A TEC

World Leader in Cement Pyroprocess Technology

Preheater Improvements

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Please note:
In the following article A TEC GmbH could also be mentioned as A TEC Advances Process Technologies GmbH, PMT; PMT-Zyklontechnik GmbH, Zyklontechnik GmbH
(= company name before 1st June 2005).

World Cement, June 2002

Preheater Improvements

Walter Kronawetter, PMT-Zyklontechnik GmbH, Austria, introduces innovative key technologies to reduce production costs and improve environmental balance.

Introduction

In order to be competitive in today's cement market, plant operators have to minimise production costs and increase production at the same time. The production of many of the older cement plants is limited by the preheater fan, resulting in a maximum pressure drop in the preheater tower. Since complete modifications of the preheater are linked with a long kiln shutdown and enormous cost, plant operators are looking for alternatives with a minimum kiln shutdown period, and employing a minimum amount of new or modified equipment.

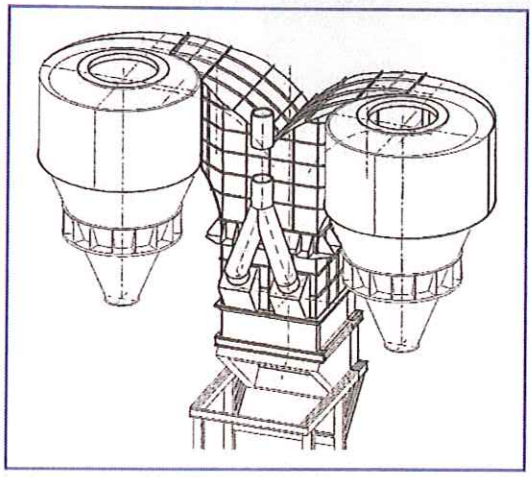

Figure 1. Modification of kiln hood.

For these reasons, PMT-Zyklontechnik offers engineering for complete modification of preheater towers in order to reduce the pressure drop significantly, which in turn will increase clinker production or reduce energy costs. Waste fuel preparation plants and installation of chlorine by-pass systems are now providing technology for clients using alternative fuels. Together with its partners in combustion technology, PMT-Zyklontechnik has the availability to create the optimum solution in research, and as a result, the optimum preparation, feeding and burning during the clinker production process. This enables the customer to fall significantly below the official emission standards outlined by government regulations and allows its clients in the cement industry to use the maximum quantity of alternative fuels to reduce production costs.

Preheater modification by engineering

In addition to delivery of equipment for optimised pressure drop and separation efficiency, PMT-Zyklontechnik also provides engineering for a plant's modification. From optimisation of riser duct and hot gas duct assembly and modification of lower preheater stage cyclones to modifications or new design of calciner and tertiary air duct, everything is provided to increase clinker production to the clients' requirements.

In the example shown in Figure 1, the aim of the modification was to stabilise the operation and produce 2500 tpd of clinker. This would be achieved by improving the chemical reaction of the sulfur content.

Cyclone installation

The HURRICLON® is a specially designed cyclone separator with two dip tubes instead of one (Figure 2). One is situated at the top, as in common cyclones, and one at the bottom. With this doubled area for the clean gases, one can keep the velocity in the dip tubes low and therefore maintain a lower pressure drop.

Additionally, one HURRIVANE® unit is welded to each dip tube, which brings further pressure loss reduction. With this low pressure drop, it is possible to design a smaller outside diameter and reach higher velocities to increase the

