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Report of an installation at Saurashtra Cement Ltd in Tanavav, India

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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).

Report of an installation at Saurashtra Cement Ltd in Ranavav, India

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The installation described in this article, the first one in the Indian sub-continent, was carried out in 1998 in the Ranavav Plant of Saurashtra Cement Ltd.

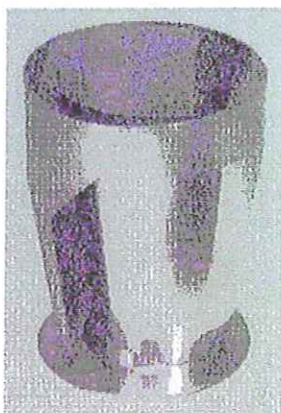


Fig 1. Vortex finder vane

In today's competitive marketplace, there is increasing pressure to keep the price of cement as low as possible, which means that the control of production costs is becoming ever more important for economic success. India, with its very high energy costs, can potentially make significant savings by reducing the amount of energy used in the production process. The modifications described in this article demonstrate how the pressure drop can be reduced significantly, and how that pressure drop brings with it a

significant reduction in energy usage. The modifications also deliver a significant increase in production because of the greater separation efficiency of the systems.

Basics

To evaluate any changes in the pressure drop of a system it is necessary to define that system independently of any changes in the gas volume. Therefore the static pressure before the system is defined as 100% and the static pressure after the system is:

$$\frac{p_{\text{stat, after}}}{p_{\text{stat, before}}} = 1 \times x\%$$

This pressure ratio can then be used for comparison of the state before and after modification

Based on this definition the pressure ratio after system modification can be calculated and set in a relation to the pressure ratio before the system. The guarantee value can then be fixed as the change in the ratios of the static pressures.

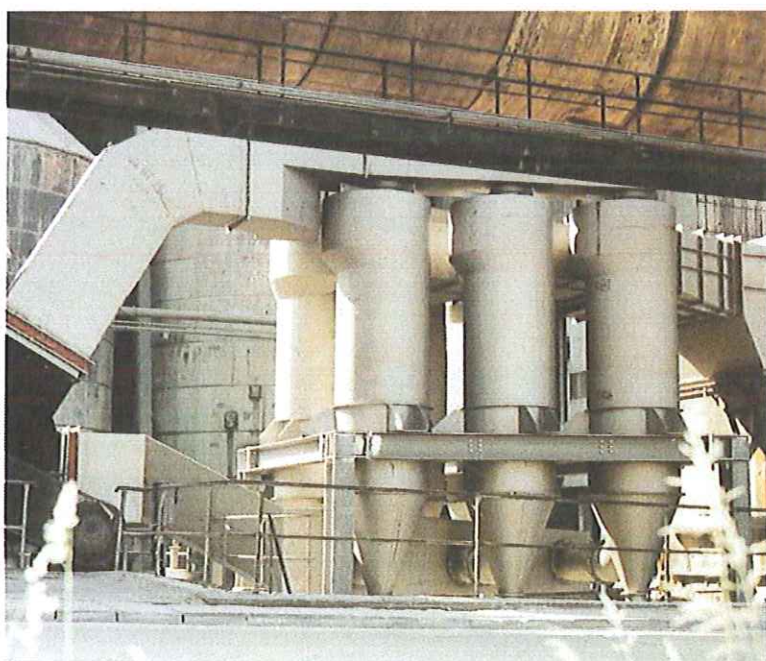


Fig 2, PMT-Zyklontechnik HURRICLON®

Product specifications

Vortex Finder Vanes - Vfv

A system of specially designed guiding vanes is attached to the lower end of the dip tube (Fig 1). They guide the airstream into the thimble, avoiding the usual high pressure drop caused by the change of direction of the stream from a rotating movement into a more or less linear movement. This yields a pressure drop reduction of between 30% and 50%.

