Case study

Sinter process gas fan performance improvements

voestalpine Donawitz Steel Plant, Austria

Turnkey retrofit of high performance sinter process gas fan for 1.65m tonne capacity steel plant in Austria.

Facing degrading fan performance due to erosion, voestalpine Stahl Donawitz turned to Howden for a solution. Howden was able to assess the situation and provide a fan with improved erosion resistance. Additional design engineering for higher performance will deliver operational savings to ensure a payback in only two and a half years, while reducing CO_2 emissions.

Challenge

voestalpine Stahl Donawitz as part of the global leading steel and technology group voestalpine, strives to deliver sustainable production by being at the forefront of techniques to maximise the use of raw resources and minimise energy use and related CO_2 emissions.

The Donawitz plant produces around 1.65 million tonnes of raw steel per year based on the basic oxygen steel making process (Linz-Donawitz). High-quality sinter is key to consistent, stable and low CO_2 blast furnace production. Therefore, the removal and treatment of sinter plant process gas is critical.

voestalpine Stahl Donawitz uses a centrifugal fan to extract large volumes of extremely hot abrasive process gases from the sintering machine through a dust removal system (ESP) before treatment. Sinter induced draft (ID) fans are some of the most arduous erosive applications encountered in centrifugal fans.

The dust composition will vary according to the ores being used and the operating conditions in the plants, but the result is always erosion. Typically this is experienced on the surface of the impeller, but in this case was initially seen in the casing.

High levels of erosion were being encountered at voestalpine Stahl Donawitz, which led them to consult Howden for an evaluation of potential improvements on the wear protection. As any work would entail the fan coming offline and a halt to production, it was critical that the solution could be implemented in as short a timeframe as possible.

The original waste gas fan in situ.

The fan impeller.

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Solution

Once approached by voestalpine Stahl Donawitz, Howden began a thorough analysis of the fan within the context of the operating duty. The main aim was to reduce the impeller speed to lower the impact of erosion and also introduce greater wear protection.

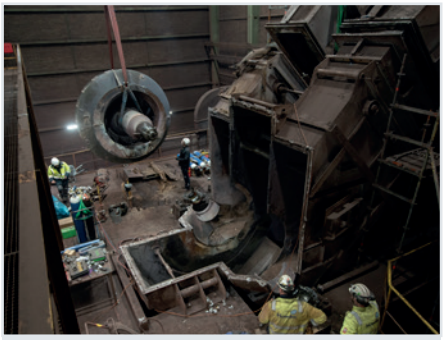
The final engineering design met the requirements by incorporating tungsten carbide for the blade entry and providing an easily exchangeable casing for future maintenance.

Based on initial temperature data, low efficiencies were also assumed. This led to an investigation of potential energy savings to compliment the work addressing the issue of erosion. To develop this added benefit, aerodynamic measurements were performed on-site to confirm the potential energy savings and to optimise the fan selection and design. Potential future capacity increases were also factored into the design process.

On the basis of CFD analysis, Howden was able to offer stringent performance guarantees. Continuous performance measurements over several months provided reliable data about the operating range over time and also confirmed no requirement for additional flow control devices, thereby saving on equipment costs.

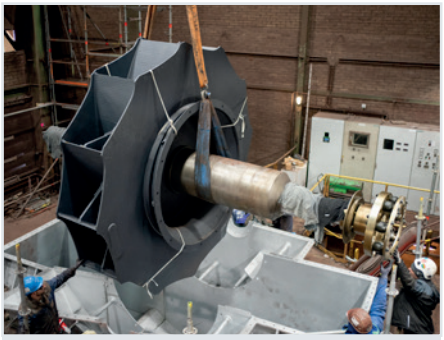
The complete solution was a turnkey retrofit involving the removal of the old fan and the installation and commissioning of a new fan and management of all subcontracted site work.

The new fan operates with a volume of 277 m^3/s, a pressure rise of 18448 Pa and a mechanical design temperature of 250°C. It was designed to fit within the existing footprint due to limited space and desire to avoid additional foundation work. The full scope included a 5.6 MW electric motor with frequency converter, oil lubrication unit and control system. The frequency converter provides increased efficiency and savings when production rates are reduced.



Removal of the existing fan and casing.

The new ducting awaiting installation.



Installation of the new fan into its casing.

Outcome

The project was completed to schedule within ten days, which ensured the minimum disruption to production as operations needed to cease during work.

Project delivery was achieved using a large team of experienced Howden personnel from Germany and the UK. Plant personnel contributed greatly to the successful delivery by cooperating closely during preparation and implementation.

The success of the project has been verified by an independent party, who concluded that the fan over-performed at three duty points, and that it was “right on target” to meet a fourth duty point.

Initial calculations revealed a potential energy savings of 900 kW, which would give a payback time of only two and a half years, excluding any savings in reduced CO_2. The eventual contracted savings were set at 1052 kW and the actual outcome exceeds this amounting to substantial cost savings, plus additional CO_2 savings, and a significantly improved resistance to erosion.