the success of the first units, we immediately redesigned ROTO-LOCK in a manner that it could be retrofitted to existing packaging machines. The only thing that will suffer with this new system is our spare parts sales", says Wolfgang Bednarz, Manager of the Business Unit Cement at HAVER & BOECKER.

3.2 Signed, SEALed, Delivered

While the ROTO-LOCK system significantly improves the dosing process, it alone cannot prevent spillage of cement from the unclosed bag valve. The traditional paper-valve bag was designed in 1926. Back then it was a revolution compared to the traditional jute bags, from which cement virtually poured out as soon as you lifted them. However, the natural tolerances in a paper valve when pressed against the bag construction after the filling process simply do not meet the cleanliness expectations of customers today.

Seen from the perspective of the end-user, the cement bag is the cement producer's business card. The way in which the cement bag presents itself not only reflects on the quality of the product in it, but also on the company that made, filled and sold it. The quality of the package radiates the cement producer's image to its market, customer, competitors, and even its very own employees. More and more cement producers are paying special attention to ensure that their packages are compact, clean and looking sharp.



Pic 16

Pic 17

In response to this market trend, HAVER & BOECKER has developed the SEAL technology. The system was designed with the goal of creating a new standard when it comes to traditional valve bag filling technology. SEAL Technology eliminates spillage by inflating a rubber sleeve lining in a specially designed filling spout during the filling process. After filling, the bag is carefully pulled off the spout and the specially designed paper valve (pic 16) is welded shut by an ultrasound sealing device (pic 17).

The result is an absolutely compact and clean bag, which will make the product stand out in any form of presentation. More importantly, the SEAL Technology prevents spillage during transport (pic 18). It also eliminates any kind of contamination or criminally motivated product extraction (pic 19) during the complete logistical process. This allows the cement producer to increase his weight accuracy exponentially without having to overfill the bag. The resulting additional product profit to the cement producing operation is significant. While in the past he gave a lot of cement to the customer free of charge, he now sells close to 100% of the product for which he invested considerable effort into making. Most producers recoup their investment in the SEAL Technology within less than twelve months. Similar to the ROTO-LOCK, SEAL Technology can be retrofitted to all HAVER & BOECKER ROTO-PACKER® sold since the year 2000.

"You would think that European cement producers would be jumping at the opportunity to make their operations stand out from the rest of the world. Much to our amazement the interest, inquiries, and installations of SEAL technology are being driven by developing countries. The cleanest cement packaging facility in the world will not be in Germany, Japan or the U.S.A., but rather in Pakistan, where we will be delivering 6 complete SEAL lines performing their duty at 3.000 bags per hour," says Frank Ormeloh, Sales Manager of the Business Unit Cement.

3.3 ADAMS & Eve

Since the beginning of cement production, we have been taught that water and cement do not go together until they are ready to be mixed and used. As a result, cement producers

Pic 18

Pic 19

have always invested very heavily in protecting their paper valve bags from water. Large buildings are required to store both empty as well as filled paper valve bags. Significant efforts and costs are required to cover trucks, railroad cars and ship decks during the transportation of paper valve bags.

What if there was a way to package cement into a completely water-tight packaging? Well, there is today. HAVER & BOECKER developed the ADAMS® technology in order to allow cement producers to fill cement into FFS bags made out of PE. Chemicals have been filled into PE using FFS technology since the 1970s. Traditionally, FFS technology could only be used when filling granular product. Filling powder into plastic was always impossible. The reason was air. Air is required to move and transport cement into the bag. However, that air is unwanted in the bag once it is filled. While the paper bag has natural pores that allow air to escape from the bag, not only during but also after the filling process, plastic does not. Motivated to break this technological paradigm, HAVER & BOECKER created the ADAMS®, a hybrid concept that combines the traditional valve-bag filling process with the FFS technology. Specially designed tubular-style bags are dispensed into the machine coming off a roll. The machine cuts, welds and forms the bag prior to delivering it to the filling spout. The traditional impeller technology fills the plastic bag while a combination of a vibrating rod and vacuum technology extracts the air out of the bag prior to welding it shut. The result is a completely sealed bag that can be transported and palletized without any instability. Neither the empty bags nor the filled bags require protection from the elements. As a result buildings for storage are no longer needed because bags can be stored at the production site, at the distributor as well as on the construction site. The same advantages as the SEAL technology apply when

Pic 20

looking at spillage. As the bag is cleanly filled (pic 20), none of the material is going to waste. This means ideal weight accuracy, and the product cannot be contaminated or retrieved from the bag during the logistical process. For the cement producers this means constant improvement to the bottom line.

