

VRPM as an alternative resource for capacity enhancement and reduced power consumption in Cement Grinding

by AMCL Machinery Limited

Introduction:

Cement industry is always in look out for energy efficient solutions. In this context the Vertical Roller Pre-grinding Mills (VRPM) has emerged as an effective solution for increasing output and reducing specific power consumption in Cement and Raw meal grinding processes. Typically, in a Cement Plant, around 65 % of electrical energy is consumed by the Raw Mills and Cement Mills. After up-gradation of grinding circuits with VRPM it is possible to achieve substantial increase in the capacity and simultaneous reduction in specific power consumption. In spite of having many advantages the real potential of VRPM system somehow has only been harnessed with recent successes.

Working Principle:

The 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 VRPM generates centrifugal force which causes material to spread over the table in uniform layer. Rollers are subjected to high compressive force 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. Superior mechanical structure and high stability permit trouble free operation. The Vertical Roller Pre-grinder Mill offered by AMCL, Ltd is shown in Figure 1.1

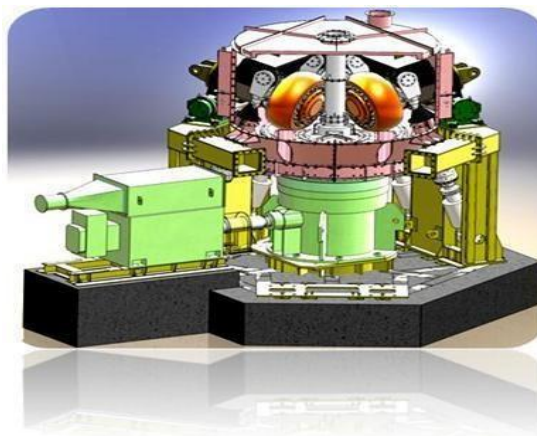


Figure 1.1

The VRPM machines are very sturdy and proven for stable operation. There are 30 such installations in India and Middle East operating for years. The design of machine is based on the technology of M/s. Nihon Cement Company, Japan.

Development phases of VRPM system

I) VRPM in Pre-grinding mode :

In the earlier installations the VRPM had been installed in the pre-grinding mode with a vibrating screen to control the particle size to a level of (-) 3 mm for feeding to Ball Mill. A typical schematic is given in figure 2.1

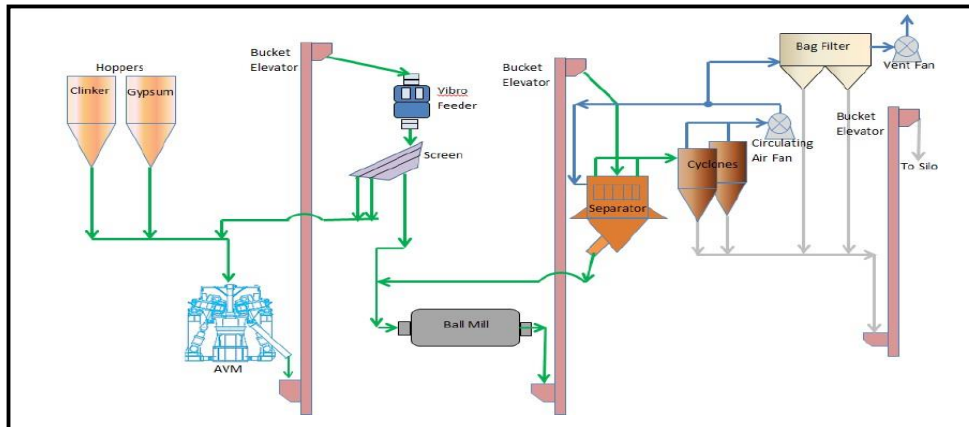


Figure 2.1

It was noticed that vibrating screens are prone to heavy maintenance and non-uniformity of particle size. Similar systems are in operation from last 10 years at ACC Chanda, ACC Tikaria, ACC Kymore and ACC Gagal for grinding cement. The increase in cement grinding capacity is around 30 – 40% and savings in specific power consumption is around 4 kwh/t.

