Kraft Curing Systems GmbH, 49699 Lindern, Germany

All Curing Systems are the Same!

If you are a company similar to AG (Acheson & Glover), at the leading edge of hard landscaping and precast solutions for over 50 years, in tune with local and regional market trends by providing world class products, an early-adoptor and a market-leader instead of an also-ran, then perhaps you could profit by reading this article and learn what AG experienced: not all curing systems are the same!

AG, located in Northern Ireland, serves the UK and Ireland with hard landscape and precast concrete products produced in 9 production sites and 1 quarry. Operating among the highest quality producers of hard landscaping concrete products in the world, a total of 2 high performance concrete block plants, 2 modern concrete block paving plants, 2 concrete brick plants, 2 concrete flag plants as well as over 400 experienced, well-trained and passionate employees and forward-thinking manager-owners establish AG as a premier supplier of high quality products.

The AG range of landscaping products, including the iconic TerraPave®, are aesthetically pleasing and highly functional – redefining the boundaries of what is possible.

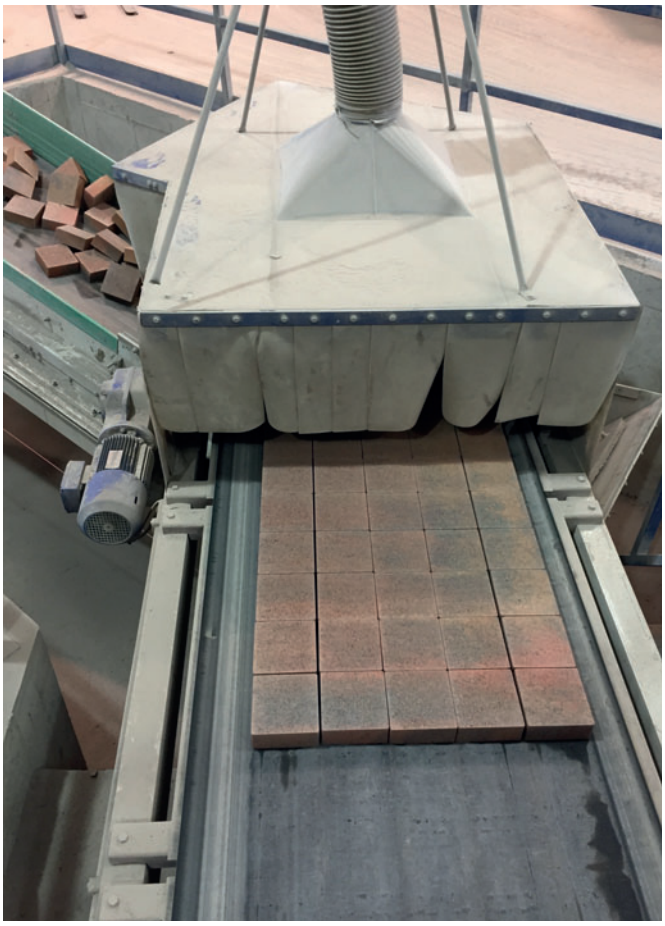
If you wish to learn more about AG and how they have been successful in reaching their 3 main constituents: major construction companies and merchants, the general public and architects, specifiers and builders, please visit their corporate site at www.ag.uk.com.

In April of 2016, AG began to feel the increased demand for tumbled concrete block paving sparked by the boom in the UK housing market. Operations Manager, Lyle Cairns, set about finding a way of increasing the productivity of the 15-year-old Masa concrete block paving plant at the Fivemiletown location. While the plant was retro-fitted with in-line tumbling – immediately after the concrete pavers exit the curing chambers, the bottleneck was the over 30-hour waiting time for the concrete to harden sufficiently to tumble without falling to pieces.

Although AG had a curing rack comprised of 14 passages, a storage capacity of 4,704 pallets, the problems were summed up in 2016 in the following context:

"AG would like to add capacity which requires an additional shift in addition to wishing to tumble in-line. At the moment, the system includes double chambers, divider-walls and roller-shutter doors. A chamber (2 passages) is filled, the door is closed and only then is when curing begins. The last into the chamber is the first out of the chamber. The curing tem-

Hardened brindled multi-color pavers leaving the curing chamber after 18 hours.