"If SEAL is the moon, ADAMS® is Mars. We realize that not every cement producer is willing to make the change from paper to plastic today, but as customers come to realize that spending a bit more on the bags will generate a major profit, the trend will no doubt pick up. And for the customers who have made the switch, they will never go back. The package is simply clean, waterproof and very profitable (pic 21)", says Sebastian Südhoff, ADAMS® product manager at HAVER & BOECKER.

Pic 21

The ROTO-LOCK, SEAL Technology and the ADAMS® concept will no doubt change the world with regards to packaging cement around the globe. However, regardless of which technology the customers wishes to deploy, the packer of tomorrow will have one thing in common: It will be intelligent. It will improve on its own settings during operation. It will learn from its own experiences and cut energy and air consumption. More importantly the packer of tomorrow will communicate intuitively with its operators and surroundings. Mode-lighting will signal its users whether the machine is running fine, requires attention, or is being serviced (pic 22a_b_c). Using data streaming services, the packer of tomorrow will send vital information to the user's cell phone (pic 23), tablet or computer. It will tell its owner what it requires in order to increase performance. HAVER & BOECKER is dedicated to the dream of an intelligent machine and claims the packer of tomorrow is already here. "After all, Washington Samuel Tyler best captured our philosophy when he said: "Our products are not an end in themselves, but a tool by which our customers can create something useful and profitable." We are committed to these words and we will ensure that our industry does not stand still. Our packers will do their part in elevating the image of the world's most sold building product and that of the cement industry, which we love so much," concludes Bernhard Pagenkemper.

Pic 22

Pic 23

3.4 RADIMAT®

Have you ever attempted to place 2400 bags per hours on a rotating high-performance ROTO-PACKER®. After considerable practice you may actually succeed in doing so for a brief period of time, but it is nearly impossible to uphold that kind of performance for a complete shift of 8 hours. In fact, HAVER & BOECKER conducted a study. They implemented a special software into 3 ROTO-PACKER® lines, which were operated manually. This software calculated the ratio between actual bags placed and bag placing opportunities. The average bag placing rate as calculated over an 8 hour shift was only 69%. For a cement plant operating 3 ROTO-PACKER® lines on a 24 hour shift, this means it will have lost 53,568 bags of cement production for the day. If the bag weighs 50 kg that equates to 2,678 tons of lost production

Pic 24

that same day. Multiply that figure by approx. US$100 / ton, this means that the plant will have lost $ 267,800 in sales for that specific day! How do you solve a problem as vital as this? The answer is simple, you automate the bag placing process by installing a RADIMAT® (pic 24). Bundles of empty bags are placed into empty-bag-magazine by hand. These bundles are conveyed into the machine. The RADIMAT® lifts each bag individually using air. This opens the valve opening. As the spout of the ROTO-PACKER® approaches, a small high speed conveyor belt presses the bag body against rubber rolls. This momentum shoots the bag out of the machine onto the spout. The RADIMAT® can do this up to a speed of 5,500 bags per hour. "The RADIMAT® has been around for decades, but in the past it was only used in high-wage countries as many cement producers in developing countries found it was more cost effective to use manual labor. Today, however, many customers recognize that the cost of lost opportunities in not placing bags is significantly higher than the cost of automation. As a result, the Cement Plant of tomorrow regardless of where in the world it is located, will always use a RADIMAT® to securely place bags with an average accuracy rate of 99,5%", says Bernhard Stövesand, the technology manager of the Business Unit Cement at HAVER & BOECKER.

Overall

Global Sales Director Bernhard Pagenkemper states the aim: "As Darwin once said, 'not the strongest species will survive, not even the most intelligent, but the species most capable of adapting to change'. Our industry is changing. While cement used to be a rare product in many parts of the world, today we have excess capacities. The game is changing for our clients. The question is no longer how much cement they can produce, but instead how efficiently can it be made. The core business of our customers is to make, sell and market high-quality cement. Our job is to provide whatever tool they require to do so. We are driven by the idea to reach every coordinate in the customer's universe. Regardless of whether he simply requires a machine, or whether he requires expertise, project management, operational support or if he wants to go to the extent of asking us to operate his equipment for him – we shall be there."

