

Case Study

Power quality analyzer enhances engine performance in mining operations



Achieving optimal performance and reliability is vital in industrial operations and is particularly crucial in the mining industry. [At Nexa Resources](#), a mining and metallurgy operation in Brazil, a critical 2,300 HP medium voltage motor drove a four-stage centrifugal pump essential to mine operations. To meet increasing demands, the pump required a higher flow rate, requiring the engine to operate at a high capacity of 3,200 HP. This increase in capacity posed risks of overload and possible mechanical failures.

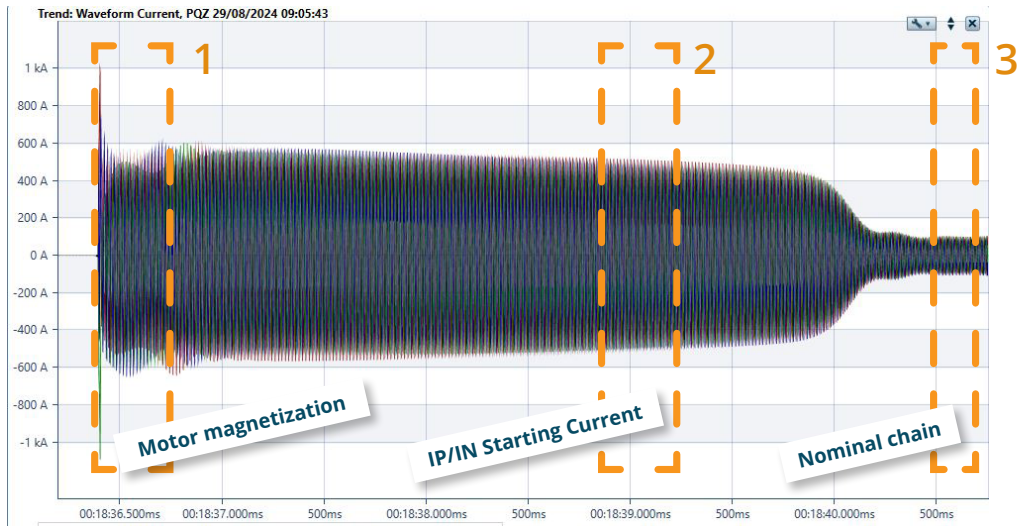
Approach

To address these challenges, Nexa's maintenance specialist conducted a comprehensive analysis of the engine and pump system using Elspec's PureBB analyzer. [The PureBB](#) is a plug and play power quality analyzer, equipped with PQZIP technology, which continuously records and stores all waveform signals at 256 samples/cycle without the need to set any triggers. The PureBB provided detailed data on operating conditions, enabling critical insights into system performance.

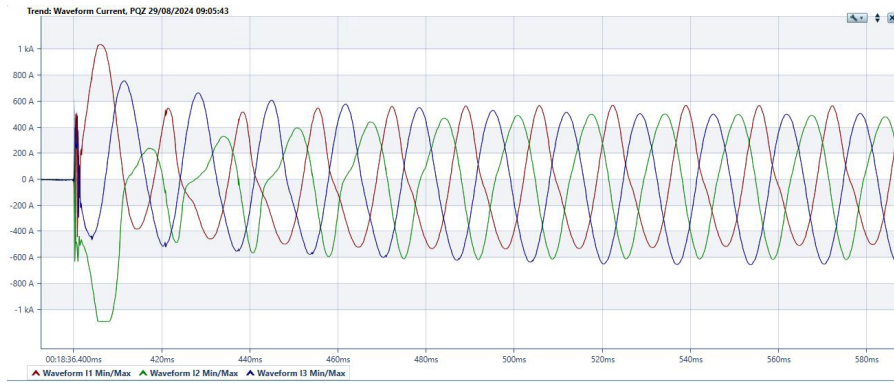


Modeling and Analysis

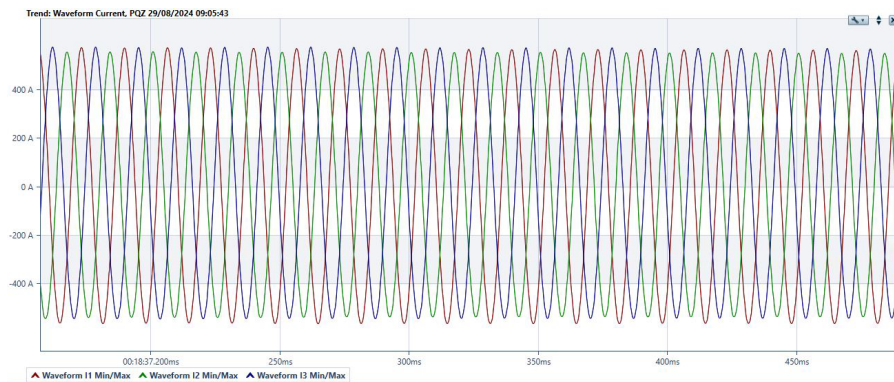
Detailed analysis was performed on motor magnetization, starting current (IP/IN) and steady-state operation, providing a comprehensive view of motor behavior under various conditions.



