The Art of BALANCE

BALANCE is a necessary part of keeping production running and preventing unplanned shutdowns.

Balance in critical equipment isn't an optional goal for manufacturing facilities. It is a necessary part of keeping production running and preventing unplanned shutdowns. It's particularly important for facilities with high demand for products, as is the case with the Oman India Fertilizer Company S.A.O.C. (OMIFCO). OMIFCO is a joint venture business established to operate a state-of-the-art, two train ammonia-urea fertilizer manufacturing facility in the Sur Industrial Estate in the Sultanate of Oman. The plant produces 1,750 tons per day of anhydrous ammonia and 2,530 tons per day of granular urea. Its products help meet the growing agricultural demand in India.

The company's goal is to produce fertilizer 365 days a year. As a result, the company has focused extensively on ensuring reliability. Its strategy includes building in redundant equipment for all critical assets, performing predictive maintenance based on vibration, flow, pressure and temperature monitoring, and completing routine preventive maintenance.

Each year, OMIFCO is able to meet its targets. The highest production values came in 2013 with 1.38 million tons of ammonia and 2.15 million tons of urea.

by Ankit Niranjan

SAVES $100,000

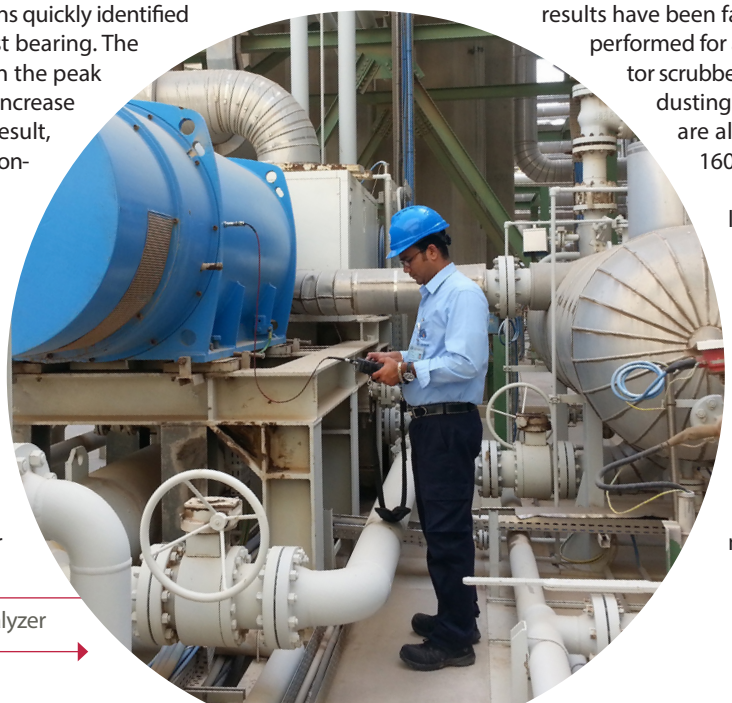
Choosing the Right Tool and Technique

Since 2012, OMIFCO has relied on a portable vibration analyzer as a key tool in ensuring reliability. Engineers routinely use trending peak waveform to assess various bearing faults. They began using the analyzer to gather vibration data from heavy-duty boiler feedwater pumps, which produce steam used in processing ammonia and urea. The data is uploaded to asset management software for detailed analysis. Using peak vibration analysis technology, OMIFCO technicians quickly identified a potential problem in a turbine thrust bearing. The impacting faults were readily visible in the peak waveform long before any significant increase in overall vibration was noticed. As a result, OMIFCO engineers began to carefully monitor that machine.

In February 2013, a sudden 50 percent increase in peak value spectrum and waveform was observed, followed a few days later by another large increase. At this time, a slight increase in turbine horizontal vibration velocity was evident for the first time. The machine was taken out of service to check the thrust bearing, which was found to be severely damaged with large pitting in the inner race and small pitting in the ball bearings. After the thrust bearing was replaced and the machine put back into service, all the vibration readings returned to normal levels.

