

## CASE STUDY:

### Fan Motor Test Reveals Damaged VFD, Prevents Safety Hazard and Process Downtime



#### The Company

Easy Tool, a Condition Monitoring Solutions Provider in Italy, works with a paint production facility in Ancona, a city along Italy's Adriatic coast. This paint producer has worked with Easy Tool since 2013, relying on their highly knowledgeable field engineers to perform regular condition monitoring services for the motors, fans, pumps, and mixers operating in their paint production facility.

Every six months, field engineers from Easy Tool spend 6 days at the paint production facility, using a variety of technologies to test their equipment, perform vibration analysis, oil analysis, and motor testing as part of their preventive maintenance program. In January 2017, Ettore Di Pasquale, Field Engineer, was performing a dynamic test on a 55-kilowatt, 4-pole motor at the paint production facility when he discovered a significant current imbalance.

#### The Application

This 55-kilowatt, 4-pole motor was driving a fan that sucks solvents from the air of the paint production department. This fan is critical for ensuring worker safety. If the fan stops running, the paint producer must stop the production process. For this reason, this critical fan and motor are tested every six months to ensure uptime.

#### The Discovery

The fan is comprised of an impeller keyed directly to the motor shaft, which is controlled by a variable frequency drive (VFD). Di Pasquale used the ALL-TEST PRO On-Line II™ energized motor testing instrument to test the fan motor and discovered significant current imbalance at the VFD input and output (see Figure 1 and 2).

"Testing showed a current imbalance of 12.4% at the input of the VFD that became 74.8% at the output of the VFD," explains Di Pasquale. "This is not good for the motor – the VFD should supply the fan motor with balanced current. Given such high levels of current imbalance and the absence of several input half-waves, it became clear to me that the motor and fan were fine, but that the VFD needed to be replaced."

***"It is important to regularly check the health of your critical machinery."***



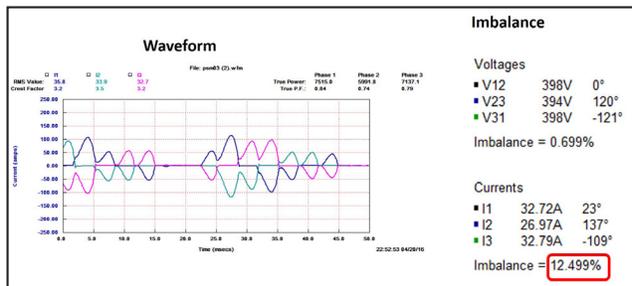


Figure 1. Measurements taken at the VFD input show an abnormal waveform. This waveform shows how the current coming into the VFD is unbalanced. For example, the straight lines from the 15 second mark to the 23 second mark are flat – which means the VFD is not receiving any current. This waveform is not normal for a healthy VFD (a normal waveform at VFD input should look like the waveform in Figure 3).

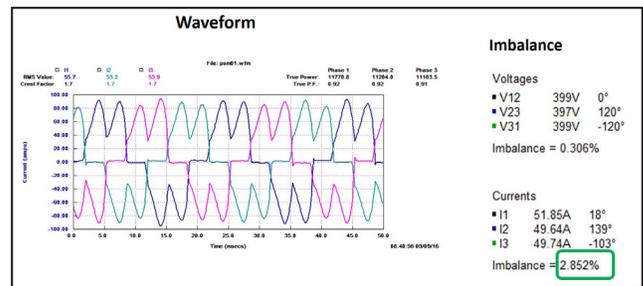


Figure 3. VFD input measurement following replacement.

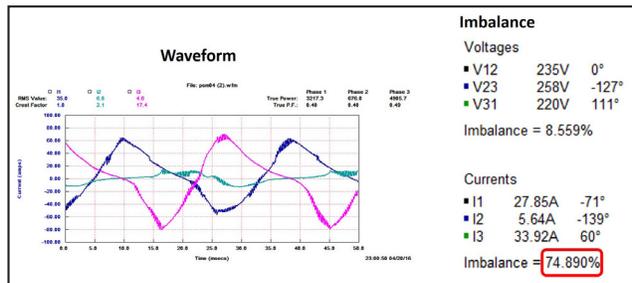


Figure 2. Measurements taken at the VFD output show significant imbalance that exists in the current fed to the motor. As you can see, the green waveform (phase 2) should be similar in shape to the blue (phase 1) and pink (phase 3) waveforms, but it is drastically different. This waveform is not normal for a healthy VFD (a normal waveform at VFD output should look like the waveform in Figure 4).

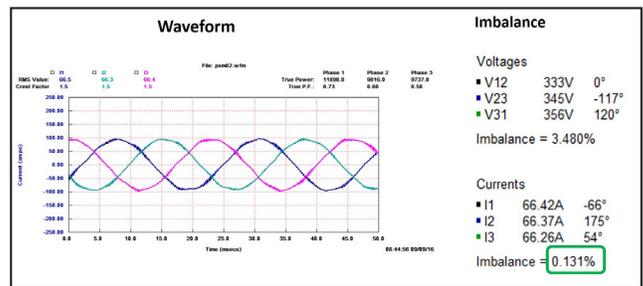


Figure 4. Output measurement of new VFD (all three current waveforms are normal).

Di Pasquale discussed the issue with the owner of the facility. He explained that this current imbalance was likely a result of an internal problem with the VFD and recommended the VFD be replaced. Even though the fan could operate with this VFD-driven motor, the motor would eventually become damaged as a result of the current imbalance.

## The Solution

Trusting Di Pasquale's recommendation, the paint producer had the VFD removed and confirmed that there had been serious damage to the VFD's internal diodes. The paint producer ordered a new VFD and was able to maintain production while waiting for the new inverter, which took 10 days to arrive. After the new VFD was installed, Di Pasquale went back to the facility to test the fan motor with the new VFD. The second round of energized motor testing with the ATPOL II™ showed healthy waveforms (Figure 3 & 4).

## Lessons Learned

Even though the fan motor had a 74.8% current imbalance, no alarm or malfunction warning had been triggered. While the VFD seemed to be functioning properly, if allowed to continue running with faulty diodes, it could have failed abruptly - which would have brought the entire production department to a halt. This paint producer essentially prevented failure of the fan motor, ensuring worker safety and avoiding lost production and the related downtime expenses.

It is important to regularly check the health of your critical machinery. There are easy-to-use portable instruments, like the ALL-TEST PRO On-Line II™ energized motor testing instrument, that can help you check the condition of your motors. When you know what is really happening with your equipment, you can make smart decisions to keep people safe and to keep your operation running smoothly.

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