Made to fit

Replacing cooler grate plates with a lane unit system combines low investment with the highest efficiency in the market, as shown by a recent project in South Korea carried out by Claudius Peters.

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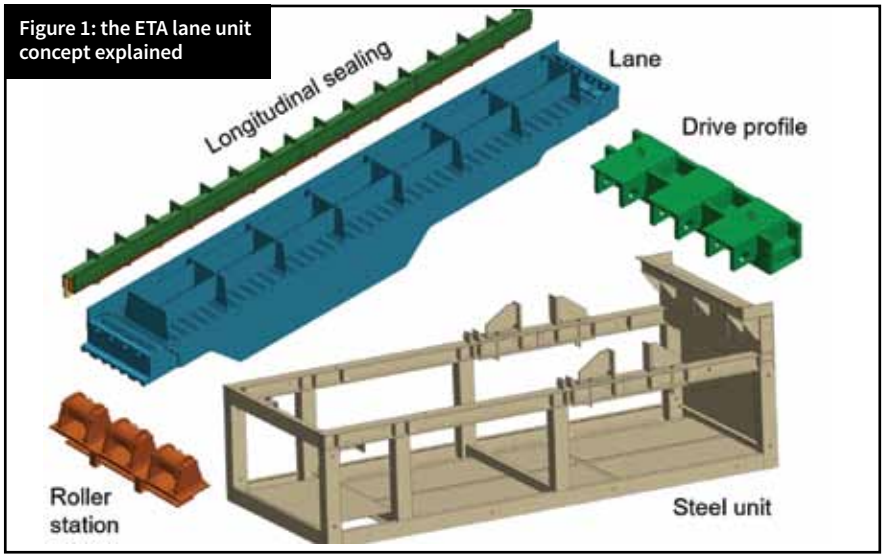
In September 2017 Ssangyong Cement replaced the old grate cooler technology at its plant in Donghae, South Korea, with a new state-of-the-art ETA cooler from Claudius Peters. As the saying goes, keep what is good and replace what is bad. The ETA lane unit system is designed to do just that, replacing the old grate cooler internal equipment, such as grate plates, grate supports and the moving frame, with the ETA top-of-the-line moving floor.

The project's target was to address the following issues:

- **Burned plates** – Donghae has a tertiary air cyclone on the burner floor with the dust return fed to the cooler. In the case of the grate cooler, the hot dust returns are pulled to the grate surface, causing plate damage. The moving principle of the ETA cooler avoids the vertical movement of the clinker, while the pebble-filled lanes protect the air inlets.
- **Fluctuations in preheater operation** – the mixed fluidised bed preheater at Donghae appeared to be very sensitive to fluctuations in the recuperation air temperature provided by the grate cooler. The high bed of the ETA cooler has a dampening effect on these fluctuations.

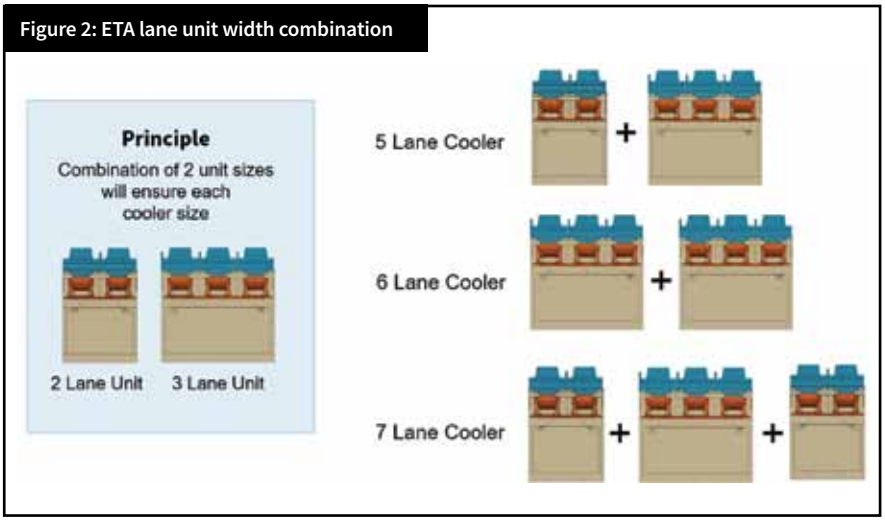
Figure 1: the ETA lane unit concept explained



- **Dust circulation** – the high air load that is needed for the grate cooler caused high dust circulation between the cooler and the kiln. The lower air load of the ETA cooler, due to the higher clinker bed, has a positive effect on the reduction in air circulation.

When the increased efficiency, low maintenance cost and high availability of the ETA cooler was compared with the operating costs of the existing cooler, it was clear the ETA cooler had a short return on investment.

Figure 2: ETA lane unit width combination



The ETA lane unit system explained

The ETA lane unit system has been specifically designed to replace the internal equipment of old grate coolers (see Figure 1). It combines standard parts to create a customised solution to reduce engineering time and ensure fast delivery. The lane unit consists of:

- a steel unit for the placement of 2-3 lanes. The combination of two- and three-lane wide steel units can accommodate a scope of 2-12 lanes
- aerated lanes with air inlets
- heavy-duty rollers to support the aerated lanes
- sealings between the lanes and at the lane sides.

