Presentation on
VRPM – An Energy Efficient Grinding System for Cement Plants

Case Study of M/s Mangalam Cement
Kota, Rajasthan
• Case Study of M/s Mangalam Cement

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• AMCL Machinery Limited were awarded the contract in August 2006 to upgrade the existing Cement Mill at M/s Mangalam Cement Limited, Kota, Rajasthan.

• AMCL designed and supplied the complete VRPM system along with three way dynamic separator for enhancing the capacity & reducing the power consumption.

• Due care had been taken to ensure that minimum modifications were carried out in the existing Ball Mill circuit.

• Before up-gradation the ball mill system was producing 70 TPH of PPC Cement at a fineness of 3400cm²/gm.

• After up-gradation the capacity has been increased to 158.5 TPH at a fineness of 3410 cm²/gm. The saving in energy consumption is more than 6 kWh/ton of Cement.
DETAILS OF CEMENT MILL AT M/s MANGALAM CEMENT LIMITED

<table>
<thead>
<tr>
<th><strong>Before up-gradation close circuit grinding mill was in operation</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>BALL MILL</strong></td>
<td>3.4 M Dia. X 16.05 M Long.  &lt;br&gt;Mill RPM: 18.  &lt;br&gt;Motor: 2 x 1485 Kw, 990 RPM.</td>
</tr>
<tr>
<td><strong>DYNAMIC SEPARATOR</strong></td>
<td>Make: Krupp Polysius.  &lt;br&gt;Model: SVZ 230/4.  &lt;br&gt;Motor :185 Kw.</td>
</tr>
<tr>
<td><strong>CIRCULATING AIR FAN</strong></td>
<td>Volume: 140000m3/hr.  &lt;br&gt;St. Pressure: 38mbar.  &lt;br&gt;Operating temp: 120 Deg C.  &lt;br&gt;Motor : 220 kW / 1000 RPM</td>
</tr>
<tr>
<td><strong>CAPACITY</strong></td>
<td>70 TPH PPC at 3400 Blaine with specific power consumption of 34.54 kwh/t.</td>
</tr>
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</table>
The coarse clinker is ground in the first chamber of the ball mill where large size ball (90 mm, 80 mm, 60 mm, 50 mm are used).

Here the incoming particles are crushed from 25 mm to less than 2.5 mm.

The feed material is subjected to compression and shear and is pulverized mainly by impact and percussion in this chamber.

Fine grinding is done in the second chamber with classifying liners where size reduction takes place mostly by attrition.

The smaller size balls are used (below 30 mm).

Cascading is not suitable for comminution of coarse material but on the other hand it is suitable for fine grinding.

Ball mill grinding efficiency is very poor for feed sizes larger than 2-3 mm.
It is evident that grinding efficiency of ball mill circuit can be increased by removing coarse grinding from the first chamber of ball mill which can be efficiently carried out in VRPM.

Rotation of the table generates centrifugal force which causes material to spread over the table in uniform layer.

Rollers are subjected to high compressive forces generated through a hydraulic system.

Clinker particles are caught between rotating table and roller and effectively ground by a combination of compressive force from roller and shear force generated by difference in circumferential speed of table and roller.

VRPM system is generally used in semi-finished mode wherein the feed size to the ball mill is reduced to (-) 1mm before entering the ball mill.
The VRPM System has been installed in semi-finish mode along with existing ball mill circuit. The details are given below:

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
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</table>
| **VRPM**                         | Model: AVM 230-3  
Table Dia.: 2300mm.  
Roller Dia. X Width: 1400mm X 500mm.  
No. of Rollers: 03  
Motor: 1200 kW/ 980 RPM. |
| **THREE WAY DYNAMIC SEPARATOR**  | Make: LNV Technologies.  
Model: CM 30-32.  
Motor: 75 kW/1500 RPM. |
| **CIRCULATING AIR FAN**          | Volume: 135400 m3/hr.  
St. Pressure: 57 mbar.  
Operating Temp: 92 Deg C.  
Motor: 330 Kw/ 990 RPM. |
| **CAPACITY ACHIEVED**            | 158.5 TPH PPC at 3410 Blaine with specific power consumption of approx. 26.65 kwh/t. |
### PERFORMANCE PARAMETERS