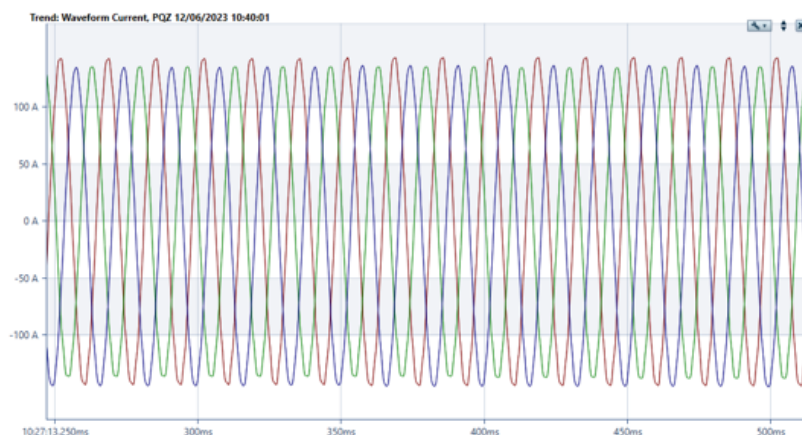
1 First Cycles of the transitional regime



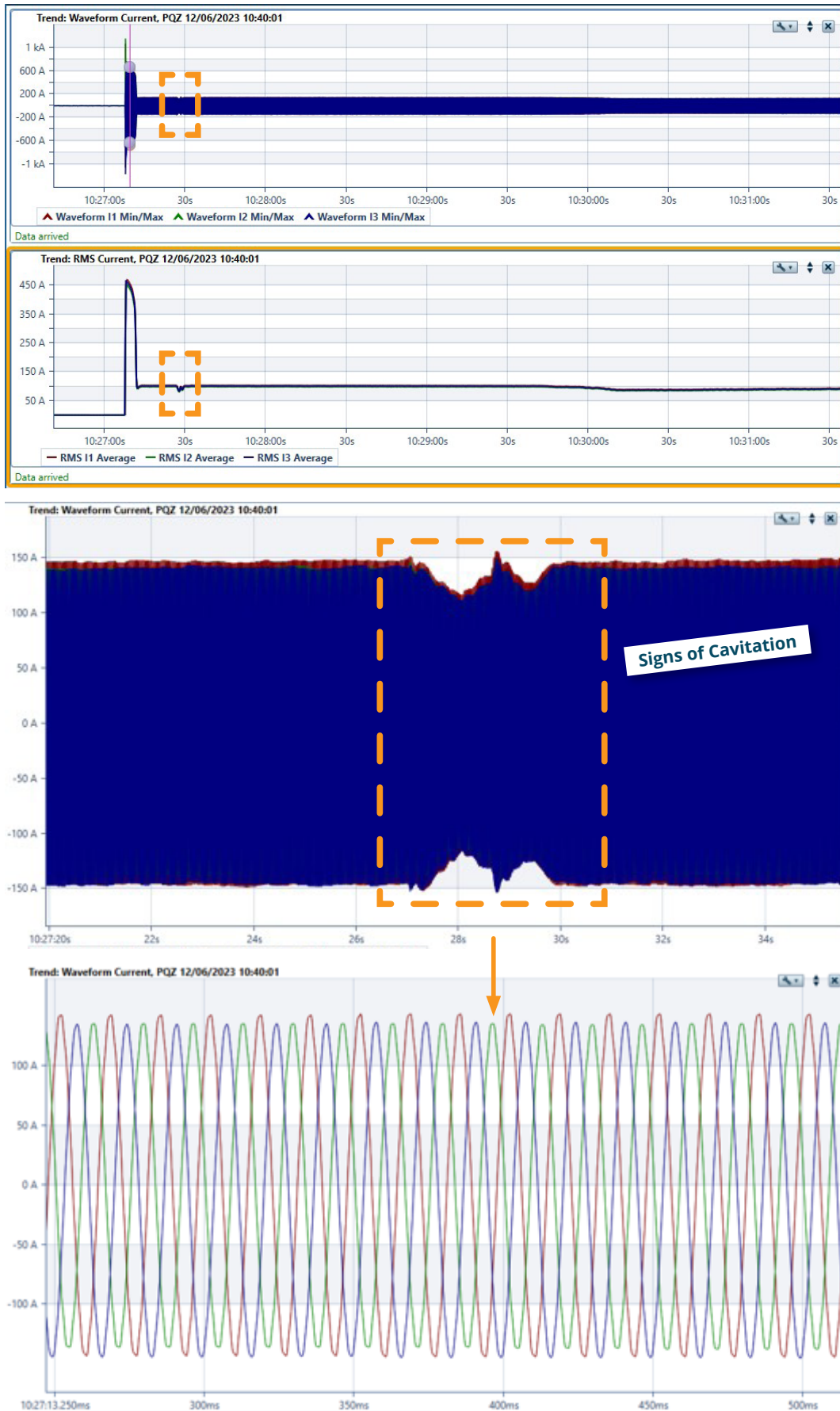
2 Transient regime - IP/NP starting current