HURRICLON®

The introduction of a second dip tube at the bottom of the cyclone gives a significant increase in separation efficiency as well as a decrease in the top particle size of the clean gas dust. Another important point is that comparable cyclone sizes now require much less space. This is because the double dip tube system can handle double the gas volume with roughly the same space requirements. Together with the Vfv the system thus gives high separation efficiency and low pressure drop.

Installation at Saurashtra Cement Ltd - Ranavav Plant

The installation in the Ranavav plant of Saurashtra Cement Ltd, carried out in 1998, consisted of three steps:

- exchange four existing cyclones in the raw mill circuit to two HURRICLON® type cyclones and adapt the piping system between raw mill outlet and fan inlet
- modification of the cyclone entry part of the two preheater top stage cyclones and installation of two Vortex Finder Vanes (Vfv)
- installation of a Vfv in the second stage preheater cyclone.

Raw mill installation

The initial installation consisted of four cyclones with one pipe to the raw mill outlet and to the fan inlet (Fig 3). There were two problems before modification: a rather poor separation efficiency and a high pressure drop between raw mill outlet and fan inlet (Table 1). A measurement of the existing situation, using the method of defining the pressure drop ratios described above, gave the following results:

The planned installation incorporated an increase in the production of the raw mill brought about by an increase in the gas volume, and a change in the nozzle position in the vertical roller mill. The newly installed HURRICLON® separators were therefore designed for a volume of 500,000 Am³/h. Because of the higher possible capacities of the HURRICLON® separators, only two of these cyclones had to be installed instead of the existing four standard cyclones (Fig 4).

The installation was carried out as described in Table 2

Process Parameters	Existing
Gas Volume (Am ³ /h)	324,000
Temperature (°C)	80-85
Pressure raw mill outlet (mmwg)	1,365
Pressure fan inlet (mmwg)	1,065
Δp mmwg	300
Pressure ratio (acc. to definition)	$1,365/1,065 = 128.2\%$
Separation rate	84%

Table 1: Initial process parameters before modification (raw mill)

The calculation of the process parameters led to the following guarantee values:	
Process Parameters	Existing
Gas Volume (Am ³ /h)	501,000
Temperature (°C)	80-85
Pressure raw mill outlet (mmwg)	1,215
Pressure fan inlet (mmwg)	1,065
Δp mmwg	150
Pressure ratio (acc. to definition)	$1,215/1,065 = 114.1\%$
Separation rate	89%

Table 2: Guaranteed process parameters after modification (raw mill)

