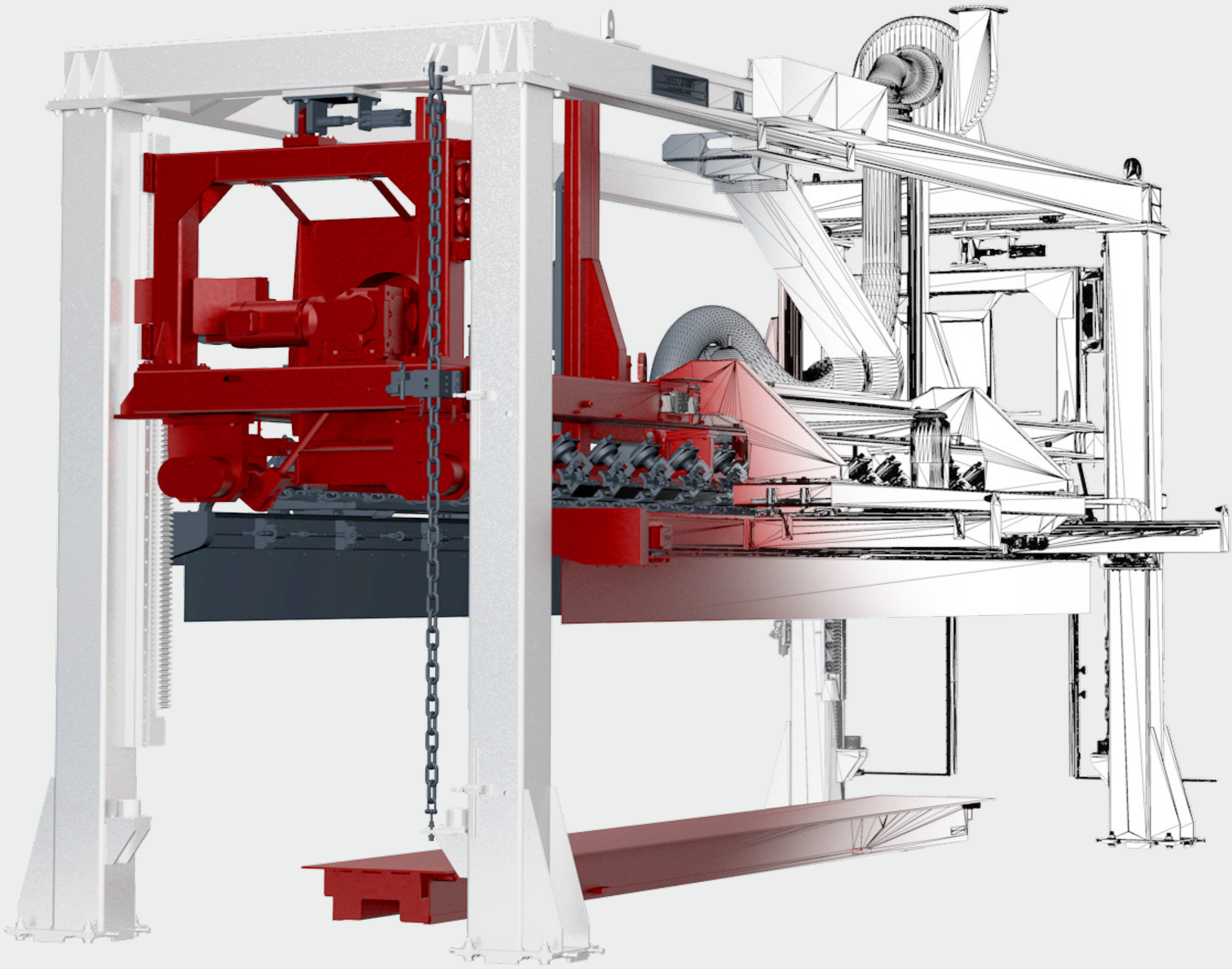
A member of TOPWERK

HESS AAC SYSTEMS

MACHINES AND EQUIPMENT FOR THE PRODUCTION OF AUTOCLAVED AERATED CONCRETE



COST-EFFECTIVE PRODUCTION SYSTEMS FOR A WIDE RANGE OF HIGH QUALITY AAC PRODUCTS

WE PUT CONCRETE INTO SHAPE

The Autoclaved Aerated Concrete (AAC) material was developed in 1924 in Sweden. It has become one of the most used building materials in Europe and is rapidly growing in many other countries around the world.

Autoclaved Aerated Concrete is a lightweight, load bearing, high-insulating, durable building product, which is produced in a wide range of sizes and strengths. AAC offers incredible opportunities to increase building quality and at the same time reduces costs at the construction site.