II) VRPM in semi-finish mode with static and dynamic separator (Figure 2.2):

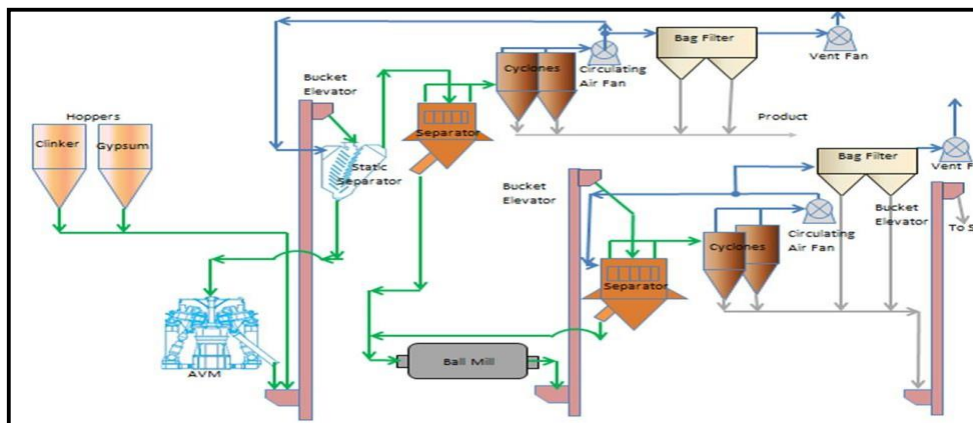


Figure 2.2

This system is most ideal for retrofit jobs. The VRPM system is installed in semi-finish mode along with static separator and dynamic separator. The coarse material from dynamic separator is sent to ball mill inlet.

The average particle size sent to the Ball Mill is less than 1 mm. Such systems are in operation at M/s. Ramco Cement Limited Jayanthipuram, Mangalam Cement Limited Kota and Sagar Cement Limited Mattampally. The capacity enhancement is upto 80% and savings in specific power consumption upto 5 – 7 kwh/ton. The performance before and after the installation of VRPM of some of the plants is given as per tables below;

M/s. Ramco Cement Limited, Jayanthipuram:

Performance of Cement Mill at M/s Ramco Cement Limited					
Parameters	Unit	Before Up-Gradation (closed circuit)	After Up-Gradation (With VRPM)	% increase in capacity	Savings in power consumption
Product		PPC	PPC		
Output	TPH	160	270	70 %	
Sp. Power	kWh/t	32.3	25.6		6.7
Fineness	Blaine	3200	3400		

M/s. Mangalam Cement Limited, Kota:

Performance of Cement Mill at M/s Mangalam Cement Limited					
Parameters	Unit	Before Up-Gradation (closed circuit)	After Up-Gradation (With VRPM)	% increase in capacity	Savings in power consumption
Product		PPC	PPC		
Output	TPH	70	160	100 %	
Sp. Power	kWh/t	34.54	26.65		7.9
Fineness	Blaine	3400	3410		

M/s. Sagar Cement Limited, Mattampally:

Performance of Cement Mill at M/s Sagar Cement Limited									
Parameters	Unit	Before Up-Gradation (closed circuit)		After Up-Gradation (With VRPM)		% increase in capacity		Savings in power consumption	
		OPC	PPC	OPC	PPC	OPC	PPC	OPC	PPC
Output	TPH	125	140	210	285	68 %	100%		
Sp. Power	kWh/t	36.5	30.2	30.8	25			5.7	5.2
Fineness	Blaine	3000	3400	3000	3400				

III) VRPM in Semi-finish mode with static separator (Figure 2.3):