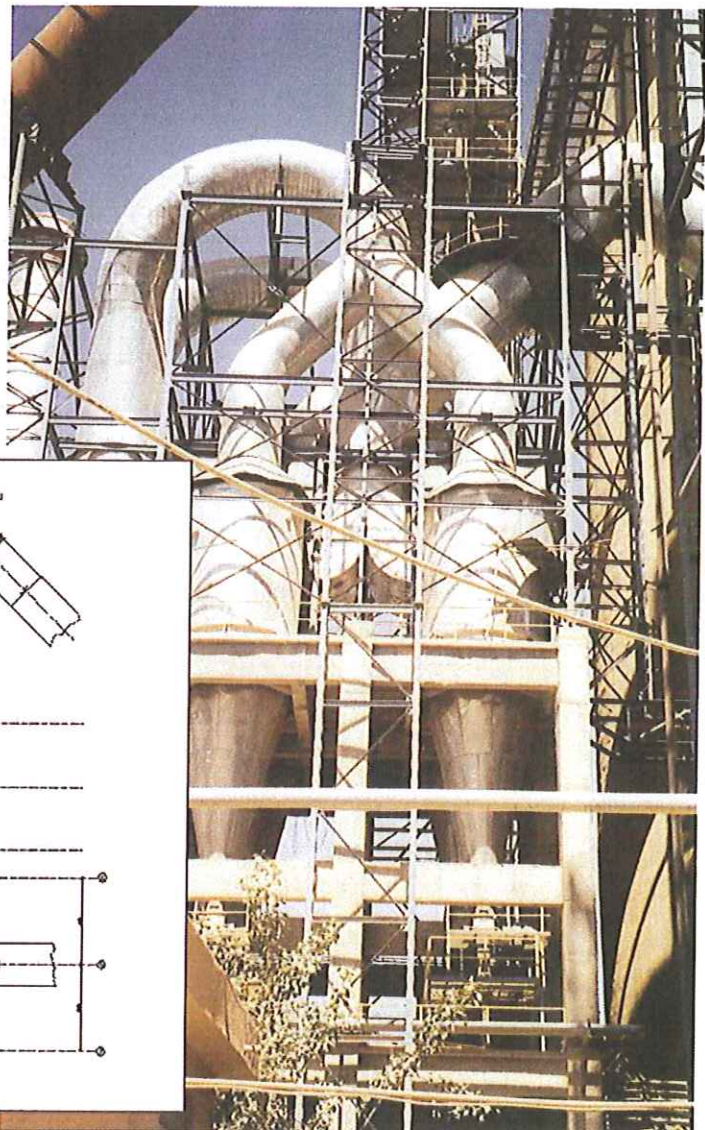


Fig 3. Raw mill cyclones before

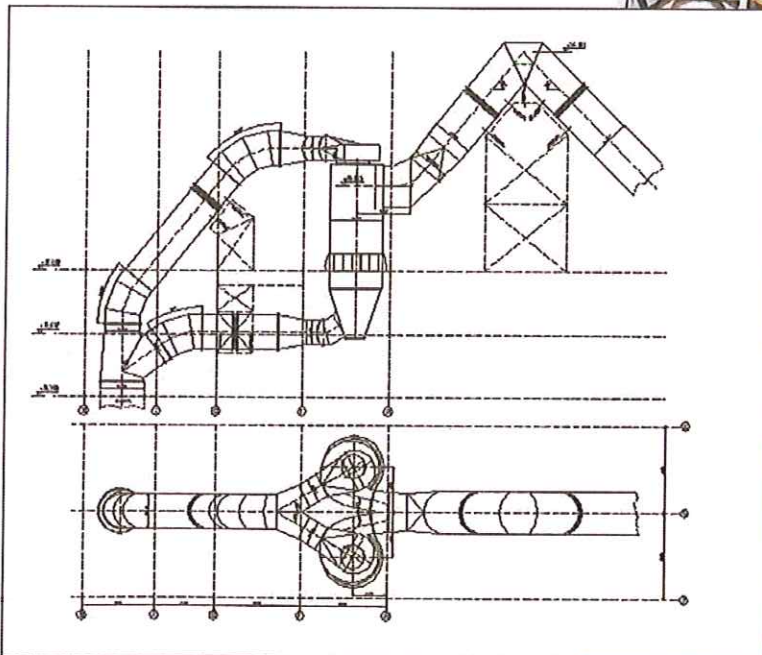


Fig 4: Sketch of HURRICLON® installation in raw mill circuit

Process Parameters	Existing
Gas Volume (Am ³ /h)	650,000
Temperature (°C)	80-85
Pressure raw mill outlet (mmwg)	1,320
Pressure fan inlet (mmwg)	1,170
Δp mmwg	150
Pressure Ratio (acc. to definition)	1,320/1,170 = 112.8%
Separation rate	91%

Table 3: Achieved process parameters after modification

Process Parameters	Existing	Guaranteed
Gas Volume (Am ³ /h)	446,000	446,000
Temperature (°C)	378	378
Pressure Cyclone Inlet (mmwg)	400	400
Pressure Cyclone Outlet (mmwg)	480	480
Δp mmwg	80	80
Pressure ratio (acc. to definition)	480/400 = 120%	480/400 = 120%
Separation rate	84%	89%

Table 4: Initial and guaranteed process parameters before modification (PH Stage 1)

