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Thin panel applications and the required production technology & know-how

An increasing need for faster and more cost-effective construction drives a global trend for continuous innovation in new building materials and more efficient building applications. It is therefore not surprising to notice an acceleration in a global shift from AAC blocks to AAC panels. For AAC producers, it is however not simply a switch of the button to change from AAC block to AAC panel production overnight [1]. Besides additional equipment required for adding reinforcement to the production process for example, which is the easiest part to overcome, the main critical element lies right in the heart of the factory: the right cutting technology.

Fig. 1: The superior earthquake-resistance performance, insulation qualities as well as its ease of installation have made AAC cladding panels a first choice for many residential construction projects in Japan [2].

Especially when it comes to the thinner elements - and the elements with a very smooth surface -within the range of AAC panel products, Aircrete is offering a proven state-of-the-art cutting technology that is suitable for production of these AAC panels: the Aircrete Flat-Cake Cutting Technology. This article elaborates on the thin AAC panel product and applications and the production technology including the process required.

In the building materials market for thin panels, without doubt AAC thin panels can be considered as a rising star. Advantages, such as lightweight (while still being very strong), concrete-based (while still being very versatile), excellent thermal conductivity (while being non-combustible) and the abundant prefab facade options for esthetical purposes are creating huge advantages over other lightweight panel applications out there. The AAC thin panel, also known as the cladding panel, is rapidly introducing its presence in many markets around the world, providing a faster and cost-effective way of constructing in the form of external façades and cladding systems. Cladding panels are already enjoying significant wall market shares in markets like Australia and Japan (Fig. 1). Both markets are not coincidentally 100% relying on flat-cake cutting technology for their production. Nevertheless, other important markets like Asia and the Americas, are rapidly embracing the thin AAC panel application. They have started with the adoption of the Aircrete Flat-Cake Technology in their respective markets with the construction of new AAC plants and with conversions of old tilt-cake based factories to flat-cake based factories.

What is a cladding system?

In general, cladding systems are prefabricated panels attached to the structural frame (usually steel or wood) of a building. They provide an additional layer of protection, thermal and sound insulation as well as weather resistance. The benefits of using AAC-based cladding systems go beyond these advantages, bringing additional contributions to the wall solution, like fire resistance, low maintenance, minimal finishing requirements and even architectural façade applications. Given the lightweight and versatility of the strong elements, AAC cladding panels are also fast and easy to install as well as cost competitive, thereby increasing speed and reducing total cost of construction projects.
AAC cladding panels within the Aircrete Building System also play an important role of being a decorative material that can easily substitute the heavy and expensive ceramic and brick products. These façade AAC boards are thin and light, but solid as they are reinforced with ultrathin coated or galvanized steel mesh. Unaffected by sunlight, rain and thermites; these panels can be painted with water-resistant high silicon content, making them extremely durable. AAC cladding panels can directly be fixed on AAC, steel, timber or concrete frames with a layer of insulation in between - if required (Fig. 2).

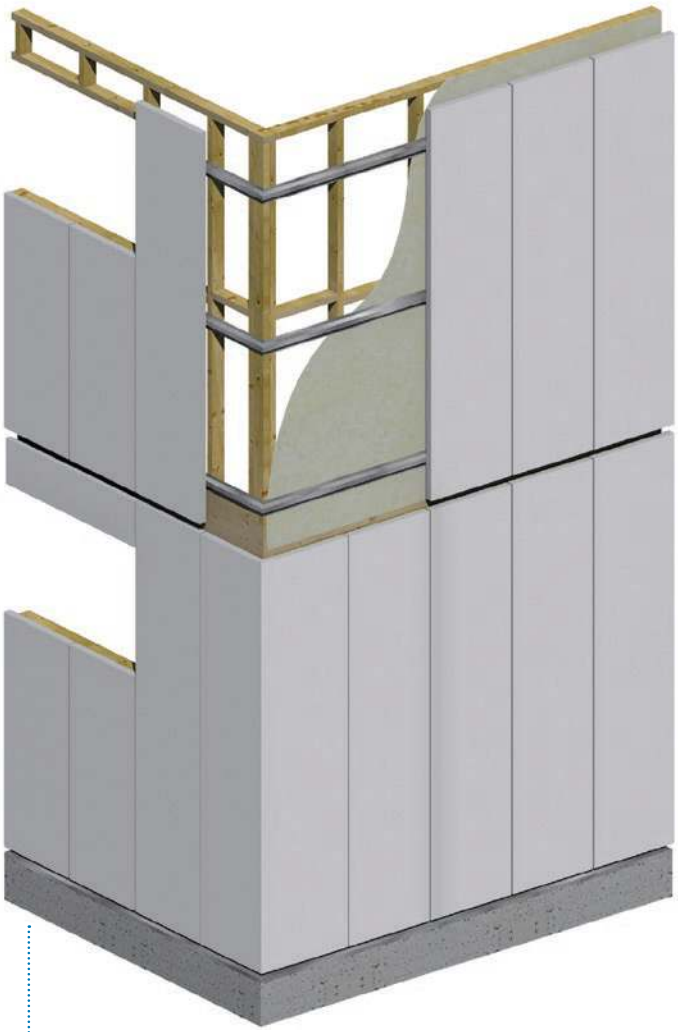

Fig. 2: An example of an AAC cladding system: thin AAC panels fixed on a steel and timber frame with a layer of insulation in between [3].