#### SPECIFIC POWER CONSUMPTION BREAKUP:

<table>
<thead>
<tr>
<th>Major Equipment</th>
<th>Specific power consumption (kWh/t) of main equipment</th>
<th>After Up-Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRM</td>
<td></td>
<td>5.71</td>
</tr>
<tr>
<td>VRM Elevator</td>
<td></td>
<td>0.17</td>
</tr>
<tr>
<td>VRPM Separator</td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>Separator Fan</td>
<td></td>
<td>1.62</td>
</tr>
<tr>
<td>Ball Mill</td>
<td></td>
<td>13.94</td>
</tr>
<tr>
<td>Ball Mill venting Fan</td>
<td></td>
<td>0.27</td>
</tr>
<tr>
<td>Ball Mill Elevator</td>
<td></td>
<td>0.32</td>
</tr>
<tr>
<td>Ball Mill Separator</td>
<td></td>
<td>0.17</td>
</tr>
<tr>
<td>Separator Circulating Fan</td>
<td></td>
<td>1.08</td>
</tr>
<tr>
<td>Separator Bag filter fan</td>
<td></td>
<td>0.09</td>
</tr>
</tbody>
</table>

#### Performance of Cement Mill at M/s Mangalam Cement Limited

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Before Up-Gradation</th>
<th>After Up-Gradation</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parameters</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Achieved</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td>PPC</td>
<td></td>
<td>PPC</td>
</tr>
<tr>
<td>Output</td>
<td>TPH</td>
<td>70</td>
<td>140</td>
</tr>
<tr>
<td>Specific Power</td>
<td>kWh/t</td>
<td>34.54</td>
<td>30.5</td>
</tr>
<tr>
<td>Fineness</td>
<td>Blaine</td>
<td>3400</td>
<td>3400</td>
</tr>
</tbody>
</table>
OPTIMAL CIRCUIT OF VRPM

VRPM System in combination of Ball Mill with Common Separator System

- The circuit is ideal for cement plants
  - Up-grading from open circuit to close circuit
  - Setting up a split grinding unit
  - Integrated plants using ball mill for cement and raw material grinding
VRPM System gives best result in Common Separator system circuit. This circuit is beneficial due to:

- Minimal equipment in the circuit.
- Common separator ensures uniform product quality of the cement.
- Efficiently operate with various cement grades and types.
- Easily accommodate material moisture with no clogging inside the mill.
- More energy efficient circuit.
- Installed in less space
- Low dust emission
- Less maintenance
ENERGY EFFICIENT MILL

- Energy efficiency can be achieved in grinding process using VRPM System. Energy consumption in VRPM system is less as compared to other grinding systems due to:

  - **Recirculation load is only 2 times** – This ensures equipment sizing to be optimal as compared to other grinding systems where recirculation load is 4-5 times.

  - **Medium Voltage Frequency Drive** – This gives freedom to change grinding pressure and rpm of the mill as per the feed and material characteristic.

  - **No Hot Gas Inside The Mill** – In VRPM system, there is no need of hot gas inside the mill to flew material moisture.

  - **No Water Spray Inside The Mill** – There is no need of spraying water inside the Mill for bed formation.

  - **Non Air swept Mill** – Material is conveyed through mechanical means in the VRPM by scrapper and bucket elevator. Hence there is no requirement of air inside the mill for conveying the material to the top.
CONCLUSION

- The VRPM System is operating smoothly in conjunction with the Ball Mill system.

- The availability of VRPM system along with the ball mill has been established.

- This VRPM has emerged as an important alternative resource to reduce power consumption and increase production of existing ball mill systems.
THANK YOU
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QUESTIONS