STEEL MILL BOILER FAN UPGRADES

ID Fan Wheel - The original wheel was compromised due to corrosion, which eventually lead to failure to operate at required capacity. The redesigned wheel was constructed of a more corrosion-resistant material to avoid potential issues in the future.

FD Wheel - Upgraded material, doubler pads, and new bearing pedestals were some measures taken to ensure this rotor would withstand field conditions.

OVERVIEW

Industry - Boilers

Application - Steel Mill

Problem - Corrosion complications resulting in rotor failure.

Solution - Redesign and change in construction material of the rotor.

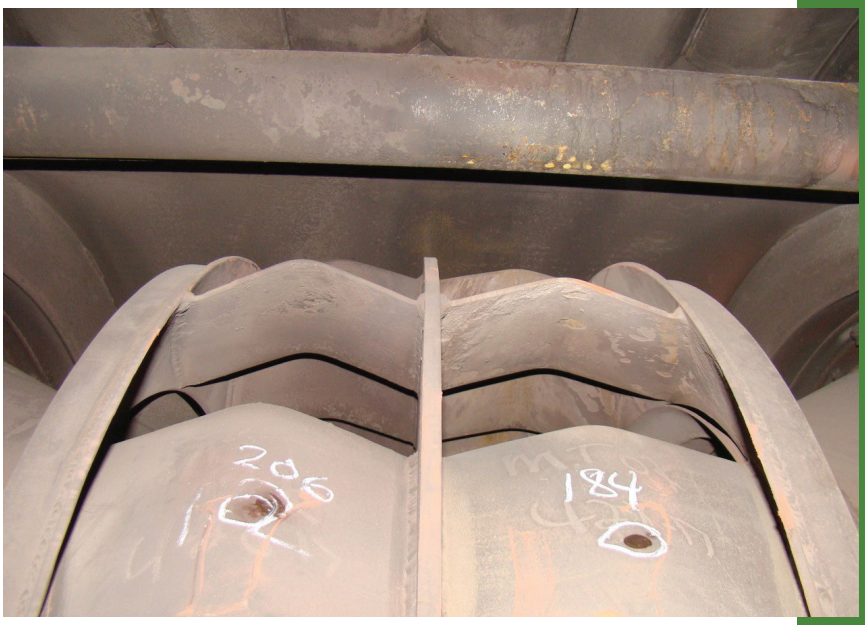
NEEDED UPGRADES TO POWER BOILER FANS MAY BE DONE WHEN CIRCUMSTANCES PERMIT.

Bad circumstances can be used to your advantage. A steel mill took advantage of an accident to upgrade the forced draft (FD) and induced draft (ID) fans in one of its power boilers. An ID fan wreck was caused by a combination of problems that resulted in rotor failure. Boiler fuel was a mixture of blast furnace gas and natural gas. An unsuspected economizer leak led to corrosion issues. High Ph from wetted ash started corrosion at weld joints and weakened the forward curved fan rotor. Then, a limit switch failure on the steam turbine governor allowed the turbine to speed up until it reached trip speed. Traditional turbine trip speed is 15 percent above normal operating speed, which

results in a rotor stress level increase of slightly higher than 30 percent. The fan rotor was originally designed to operate safely in the overspeed condition, but the corrosion weakened its welds and it collapsed due to the overload.

Once the cause of the failure was identified, emergency repair was initiated. The casing, dampers, rotor shaft and hub were not in reusable condition. It was also determined the original rotor material was A-36. A design review revealed that an upgrade to A-588 material would provide a nearly 40 percent increase in yield strength and a significant increase in resistance to future corrosion with very little cost difference. Once this was reported, the steel mill decided to implement the upgrade. The mill was also in the process of replacing its existing water-cooled sleeve bearings with split roller bearings, so new bearing pedestals were designed to adapt the new bearings to the existing sole plates.

While the boiler ID fan was being repaired, the FD fan was inspected. This fan was being run overspeed to meet boiler capacity, and signs of blade yield were apparent from the displaced geometry at the blade tip. Once this inspection was complete, stress analysis of the rotor was performed to review its design. Rotor material was upgraded to A-514 to nearly double the material's yield strength. Doubler pads were also added to reduce



FD Fan Original - Most of the components, including this rotor, needed to be redesigned and replaced for the FD fan.

high localized stress levels exposed by the analysis. Shaft critical speed was rechecked to make sure the rotor was capable of operating overspeed, and it was determined the existing shaft and hub could be re-used. As with the ID fan, new bearing pedestals were designed to allow the mill to upgrade the FD fan bearings.

Review of design parameters is important during a fan rebuild and is worth the effort. The fact that the mill was already invested in the bearing upgrade meant they were ready to implement that change. No one looks forward to a fan crash, but using the time wisely and reviewing the circumstances to maximize fan value resulted in superior products for the mill.

- **Steve Nelson**, a technical consultant to the New York Blower Company

The New York Blower Company uses advanced testing technology and experienced engineers to determine the best solution to a variety of problems, ranging from corrosion to excessive wear to high vibration and unbalance. Regardless of the original manufacturer, reverse engineering is utilized to repair, replace, and retrofit complete fans or component parts. With over 130 years experience, trust the industry experts.