Christian Pfeiffer

# Successful modernization of a separator in a cement grinding plant at the Schelklingen cement works



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## SUMMARY

At the start of 2012 the Christian Pfeiffer Maschinenfabrik GmbH from Beckum fitted a new cage rotor, an improved louvre ring and an air seal to a QDK 38-N separator of the 3rd generation that it had supplied in the 1990s to a cement grinding plant in the Schelklingen cement works belonging to Heidelberger Cement AG. The cement works near Ulm currently operates four cement grinding plants. The grinding plant in which the separator was modernized has a 4.4 m diameter x 15.25 m two-chamber ball mill that is now used mainly for the production of CEM II/A-LL 32,5 R cement. The cement is ground to finenesses corresponding to 3100 to 4800 $cm^2/g$ Blaine. The modernization of the separator, which took only a few weeks, achieved significant improvements in throughput and specific energy demand. The throughput was increased by 14.5 % when producing CEM II/A-LL 32,5 R cement and at the same time the specific power demand of the grinding plant was lowered by 13.78 %. The Tromp curves recorded before and after the modernization confirm that these significant improvements can be attributed to the optimization measures that were carried out on the separator. Before the start of the modernization work the separator bypass was close to 30 % but after the optimization this value was only 7 %. Significant separator components were retained when the modernization measures were carried out so it is expected that the conversion costs will be amortized within a few months.



## ZUSAMMENFASSUNG

Im Zementwerk Schelklingen der Heidelberger Cement AG wurde Anfang des Jahres 2012 durch die Christian Pfeiffer Maschinenfabrik GmbH aus Beckum ein von diesem Unternehmen in den 1990er Jahren gelieferter Sichter der 3. Generation mit der Typenbezeichnung QDK38-N innerhalb einer Zementmahlanlage mit einem neuen Sichtkorb, einem verbesserten Jalousie-Ring sowie mit einer Luftabdichtung ausgerüstet. Das Zementwerk in der Nähe von Ulm betreibt gegenwärtig vier Zementmahlanlagen. Die Mahlanlage, an der die Sichtermodernisierung vorgenommen wurde, ist mit einer Zweikammer-Kugelmühle mit den Abmessungen ∅ 4,4 m x 15,25 m ausgerüstet, auf der heute vornehmlich ein Zement der Sortenbezeichnung CEM II/A-LL 32,5 R erzeugt wird. Der Zement wird auf Mahlfeinheiten entsprechend Blainewerten von 3.100 bis 4.800 $cm^2/g$ gemahlen. Mit der Sichtermodernisierung, die nur wenige Wochen in Anspruch nahm, wurden signifikante Verbesserungen beim Durchsatz und spezifischen Energiebedarf erzielt. Bei der Herstellung eines Zements der Qualität CEM II/A-LL 32,5 R gelang es den Durchsatz um 14,5 % zu steigern, wobei zugleich der spezifische Energiebedarf der Mahlanlage um 13,78 % gesenkt werden konnte. Dass diese signifikanten Verbesserungen auf die am Sichter durchgeführten Optimierungsmaßnahmen zurückzuführen sind, dokumentieren die vor und nach der Modernisierung des Sichters aufgenommen Trompkurven. Lag der Bypass des Sichters vor Beginn der Modernisierungsarbeiten bei nahe 30 %, so betrug dieser Wert nach der Optimierung nur noch 7 %. Da die Durchführung der Modernisierungsmaßnahmen unter der Beibehaltung wesentlicher Sichterkomponenten erfolgte, kann mit einer Rückflussdauer der aufgewandten Umbaukosten von wenigen Monaten gerechnet werden.




(English text supplied by the author)

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## Erfolgreiche Sichtermodernisierung an einer Zementmahlanlage im Zementwerk Schelklingen

### 1 Introduction

At the start of 2012 the Christian Pfeiffer Maschinenfabrik GmbH from Beckum modernized a QDK 38-N separator of the 3rd generation that it had supplied in the 1990s for a cement grinding plant in the Schelklingen cement works (◗ Fig. 1) belonging to Heidelberger Cement AG. During this modernization work the separator was equipped with a new cage rotor, an improved louvre ring and an air seal.

