THE CDS SUCCESS STORY – ULTIMATE CURING FOR THE CONCRETE PRE-CAST INDUSTRY

It is generally known that the fundamentals of optimum curing conditions for concrete consist of temperatures between 85ºF and 120ºF with the relative humidity as high as practical and some form of air circulation. Cement content also plays a part in curing and this will be addressed later in this article. For pavers, the optimum standard temperature would be 85ºF to 105ºF. Temperature variations can cause major problems, such as strength and color variation due to differences in the cure rates. The optimum humidity should be maintained between 85% to 95%. Saturation of the air occurs at 100% humidity and should be avoided because this will result in condensation, which can negatively affect the concrete surfaces and metalic equipment. Some form of consistent air circulation is optimum because without air movement, hot air and steam naturally rise. Exceedingly hot humid "dead spots" then develop. The negative result is that the chambers are hotter at the top while much cooler at the bottom. This can also result in uncontrolled faster cure rates at the top and much slower rates at the bottom of the chamber.

Over the years, various methods of heating curing chambers have been used, including direct steam injection, oil heated radiators and heat pump systems. One of the major problems with the older systems was that most of the hot humid air escaped into the main production area where it could then condense on the roof structure when the chambers were opened. Another problem is related to steam, which produced at 212ºF, is 100% saturated. It condenses as it cools and it can "rain" within the chamber, causing drips on the product and corrosion on any uncoated steel in the chamber. The heat energy in the steam can also be lost, without good circulation and insulation, making those systems very inefficient and expensive to maintain. Some systems made use of hot air or steam circulation and some did not. It is very important to control humidity but, this was frequently not possible with the older systems. Brett Landscaping planned to solve these problems with their recent installation of a CDS Curing System.

The system described in this article was developed by CDS Inc., which has many years of experience in industrial curing systems. They are represented in North and South America by Concrete Technology Integrators, Inc. (CTI, Inc.).

To achieve higher curing efficiency, the chamber, finger car, elevator and, lowerator are totally enclosed within an insulated curing chamber. This photograph shows the insulated cladding panels that form the front wall of the curing chamber.

With the CDS system, the air within the curing chambers is efficiently circulated to achieve consistent curing conditions. The temperature and the humidity levels are automatically monitored and controlled to tight tolerances. The air is well circulated and controlled which results in the benefits of improved energy efficiencies and lower operating costs. In fact, with this system, the humidity is maintained between the desired humidity range of 85-95%, without saturating the air. No condensation occurs because there are no “cold bridges” and the insulation enclosing the chamber is designed correctly. It was this target of efficiency that Brett Landscaping was aiming to achieve when they planned to add a new block plant to their facilities.

The curing system at Brett’s Cliffe plant consists of a gas heater, air handling unit and insulated ductwork to equally distribute the warm humid air to all parts of the chamber. The system also includes motorized dampers, a sophisticated temperature and a humidity control system with a patented water atomization system, which effectively avoids uncontrolled vapor generation.

The Cliffe plant curing system was a further improvement of the CDS system outlined above by having the curing racks, finger car, elevator and the lowerator all totally enclosed. The well insulated roof and the walls form part of the main building structure. The front wall of the chamber is manufactured from insulated cladding panels provided with access doors. The products enter and leave the curing chamber through openings fitted with air curtains that can be adjusted to allow for varying cube heights.

The extra isolation that is provided by these curtains means that very little air escapes from the curing chamber into the production plant.

To test the conditions in the chamber, this small mild-steel plate was suspended inside the curing chamber for one year. Both ends of the plate were first coated with a rust preventing fluid, but the center was left untreated. The entire plate is rust free.

One significant advantage of having an enclosed curing chamber system is that fresh product is in the optimum curing environment within the shortest possible time after leaving the block making machine. This starts the curing process at the earliest possible moment and avoids the risk of surface evaporation that can cause efflorescence and a friable surface. The improvement in surface hardness can be seen when different products are compared.

The pallets are also suitable for the higher temperatures in the chamber.

When people examine the curing system control panel, they see a display of a temperature of 95ºF and a relative humidity of 95% even though there is no condensation within the chamber. The racks, finger car, elevator and lowerator are all dry. The photo of the mild-steel plate left inside the curing chamber for a year shows it to be rust free even though the center was left untreated while both ends of the plate were coated with a rust preventing coating.

There are other possible benefits from curing with controlled temperature, humidity and air circulation. Curing temperature and humidity are maintained constant – summer and winter alike – and there is no need to use additional cement to combat cold weather conditions.