AAC is produced out of a mix of quartz sand and/or pulverized fly ash (PFA), lime, cement, gypsum/anhydrite, water and aluminium and is hardened by steam-curing in autoclaves. As a result of its excellent properties, AAC is used in many building constructions, for example in residential homes, commercial and industrial buildings, schools, hospitals, hotels and several other applications. The construction material aircrete contains 60% to 85% air by volume. The solid material is a crystalline binder, which is known as Tobermorite. The chemical composition of Tobermorite shows silicium dioxide, calcium oxide and water. Besides the binding phase Tobermorite, AAC contains grains of quartz and in minor amounts some other minerals.

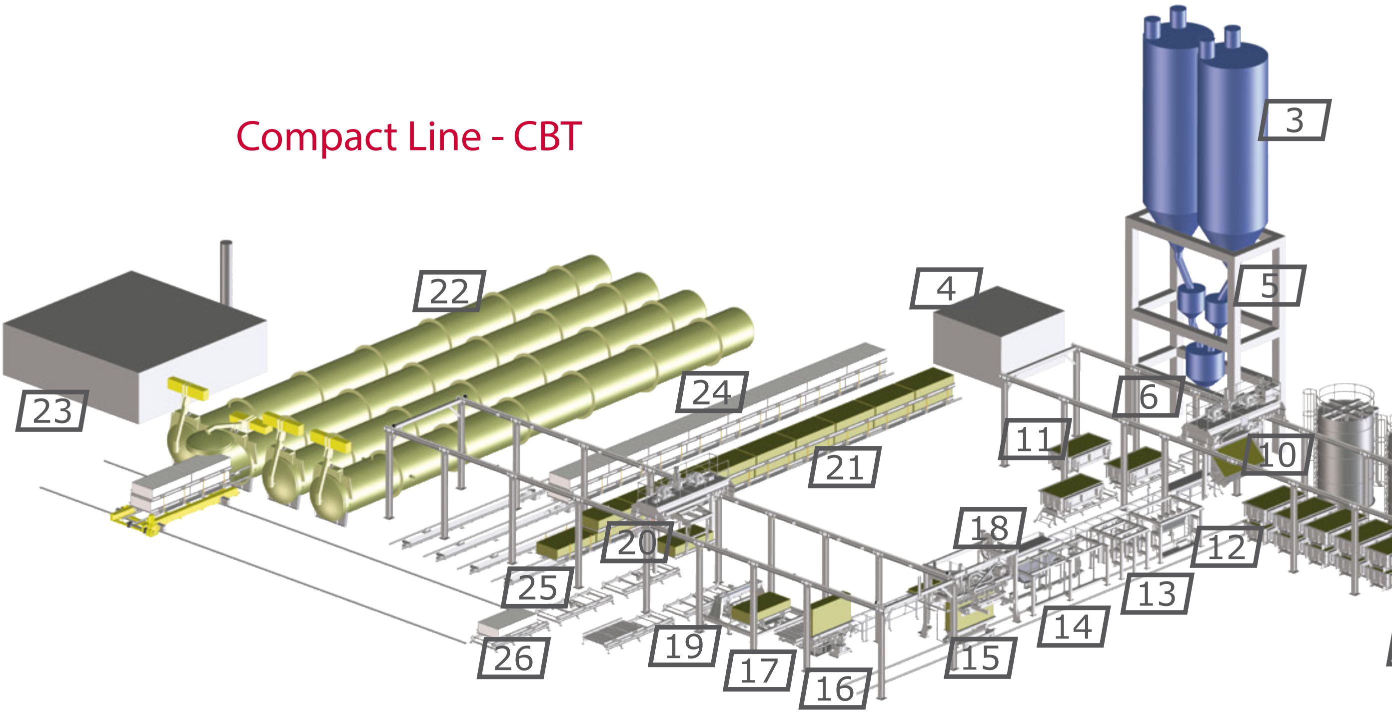
The silicium dioxide is obtained from silica sand, fly ash (PFA), or crushed quartzite. It is possible to obtain silicium dioxide as a by-product from other processes, e.g. foundry sand. The calcium oxide is obtained from quick lime, hydrated lime and cement. Gypsum/anhydrite is added in small quantities as a catalyst and for optimizing the properties of AAC. Aluminium powder/paste is used as expanding agent.

