BETTER GRINDING AT JAYPEE BELA CEMENT

A.K. Dembla, Humboldt Wedag India, V.K. Jain, Arvind Nema, Jaypee Bela Cement, India, and S. Strasser, KHD Humboldt Wedag AG, Germany, describe a project to upgrade the grinding capacity of the No.1 cement mill at the Jaypee Bela plant.

INTRODUCTION
The cement grinding capacity of cement mill No. 1 at the Jaypee Bela Cement plant at Jaypee Puram, District Rewa, Madhya Pradesh, India, has been successfully upgraded by Humboldt Wedag India (HWI) and KHD Humboldt Wedag AG (KHD). The plant belongs to Jaypee Associates Ltd (JAL) a leading Indian business group. JAL ordered the largest roller press in India, with 3000 kW drive power. Cement production from the single mill system is expected to reach approximately 280 tph. Holtec Consulting Pvt. Ltd provided consultancy services to the group for this project. A view of the Jaypee Bela plant is shown in Figure 1.

THE JAYPEE GROUP
Jaypee Cement has three modern computerised process control cement plants with a total capacity of over 6.5 million tpa. The total capacity at the Jaypee Rewa plant is 4 million tpa from two units: unit 1 commissioned in 1986 and unit 2 commissioned in 1991. The Jaypee Bela plant, which has a capacity of 2.5 million t, was commissioned in 1996.

The Jaypee Group is a well diversified infrastructural industrial group with a turnover of approximately Rs3000 Crores. The group is a leader in the construction of river valley and hydropower projects on a turnkey basis. The company is now also making its foray into highway construction. The group also provides consultancy for mega hydropower projects and has interest in the tourism and hospitality
sectors, operating four deluxe five-star hotels in India, along with a golf course in India.

In addition to this, the Group is also heavily involved in education, from the grassroots level through to higher technical education. It aims to provide education at all levels of the learning curve, to help the younger generation to become economically independent, as a ‘not for profit’ trust. It has 11 educational institutes, detailed below, spread across three states (Madhya Pradesh, Uttar Pradesh and Himachal Pradesh) imparting education to over 7500 students.

- Three higher technological education institutes: one each in Noida (Uttar Pradesh), Guna (Madhya Pradesh) and Solan (Himachal Pradesh).
- Two degree colleges in Anoopshahr (Uttar Pradesh).
- Two vocational technical training institutes: one in Jaypennagar Rewa (Madhya Pradesh) and one in Hamirpur (Himachal Pradesh).
- Four primary to higher secondary schools: three in Jaypennagar Rewa (Madhya Pradesh) and one in Anoopshahr Uttar Pradesh.

**RETROFITTING TARGETS**

The Jaypee Bela plant approached Humboldt Wedag India to upgrade its cement mill No.1, a closed circuit mill with Sepax air separator. The modification of the circuit was based on the following objectives:

- Increasing the grinding capacity of the system from 150 - 250 tph at a fineness of 3000 cm²/g according to Blaine.
- Reduction in specific power consumption by 10 - 12%.
- Fulfilling market requirements and maximising use of fly ash to produce blended cements.
- Further optimisation in order to exploit the maximum potential grinding capacity.

**PLANT CONCEPT**

The existing cement mill was supplied by L&T and installed in 1995-96. The size of mill is 4.6 m dia x 16.5 m length, incorporating a MAAG central drive (CPU-38) with a rating of 5000 kW. The mill is used to produce OPC cement. The original mill circuit had a Sepax air separator in closed circuit with arrangement of bag filter for venting excess air from the system. The ball mill had a separate venting through ESP. The mill was originally fitted with a combidam partition diagram.

It was envisaged that the existing ball mill would be used with a new grinding circuit, consisting of a roller press, V-Separator and dynamic SKS-separator, designed by KHD Humboldt Wedag AG, Germany. The existing Sepax separator along with the fan has been removed. A new bag filter and fan was used for SKS venting. It is an ‘S type circuit’, in which the product from the V-Separator and the mill are separated in one SKS-Separator. The rejects of the SKS-Separator are conveyed to the ball mill via a solid flow meter. The product from the SKS-Separator is collected in cyclones and transported to existing cement silos.

The flow diagram of the mill circuit with material balance is shown in Figure 2.
An option is also provided in the circuit to take all of the SKS-Separator rejects to the roller press, which would be run in finish mode without a ball mill.

With the roller press in semi-finish mode it was decided to convert the existing two chamber ball mill into a single chamber mill by removing the intermediate diaphragm. This allowed an additional 500 mm of grinding path and easier control of the mill loading. The design data of main equipment installed in the cement mill circuit are given in Table 1.