Depalletized pavers on their way to the in-line tumbler.

Tumbled paver surface ready for packaging.

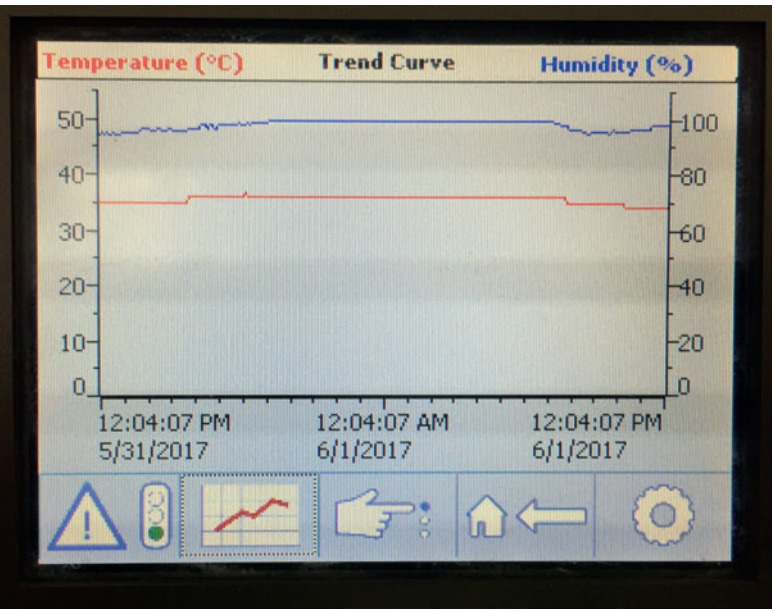
perature does not reach the set-point. The lack of early strength is preventing AG from adding additional capacity."

Although achieving the early strength sufficient to tumble in-line earlier than 24 hours was the main issue, other problems such as high fuel und cement costs, color consistency, efflorescence control and weak corners and edges contributed to the decision to move in a different direction.

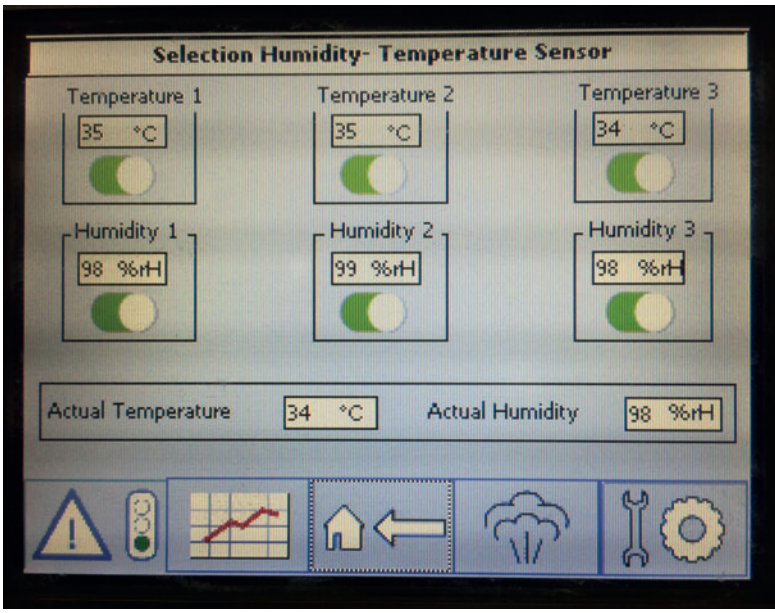
A visit to Kraft Curing System's at the 2016 bauma exhibition in Munich, Germany, convinced Lyle Cairns that they were the right partner for "fixing" the curing issues they were facing. In fact, AG have worked with Kraft Curing Systems since 1996 with the installation of the very first curing system in Northern Ireland for the accelerated strength gain of concrete flags. Since that time, AG have installed a total of 5 curing systems for the accelerated curing of various concrete hard landscaping products.

