

GEAR FAILURE IN A FERTILIZER PRODUCTION MILL



DIAGNOSIS

DETECTED ANOMALY

SEVERE GEAR CONTAMINATION

PROBABLE ROOT CAUSE

SEAL LEAKAGE LEADING TO LUBRICANT CONTAMINATION

DETECTION LEAD TIME

THREE MONTHS IN ADVANCE

UP TO **65k€**

Estimated avoided cost, considering gear replacement and downtime.

LOCATION: Brazil
ASSET: Mill
SECTOR: Chemical/Fertilizer
4000 V / 92 A / 522 kW / 60Hz

The diagnosis was generated without additional sensors, relying solely on electrical measurements.

During normal steady-state operation, PreditMot identified a **progressive upward trend in the Load Variation indicator, exceeding the predefined alarm thresholds.**

KEY OBSERVATIONS

- The trend developed **without changes in process demand or operating setpoints**
- The deviation was **persistent**, not transient
- Alarm severity increased rapidly, triggering a **high-criticality alert**

This behavior indicated abnormal torque fluctuations inconsistent with normal mechanical loading.

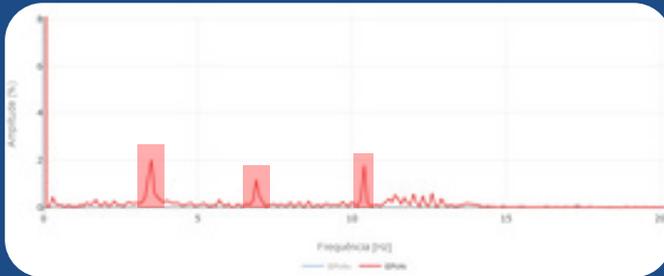


TREND OF LOAD VARIATION FAULT INDICATOR

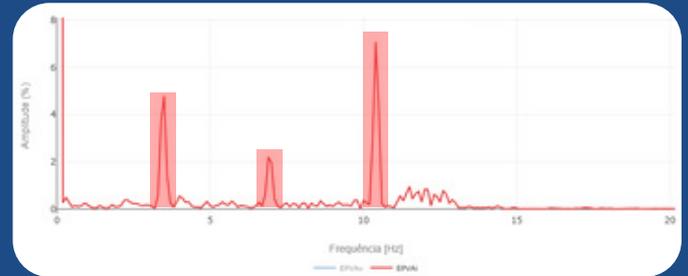
A detailed frequency-domain analysis of the stator current revealed:

- **A pronounced spectral component at 3.5 Hz**
- Clear **harmonic amplification** of this component
- Absence (or very low magnitude) of these components under baseline conditions

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SPECTRAL ANALYSIS UNDER NORMAL OPERATION



SPECTRAL ANALYSIS UNDER DEVELOPING PROBLEMS

Based on:

- The known rotational characteristics of the mill gear system
- The relationship between mechanical irregularities and torque modulation reflected in stator current

A targeted inspection was performed focusing on the gearbox assembly.

Findings:

- Significant gear contamination
- Evidence of seal leakage
- Condition fully consistent with the ESA-based diagnosis

The inspection confirmed both the **failure mode and the location** predicted by PreditMot.



SEVERE GEAR CONTAMINATION

IMPACT & BENEFITS

- ✓ Prevention of catastrophic gear failure
- ✓ Avoidance of unplanned mill shutdown
- ✓ Reduced corrective maintenance scope
- ✓ Extended gearbox service life

KEY TECHNICAL TAKEAWAY

This case demonstrates how electrical variables can reliably reflect mechanical degradation and how ESA enables early, physics-based fault detection in gear-driven assets, even in harsh industrial environments where conventional sensors are difficult to deploy.