Advanced Cyclone Systems
PART OF SUNDS FIBERTECH

CASE STUDY

Hurricane HR System to Reduce Ash Particle Content in the Exhaust Hot Gases of a Pre-heater Cyclone Tower

Foreword

Advanced Cyclone Systems, (ACS) designed and supplied a Hurricane cyclone system for Duna-Dráva KFT cement plant in Beremend, Hungary, (a member of the Heidelberg Cement Group, the global market leader in aggregates), as part of an energy recovery project.

To maintain the quality of the ground Pet Coke within the specifications in terms of ash content, ACS was contacted with the objective of designing a cyclone system to minimize the concentration of very fine dust particles in the hot exhaust gas stream leaving the preheater tower (Fig. 1).

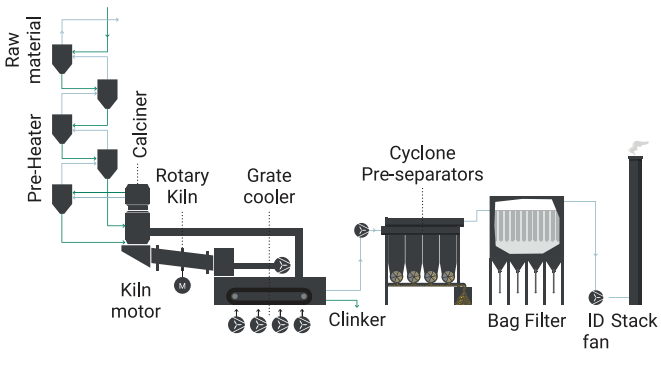


Fig. 1 – Process diagram

Problem and Solution

In order to ensure that the ground Pet Coke is within the ash content specifications (specifically within a minimum calorific value), the dust inert particles needed to be removed from the gas stream.

The goal was to minimize the dust concentration in about 10% of the total hot air (37 513 m^3/h at 327°C) with the lowest impact to the gas temperature. To design the most efficient cyclone system, ACS used the specific operating conditions of the plant, such as the particle size distribution, density, inlet concentration, temperature and gas flow rate.

ACS provided a Hurricane cyclone system (Fig.4) to reduce emissions by 87.15–92.92% representing a decrease of very fine dust concentration from 42 100 mg/Nm^3 down to below 4 200 mg/Nm^3 with a pressure drop of only 1.3 kPa.

The Hurricane cyclone system is composed by 12 HR cyclones, ø700mm each, arranged in two batteries of six cyclones in parallel, with a discharge hopper and a gas plenum per battery and a double flap valve for the dust discharge of each hopper. All equipment was manufactured in carbon steel ST37.

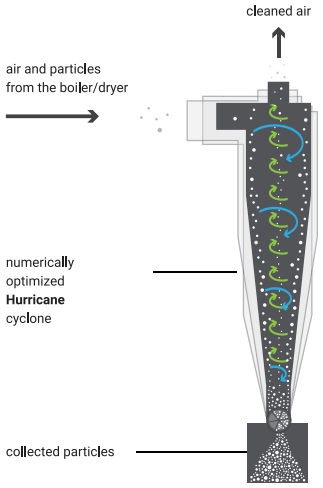
The number and size of cyclones is determined based on ACS cyclone design optimization and particle agglomeration in-house developed computer program.

ACS Cyclones

Hurricane cyclones are patented numerically optimized cyclones. **Hurricane** geometries maximize powder collection for each different application, while minimizing reentrainment and keeping pressure drop at reasonable levels. Hurricane cyclones demonstrate impressive efficiencies in capturing very fine powders with a Volume Median Diameter (VMD) of less than 5µm.

These cyclones are the output of nonconvex nonlinear problems formulated and solved after years of work in partnership with the Faculty of Engineering of Porto and incorporate the most recent findings of the impact of agglomeration in the cyclone collection efficiency (Chemical Engineering Journal 162 (2010) 861–876).