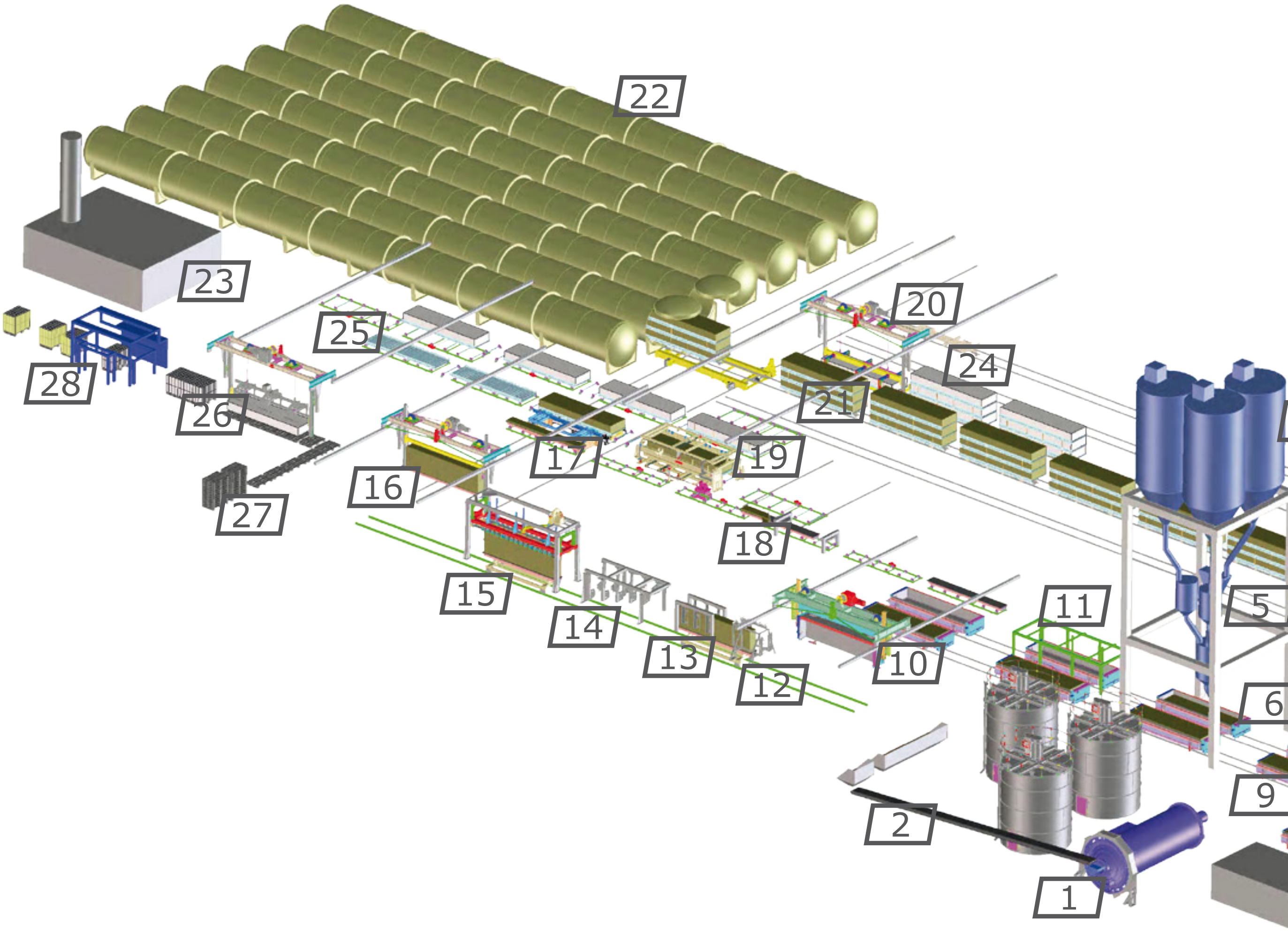
In specific applications additional (chemical) components can be added to enhance the AAC properties during production and in the final product. Special agents allow the use of certain waste materials as a valuable new raw material for the production of high quality AAC, hence adding to sustainability and a circular process.

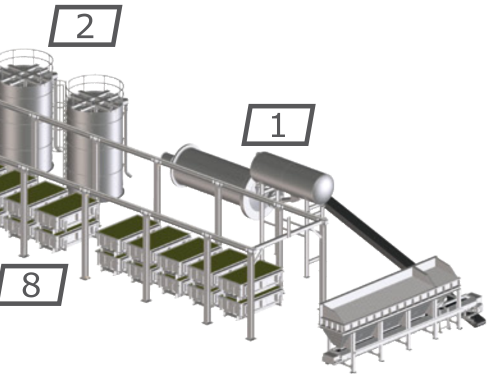
Advantages of AAC

- Large variety of sizes: AAC can be produced in a large variety of sizes, from standard blocks to large reinforced panels;
- Excellent thermal insulation: AAC has a very low thermal conductivity and therefore a very high thermal energy efficiency is achieved.This results in cost savings for heating and cooling;
- Extremely lightweight: AAC weighs approximately 50% less than other comparable building products;
- High compressive strength: AAC is a solid product, therefore making it highly load bearing. The entire surface area is used in structural calculations;
- High dimensional accuracy: as a result of its dimensional accuracy, AAC is extremely easy to install, as no thick set mortar is required;
- Great acoustic insulation: the porous structure of AAC provides a high acoustic insulation;
- High fire resistance: AAC has an extremely high fire resistance rating of at least 4 hours;
- Termite resistance: AAC can not be damaged by termites or insects;
- High workability: as a result of the excellent size/ weight ratio, AAC allows rapid construction work. Even though AAC is a solid building material, it can be cut, sawn, drilled, nailed and milled like wood, making it an easily workable product;

