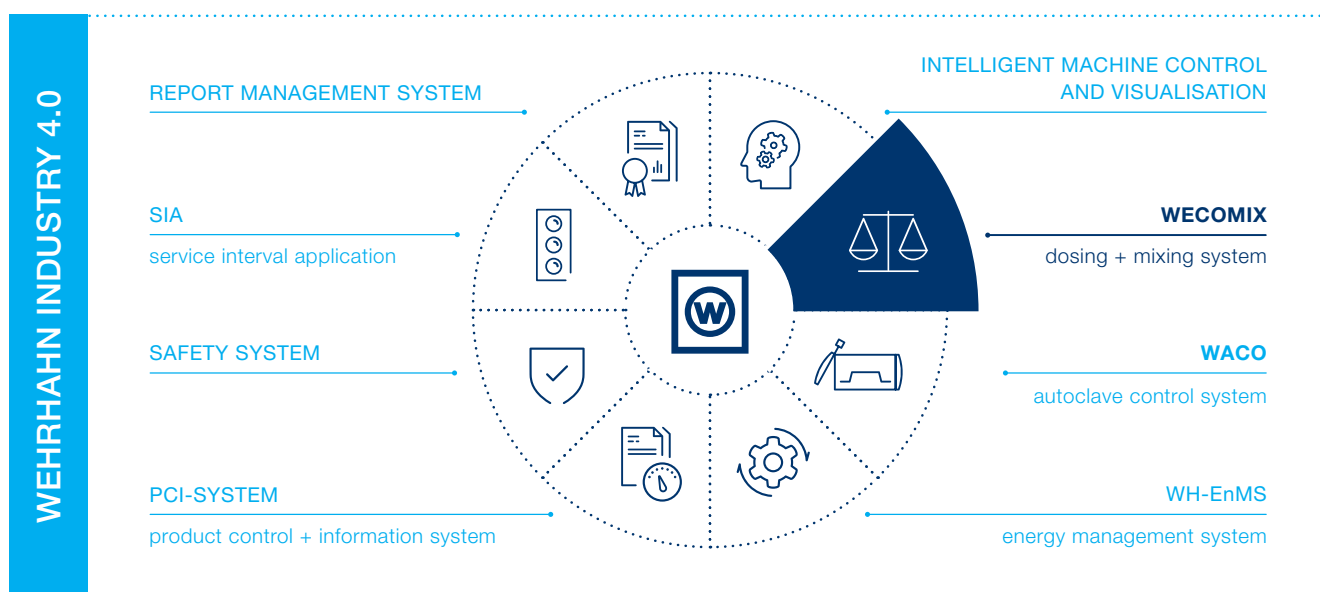


Intelligent automation modules in AAC production plants – part 2: dosing and mixing control system

In part one of a series of articles, published in AAC worldwide issue 4/2019, Wehrhahn focused on the autoclave control system. Part two of this series of articles focuses on the dosing and mixing control system. Intelligent electric control systems have a decisive influence on plant productivity. State-of-the-art AAC production plants include overall automation systems with a bundle of different control modules which communicate with each other to ensure high plant efficiency rates. In Wehrhahn AAC production plants customers may benefit from eight such control modules. This sounds very complex, but is rather intelligible once the modules are individually introduced.

The dosing and mixing control system is an important tool in the process of AAC and sand lime brick production. A properly and accurately working dosing and mixing plant is the main feature to provide constant compositions of the mixture at a constant temperature level, even in varying environmental conditions throughout the year: day- or nighttime, sunny or rainy weather, in winter or in summer. The reliability of a correct and automated mixing process ensures the best product quality in relation to

lowest manpower demand. AAC consists mainly of ground sand (SiO_2 -component), binders (CaO -component), like lime and cement, water, gypsum and a gas generating agent (aluminium). All these components are mixed in various quantities, depending on the required product properties, densities and the preselected mix formulae. The use of fly ash or other puzzolanes instead of or besides sand is very common in some countries.