The Schelklingen cement works near Ulm currently operates four cement grinding plants. The modernization of the separator was carried out in a grinding plant with a 4.4 m diameter x 15.25 m two-chamber ball mill equipped with trunnion bearings and a classical girth gear and pinion drive. The mill has a lifter lining in the preliminary grinding chamber and classifying lining in the second grinding chamber. This grinding plant is now used mainly for the production of CEM II/A-LL 32,5 R cement, which is ground to finenesses corresponding to 3 100 to 4 800 $cm^2/g$ Blaine. The modernization of the separator, which took only a few weeks, achieved significant improvements in both the throughput and the specific energy demand of the cement grinding plant.

### 2 Description and function of the QDK high efficiency separator

The QDK high efficiency separator (◗ Fig. 2) is designed so that the ground material is conveyed via two diametrically opposed feeding chutes to a rotating material distribution plate. Due to the high rotation speeds the material is thrown between the louvre ring and the rotating cage of the separator. The small particles are drawn into the rotating cage through the blades of the cage and then collected by cyclones or filters. Using filters for the collection process has the advantage that the temperature of the grinding process can be controlled by adjusting the supply of fresh air. Different material finenesses can be obtained by regulating the speed of the rotating cage and/or the amount of air in the QDK high efficiency separator. The most important technical and technological parameters of the separator are listed in ◗ Table 1. One of the characteristics of the Christian-Pfeiffer-QDK high efficiency separator is the almost wear-free air seal (◗ Fig. 3) between the rotating cage and the housing so that the two parts do not touch each other. The air seal between the rotating cage and the housing prevents the coarse particles from passing into the finished product. This special seal is one advantage of the Christian Pfeiffer separator over other sep-

Table 1: Technical parameters of the Christian Pfeiffer QDK high efficiency separator

| Designation | Unit | Value |
|---|---|---|
| Cage rotor dimensions | m dia. x m | 3.2 x 1.925 |
| Max. air throughput | $m^3/h$ | 248 000.00 |
| Max. circumferential speed | m/s | 42.00 |
| Installed rating | kW | 400.00 |

Figure 1: View of the Schelklingen cement works, located near Ulm

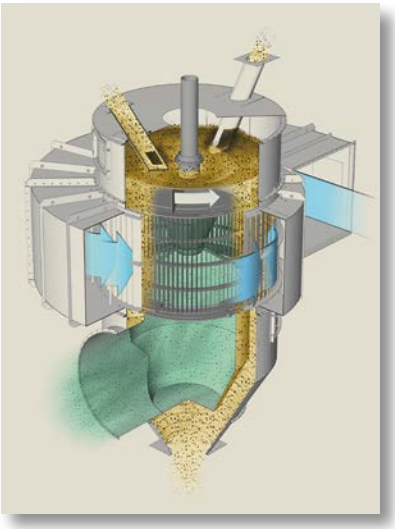

Figure 2: 3D representation of the Christian Pfeiffer QDK high efficiency separator

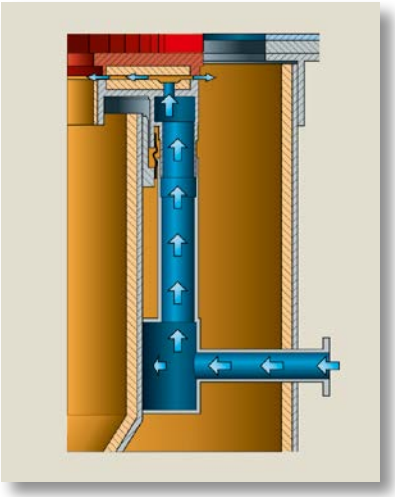

Figure 3: View of the wear-free seal between rotating cage and adjusting ring

arators. The seal is nearly free from wear and can be adjusted very precisely.

## 3 Results of the separator modification

In addition to the routine maintenance of the rotating cage and the louvre ring it was decided in 2012 that, due to normal wear during operation, the rotating cage should be changed to the latest design after a service life of at least 18 years. It was also decided that the mechanical seal should be replaced by an air barrier seal and that the customer's requirements for increased grinding efficiency and reduced energy costs should be met. With the help of a CFD analysis the separating area and air channel were modified and the rotating cage and the louvre ring were optimised. In the new design, the blades of the rotating cage and the air guide vanes of the louvre ring have been arranged in the direction of the air flow. ❱ Fig. 4 shows the air flow in the separator obtained by CDF analysis.