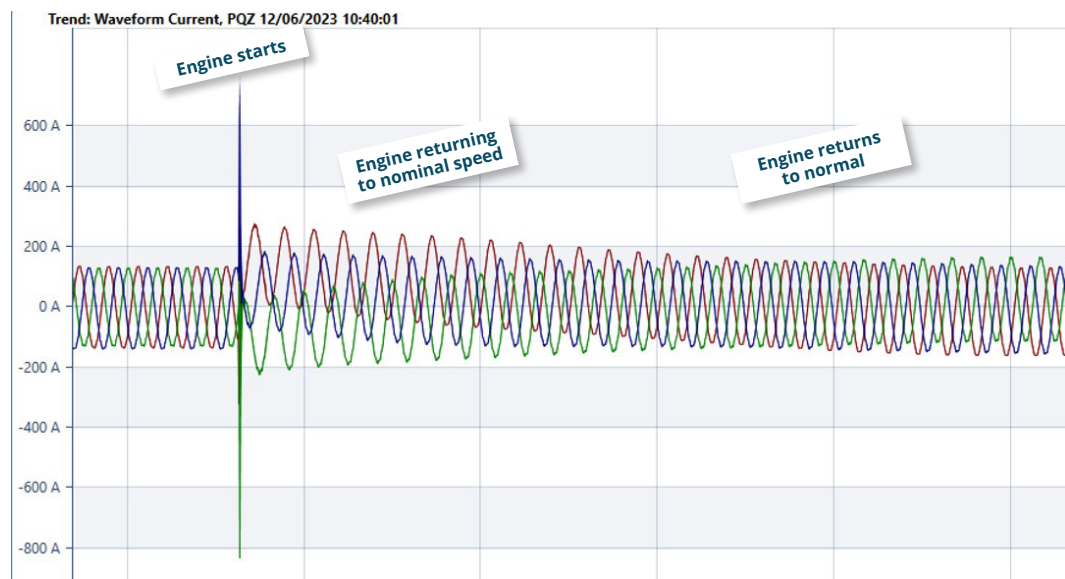
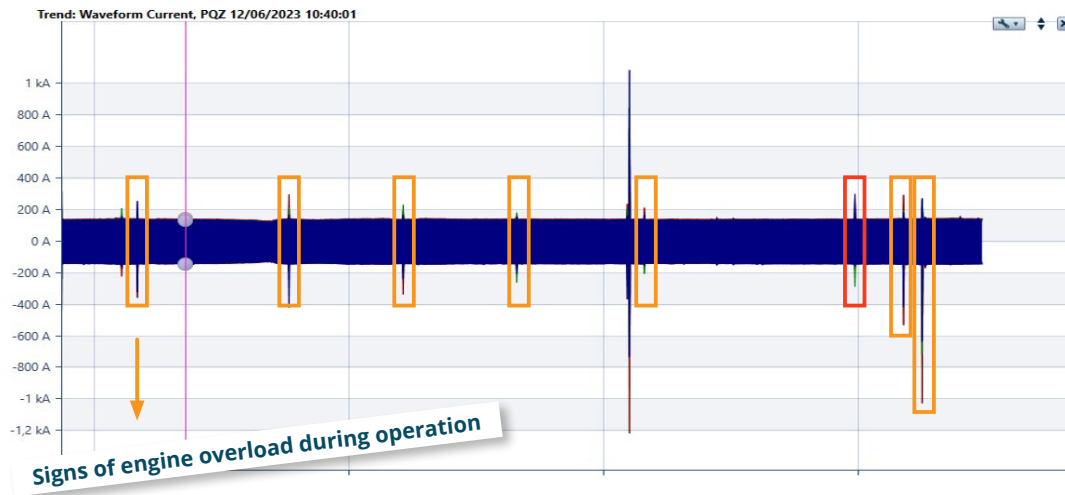