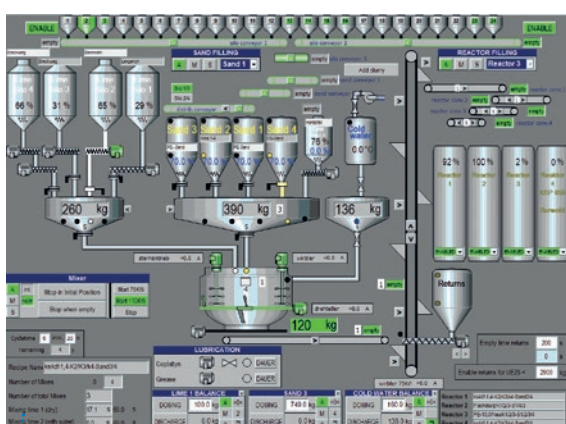
AAC - automation modules for a precisely coordinated Automation Control System.



Graphical symbols on the operator screen give a clear overview of the AAC dosing process

The binding materials react with water and form hydrates in an exothermal reaction. The temperature rises which increases the speed of all chemical reactions in the mix. While the gas development of the aluminium creates lots of small pores and the cake rises to about double of its initial height, the viscosity of the mixture increases. Finally, the cake is hard and dry enough to be cut into individually defined sizes, to blocks or panels. This sounds rather simple, but is a very complex process during which the rising and stiffening of the cake has to be well balanced.

The right composition of all ingredients and a controlled temperature development provides a high-quality green cake, which can precisely be cut und transported to the autoclaves. A suitable dosing and mixing control system enables the operator to monitor the current dosing and mixing process by graphic symbols on a screen.



Flow chart operator screen for mixing control of a sand lime brick factory

Mandatory features

For the different kinds of products a pre-defined recipe is stored which enables the operator to select the

suitable recipe according to the current production plan. Whilst the production is running based on a selected recipe, the operator can simultaneously check the subsequent recipe offline, or create or adapt a new formula. All automatic calculations are carried out based on the current raw material data.

As mentioned above, a continuous and constant dosing is essential to achieve a perfect, homogenous quality. For that purpose the Wehrhahn Wecomix dosing and mixing control system is a self-learning dosing optimisation system which automatically adjusts the dosing sequence depending on the material flow to avoid over- or under-dosage.

The slurry densities of return slurry and sand-/PFA-slurry are continuously measured. The results are directly transferred to the calculator and the recipe is automatically adjusted according to the variation of densities in order to ensure the desired water-solid-ratio and C-/S-ratio of the mixture and the desired properties of the final product.

The raw material temperatures are continuously measured and considered during the entire process, so that the desired mixer outlet temperature will be kept constant by adding the correct amount of hot and cold water. Alternatively, the desired cutting temperature can be determined as set point. The heat of the exothermic chemical reactions is calculated and used to forecast the cutting temperature.

A higher productivity is based on a reduced cycle time due to simultaneous charging of the balances. The whole dosing and mixing process is optimised.

Due to individual automatic modes for both the mixer and the balances the dosing of each raw material component can be switched to manual mode while dosing of all other components continue in automatic mode. When switching the raw material component back to automatic mode, dosing is automatically finalised resulting in time-saving and easy operation.



Useful settings

Depending on the chemical composition of the available raw materials a suitable dosing order for the addition of the components into the mixer has to be determined. The optimal dosing sequence into the balances and into mixer can be flexibly adjusted and stored in a recipe handling system. This provides the best possible process conditions for individual product requirements.

Important raw material properties, such as CaO- or SiO₂-content or the heat capacity which are required for an exact calculation of the temperature development in the mixer and in the cake are stored in product specific recipes. Process parameters, like automatic mixer-, slurry balance- and pipeline-cleaning processes, different discharge speeds, dosing screw settings, etc. are adjusted and stored as additional recipe parameters. The data can easily be updated, e. g. in case of change or variation of raw material qualities. A constant high and stable product quality with predictable properties, such as density, compressive strength and other specifications is ensured.