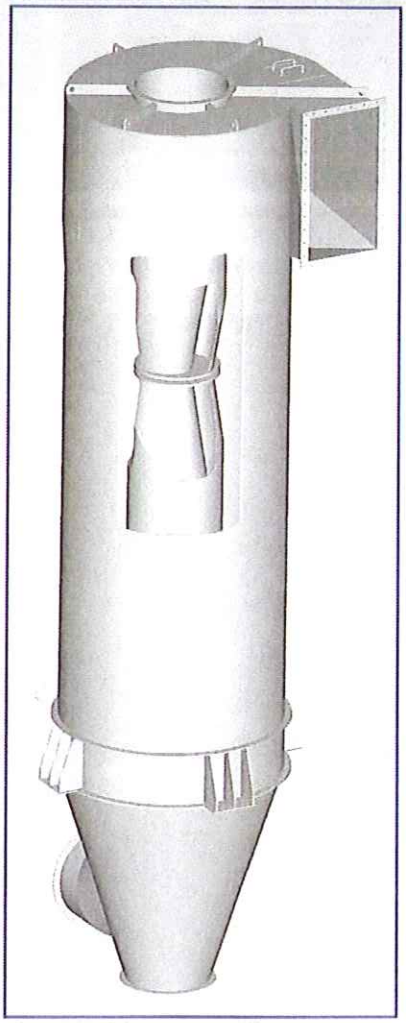

Figure 2. The HURRICLON®.

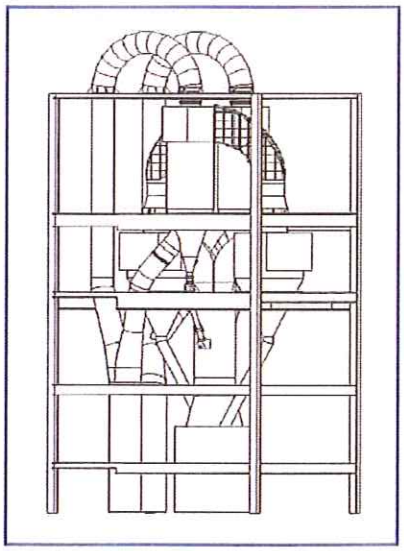

Figure 3. Preheater in Italy.

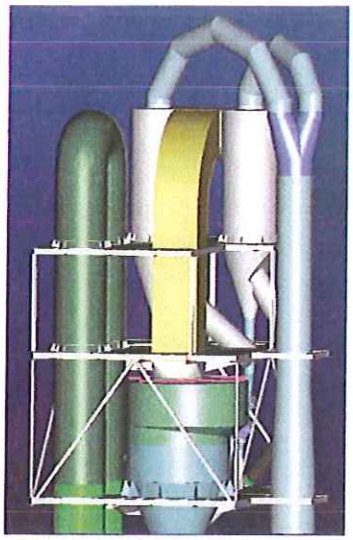

Figure 4. Preheater in Portugal.

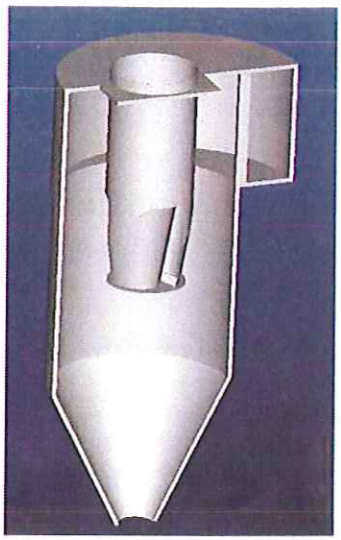

Figure 5. HURRIVANE® installation in a common cyclone.