Compact Line - CBT

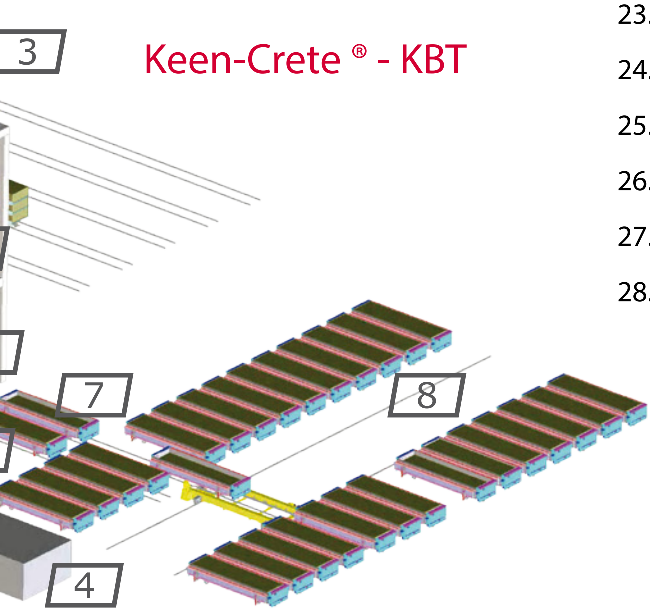






1. ball mill system for milling sand and course anhydrite
2. slurry tanks
3. silos for lime, cement and fine anhydrite
4. aluminium powder / paste preparation
5. dosing and mixing
6. casting into the mould
7. position for reinforcement insertion
8. rising / pre-curing
9. position for extraction of reinforcement holding pins
10. tilting the cake with tilting manipulator
11. mould oiling
12. pre-cutting
13. vertical cutting and profiling
14. horizontal cutting
15. cross cutting and handgrip milling
16. platform manipulator
17. back-tilting of the cake onto a cooking frame
18. platform return and bed waste removal
19. green separation
20. multifunctional manipulator
21. stacking and buffering of green cake
22. autoclaving
23. steam preparation
24. buffering and destacking of hardened cakes
25. frame circulation, cleaning and oiling
26. unloading and transfer to the packaging line
27. pallet destacking and transportation
28. covering with foil

Keen-Crete ® - KBT



Raw material preparation and mixing

A ball mill wet-grinds the quartz sand with water to a sand slurry. The sand slurry is stored in slurry tanks and pumped into the slurry weighing hopper in the mixer tower. The binders (lime, cement and anhydrite) are stored in silos. It is also possible to mill the anhydrite together with the sand in the ball mill. The aluminium powder or paste is prepared in a separate building where it is dispersed in water.

All the components are accurately weighed, and are released into the mixer in a pre-defined order. The HESS recipe and temperature control system constantly monitors this process.

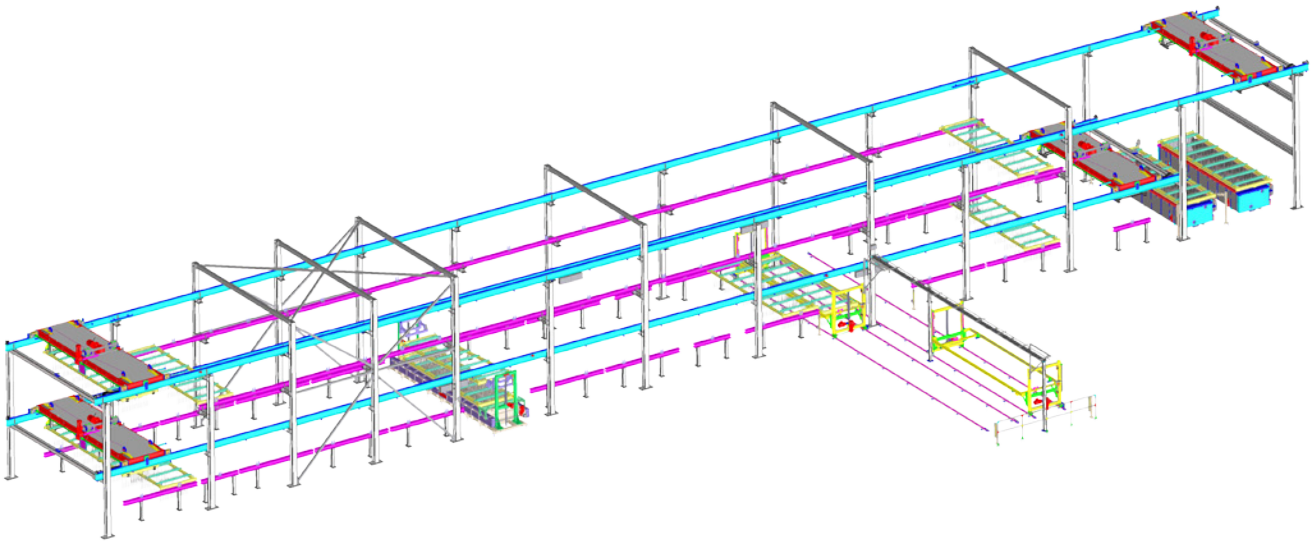
HESS also has the knowledge and the experience to produce AAC with alternative raw materials, for example with fly ash.