A single Hurricane is more efficient than any other known cyclone available in the market for the same pressure drop.



Design Basis

Solids	**Ash particles**
Particle size distribution	**Fig. 2**
Temperature (°C)	**327**
Actual flow rate (m^3/h_{wet})	**37 513**
Normalized flow rate (Nm^3/h_{wet})	
Product load into cyclone system (mg/Nm^3)	**42 100**
Site location	**Outdoors**

System SPECS | Emissions

Particle density (Kg/m^3)	**0.6**
Guaranteed efficiency (%)	**> 87.0**
Expected total pressure drop (kPa)	**1.3**

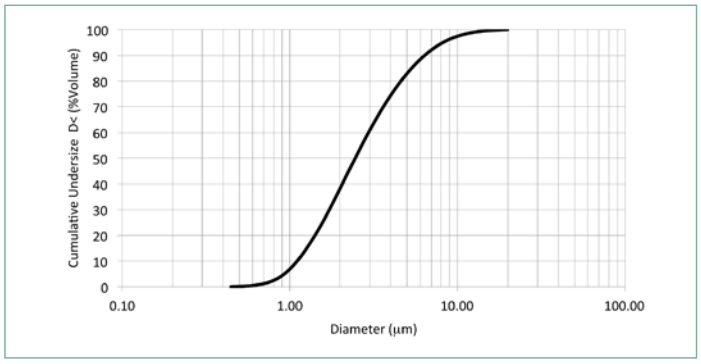


Fig. 2 – Particle size distribution used in simulations

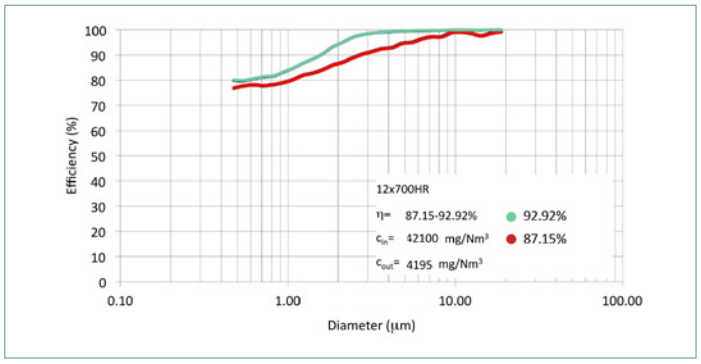


Fig. 3– Predicted max. and min. grade efficiency curves with corresponding global efficiency values.

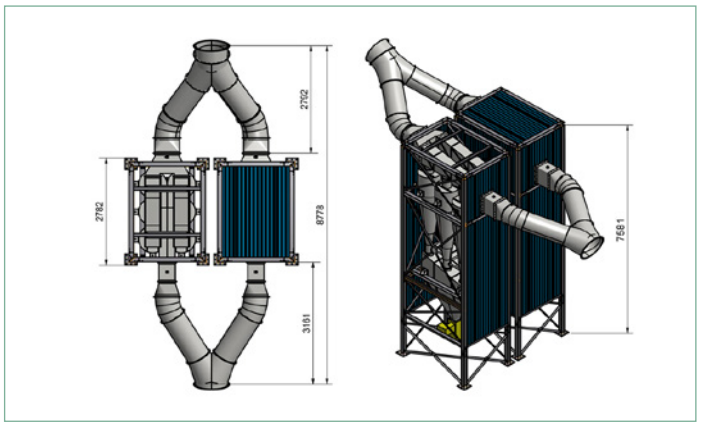


Fig.4 – ACS Solution [12HR ø700mm]

Conclusions

ACS succeeded in reducing the dust level to guaranteed values. The client is very satisfied with the quality of the PET Coke which is within the required specifications.

ACS's cyclones are the simplest, most efficient and economical way to reduce the dust content to a minimum in process gas stream at very high temperatures.

ACS has also provided solutions for the heat recovery from the clinker cooler exhaust gas.