



A TEC

World Leader in Cement Pyroprocess Technology

Optimising efficiency

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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).

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Figure 1: HURRIVANE®

Following extensive research and development work, a successful device has been created in the form of the HURRIVANE® which is as simple as the tube itself, but allows maximum energy savings.

Under practical conditions, 30 per cent reduction in pressure losses have been demonstrated. In the case of large gas quantities and retrofitting of the HURRIVANE, results in savings of around 1MkW/h annually and a pay-back of less than two years have been witnessed. With the HURRICLON® optimum separation efficiency can be achieved alongside pressure loss reduction.

Answers to practical demands

The HURRIVANE constitutes a simple tube, which takes in the gas flow just within the dip tube radius where the flow losses are small, and creates a favourable flow path into the exhaust itself.

Projects where the HURRIVANE system has been successfully and practically applied, include the following:

- **Project 1:** Retrofitting preheater 1 cyclones stage 1 with HURRIVANE at Dyckerhoff Zement GmbH Göllheim plant
- **Project 2:** Optimisation of cyclone intake situation and retrofitting of preheater 2 cyclone stage 1 with HURRIVANE Dyckerhoff Zement Göllheim plant
- **Project 3:** Retrofitting HURRIVANE at raw mill cyclones at Lafarge Perlmooser Mannersdorf plant
- **Project 4:** Retrofitting preheater cyclones stage 1 with HURRIVANE and entry duct modification at Cementos Hispania Yeles plant.

The HURRICLON separator with double dip tube and two units HURRIVANE provides up to 50 per cent pressure loss reduction and improved separation efficiency.

The first target in the development of this new design was to increase the air volume that can be handled by a single

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by Ing Markus Kaufmann – PMT-Zyklontechnik GmbH

The most important dimensional factors in centrifugal separators are the throughput volume, the pressure loss and the separation efficiency. The reason for the economic significance of pressure loss lies in the fact that during the service life of the cyclone, around 90 per cent of total costs derive from the energy required to compensate for pressure losses. Markus Kaufman of PMT-Zyklontechnik, discusses a range of kiln and preheater optimisation studies which have resulted in some appreciable efficiency gains.

cyclone with the same size of the system, as the dimension of a cyclone is primarily limited with the dip tube area. This led to the introduction of a second dip tube coming into the cyclone from the bottom.

During the extensive research phase a substantial improvement in the separation efficiency and a significant reduction of the clean gas

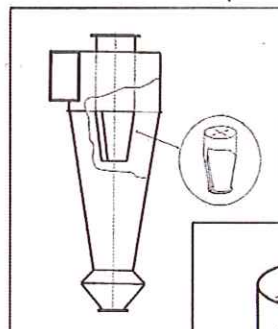


Figure 2: (above) Cyclone including HURRIVANE®

dust particle sizes could be observed, due to the smaller diameter of the outside shell, leading to higher circumferential velocities.

Another reason for this improvement is that the turbulences caused by the vortex in the lower part of a standard cyclone could be omitted. This turbulent streams lead to a

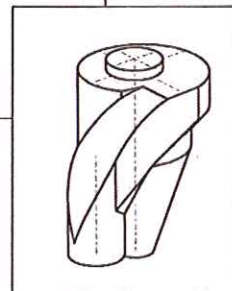


Figure 3: Cyclone with optimised entrance spiral

	Before modernisation		After modernisation		Improvement	
	Pressure loss	Residual dust	Pressure loss	Residual dust	Pressure drop reduction	Energy savings per year
Project 1						
Göllheim plant	12mbar	62g/Nm ³	7mbar	61g/Nm ³	41%	350,000kW
Project 2						
Göllheim plant	30mbar	30-35g/Am ³	14mbar	30-35g/Am ³	53%	1,600,000kW
Project 3						
Mannersdorf plant	14mbar	approx 44g/Am ³	7mbar	approx 36g/Am ³	50%	750,000kW

	Before modernisation		After modernisation		Improvement	
	Pressure loss	Feed	Pressure loss	Feed	Pressure drop reduction	Production increase
Project 4						
Cementos Hispania	16mbar	56t/h	9mbar	66t/h	44%	18%
E-Yeles	16mbar	56t/h	7mbar	56t/h	56%	0%

rejecting of already separated dust particles into the air stream going into the dip tube. As in the new design the vortex is fixed in two positions - the upper and the lower dip tube - these turbulences are nearly not existent any more and therefore the particles can leave the unit through the dust discharge unaffected, see Figure 4.

