

## Case study

# Cleaning of Piezoelectric stacks

acp systems AG -  
technology leader for advanced clean production



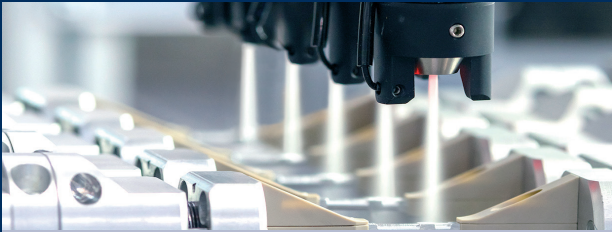
### Subject of the case study

Piezo actuators directly convert electrical energy to mechanical energy through the piezoelectric effect. This means they have no moving parts that generate friction or wear, they are highly responsive and can achieve very high acceleration rates, which means they are suitable for high speed sinusoidal operations. Piezoelectric stack actuators are capable of operating in challenging environments such as vacuum, cryogenic, and in magnetic fields, making them suitable for applications in the consumer electronics, aerospace, semiconductor and automotive industries. In automotive they are used as high frequency valves in advanced common-rail diesel engines. Particle contamination in production is an issue that must be managed.

### Requirement

Grinding processes in the shaping of piezoelectric stacks leaves a contamination of piezoceramic particles on the 3D surface of the stack that must be removed to avoid short circuits between the 80 µm layers. Wet cleaning processes were not efficient enough; leaving particles, consuming excess energy, and requiring unnecessary handling of wastewater.





## CO<sub>2</sub> snow-jet cleaning



### Objectives in Manufacturing

Dry, particle and film free products

### Features & benefits

- Dry, chemical-free cleaning
- Fast & efficient (no drying cycle required)
- Residue free
- Selective
- No chemicals or wastewater
- Kind on the environment (recaptured CO<sub>2</sub>)
- Manual or automated

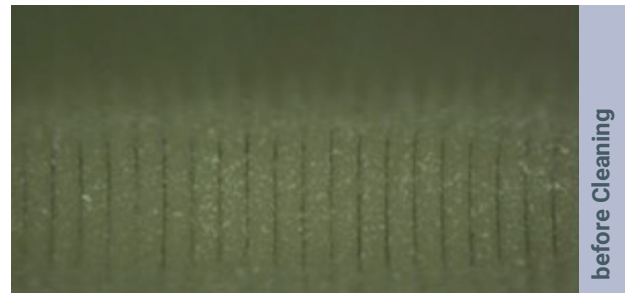
### Why acp?

acp systems AG was already well known to the leading supplier of automotive parts 'Continental AG', who already understood the CO<sub>2</sub> snow-jet cleaning process in other automated cleaning applications. Initially, the CO<sub>2</sub> snow-jet cleaning of piezoelectric stacks was integrated into existing automation, for lower production runs and to allow time for qualification. However, when production demand increased to a 3-shift operation, the capacity of this initial system was no longer sufficient.

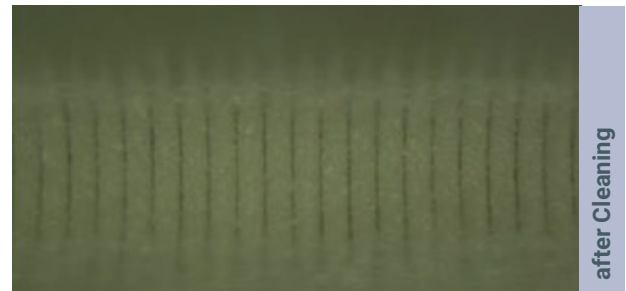
acp systems AG was then commissioned to supply a fully automated turn-key system with integrated CO<sub>2</sub> snow-jet technology to meet new production volumes.

## The solution

6080 stacks are cleaned in a single 8-hour shift with a technical availability of 98.5%. Trays of stacks are loaded into the production cell, then each stack is pick-and-placed into a group of 5 and indexed on a turntable into an enclosed and extracted cleaning zone. During the cleaning process, a 5-nozzle array is indexed, and the stacks rotate providing a complete 3D clean within within a cycle time of 22.5 seconds.



before Cleaning



after Cleaning



## Summary & benefits

With this technology, the customer Continental AG was able to automatically clean the piezo stacks of particles using a dry, chemical and residue free process to a continuous, repeatable and reliable quality required to remove the risk of short circuits in the layers of the stacks. The system provided enough autonomy to provide continuous operation over a shift, reducing manual labour and logistics.

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