3 Engine at steady state



3 Operational Analysis after start-up and an anomaly identified:





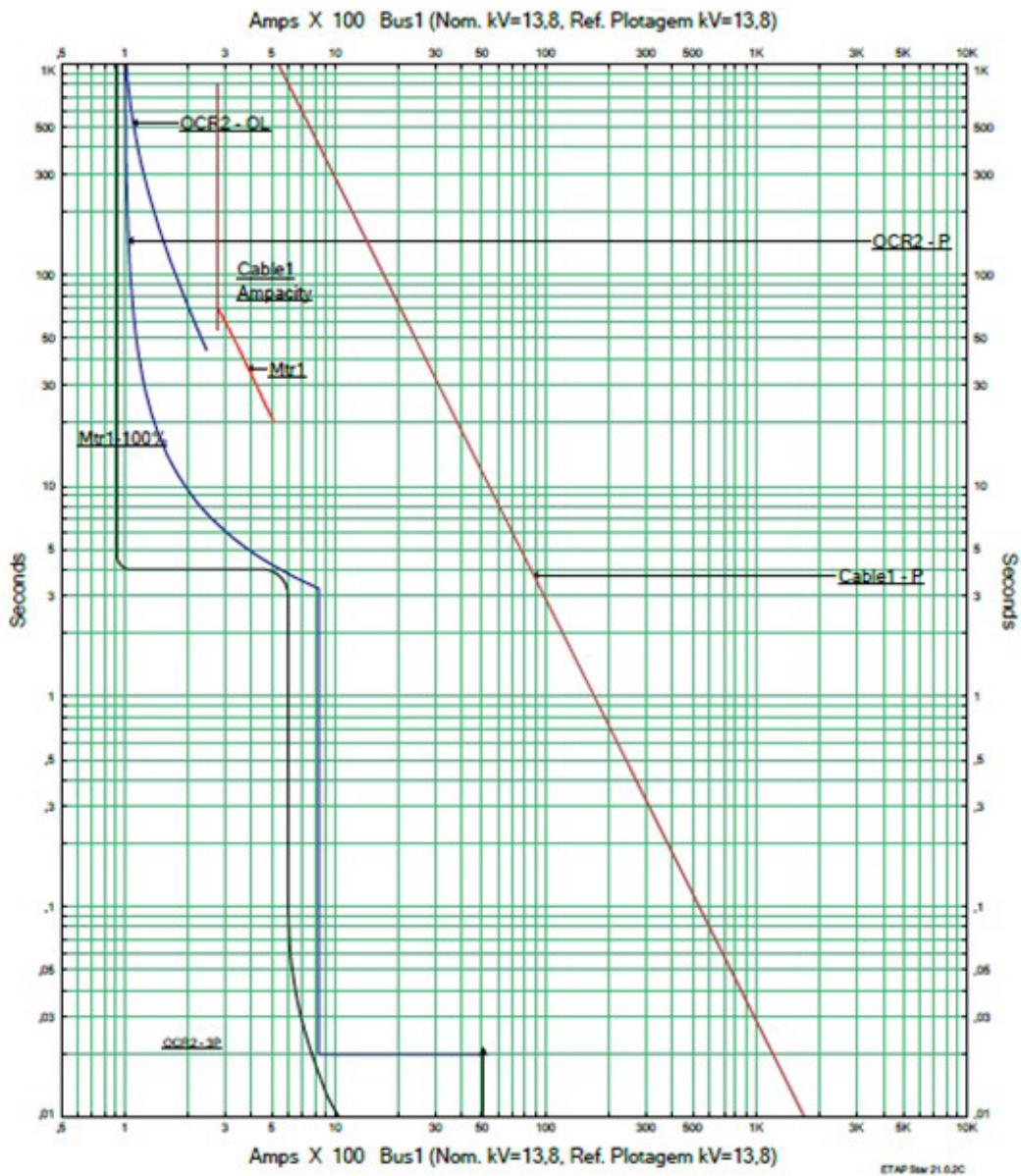
Results

The analysis revealed Cavitation and Overload conditions of the engine. The PureBB continuous waveform recording identified signs of cavitation and engine overload during operation. These issues were traced back to the pump shaft momentarily blocking due to material passage in the rotors, which directly impacted the motor's current.