What convinced AG was not only the relationship that existed between the two companies, but also Kraft Curing's experience with solving similar curing problems at well reputed producers in Ireland, the UK, Germany and Poland.

Packaged concrete pavers ready for dispatch.



The "Touch-to-Cure" color user interface, available from 6" to 22", provides the curing temperature (red line) and curing relative humidity (blue line) values in real-time and for the past 24 hours.



The Touch-to-Cure" color user interface, available from 6" to 22", displays values from all temperature and humidity sensors located in the curing chamber (in this project, 3 sensors).

"We had a meeting with Michael Kraft at the Masa plant in Fivemiletown and he explained why the curing system we had was not the right solution for the outcome we were seeking – in-line tumbling earlier than 24 hours after production. He explained that it was not only about the equipment installed. Also, the design of the system and the curing chamber was not conducive to high early strength concrete. There were several factors at fault that required us to leave the pavers in the chamber for over 30 hours after production. First, the last pavers that were loaded into the chamber were the first ones out. They had the least amount of maturity and strength. Second, the time it took to fill a curing chamber (2 passages) was almost 3 hours. Thus, the door was not closed and the temperature of the concrete could not be raised until 3 hours after production – a waste of 3 hours' time. Third, while the chamber temperature was set to 60°C (140°F), the temperature never increased above 40°C (105°F) and took over 12 hours to reach 40°C. Other cost and quality issues that we were facing were also a result of the individual curing chamber design and equipment's inability to cure effectively."

Michael Kraft explains "the inherent challenge of the individual chamber design in conjunction with an air circulation, heating and misting system is the equipment's inability to provide an accelerated temperature rise due to the low energy content of heated air. Increasing the temperature of the incoming air only serves to dry-out the concrete resulting in low strengths, soft corners and edges, high absorption and lower resistance to the forces of freeze-thaw and efflorescence."

Instead of the individual chamber design, Kraft Curing proposed a single atmosphere curing chamber (big box design). Explains Michael Kraft "The outside walls and ceiling of the existing 14 passage rack was well insulated. Changing the design to a single atmosphere curing chamber simply required removal of the 6 divider walls and 7 roller-shutter doors and insulation around the transfer car area, elevator and lowerator."

While AG were convinced with the concept and under 24-hour outcome, there was one additional hurdle to clear in order that the project could move forward. Lyle Cairns and Works Manager, Declan McStravick, could not lose any production down time in the booming market. "We could give Kraft Curing the plant for only 13 days over the winter shut-

Insulated transfer car area including elevator and lowerator. Double-door for equipment access, personnel door and large window.

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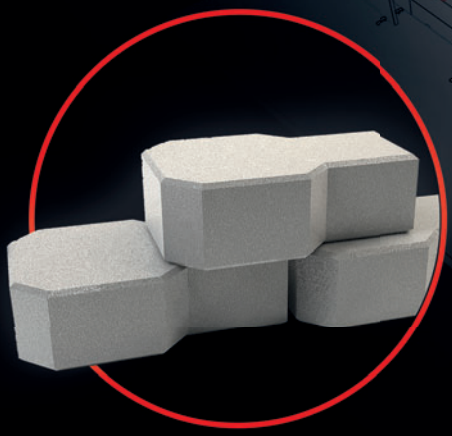