MODIFIED GRINDING SYSTEM

V-Separator
The success of the V-Separator is now well established, with 50 installations working successfully all over the world, including India. Due to its simple design it is easy to maintain and is less prone to wear. Since it is static in nature there are no moving parts and hence it does not consume any power. In the circuit, the V-Separator operates in closed circuit with the roller press and performs the job of coarse separation. The fine product is pneumatically conveyed to the SKS-Separator for a final cut into the finished product and rejects of below 0.8 mm in size for further grinding in the ball mill. In addition, cooling of hot clinker or drying of moist feed are no longer limitations of roller press grinding circuits, as they can be efficiently carried out in the V-Separator by introducing fresh air or hot gases up to 600 °C.

SKS-Separator
A dynamic separator Sepmaster SKS-V 3750 has been installed to match the higher capacity. It receives feed from the V-Separator directly and from the ball mill via bucket elevator. The finished product from both the roller press and the ball mill is separated by adjusting the speed of the Sepmaster-rotor. Rejects of below 1.0 mm are sent to the ball mill for further grinding. The Sepmaster is proven to be well suited for increasing the productivity of mills.

<table>
<thead>
<tr>
<th>Description</th>
<th>Before modification</th>
<th>After modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output, tph</td>
<td>138 @ 3000 Blaine</td>
<td>260 @ 3000 Blaine</td>
</tr>
<tr>
<td>Specific power, kWh/t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>roller press drive</td>
<td>—</td>
<td>8.50</td>
</tr>
<tr>
<td>ball mill drive</td>
<td>30.09</td>
<td>15.00</td>
</tr>
<tr>
<td>separator</td>
<td>0.47</td>
<td>0.47</td>
</tr>
<tr>
<td>separator fan</td>
<td>2.88</td>
<td>2.35</td>
</tr>
<tr>
<td>Total</td>
<td>33.44</td>
<td>26.32</td>
</tr>
</tbody>
</table>
already in operation. The compact design low operating and wear/maintenance cost, along with excellent product quality are some of the significant features of this separator.

Roller press
The RP-16/170/140 roller press installed at the plant is the first of its kind in India. The roller surface is an interrupted line profile (ILP) type and has the advantage of needing only simple welding locally from time to time. This kind of roller surface offers better nipping properties so that the roller press power can be utilised to the full. Furthermore, the gaps between the profiles are filled with material being ground, which reduces wear rates by autogenous wear protection. Figure 3 shows the roller press installed at the site, and a roller with the interrupted line profile of the roller surface is shown in Figure 4.

ROLLER PRESS CONTROL SYSTEMS
For the roller press, it was necessary to provide the ability to monitor operating parameters such as pressure, motor power and gap geometry to ensure efficient grinding, uniform product quality and safe operation. Such control is performed automatically with the aid of the ROLCOX® control and monitoring system, a software specially developed by KHD Humboldt Wedag, Germany, for roller press operation. This system requires no adjustments by operators except for setting and occasional readjustment of the operating parameters.

ROLCOX® incorporates the control functions of the roller drive, the gear and bearings lubrication, the hydro-pneumatic supporting system and all other internal functions required for the regular operation of the roller press. It is integrated into the process by corresponding interlocking circuits and all necessary signals are transferred between ROLCOX® and SCADA.

PROJECT EXECUTION
All equipment was supplied on a turnkey basis by HWI. For the first time, the entire machine base frame of the roller press was fabricated in India. The civil structures which house the main equipment were planned and erected adjacent to the existing grinding plant without affecting the operation. The newly erected structure is shown in Figures 5 and 6. The final hook up to the mill circuit was achieved in only 15 days with minimal production losses. It was a very challenging target, since HWI had to deliver complete items within a short time span of just four months, from March to June 2003. The project was only completed successfully and on time thanks to the dedicated joint team effort of Jaypee and KHD/HWI. The important milestones in the project execution were as follows:

- Orders for all items placed by October - December 2002.
- Roller press rolls received at site in June 2003.
- Plant erection work completed in October 2003.
- Plant commissioned in January 2004.
- New system hooked up to existing ball mill circuit within only 15 days.

OPERATING RESULTS
A comparison of performance parameter operating results before and after the modification is given in Table 2. It can be seen that the targets of guaranteed output and power consumption were easily met. It has also been observed that there is an improvement in the strength of cement with the same Blaine number. At present, the fly ash handling system is under construction: the above comparisons are made based on OPC grinding.

CONCLUSION
The results achieved at Jaypee Bela clearly highlight how the upgrading of existing grinding systems with roller press, V-Separator and SKS dynamic separator from KHD Humboldt Wedag AG provides a distinct technical advantage in improving performance. The present system has taken up operation successfully and within a minimum timeframe. The specified objectives were also fully achieved.

Better Grinding At Jaypee Bela Cement (Copy of World Cement September 2004)
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