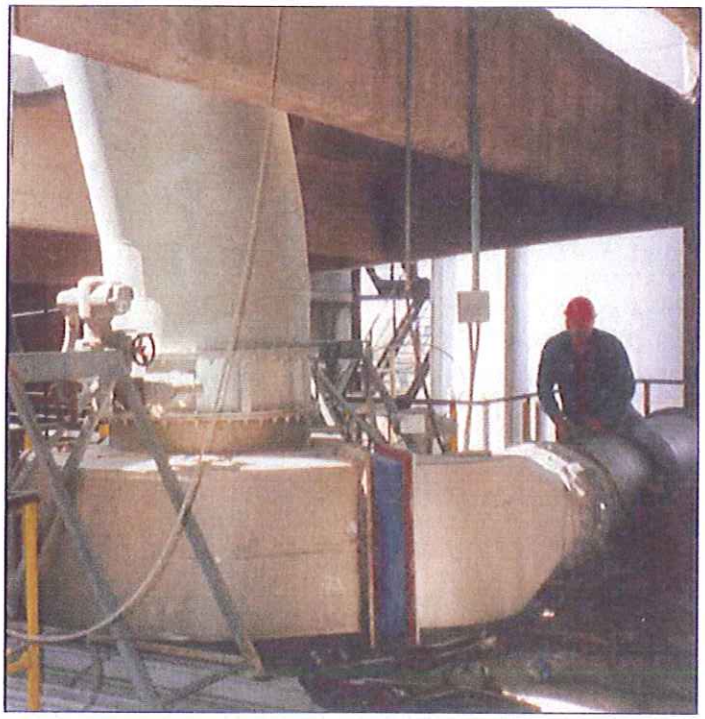

Figure 6. A by-pass quencher unit installed in Italy.

centrifugal forces, thus resulting in a better separation efficiency. Depending on the particle size distribution, gas quantity and dust load, the HURRICLON® is able to reach a separation efficiency of up to 99%. Compared to common cyclones, the HURRICLON® requires less space, therefore the peripheral investment costs are also lower. With this reduced space requirement, it is possible to build a smaller HURRICLON®, or replace two existing cyclones with one HURRICLON® unit.

Up to now, 400 HURRICLON® units have been installed worldwide for different applications, from wood to sugar to the cement industry. The main applications in a cement plant are the preheater tower, raw mill, cement mill and clinker cooler dedusting. Several preheater towers are now equipped with a HURRICLON®, examples of which are shown in Figures 3 and 4.

Installation into conventional cyclones

The HURRIVANE® is a device that is simply installed into the cyclone by welding it to the existing dip tube (Figure 5). In principle, it consists of two or three guide vanes, which guide the vortex in the cyclone into the dip tube. These guide vanes are especially designed to minimise the effect of the change of the gas flow from circular to linear movement. Each HURRIVANE® is customised to the existing parameters of the existing cyclone. The delivery is either as a complete unit or in pieces, which are welded together inside the cyclone and mounted to the existing dip tube.

Most of the pressure loss (approximately 70%) in a cyclone is caused by the change of direction of the gas flow from circular to linear movement when entering the dip tube. The HURRIVANE® is able to reduce this pressure drop caused by the dip tube by approximately 50%, which leads to an overall saving of the cyclone of 30%. This value is guaranteed by PMT-Zyklontechnik and has been reached in all of its installations.

Bypass installation

In the sintering zone of rotary kilns, parts of alkalis, sulfur and chlorine are liquid/gaseous. Above approximately 800 °C alkalis, sulfur and chlorine start to volatilise. With the gas flow through the kiln, the volatile parts arrive at the colder preheater, where they condense on the material. This mechanism is the start of recirculation. When diverting part of the gases through the bypass valve, by side-tracking part of the gases in the lowest part of cyclone stage IV riser duct, it is possible to reduce the circuit.

The increase in heat consumption caused by the bypass operation amounts to 4 - 5 kcal/kg of clinker/1 vol% bypass. The kiln dust turned aside by the bypass valve amounts to approximately 0.1 % per 1 vol% by-pass depending on the weight of the raw mix. The temperature of the bypass gases at the bypass valve is approximately 1100 °C. The chemical/physical behaviour of alkalis, sulfur and chlorine requires the use of cold air for cooling the bypass gases to approximately 450 °C. This cooling air will be pressed in a quenching chamber, with a fan driven by a speed controlled motor. The gases will be transported through a piping system to an existing/modified electrostatic precipitator in which the gases are dedusted. The gas transport is carried out by an existing/modified fan driven by a speed controlled motor after the electrostatic precipitator. The clean gases after the fan will be used for drying raw material or in a future extension for drying slag.

Since 1998, PMT-Zyklontechnik has installed several by-pass system units, including engineering for complete installation (tests, calculation, workshop drawings of the bypass system, specification of equipment, instrumentation and interlocking) and delivery of the quenching chamber, as demonstrated in Figure 6.