The brand-new Wehrhahn mould cover minimises required release oil quantities and sticking tendency on the mould surfaces.



The determination of the correct discharge velocity is important. The mixture should be discharged into the mould as fast as possible to minimise gas losses in the mixer, but in a way that it has to be avoided that the mould oil will be washed away. With the Wehrhahn dosing and mixing control system We-comix the discharge velocity is adjustable for each recipe. In addition, the brand-new Wehrhahn mould cover minimises required release oil quantities and sticking tendency on the mould surfaces.

Reporting and analyses

Trend charts of dosing and discharge sequences for each balance help to optimise the cycle time and to reveal irregularities or maintenance requirement.

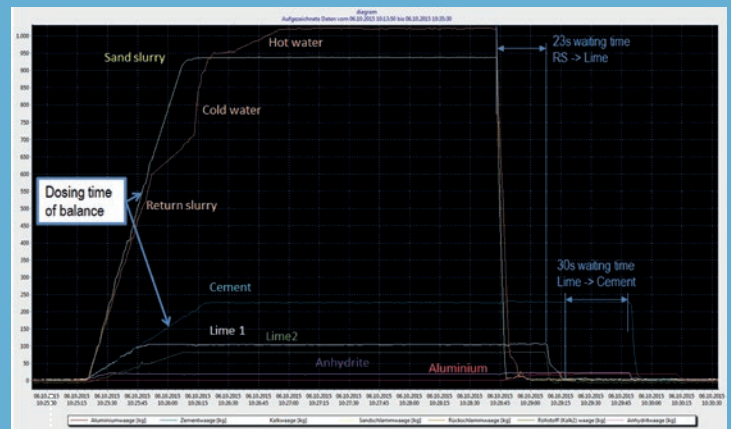
Each produced cake gets a unique “cake-ID” assigned to this batch. All relevant data concerning this batch, such as mix formula, temperatures, slurry densities, mould number, timestamps, etc. and all following production parameters for precuring, cutting, autoclaving and packing will be connected with this cake-ID. All data are stored in an SQL data base as a complete set of important process and production parameters for each single cake. The product data handling provides quality control information available for the production management in real time. Additionally to the integrated mix report which stores all mix relevant data into a locally installed SQL-database all data will be transferred to the Wehrhahn-DBX-Manager database containing the data from the whole production process. The DBX-Manager is installed on a server in the plant or in the office building. Based on the unique cake-ID the cake can be tracked throughout the production process. The Wehrhahn-DBX-Manager is used to evaluate KPI (Key Performance Indicators) which indicate plant efficiency.

Some examples of important data for different company departments:

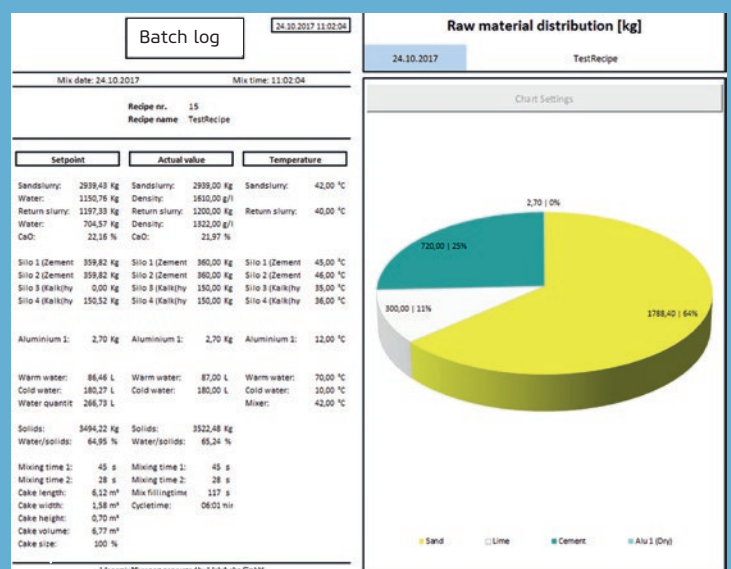
- Cost per mix, cost of product type or quantity of product, etc.
- Raw material consumption per each unit of the packed products
- Mixer effectiveness by motor power measurement, depending on recipes
- Correlation between cake end-temperature after precuring and mixing outlet temperature and reject rate
- Overview of the cycle time for each mix, the productivity of different product types or the number of recipe changes