As experience with the portable analyzer increases, so do the ways it brings value. The maintenance inspection team began using the analyzer for in situ balancing of fans. The team used dynamic balancing, a two plan balancing method. With more than 12 uses of this application, the results have been fast and accurate. In situ balancing was performed for a variety of fans, including the granulator scrubber fan, the fluidization air fan and the dedusting fan in the granulation unit. These fans are all large in size and driven by 1350 kW, 1600 kW and 90 kW motors, respectively.

A persistent problem with a motor led the maintenance inspection team to add vibration monitoring to their routine. In each ammonia plant, there are three ammonia booster compressor drivers that pressurize ammonia. These compressors are powered by electric motors. To run the process, two out of the three motors are required to run at all times. One particular motor had a history of high bearing temperature and high vibration. The maintenance team monitored the motor



OMIFCO relies on a portable vibration analyzer as a key tool in ensuring reliability →

OMIFCO saved a total of $100,000.

closely with data on vibration and temperature captured every two weeks. This particular motor also required frequent rotor balancing. Each time, the problem would stop for a short period and then start again.

After the third incident of high vibration and temperature, the motor was removed and brought to the vendor's maintenance shop. The vendor found damage in the journal area. Using metallic spray and a lathe, the vendor repaired the issue. The part was returned to the motor and the balancing was done in the maintenance shop.

With high demand for its products, ensuring smooth operation of critical equipment is a top priority for OMIFCO

The motor was reinstalled, but the analyzer still indicated a high vibration. To determine the root cause, the maintenance team performed a number of tests. The results of an impact test on the motor's non-drive end and drive end vertical position showed no sign of resonance. The team checked the cross phase on the motor's foundation, foot and casing, but didn't find any looseness. The phase difference between horizontal to horizontal was found equal +/- 20 degrees with vertical to vertical, which is within the normal range.

In short, the tests indicated that the only issue was with non-balance. The vendor had already balanced the motor at its maintenance shop, so that option had already been attempted. Yet, risk was still high, as if the rotor was not repaired. Catastrophic damage could occur, resulting in a safety threat and loss of ammonia and urea production.

The management team was resigned to replacing the rotor at a $40,000 cost. But, the internal maintenance team had an inkling that they could balance the motor in situ, using the portable analyzer.

Balancing a motor in situ had never been attempted. The perception was that it would not be easy. As there had been no previous cases where such a large motor balancing had been attempted on-site, it was difficult to select the weight planes considering the limitation of space.

Yet, even knowing the potential difficulties, the team was confident the approach could work. Eventually, management became convinced of the benefit of letting them try.

Once they had the motor cage open, the maintenance team used the fan as plane 1 and coupling as plane 2 and added trial weight calculated by the vibration analyzer. After the start-up of the machine, the analyzer calculated the correction weight that had been applied at both weight planes. Within four hours, team members were able to get the vibration to a normal level by removing 45 grams of trial weight and adding 1,159 grams in plane 1 and 612 grams of correction weight in plane 2. The balancing data was entered into the predictive maintenance software and the appropriate reports were generated. The entire balancing operation was wrapped up in less than a day. In comparison, removing the motor would have taken it out of commission for up to three days.

With the in situ balancing approach, OMIFCO eliminated the cost of replacing the rotor, manpower costs in removing the equipment and reinstalling, and paying the vendor for a second round of balancing. In total, OMIFCO saved $100,000. Confidence in the technicians increased and the skeptics among the management team congratulated the team on its success.

Using the portable vibration analyzer made balancing simple and saved OMIFCO time and resources. In addition, the maintenance team's increased experience using the portable analyzer has made in situ balancing a viable option for an increasing number of assets. For OMIFCO, practicing the art of balance is now a key part of the solution to ensuring production availability.

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