Waste fuel burning

The cement industry is an ideal field for using alternative fuels, as it guarantees savings in production where

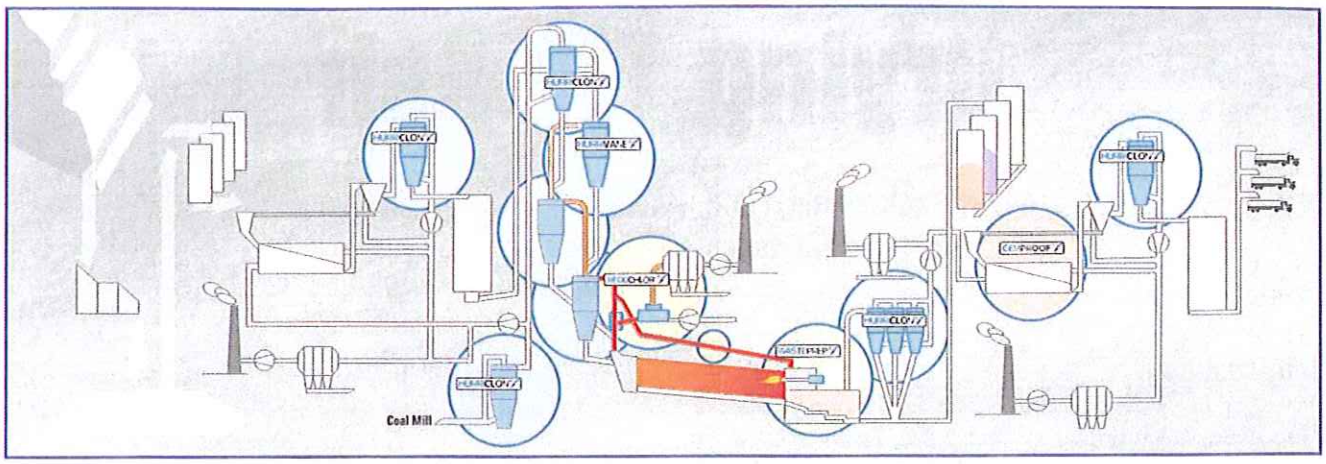

Figure 7. The principle of the installed waste fuel preparation process.

there is a high ratio of fuel costs to total production costs. Alternative fuels are perfectly suited for replacing expensive fossil fuels. On the one hand, energy costs can be reduced drastically; while on the other hand the environmental impact is positive. By using less fossil fuel, CO_2 emissions are reduced and resources are saved.

The materials that can be used in the WASTEPREP® process range from waste oil and solvents, contaminated wood, tyres, plastics and domestic waste to animal meal with calorific values of 2000 - 8000 kcal/kg (Figure 7). The preparation process includes every necessary step from the delivery of the raw alternative material to the burner, including storage, conveying, separating, shredderring and dosing. The alternative fuels are brought into the kiln through the main burner, except prepared tyres and rubber, which are fed into the kiln entrance.

Currently, eight plants are in operation; five for animal meal and three for plastics and rubber preparation. The substitution of conventional fuel is 10 - 50%. The results of the emissions tests show that there is no significant influence in burning alternative fuels, and the impact on the produced clinker is not substantial.

Utilisation of alternative fuels and animal meal offers many advantages for the economy, and they are available in sufficient quantities everywhere, whereas conventional fuels are in short supply or are not available in many countries.

Conclusion

In most cases, the limitation of preheater modifications is concerned with the structure of the existing preheater building in terms of space and load. By using HURRICLON®, both of these potential problems can be overcome due to the double gas throughput of HURRICLON® compared to conventional cyclones. Another limiting factor is often the existing preheater fan. As higher production requires higher gas quantities, the installation of HURRIVANE® in existing cyclones can be useful to reach this target. These technologies, combined with the engineering experience of PMT-Zyklontechnik, place a new perspective on preheater upgrading projects.

The main advantages of installing the by-pass system are as follows:

- Controlled clinker quality.
- Continuous kiln operation.
- Increase in production.
- High degree of flexibility.
- Low amount of by-pass dust.
- High chlorine, sulfur and alkali concentration in by-pass dust.
- Avoidance of extremely high salt values in hot meal.

Where bypass installation is concerned, it is possible to use a high amount of 'secondary' fuel and raw materials, which often contain higher levels of chlorine, alkalis and sulfur. Under these preconditions, the result of by-pass installation is a potential reduction of production cost.

Enquiry no: 20