

Hurricane HR System

for product recovery and
particle emission control
of a 12t/h dryer



FOREWORD

Advanced Cyclone Systems (ACS) has designed and supplied a Hurricane cyclone system for Vert Deshy (Meximieux, France).

Created in January 2005, Vert Deshy is specialized in the production, sale and distribution of wood pellets. The plant produces about 35 tonnes of pellets a year with a capacity of up to 45 tonnes.

Since 2010 Vert Deshy has been supplying secure granules in bulk or bagged in its catchment area throughout the Rhône-Alpes region and over a large part of eastern France, throughout the year.

IDENTIFYING THE PROBLEM AND SOLUTION

ACS was asked to propose a solution to replace the old cyclone with a more efficient system, in order to increase the recovery of the product while respecting the limit value of particulate emissions (VLE). Vert Deshy uses a natural hot gas fuel generator, with the flow of heated exhaust gases passing through a rotary dryer where the wet product is dried and recovered in cyclones before the next step of the granulation process. Emissions from the old cyclone were approximately $240\text{mg}/\text{Nm}^3$, which is above the emission limit value (VLE) of $50\text{mg}/\text{Nm}^3$. Part of the flow was recirculated through the dryer to recover the heat, but the remaining portion was released to the atmosphere, which represented a loss of product and especially an environmental problem. An isokinetic sample of dust was collected at the stack and another at the outlet of the old cyclone. ACS then measured these samples in a laser analyser to obtain the particle size distributions (PSD) and combined the information from the two samples to reconstruct the PSD (by mass balance) at the entrance to the old cyclone (Fig.3).

After determining the actual inlet PSD, ACS designed a high efficiency cyclone system, consisting of 2 optimized Hurricane HR cyclones with a diameter of 2500mm (8ft), arranged in parallel. The system is able to guarantee emissions below $60\text{mg}/\text{Nm}^3$ (expected $<20\text{mg}/\text{Nm}^3$).

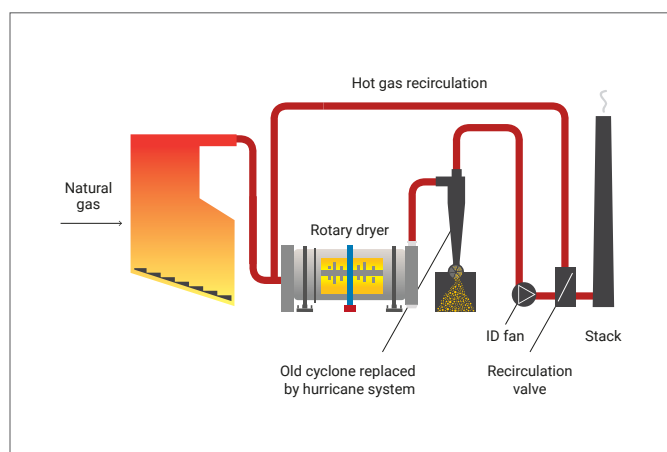


Fig. 1 – Process diagram

ABOUT HURRICANE CYCLONES

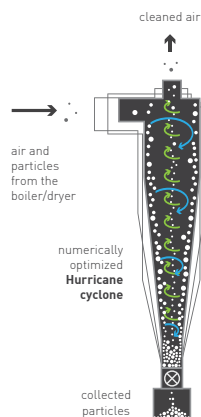


Fig. 2 – Hurricane cyclone

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 5 μ m.