Literature:

[1] ZKG-Handbuch Zementanlagenbau 2013/2014 – Leitfaden für Einsteiger in die Zementindustrie. Bauverlag BV GmbH, Gütersloh, 2013
[2] Verfahrenstechnik der Zementherstellung. VDZ-Tätigkeitsbericht 2005–2007
[3] Zementrohstoffe in Deutschland – Geologie, Massenbilanz, Fallbeispiele. Bundesverband der Deutschen Zementindustrie.V.; Verein Deutscher Zementwerke e.V. – Düsseldorf: Verlag Bau + Technik, 2002
[4] Buschmann, H.: "Safety first" for Large Silos in the Cement Industry. Cement International, 2/2008, pp. 66-75.
[5] Bostelmann, J.: Inland Terminal Paris. ICR, May 2015
[6] Hepberger, M., et all: Conversion of a Cement Silo to a 5 Compartment Silo. Cement International, 5/2011, pp. 62-69.

(This article is coming soon.)

PALLETIZING AND LOADING TECHNOLOGIES

Made by
NEWTEC BAG PALLETIZING

"Tomorrow's palletizers and loading systems will enhance the delivery of the package by treating both the bag and the operator with more care than ever before."

Jean Uragano, Sales Director

(This article is coming soon.)

SHIPPING TECHNOLOGY

IBAU HAMBURG

“Tomorrow’s shipping technology will have to warrant an optimal loading and unloading design in relation to the maximum cargo hold capacity.”

Ingo Urbach, Sales Manager

(This article is coming soon.)