The technology and expertise behind AAC cladding panel production

The reinforcement section

Steel-reinforced AAC panels provide lightweight, durable and high-performing wall, floor and roof

Fig. 3: A close-up view of the reinforcement assembly area prepared for thin panels.

Fig. 4: Flat-cake cutting enables all the cuts on the cake remain open after cutting, ensuring no risks of sticking.

solutions. Panel reinforcement is fabricated from concrete reinforcing steel, which is usually supplied as coil. A fully automatic welding machine is an automated solution for welding steel on-site into cages or meshes. The automized reinforcement frame configuration reduces the need for additional operators or manual handling and therewith enables higher production efficiency and a greater variety of products. Besides, precise positioning of the reinforcement within the panel at this stage is crucial for the cutting phase, which all plants need to achieve for an efficient cladding panel production (Fig. 3).

The essential flat-cake cutting technology

The production of thin and super smooth surfaced AAC elements requires the right cutting technology. Elements thinner than 75 mm can only be sustainably (i.e. without significant waste) produced on a flat-cake cutting line (Fig. 4). In theory, these elements can be produced on other cutting technologies as well; though not with effective full mould utilization, quick cycle time, super smooth surface and low waste levels. As gravity will put pressure on the bottom elements in the cake, this will result in addi-

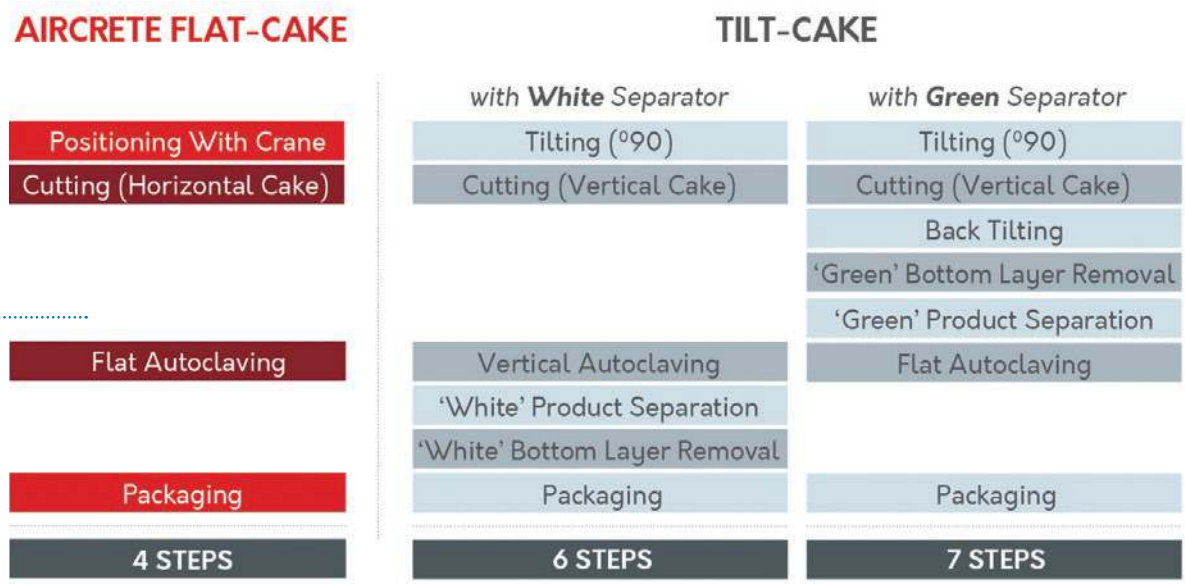

Fig. 5: Comparison of the steps required in flat-cake vs. tilt-cake systems.