Process Parameters	Achieved
Gas Volume (Am ³ /h)	402,900
Temperature (°C)	378
Pressure Cyclone Inlet (mmwg)	340
Pressure Cyclone Outlet (mmwg)	390
Δp mmwg	50
Pressure ratio (acc. to definition)	390/340 = 114.7%
Separation rate	91%

Table 5: Achieved process parameters after modification (PH Stage 1)

Process Parameters	Existing	Guaranteed	Achieved
Gas Volume (Am ³ /h)	608,400	608,400	532,523
Temperature (°C)	622	622	600
Pressure Cyclone Inlet (mmwg)	260	260	270
Pressure Cyclone Outlet (mmwg)	400	360	340
Δp mmwg	140	100	70
Pressure ratio	400/260 = 154%	360/260 = 130%	340/270 = 125.9%

Table 6: Summary of process parameters before and after modification (PH stage 2)

From this the guarantee was defined as 14.1% decrease in pressure drop and 89% separation efficiency.

In this installation four existing cyclones (Ø 3,350mm) after a vertical roller mill have been replaced by two HURRICLON® HU3600CT cyclones (Ø 3,600mm). Additionally the piping between the mill outlet via the HURRICLON® to the fan inlet has been redesigned to create an optimum pressure loss situation.

After running the plant for several weeks a final measurement of the guaranteed values was carried out and gave the values shown in table 3.

The initial production rate of the system was approximately 240t/h, but with the significantly increased air volume and some changes in the mill itself the output was increased to approximately 290 - 300t/h.

Preheater Stage 1

Here the biggest problem was quite a low separation rate of about 84% (see Table 4). The target was therefore to increase this value and maintain the same pressure drop level.

This was done by changing the existing thimble to a smaller size. The increase in pressure drop coming with such modifications could be nullified by attaching a Vfv to the thimble's lower end. Measurement of the values and application of the described definition procedure led to the following results shown together with the guarantee values:

After installing the smaller thimble and the Vfv the system was operated several weeks before the measurements of the guarantee values were carried out. The results can be found in the summary in Table 5.

Preheater Stage 2:

In this installation the target was basically to reduce the high pressure drop by implementing Vortex Finder



Fig 5. Raw mill cyclones after HURRICLON

Guide Vanes. The initial values, the guaranteed and the achieved ones are summed up in Table 6.

The results show a pressure drop reduction of about 50% of the initial value.

Conclusions

The modifications caused a significant decrease in pressure drop even when increasing the gas volume and production, as in the case of the raw mill circuit. Taking all improved parameters into account, such as the pressure drop reduction and decrease in specific energy consumption per ton, together with increased production, the complete installation has a payback period of just a few months. And an inspection of the system after it had been running for several months showed that it had been possible to integrate the new and modified components effectively into the existing system. ■

POWERFUL RADIAL ACCELERATION UP TO 5000G

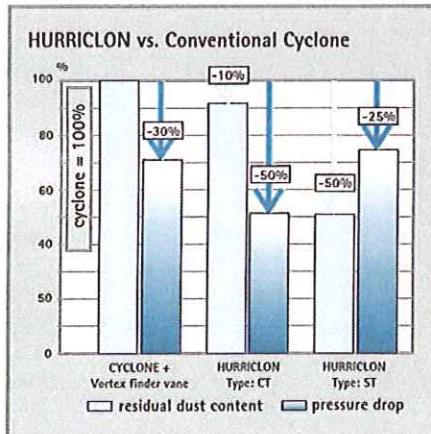
With the development of the VORTEX FINDER VANES the vortex will be guided into optimal streamlines which results in a very low pressure drop and low energy consumption.



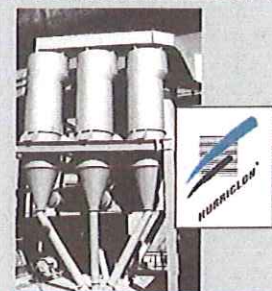
POWDER SEPARATING

References for:

- Clinker cooler dedusting
- Preheater cyclones
- Cement grinding
- Raw meal grinding
- Separation before coal mill



HURRICLON



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