Relevant information concerning maintenance requirements caused by increased dosing or discharge times or high-power consumption for a recipe.

The charge report is an Excel sheet which can be opened on a standard windows pc. Via LAN or Wifi all data will be transferred online from the DBX-Manager database. The users have access to the mix report



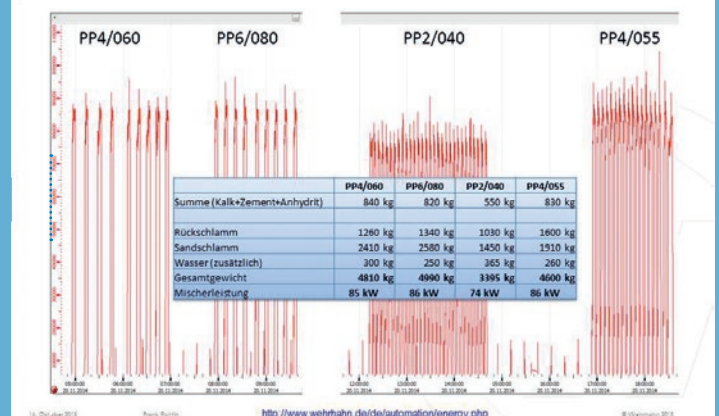
Trend charts of dosing and discharge sequence



The charge protocol as an excel sheet for every windows PC

Dosing and mixing

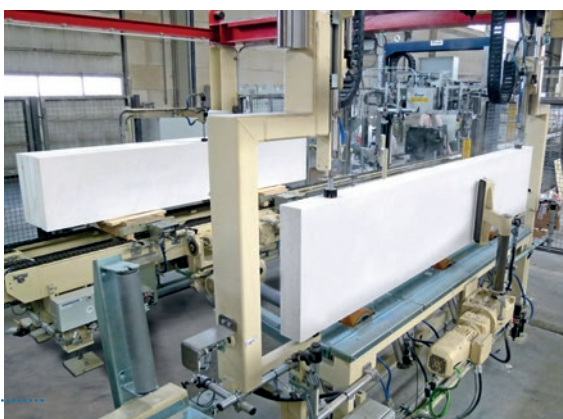
Energy consumption of mixer engine



Energy consumption of mixer for different product densities



Wecomix dosing and mixing system enables the manufacture of high-quality AAC and sand-lime products



on their own personal computer, even far away from the operator panel. The charge report comprises of mix report data tables, a datasheet of each batch, graphical diagrams of raw material consumptions and product types. It provides all relevant information concerning raw material consumption and flexible trend charts for a user-defined time frame.

In addition to the detailed reporting system an automatic adjustment of machine parameters, like cutting speed, packing dimensions, etc. for each individual cake is possible. The automatic control of machine and process parameters is part of the PCI-System (Product Control and Information System) which will be described in a further part of this series of articles.

Wecomix dosing and mixing system is a key tool besides other automation system modules in AAC plants, e.g. energy management, service interval application and autoclave control system, etc. More reports will follow in the next issues of AAC worldwide.



Frank Pottin studied automation engineering in Bremen. Immediately after completing his studies, he began with the electrical design, programming and commissioning of Wehrhahn AAC production plants. Today he has over 27 years' experience in AAC production. As Director Electric and Automation, with his team of more than 30 Automation specialists, he continually develops new innovations for AAC production.

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See here a video about Wehrhahn automation. Scan the QR-code with your smartphone.



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