Casting, rising/pre-curing and mould circulation

The mould consists of four fixed sides and one detachable platform. The inner mould surfaces are covered with demoulding release oil before casting. This oil is applied either manually or automatically. The mix is then poured into the moulds. A mould circulation system conveys the moulds to the rising area, where the cake pre-cures for 2-3 hours after which it is ready for cutting. Depending on the plant design, the moulds are handled by a mould traverser or by a tilting-manipulator.

Reinforcement preparation

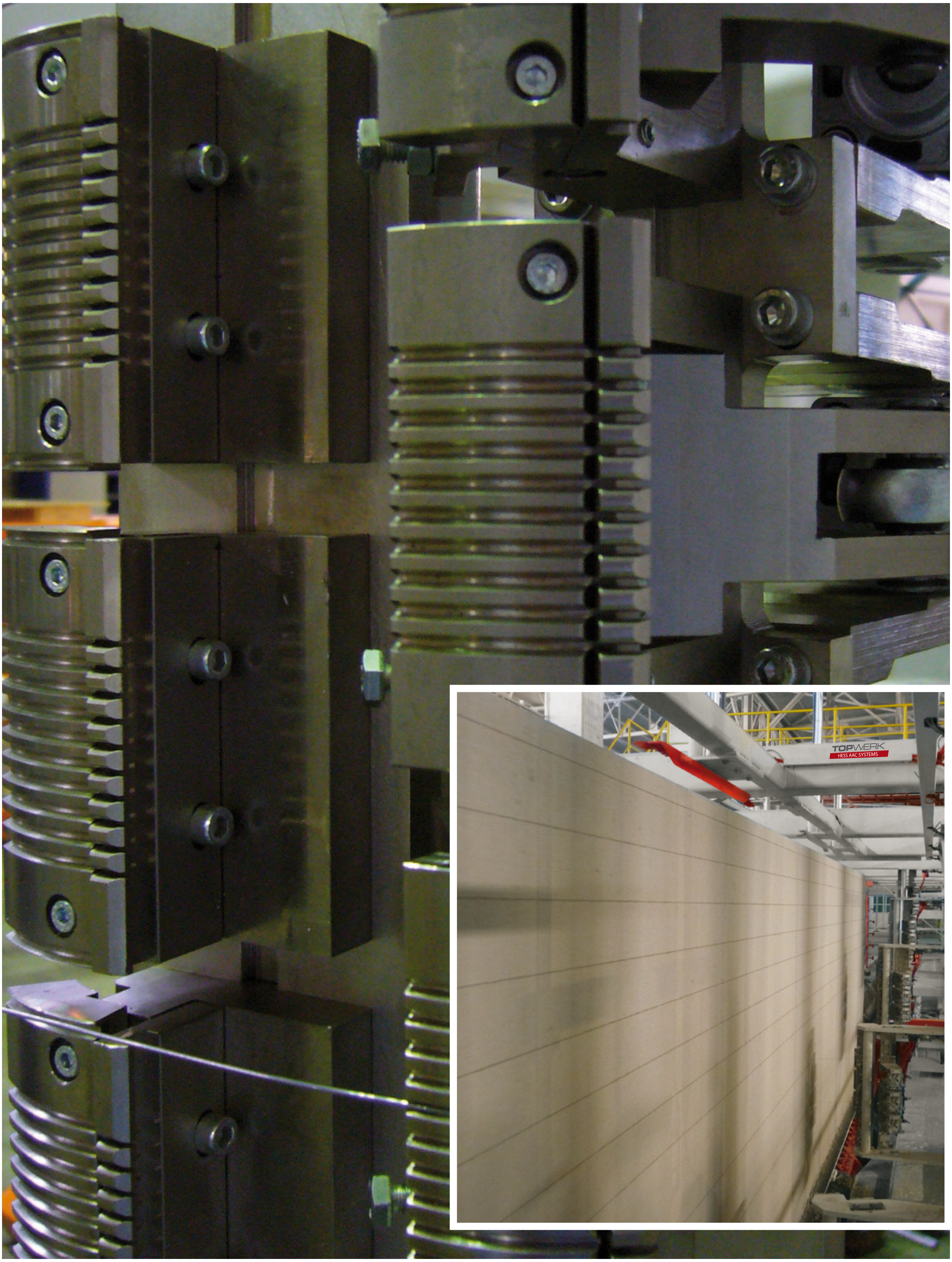
The HESS systems are also ideal for the production of large format reinforced panels. Depending on the required capacity, the reinforcement cages are outsourced or welded on site. The cages are then assembled per mould and hung onto holding frames with cross bars and needles. A corrosion protection is then applied. Immediately after the mix has been poured into the mould, the waiting reinforcement frame assembly is inserted. Before cutting of the cake, the holding frames with needles are lifted, leaving the reinforcement in the cake.