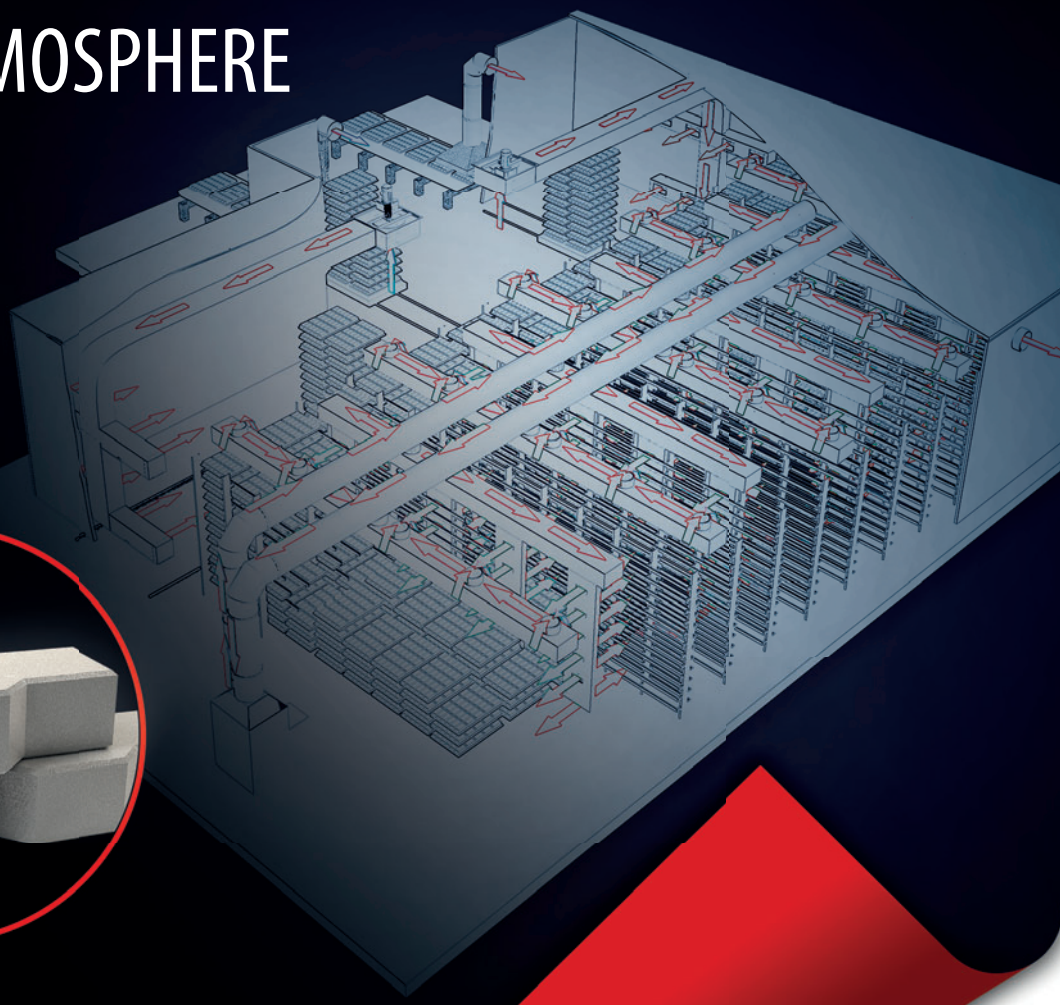

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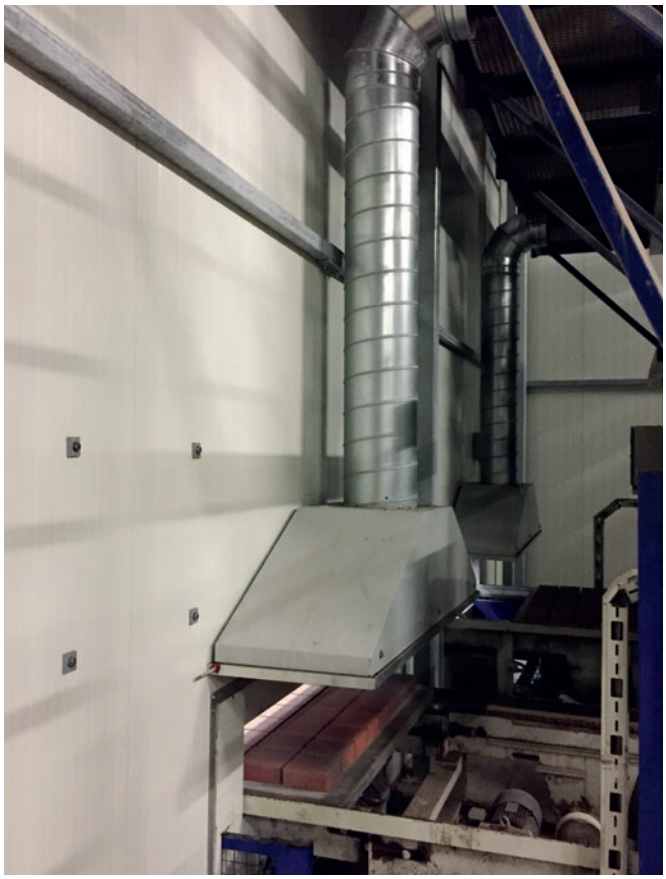

