PENTAIR ENVIRONMENTAL SYSTEMS

Solving Filter Cleaning Problems with Goyen

Figure 1
One of 8 manifolds fitted with 21 Goyen CA50T diaphragm valves.

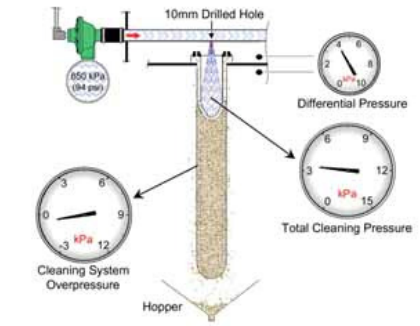

Figure 2

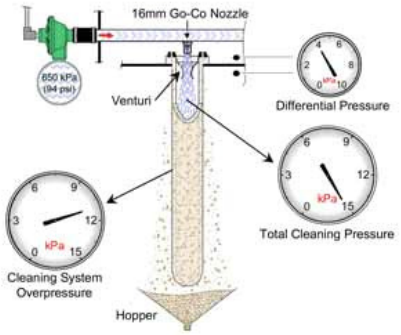

Figure 3

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The engineering team at Goyen have earned an excellent reputation internationally for their expertise in the reverse pulse jet cleaning of filters used in dust collectors for scrubbing air and gas of particulate. Goyen often are asked to apply their unique knowledge to solve dust collector problem. This becomes especially important when these problems impact the productivity of upstream processes, sometimes to the value of thousands of dollars per hour.

This particular example of a large Australian alumina plant was, at that time, one of the most demanding applications the engineers at Goyen had been asked to consider. The recent expansion of the refinery incorporated a liquor burner. A dust collector was installed on the liquor burner gas stream. The relatively low dust particulate target, high operating temperatures as well as the need to reprocess collected dust, created a unique application for dust collection. The intense heat generated by the kiln also complicated the dust collection process. As the kiln was required to operate at constant temperatures in excess of 900°C, the dust was extracted at temperatures exceeding 200°C. Therefore, only a limited number of high temperature alternatives were available.

A well-designed dust collector using fabric filters can be expected to operate extremely efficiently for extended periods. These 'baghouses' are capable of removing contaminants from a dust stream of up to 900°C in certain applications. However in this case the abrasive nature of the particulate had been causing problems with the life of the filter elements. The plant decided to retrofit their dust-collector with ceramic filter elements in order to achieve better filter life at temperature, and for better wear resistance.

Although the initial reverse pulse cleaning system was suitable for fabric bags, the dense ceramic elements could not be cleaned with the compressed air pressure available, causing the differential pressure (ΔP) across the filters to rise. This forced the plant to take the dust collector off-line for cleaning whenever the ΔP approached 5kPa. The ΔP climbed to 5kPa on almost a daily basis. To compound the situation, shut down periods became longer, forcing an urgent resolution. These problems were exacerbated by frequent kiln damage due to the chipping of bricks in the kiln, caused by extreme temperature fluctuations. The cost to the plant was in the order of $30,000 per week.

Therefore, a decision was made to consider retrofitting the existing reverse pulse cleaning system. It was at this point that Goyen were approached to contribute their pulse cleaning system expertise to the process. Goyen were asked to assess the effectiveness of the existing reverse pulse jet filter cleaning system and make recommendations. The plant was interested in exploring the possibility of using a Goyen proprietary pulse cleaning GOCO nozzle design with or in place of venturis. Goyen had previously conducted similar evaluations for most of the world's largest reverse pulse jet filtration system designers and suppliers, quantifying modifications and improvements.

Goyen utilised its own proprietary 'GOCO' software package and world-class test facility to evaluate the performance of the existing filter cleaning system. Employing mathematical modelling and thorough testing, the engineers identified why the original configuration provided ineffective filter cleaning. For a ceramic filter to be cleaned effectively, each reverse pulse requires enough pressure to overcome, and then exceed, the pressure of the forward flow and the resistance of the filter media itself. It is the residual amount of reverse pressure from a pulse, the 'Overpressure', that fractures the dust cake and cleans the ceramic filter. The tests revealed that the original cleaning system was generating only 3.45kPa of reverse pressure; not enough to even equalise the forward pressure of 4kPa (see Figure 1).

Goyen engineers evaluated a number of possible modifications that would dramatically improve the cleaning performance of the original system using the GOCO software, computational fluid dynamics, and the testing facility. Performance improvements were quantified for modifications to the initial system.

The testing and modelling showed that the combination of the GOCO nozzles and venturis increased the cleaning system overpressure so significantly that the pulse cleaning system operating pressure could be reduced if this configuration was adopted (see figure 2). With this combination, the plant could resolve the high differential pressure problem and reduce the electricity consumption of the liquor burner (via fan power reduction and air compressor savings), as well as minimising downtime. Moreover, this configuration would also offer the flexibility to treble the dust load if necessary, and still clean the elements. Therefore, the liquor burner's dust collector would no longer restrict production levels.

Thanks to the thorough investigative work of Goyen engineers, this solution could be implemented at a cost of a little more than one week's lost productivity, and provided scope for plant productivity growth.