Tilting

The tilting manipulator tilts the mould by 90°. The manipulator unlocks the mould and removes the mould body, so that the cake remains on one mould side/platform for cutting. This tilting system has proven to be the safest method for tilting the cake into the vertical cutting position, as the cake is remaining on the platform/mould side for the cutting process.

This way of handling results in optimal efficiency in raw material consumption due to the low mechanical forces on the product in the green stage and reduces the risk of cracks and product damage.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Cutting

The cake is cut by high precision cutting machines. Cutting is done by cutting knives and by pneumatically tensioned cutting wires.

- The pre-cutter and vertical cutter cut the block length and panel width. In this station the profiling (tongue and groove) can be cut into the cake with profiling knives;
- The horizontal cutter cuts the block and panel thickness; for special demands in surface finish and thickness accuracy beyond the traditional building standards, HESS provides proven alternative cutting systems with oscillating wires while maintaining the advantages of the tilt cake cutting system;
- The cross cutter cuts the block height and the panel length. Optionally hand-grips can be milled in the blocks in the green stage;

Back-tilting and bed removal

The HESS plants have combined the advantages of the tilt-cake and flat-cake system. After the cutting is completed, the cake is tilted back by 90° onto a cooking frame. In the HESS system no part of the mould or platform used for cutting goes into the autoclaves. After the cake has been tilted back into the horizontal orientation, the bottom/bed waste will be removed before autoclaving. Autoclaving the cake horizontally on the cooking frames allows efficient autoclave loading and, most importantly, will prevent most of the sticking of the layers, which is a typical disadvantage of the traditional tilt-cake systems.

HESS SYSTEMS PRODUCE NO PROCESS RELATED WASTE!

One of the HESS innovations is the green separator. Here the horizontal cuts (now laying vertical) are carefully separated before autoclaving, leaving a small gap between the layers. This innovation eliminates any sticking, which is typical for other tilt-cake systems. Further this green separation substantially improves the autoclaving process as steam can penetrate into the cake more effectively. Although the principle of separation has often been copied, the HESS technology for this production method has been proven as the most reliable with the lowest risk of product damage.

Frame and bogey circulation

The green cakes on the cooking frame are stacked three high onto autoclaving cars, referred to as bogeys. Autoclave buffer tracks in front of the autoclaves ensure that the cutting and packaging processes are less dependent on one another. An autoclave traverser is used for loading and unloading the autoclaves, ensuring that this process is performed in the shortest possible time, in order to optimise autoclaving capacity.

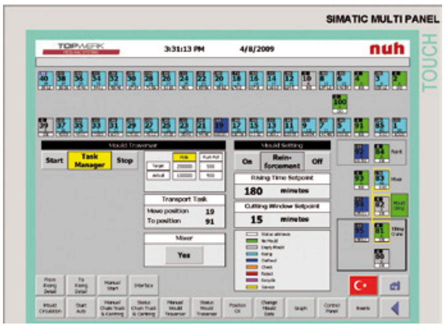
Autoclaving

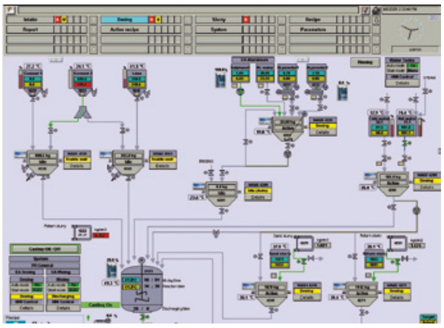
In the autoclaves the cakes are cured for ca. 10–12 hours at a temperature of 190° C with saturated steam at a pressure of 12 bar. The fully automatic autoclave control system ensures a safe and optimal autoclaving process, also allowing for steam transfer and energy reuse in combination with the condensate system, in order to cut back fuel costs for the steam generation to 50%.