All chamber entry and exit openings are covered by exhaust hoods with built in ventilators in order to prevent the escape of heat and moisture from the chamber into the production area. The hoods are heated to prevent the formation of condensation which could drip onto the fresh product and cause spots.

Air circulation outlets, located at each level in the curing chamber, for very low air velocity and very high consistency. In this project, there are a total of 14 vertical ducts with 308 air circulation outlets and 64 return inlets.

down between the 27th of December and the 7th of January. We needed to be operational on the 8th with a functioning curing system." Kraft Curing agreed with the terms of installation and the project was installed in the last days of 2016 and first days of 2017.

During 13 days, Kraft Curing provided the complete mechanical installation of the insulated walls and ceiling around the transfer car area, elevator and lowerator, doors and windows, installation of the complete curing system including heating unit, duct, moisture addition system and electrical installation of lights in the curing chamber, all temperature/humidity sensors and motors. The system was commissioned beginning on 7 January.

Insulation is overlooked as the simple installation of insulated panels with self-taping screws and joints covered over with trim. What works for an insulated building does not work for a curing chamber. The process of sealing, foaming and insulating a curing chamber is important not only in reducing energy costs to the bare minimum but also prevents temperature inconsistency, spots on the concrete surface resulting from condensation drips, standing water and primary efflorescence.

In the weeks following commissioning, different chamber temperatures and relative humidity were tested and finally stabilized at 35°C (95°F) and 95% relative humidity, with a maximum allowable rH of 99%. The chamber is dry, there are no condensation drips or spots. The equipment is operating reliably. The operator is able to see into the curing chamber due to the bright lights and window. There are no issues with the production pallets.

The first weeks' results proved the single atmosphere chamber was the key to success in the goal of tumbling within 24 hours and less of production. The concrete paver quality after tumbling within 24 hours was better than the previous curing time of over 30 hours.

What began in 2016 as a search for increased productivity and a higher output of tumbled concrete block paving has become, at the end of 2017, a whole lot more.

In the past year, AG has been able to compare the performance of the concrete products in terms of defects, strengths, appearance and production cost and the curing system in terms of maintenance, energy costs and reliability. The results speak for themselves.

At 98% relative humidity, all steel rack, equipment, wall, ceiling surfaces and floor surfaces are dry and stay dry 24 hours per day and 365 days per year.

Besides the increased early strength and eliminating curing as the bottleneck in production, there has been a 12.5% reduction in energy costs (gas consumption) over the first 12 months.

The colors are more consistent with the paver surface being a more consistent shade of color – top to bottom and front to back. The corners and edges are strong and there have been no problems with efflorescence and no customer complaints.

The elimination of the seven (7) roller-shutter doors by switching to a single atmosphere concept has reduced maintenance in the plant overall.

In conclusion, the new curing system is a better concept and a better design than the original system. In comparison to the individual chamber curing system, the Quadrix accelerated concrete curing system reduced the curing duration required for in-line secondary processing from over 30 hours to under 24 hours – a reduction of 20%, reduced energy gas consumption by 12.5% as well as electrical consumption and provides a more consistent concrete appearance. ■

FURTHER INFORMATION

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