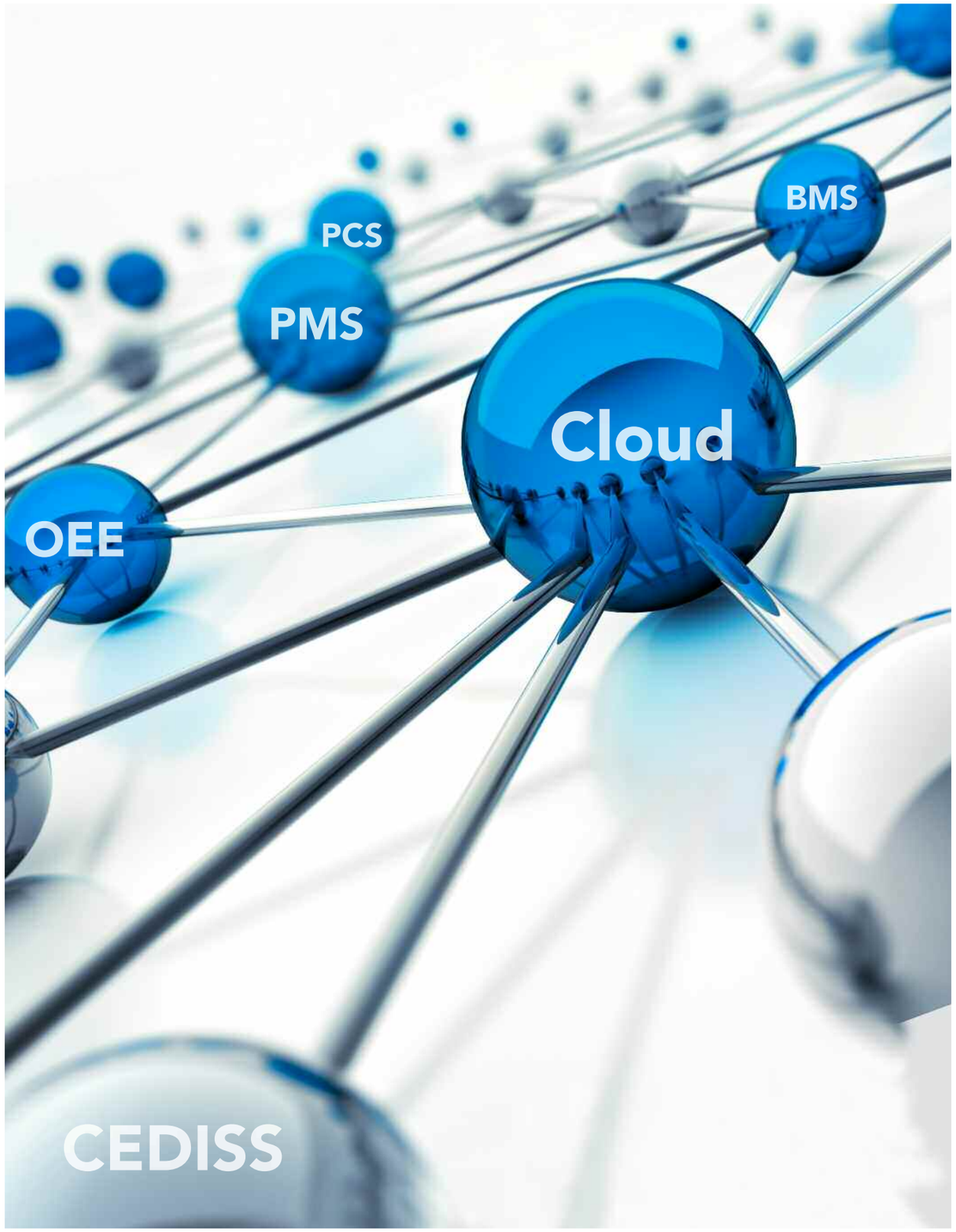
AUTOMATION AND ENGINEERING TECHNOLOGIES

HAVER & BOECKER

AUTOMATION

"The Cement Plant of Tomorrow will allow complete control over product and process. It will be easy to operate. Data will be communicated intuitively. With this power in hand we will be able to minimize energy consumption and reduce our plants' impact on the environment."

Rainer Schulze Frielinghaus, Head of the Sales



(This article is coming soon.)

SERVICE WORLDWIDE

„Tomorrow´s service will no longer focus on the machine alone, but instead pursue the interest of its owner, operator and maintenance team. It will be proactive, diligent and adaptable to any circumstance. It will offer complete transparency at all times and at any location in regards to the processes' condition, its performance and optimization potential."

Engelbert Köß, Head of HAVER Service

COMMISSIONING YOUR FLOW

We understand your desire to get your new or upgraded equipment up and running quickly and smoothly. We also understand that safety is your highest priority. Therefore, we are focused on modernizing your production lines as safely as possible within the set time frames you wish to achieve. You determine the degree of services you wish us to provide. You determine the degree of services you wish us to provide. These services can include:

- Turn-Key Installation and/or Supervision and Review
- Mechanical Installation and/or Supervision and Review
- Electrical Installation and/or Supervision and Review
- Construction Site Management
- Safety Audits & Checks
- Commissioning
- Start-Up Support
- Calibration Services

ASSISTING YOUR FLOW

We understand that unplanned interruptions in your flow cause you major headaches. In case of an emergency, quick and accurate help is critical in order to avoid upsetting your customers.
Therefore, we offer you the following line of assistance services,
designed with your sense of urgency in mind:

- Specially designed Service Pad, allowing you to contact us via Skype for immediate analysis and response
- Remote-Service Packages
- Emergency onsite visits
- Equipment Rental Solutions
- Hotline 24/7
  HAVER & BOECKER-Service-Hotline +49 (0) 2522 30-371

SUPPORTING YOUR FLOW

We understand how valuable your process is to you. The total cost of ownership is key to your competitiveness. A smooth, constant and continuously improving flow is vital to your success. Our Support Specialists are motivated to design the best possible flow for your organization together with you. By analyzing the complete process and jointly working on solutions to eliminate bottle necks, we will partner with you to maximize efficiency and effectiveness of your system. Our support team is also specialized on training your team in the training room as well as in the field. Our services are truly unlimited.
Some examples include:

- POP – Plant Optimizations Programs
- Machine Conversions and Upgrades
- Preventative Maintenance Programs
- Spare Parts Management Strategies
- Energy Management Programs
- Safety Enhancement Programs
- Plant Management Strategies
- Operator Certifications
- Fault Statistic Analysis
- Shift Reporting
- Vibration Analysis

ORIGINAL SPARE PARTS

We understand that spare parts are always a very important topic to you as they are usually associated with costs and logistical challenges. The temptation to save on parts by purchasing low-priced components or simply avoiding necessary exchanges often exists.
However, the costs and frustrations of an unplanned interruption in your process due to a failed part are always
exponentially higher than the investment into original spare parts.
HAVER Originals are specially designed and quality tested with your reliability and safety in mind. In order to make your procurement experience as pleasant as possible we have
designed the following spare parts services:

- Onsite Spare Parts Consultation Services
- Strategically located parts distribution centers
- Spare Parts Identification and Documentation Services
- In-Time Spare Parts Update Services
- Installation Tool Kits
- HAVER WebShop