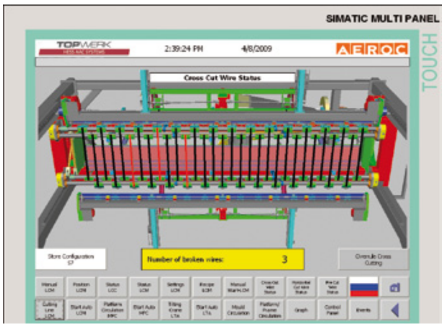
Unloading and packing

After the autoclaving is completed, the cakes are destacked and unloaded from the cooking frames. HESS offers a large variety of packaging solutions, ensuring that the finished products are packed according to local market requirements. Usually blocks will be delivered as packs on wooden pallets, strapped and/or covered in foil.

HESS also offers a wide range of post-autoclaving handling for reinforced products, such as packaging lines, sawing and shaping systems.





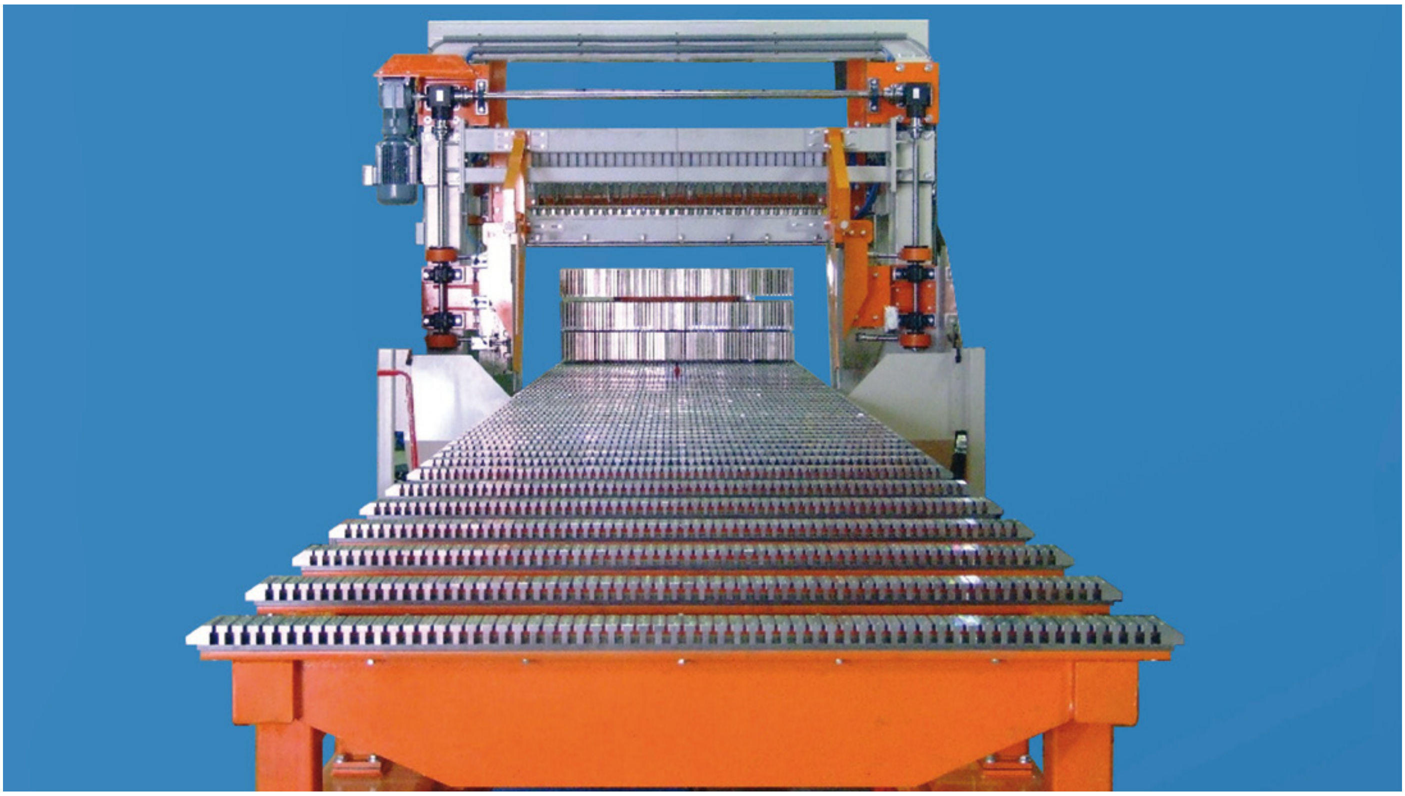


Process control and plant automation

The entire production process is controlled by modern automation systems designed by HESS on the basis of Siemens S7 control system, using standard components that are available world-wide. User-friendly, multi-lingual operator interfaces with touchscreen monitors allow easy and understandable operation. The HESS remote diagnostics do not only allow access for on-line support but are supported with modern Industry 4.0 technology. Cloud based data collection technologies allow the user to be in control over the production process on-line with a wide range of diagnostics available at hand wherever desired.