Project 5: Installation at preheater stage 1 with 2 units HURRICLONE and modification of stage 2 cyclones with 2 units HURRIVANE.

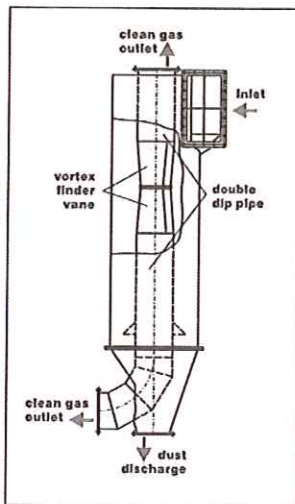


Figure 4: Hurriclone with Hurrivane

problems can be fulfilled because of double gas throughput of hurriclone compared to conventional cyclones. This technology places a new perspective on preheater upgrading projects.

Conclusion

Depending on the main target, either minimised pressure drop level or maximised separation efficiency the HURRIVANE or hurriclone will be a solution for every field of application. Beginning from the

raw mill dedusting, via the preheater system and the clinker cooler dedusting all the way to the cement mill dedusting.

Due to the fact that the expenditure on energy for a cyclone over a period of 10 years constitutes 90 per cent of total plant costs, enormous cost advantages can be achieved by reducing the pressure loss of cyclones up to 50 per cent with a well-designed cyclone intake and HURRIVANE or installing HURRICLONE.

Chlorine by-pass system

In the sintering zone of rotary kilns, different proportions of alkalis, sulphur and chlorine are both liquid and gaseous. Above a temperature level of approximately 800°C, alkalis, sulphur and chlorine start to volatilise.

With the gas flow through the kiln, the volatile parts then arrive at colder preheater, where they condense on the material. This mechanism is the start of recirculation.

When diverting part of the gases through the by-pass valve, by side-tracking part of the gases through the by-pass valve, by side-tracking part of the gases in the lowest part of the cyclone stage IV riser duct, it is possible to reduce the circuit.

The temperature of the by-pass gases at the by-pass valve is about 1100°C. The chemical/physical behaviour of alkalis, sulphur and chlorine requires the use of cold air for cooling the by-pass gases down to about 450°C. This cooling air is compressed in a quenching chamber.

One of Cementir SpA's production lines is located in the city of Taranto in southern Italy, close to the seaside. The results are as follows.

- Hot meal improvement with eight per cent by-pass
- Na₂O - 10 per cent
- K₂O - 52 per cent
- SO₃ - 32 per cent
- Cl - 79 per cent

With a by-pass installation, it is also possible to use a high amount of secondary fuels and raw materials which often have a higher content of chlorine, alkalis and sulphur. Under these preconditions, the benefits of a by-pass installation is a potential reduction of production costs.

Description	Before modification	After Modification	Improvement
Pressure drop of stage 1 and 2	37mbar	16mbar	-57%
Power consumption of ID fan	200kW	850kW	-30%
			saving of 2.8 miokWh/year
Clinker production 2450t/d	2450t/d		

Table 3: Project 5, Installation at preheater stage 1 with 2 units stage 1 with 2 units Hurriclone and modification of stage 2 cyclones with 2 units Hurrivane

By the middle of June 1999 the ecerclion including the refractory lining was successfully completed after a kiln shutdown of three weeks and the kiln could be restarted. After approximately three days, a capacity of 2500tpd was realised.

In most cases, the limitations of preheater modification are concerned with the structure of the existing preheater building, in terms of space and load. By using HURRICLON both of these potential