The lanes, rollers and sealings are standard parts, enabling a short delivery time. Each ETA lane is twice the width of the old Fuller grate plate design, on which most grate coolers are based. Therefore, an 8ft grate cooler can be replaced with a four-lane ETA cooler, a 10ft grate cooler by a five-lane ETA cooler, a 12ft grate cooler by a six-lane ETA cooler, etc (see Figure 2).

At Donghae, the first stage of the 16ft stage cooler was replaced with an eight-lane ETA cooler.

In terms of cooler length, by combining 3.3m- and 4.4m-long units, the cooler can be replaced with an accuracy of 1.1m in length.

The steel structure of the lane units can also be locally supplied. Therefore, workshop drawings are readily available. As an alternative the steel units can be supplied with roller hydraulic cylinders, lanes and sealing as a pre-assembled module. The advantage here is that the units are built at well-equipped workshops, therefore ensuring accuracy. Another benefit of pre-assembly is quicker installation, reducing the kiln stop time.

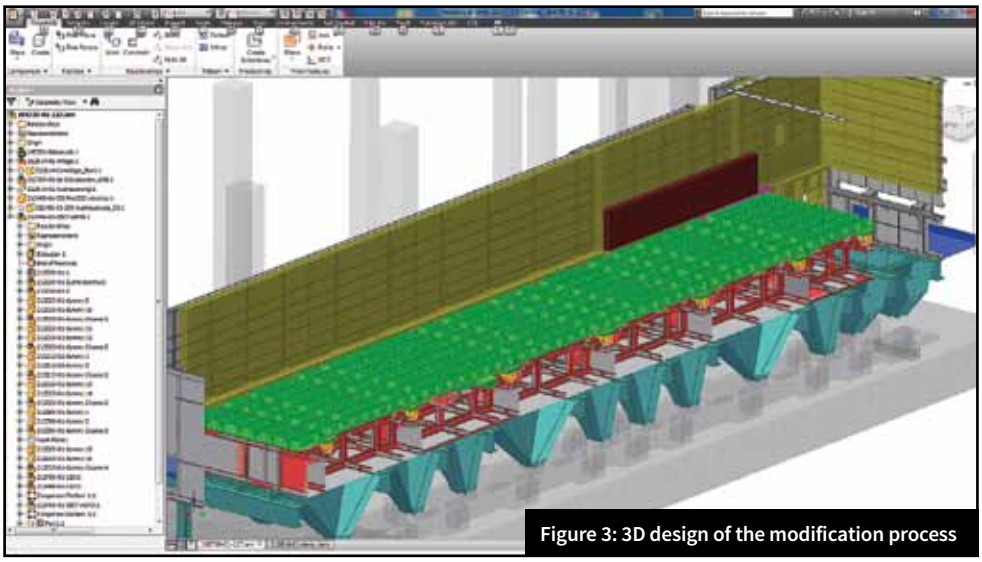


Figure 3: 3D design of the modification process

Modification execution

The cooler replacement at the Donghae plant was planned in such a way that the cooler internals, including the grate plates, grate supports and moving frame, were removed and the existing cooler housing was salvaged. The cooler modification process can be broken down into 10 steps (see Figure 3):

- **Step 1** – as the cooler internals will be completely stripped, it is necessary to support the cooler upper part from the outside against buckling of the columns. Usually the upper part will be connected to building columns so that it is statically safe. This can be carried out before the kiln stop.
- **Step 2** – the grate plates, grate supports, moving frame, support axles and drive axles are completely removed. The hydraulic drive unit and the cooling air fans that will not be reused will also be removed.
- **Step 3** – in many cases the lower side wall has to be adapted to connect the lane units to the side of the cooler. This is to enable the refractory to be placed at the correct height and to prepare the connection between the existing lower side wall to the lane units.
- **Step 4** – minor modifications are made to the cooler upper part steel work.
- **Step 5** – static inlet or HE-module placement and steel frame. This involves placement of the steel frame on which the steel units will be placed. The frame will be levelled so that the erection of the steel units can be carried out quickly.
- **Step 6** – the steel units are placed and welded to the steel frame. For a wide cooler, as in the case at Donghae with an eight-lane cooler, the outside steel units will be placed first followed by the middle steel units.
- **Step 7** – placement of the crusher. Preparing the support structure can be carried out beforehand. In the Donghae project, the existing roller crusher was reused.
- **Step 8** – installation of rollers and cylinders. On the fixed steel units, the rollers and hydraulic cylinders can be mounted and aligned. As the steel units were already mounted on a levelled frame, the alignment of the rollers is usually a simple procedure.
- **Step 9** – the upper part of the cooler above the roller crusher will be extended if necessary.
- **Step 10** – lane and sealing assembly. The lanes are placed on the aligned rollers and connected to each other. Finally, the sealing is replaced – the cooler is now ready. All works outside the cooler, such as the hydraulic aggregate and new fans, are not as critical so can be carried out in parallel with the 10 steps of the cooler modification.

Lane unit erection

At Donghae the complete kiln stop took only 45 days with the erection team working 10h/day. The ETA cooler exceeded all expectations. The aforementioned performance issues were diminished, allowing the facility to reduce its production costs and maximise profits. There is no longer a need to replace the grate plates every year, and with a five-year guarantee on the rollers, HE-Module plates and the aerated lanes, the ETA cooler sets new standards for maintenance costs.

The long-term low operation cost of an ETA cooler offers the lowest total cost ownership on the market. The technology shows that looking beyond the initial investment is a smart move. ■