Process know-how

HESS has a modern laboratory, equipped with all necessary equipment and apparatus to perform vital raw material tests. Not only the raw material characteristics are checked, but also small scale AAC production is possible, allowing HESS to gain important information on raw material production behaviour and final product quality, to ensure trouble free putting into commercial operation of the plant after a green field installation or major modification.



Upgrade of existing Hebel type cutting systems

In order to increase the quality of the product as well as the reliability of the plant, without investing in a complete new cutting machine, the modification of the Hebel technology based cutting machine is possible.

- Cutting table with moving bridges;
- Needles with rectangular design;
- Balance opposed double set of cross cutting shafts;
- Vertical wire tensioning system;
- Top crust removal system;
- Horizontal cutting system for lintel cutting;
- Counter pusher with pusher package;
- Bottom and top profiling system;
- Control system;
- Hydraulic system;

Highlights

- Short installation time;
- Proven technology;
- The existing logistics and production technology do not require major changes;

HESS can also undertake the modification of other AAC plant systems.

Based on HESS vast experience with many different production systems and technologies, HESS can carry out a AAC plant assessment. During this scan different aspects of the operation are thoroughly reviewed like the process technology and quality control, the production plant and its condition as well as the organisation and management of the factory to find the right angles for improvement of the business and making it more profitable.

Compact Line – CBT	CBT-210	CBT-320	CBT-430
Theoretical capacity	210 m^3 / day	320 m^3/day	430 m^3/day
Cakes / day	75	120	160
Cycle time	18,0 min / cake	11,3 min/cake	8,4 min/cake
No. of autoclaves (32 m)	2	3	4
No. of rising places	9	13	17
Net cake size	3,0 x 1,5 x 0,6 m = 2,7 m^3		

Compact Line CBT – HP	CBT-HP 300	CBT-HP 450	CBT-HP 600	CBT-HP 750
Theoretical capacity	300 m^3/day	450 m^3/day	600 m^3/day	750 m^3/day
Cakes / day	56	84	112	140
Cycle time	24,4 min/cake	16,1 min/cake	12,1 min/cake	9,6 min/cake
No. of autoclaves (37,5 m)	2	3	4	5
No. of rising places	7	11	14	17
Net cake size	6,0 x 1,5 x 0,6 m = 5,4 m^3			

Keen-Crete® Line – KBT-S	KBT-S-450	KBT-S-680	KBT-S-900
Theoretical capacity	450 m^3 / day	680 m^3 / day	900 m^3 / day
Cakes / day	84	126	168
Cycle time	16,1 min / cake	10,7 min / cake	8,0 min / cake
No. of autoclaves (43,7 m)	2	3	4
No. of rising places	9	13	18
Net cake size	6,0 x 1,5 x 0,6 m = 5,4 m^3		

Keen-Crete® Line – KBT	KBT-900	KBT-1130	KBT-1360	KBT-1580
Theoretical capacity	900 m^3/ day	1.130 m^3/ day	1.360 m^3/ day	1.580 m^3/ day
Cakes / day	168	210	252	294
Cycle time	8,0 min / cake	6,4 min / cake	5,4 min / cake	4,6 min / cake
No. of autoclaves (43,7 m)	4	5	6	7
No. of rising places	18	23	27	32
Net cake size	6,0 x 1,5 x 0,6 m = 5,4 m^3			

Keen-Crete® Line – KBT-L	KBT-L-1580	KBT-L-1810	KBT-L-2040
Theoretical capacity	1.580 m^3/ day	1.810 m^3/ day	2.040 m^3/ day
Cakes / day	294	336	378
Cycle time	4,6 min/ cake	4,0 min/ cake	3,6 min/ cake
No. of autoclaves (43,7 m)	7	8	9
No. of rising places	33	38	41
Net cake size	6,0 x 1,5 x 0,6 m = 5,4 m^3		

Based on a pre-curing time of 2,5 h and on 2 autoclave cycles/day. These are dependent on raw materials and product mix. Other autoclave lengths and net cake volumes are possible and will change the capacity data. Reinforced products with a length of max. 6 meters can be produced on all Keen-Crete® Lines

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