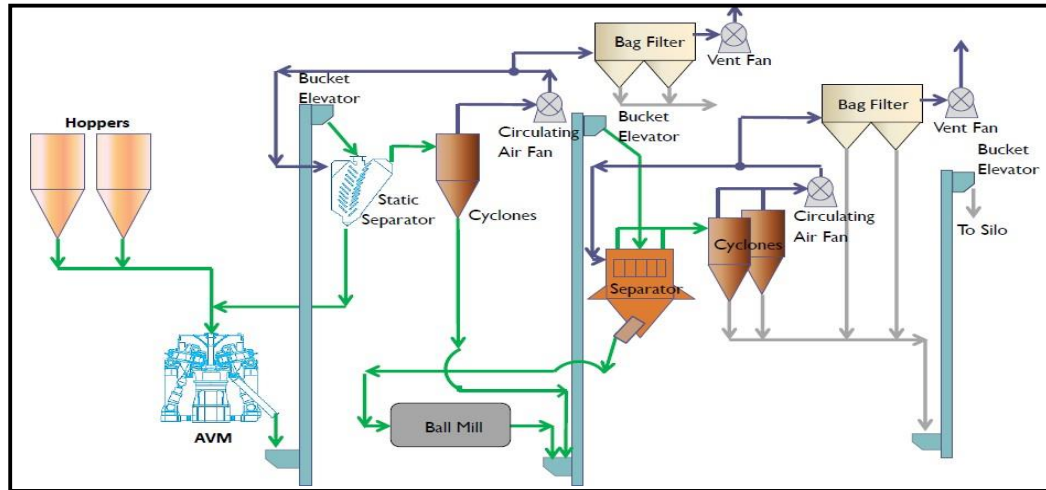


Figure 2.3

This is most suitable when the VRPM is located at a distance from Ball Mill or one number of VRPM has to cater to two Ball Mills or more. The capacity enhancement is upto 70% and savings in specific power consumption upto 5 – 7 kwh/ton is expected. Such systems are in operation at M/s. Century Cement Limited, Baikunth and Maihar Cement Limited, Satna.

M/s. Maihar Cement Limited, Satna:

At Maihar Cement plant, the existing Ball Mill system has been upgraded with VRPM in Pre-grinding mode along with vibrating screen in 2004 resulting in 30 % increase in production capacity and savings of over 3 - 4 kwh/t. Now, the VRPM system has been changed to semi-finish mode by installing static separator which has resulted in further savings of over 3 kwh/t and with 33% increase in production capacity. The results are tabulated below;

Parameters	Unit	VRPM in Pre-grinding mode	VRPM in Semi-finish mode	% Increase in Capacity	Savings in power consumption
Product		PPC	PPC		
Output	TPH	170	226	33 %	
Sp. Power	kWh/t	31.09	27.92		3.17

IV) VRPM along with Ball Mill in split location system (Figure 2.4):

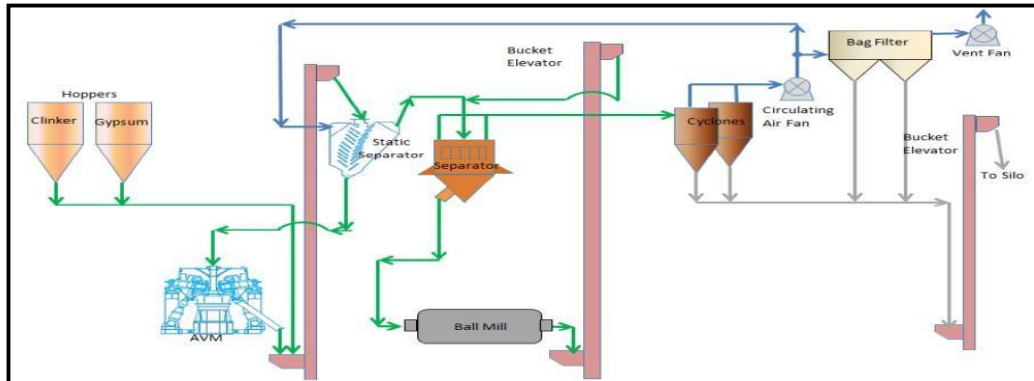


Figure 2.4

This system is ideal for split location grinding units. The main advantage of this system is to have less no. of equipment and lower power consumption. Similar system is in operation at M/s. BCL, Raebareli where the VRPM system is used to produce PPC Cement.

Feasibility studies, System Engineering and after sales services:

Most critical aspect is in designing such systems is the proper balancing of equipment more so in retrofit jobs. In one particular case real benefit could not be derived due to mismatch in capacity of downstream equipment which was set right subsequently. AMCL now is fully equipped to carry out feasibility studies, process engineering, system design and layout preparation for projects related to both Clinker grinding as well as Raw material grinding.

AMCL has given due importance to prompt after sales services to ensure customers satisfaction. A team of Engineers has been developed for deputation on short notices.

Conclusion:

- VRPM has emerged as an important alternative resource for capacity enhancement and reduced specific power consumption for plant having capacity ranging from 50 tph to 220 tph on OPC basis.
- The VRPM is found to be most suitable for up-gradation of the existing Ball Mill system wherein the capacity can be increased upto 60-90% and the power consumption can be reduced by 5 kwh/ton to 7 kwh/ton for Cement grinding.
- The payback period considering both the savings in energy consumption and increase in production is very attractive.
- The VRPM systems are of sturdy design and are well proven.

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Venue: Manekshaw Centre, Delhi Cantonment, New Delhi, India