EVOLVING INTO A WORK OF ART

IBAU HAMBURG

"Our customers, especially the privately held companies, are often owned, chaired or managed by very forward-looking people. They do not just want to make cement, but change the course of the world"

Reiner Meyer, Managing Director of IBAU Hamburg

PROJECT DESCRIPTION

Customer: SEMAPA / CIMENTS CALCIA

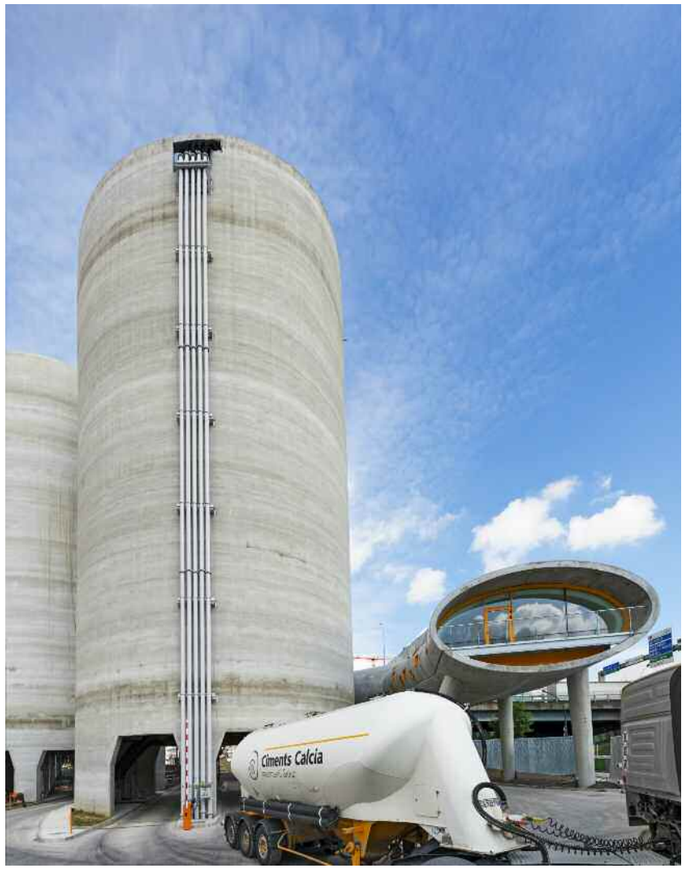
Planning, design, delivery and erection of the industrial equipment for the transshipment terminal in Paris, France, by order from the City of Paris, within the framework of a "Marché", who has leased this Terminal to CIMENTS CALCIA.

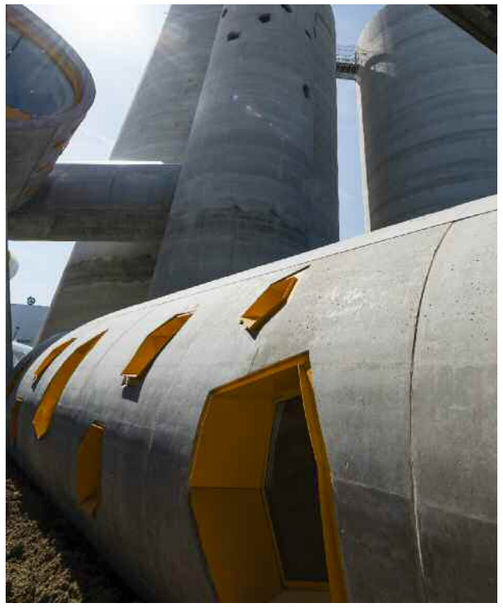
Scope of supply – IBAU HAMBURG

- Equipment of the rail wagon unloading quay with a total of 52 wagons connection points leading to 4 discharge pipes DN 200
- Compressor station for the generation of compressed air for the wagon unloading
- A truck unloading station at the silo
- Silo equipment for 2 x 3-chamber-silos Ø 19,5 m, volume per chamber 800 m³
- 2 truck loading stations, including weighbridge, under each silo, including delivery and erection.
- 2 x 2 Bypass pipes from the four weigh-bridges to one buffer silo under each silo (in case the truck has been overloaded).
- Dedusting installations for the silos and loading stations.
- Complete pilot air feeding for the terminal.
- Dust suction pipes underneath the silos

CIMENTS CALCIA

I BAU HAMBURG





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