For the manufacture of segmental pavers**,** landscape flags and segmental retaining wall or other decorative products, the key factors are better color consistency, lower energy consumption and high early strength at the lowest possible process costs. The consistent curing conditions maintained within the curing chamber provide color consistency throughout the whole chamber, top to bottom and side to side, giving brighter colors and

greatly reduces efflorescence. Low energy consumption is achieved because the heat of hydration of the cement is more completely used. Very little energy is lost through the well-insulated walls and during warm weather conditions, with continuous operation, the heaters may not actually fire at all because the heat that is needed is being generated by the heat of hydration. The temperature in the chambers is continuously monitored and fuel is burned only when it is necessary to maintain the temperature. Elevated temperature curing (up to 120ºF) is used to generate early strength. This makes it possible to reduce the cement content and cost, or to use less expensive cement substitutes such as furnace slag, etc for further cost reduction.

Wet products entering the curing chamber through the air curtain.

For Brett Landscaping one of the most important benefits was higher product quality. They always favored bright and vibrant colors. The higher product quality experienced by Brett has included very good color consistency with efflorescence virtually eliminated. The improved and reliable results achieved by the curing system have helped to ensure that their products are preferred by their customers.

Samples of products with CDS curing on the left and without CDS curing on the right

Process cost savings has always been important to Brett therefore they have used furnace slag with the CDS system to provide significant pigment and cement savings. When furnace slag is used as a cement replacement material early strength can be a challenge. This is overcome by the elevated temperature curing provided by the CDS system. At the Cliffe plant, Brett has been able to compare the results achieved by two similar manufacturing plants: one operating with the benefits of the CDS system and the other plant with a curing chamber without any special curing system. Brett has been able to confirm that much more cementitious material could be used in the plant with the CDS system while still maintaining the required strength, frost and abrasion resistance specifications.

The controlled and consistent curing environment provided by the CDS system can make more cost-saving opportunities possible as a company like Brett develops its manufacturing and process procedures. An example is that when pavers from the CDS equipped plants are tumbled in line, the improvement achieved by the extra hardness and toughness of their surface is easily noted.

Freshly cured products leaving the chamber

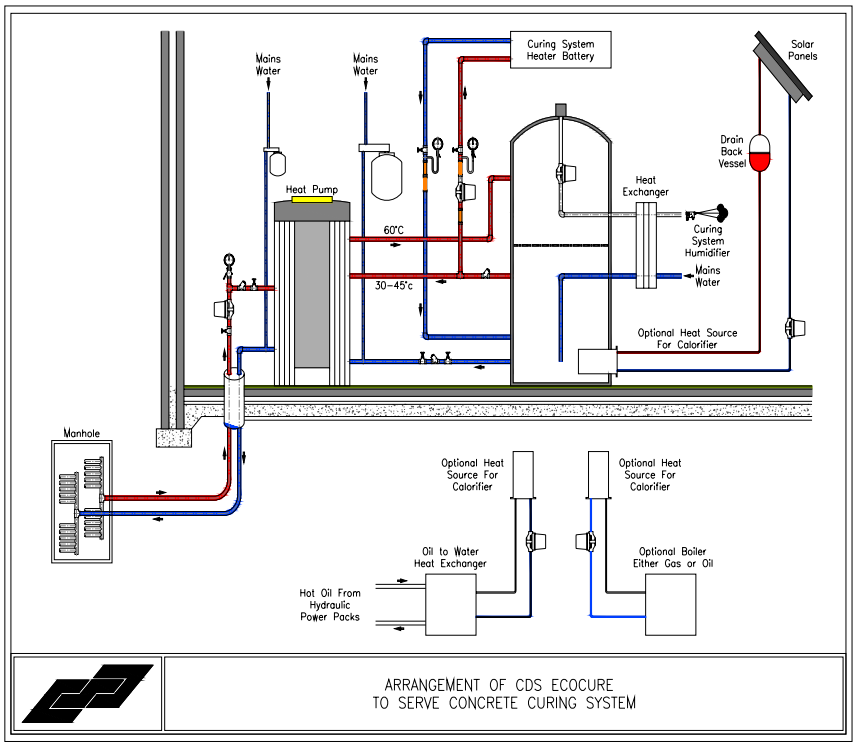
Slat conveyor carrying products into the yard

Based on the outcome and performance at the Cliffe plant, Brett has recently installed two more systems.

In addition to this CDS has now in excess of 100 successfully operating curing systems worldwide. Working with our partners in Europe, USA, Dubai and India CDS has a rapidly growing market.

With the increasing demand of lower manufacturing costs & a more environmentally friendly ‘greener’ system CDS has now implemented and Trademarked the CDS ENVIROCURE System that will enable manufacturers worldwide to utilize the local ‘green’ fuel options instead of the traditional fossil fuels that are having an increasing cost. CDS can provide a solution that will allow the use of Bio Fuels, waste oils, Geo Thermal and Solar as required if a combination of any.

This system will enable producers to certainly reduce operational costs, provide an ideal curing conditions for the plant aswell as being environmentally aware. CDS has this technology.



Please Contact us at:-
CDS Inc is Cinderhill Trading Estate, Weston Coyney Road, Longton, Stoke-on-Trent ST3 5Ju (Phone: 01782 336666. Fax: 01782 599729).
www.cds-concrete.com
info@cds-concrete.com