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

• Fuel	[Natural gas]
• Type of particles	[Wood milling dust]
• Particle size distribution	[Fig.3]
• Gas flow temperature (°C)	[60]
• Actual flow rate (m³/h)	[65 000 - 85 000]
• Normalized flow rate (Nm³/h _{dry})	[52 228 - 64 250]
• Inlet concentration (mg/Nm³ _{dry})	[115 237]

SYSTEM SPECIFICATIONS | EMISSIONS

• Expected separation efficiency (%)	[>99.987]
• Expected emissions (mg/Nm³ _{sec})	[<20]
• Emissions to guarantee (mg/Nm³)	[60]
• Expected total pressure drop (kPa)	[1.1 à 1.8]

VERIFIED RESULTS

• Measured emissions in Nov/2018 (mg/Nm³ _{sec})	[15]
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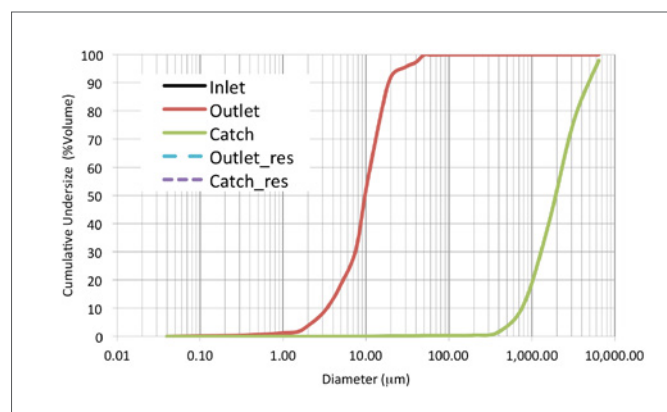


Fig. 3 – Particle size distribution used in simulation

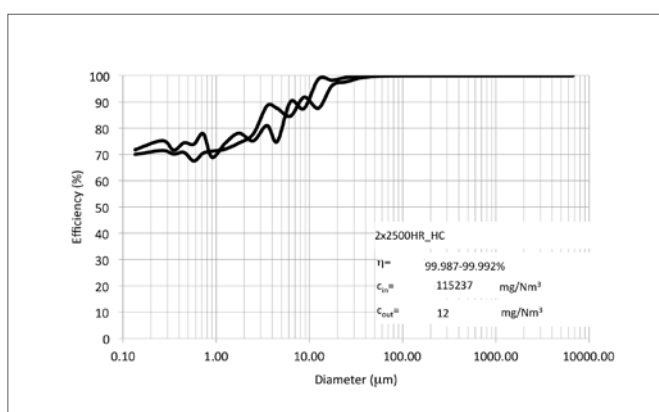


Fig. 4 – Predicted maximum and minimum grade efficiency curves with corresponding global efficiency values

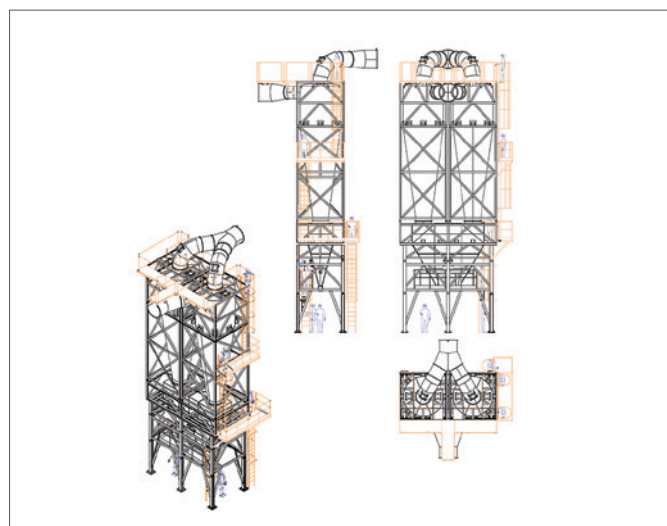


Fig.5 – ACS Solution [2 HR Hurricane cyclones | ø2500mm]

CONCLUSIONS

By installing the Hurricane cyclone system with particle emissions measured at 15mg/Nm³ and a visually clear stack, Vert Deshy can be considered as an example in terms of emissions, not only in France, but also at the global level. In addition to the minimal impact on the plant environment, the considerable reduction of product losses by more than 93%, is an obvious optimization and represents significant savings for the company.