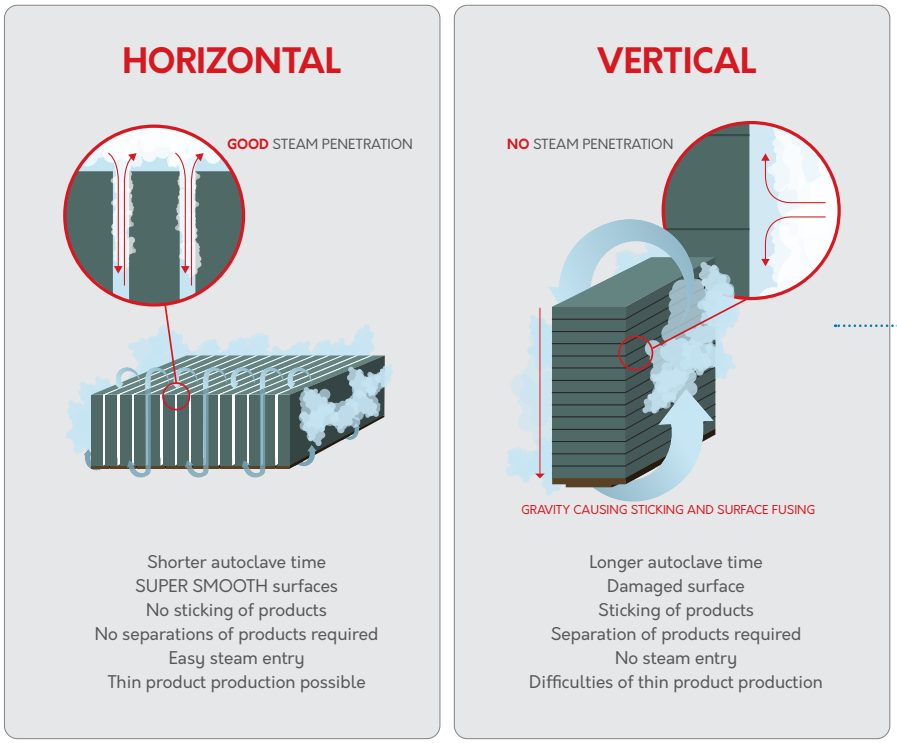

Fig. 6: Main advantages of horizontal versus vertical cutting during the auto-claving process.

tional handling with back-tilting and green separation to prevent the so-called sticking, which in the end, results in additional waste. Less cake handling substantially reduces the risk of damage to the cake, meaning less requirement for sorting and large reduction of white waste.
This reduction of handling is especially important when producing thin panels. For example, in a tilt-cake cutting line, a 50 mm thick panel produced in a standard 1,5 m wide mould, has to be handled 30 times in the green – very vulnerable – state of the cake. Next to the risk of damaging the product, this will put an enormous pressure on the cycle time and reduce the output of the plant. This is a clear advantage of the flat-cake cutting technology, where only 4 steps (where the cake is only touched/transferred twice) are required from the de-moulding phase to packaging (Fig. 5). As a result of the flat cutting orientation, all the cuts on the cake remain open after cutting, ensuring no risks of sticking. In addition, these open gaps will ensure a better and more efficient autoclaving process through good steam penetration (Fig. 6).

After-treatment and the Aircrete panel milling system

The after-treatment line also plays a vital role in the production process, as it allows for possibilities to even further finalize the prefab element before it goes to site, supporting the trend of moving construction from the building site to the factory. In the after-treatment area, patterns can be milled on finished panels to provide them with esthetical appearances and the panels can even be coated and paint-

Fig. 7: Cladding panels can be milled, coated and painted to enhance performance and esthetical appearances [4].

ed before being packed and shipped (Fig. 7).

Note that this milling and coating of panels is not limited to thin panels only but can be applied to the full range of AAC panels.
The Aircrete panel milling system itself is a complete solution with a programmable CNC milling machine suited for AAC panels (Fig. 8). This solution includes the machinery, control system, first batch of milling tools as well as integration with the rest of the systems and the existing equipment. By choosing the right tools in combination with the embedded software, all type of patterns, even texts can be milled on the cladding panels (Fig. 9).

The Aircrete panel milling system is available in two versions. The first option is a fully automated line which is integrated into the unloading section as a separate bypass including the packaging system following after-treatment. This is intended for mature markets which require a high volume of surfaced milled products. The other alternative is a semi-automated system, whereby the panels are loaded and unloaded onto the milling system semi-manually.
Thin cladding panels have one of the biggest growth potentials in AAC, as it can be integrated with the exsiting building solution by substituting other materials or complementing the traditional building systems. With the right technology and know-how, the possibilites in applications and patterns is almost unlimited.

Fig. 8: Aircrete panel milling system.

References

[1] "Designing an AAC plant for high-volume, just in time and diverse panels production" AAC worldwide, Vol. 2, 2019
[2] Asahi Kasei Construction Materials Co. website https://www.asahikasei-kenzai.com/akk/powerboard/
[3] Resource: CSR Hebel PowerPanel50 External Wall System – New Zealand Design and Installation Guide, p.35
[4] Photograph taken from Asahi Kasei Construction Materials Co. showroom

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Fig. 9: Texts and even logos can be milled on AAC cladding panels with the Aircrete surface panel milling system.