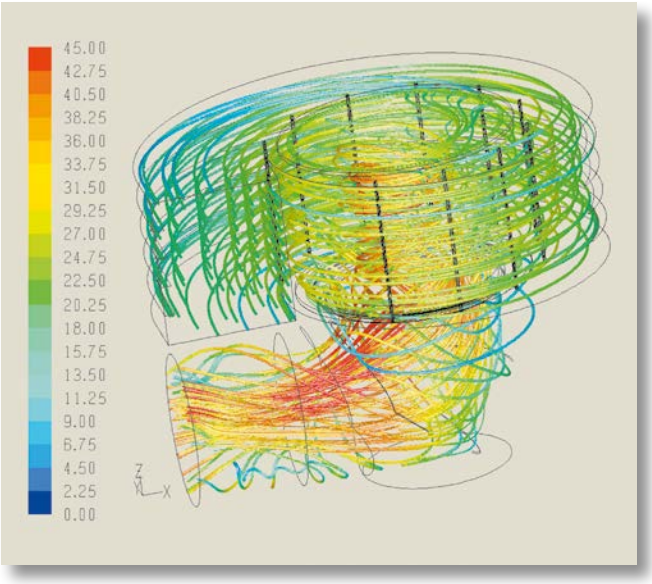


Figure 4: CFD analysis of the air flow in the Christian Pfeiffer QDK high efficiency separator

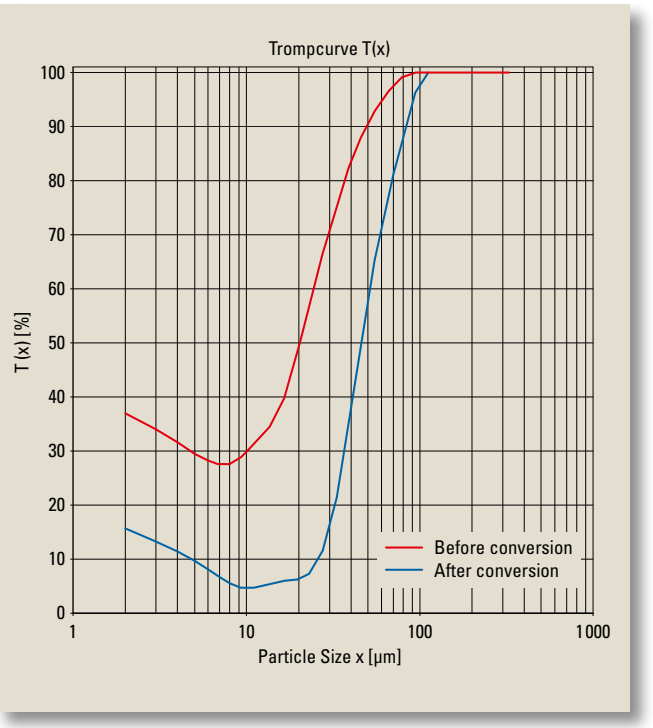


Figure 5: Comparison of the Tromp curves before (red) and after modernization (blue) of the separator

The remodeling measures took place In February 2012 and the modernised separator was put into operation at the beginning of March. The first reliable results for producing CEM II/ALL 32,5 R cement were available four weeks after start-up.

An increase in throughput of 14.5 % was reached after the remodelling and the savings in specific energy consumption were 13.78 %. Part of the good results certainly has to be attributed to the confined air seal that was installed. The mechanical seal was no longer perfectly adjustable due to wear and this produced more coarse-grained material. However, the change to the new separator design was decisive. Separator tests before remodelling had shown that it was only possible to achieve a bypass of nearly 30 %, which was normal in previous separators of this type, while a bypass of less than 7 % was measured with the new design. For example, where a fineness of 3800 $cm^2/g$ Blaine had previously been necessary to obtain the required early and final strengths, the production of a cement with a fineness of 3600 $cm^2/g$ Blaine is now enough to reach the same cement strength values. ❱ Fig. 5 shows the Tromp curves before and after modernization of the separator.

## 4 Final remarks

Operators of cement plants who installed a separator in the 1990's or earlier should consider modernization. The innovative changes in separator technology may help to produce a significant reduction in the specific energy consumption of an existing grinding plant. It should be noted that existing separators do not have to be replaced by new separators; it is often enough to remodel them to the latest design, as in the Schelklingen cement works. Under constant market conditions the investment costs in the Schelklingen plant will probably have been amortized within a few months. ❰

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There is more potential in your plant as well. Higher capacity. Better quality. Lower energy consumption. Get in contact with us!

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**more than**
**30%**
**of energy**
**per ton of finish product***

* depending on feed material and plant design

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