

Balancing Big Fans

GCC Dacotah Cement's plant in Rapid City, South Dakota, had been experiencing problems as a result of severe vibration in the draft fan caused by minute particulates. The problems were resolved by Lord Corp.

Introduction

As the 104 in. dia., 1250 hp induced fan draws hot gas off the rotary kiln, some particulates stick to it before reaching the baghouse for removal. These particulates build up, forming a hard coating up to an inch thick. Changes in temperature then cause pieces of the coating to break off. This alters the balance of the fan, resulting in severe vibration.

The kiln had to be shutdown every 2 months to sandblast the accumulated material from the fan. Cleaning often took 6 h and, by the time the kiln was back in service, 12 h of production were lost. During times when the demand is high each ton of clinker lost is critical. Equipment must be able to operate continuously, as 1000 t of clinker would be lost every 12 h.

In addition to accelerated bearing and motor wear, another maintenance problem arose from these frequent shutdowns. The steel structure of the kiln is protected from extreme process heat by a refractory lining. Expansion and contraction in the refractory due to the repeated heating and cooling during unplanned fan shutdowns caused sections of it to fail, meaning additional costly repairs.

The BalaDyne solution

In 1997 a BalaDyne IV Automatic Fan Balancing System was installed at the plant, designed to continuously monitor and correct unbalanced conditions.

The balancing head of the system mounts directly onto the fan shaft. The head is divided into four chambers, which contain a unique high specific gravity balancing fluid. When the

balancer controller detects an imbalance, the temperature of the fluid in the chamber on the heavy side is increased, changing it from liquid to gas. The gas transfers through a shuttle tube to the chamber on the light side, where it condenses and returns to liquid. This process continues until the controller senses that balance has been restored.

The non-contact power supply in the rotary transformer eliminates the need for maintenance, sending power and data across an air gap between a stationary primary coil and a rotating secondary coil.

Finding sufficient space for the balancer, and protecting it from heat radiating from the nearby 343 °C (650 °F) process air stream, presented significant problems. The space available at the plant was limited and conditions were very hot. The system was successfully installed by tailoring the balancing wheel to fit the available space, and designing a cooling fan and ventilation holes in the balancer housing. Additional ventilation was provided by an externally mounted blower.

B4Setup

Dacotah also installed BalaDyne's optional B4Setup for Windows software. This helps analyse the vibration of the fan, as well as predict future problems, to allow repairs to be carried out during planned maintenance operations. The automatic fan balancer controller stores significant balance events in its memory. This data can then be retrieved and analysed to provide critical information about the fan's performance, including maximum and minimum vibration levels, balance frequency and fan sensitivity.

The software also calculates a 'fan signature', measuring the frequency response through the entire rotor operating speed range. It also detects problems inherent in the fan structure, including resonance frequencies, shaft misalignment and other mechanical irregularities.

Prior to balancer installation, the fan's vibration would reach levels up to 20 mils. The high-capacity (1380 oz./in.) balancing system currently maintains vibration levels between 0.8 - 1.2 mils of vibration. The system continually corrects for fan imbalances caused by particulate build up and spalling. This results in extended plant runs, reduced maintenance costs, and increased clinker production.

The fan stays in balance and only has to be cleaned during scheduled plant shutdowns. It totally eliminates the lost production factor, and due to its success a second system was also installed in 1998.



Another view of the balancing system installed on the E24 fan.



Lord fan balancing system installed on Buffalo Forge (Howden) E24 Preheater fan. The fan is 104 in. dia., 1200 Hp and runs at 1180 rpm.



Lord fan balancing system installed on Buffalo Forge (Howden) 57.5 in. dia., 75 Hp, 1800 rpm ID Fan.



Close-up view of the balancer installed on the E24 fan. The top portion of the balancing ring is visible.

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