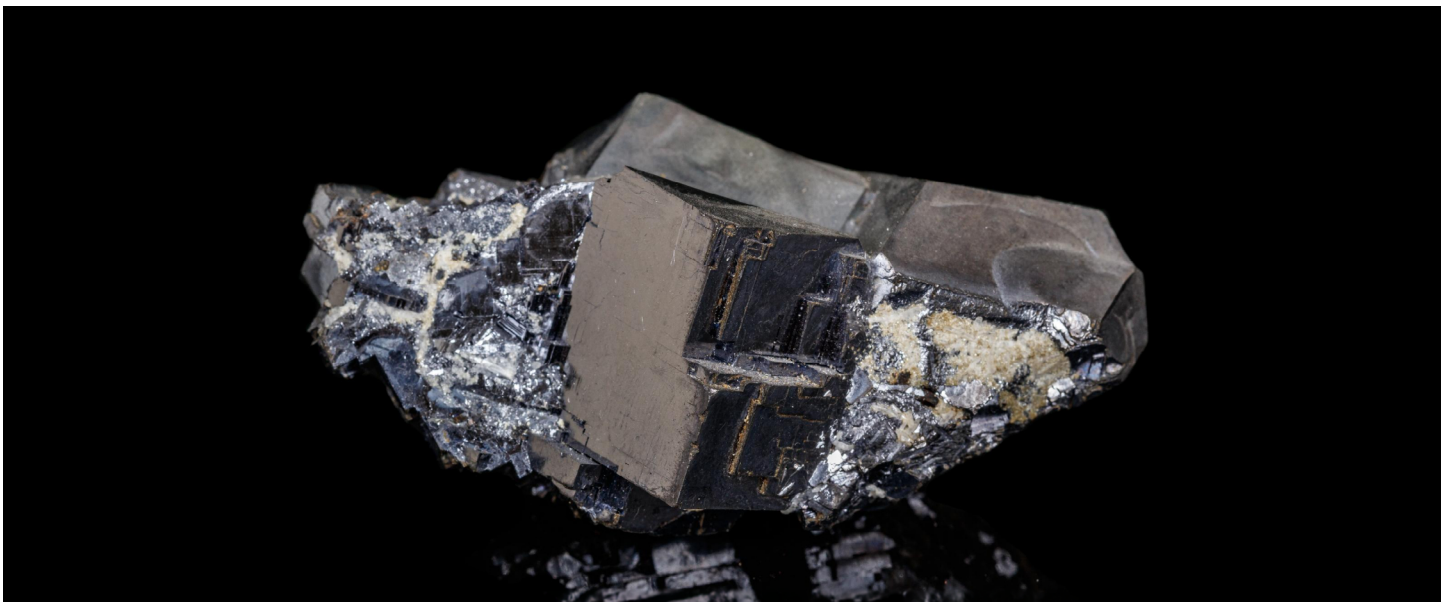
Actions Implemented

1. ETAP Software Configuration: ETAP software was configured to perform a Protection and Coordination study of the electrical system. Multiple curve simulations were conducted to identify the optimal protection settings, ensuring the motor's safety and efficiency.
2. Refined Protection Settings: Adjustments were made to the selectivity of the protection system, tailoring it to the specific operational needs of the motor and the broader system.





- Improved Protection and Longevity: The refined protection settings ensured that the system was protected not just at the motor level but comprehensively across the entire operational system. This holistic approach enhances the motor's lifespan and reliability, supporting the mine's increased production demands.



Conclusions

Combining detailed operational analysis with tailored protection settings enabled the company to optimize the motor's performance and extend its useful life, ensuring continued efficiency and reliability in the demanding mining environment.

This case study demonstrates the effectiveness of using [continuous waveform recording](#) power quality Analyzers like Elspec's PureBB to diagnose and address complex issues in industrial motor systems.

Continuous waveform recording is crucial in cases like this for several reasons:

1. **Capturing High-Resolution Data:** Recording at 256 samples/cycle ensures that all transient events and subtle anomalies in the electrical signals are captured. This high-resolution data provides a detailed view of the motor's electrical characteristics, which is essential for identifying issues such as voltage sags, spikes, or harmonic distortions.
2. **Identifying Transient Events:** Transient events, like short-term voltage dips or surges, can significantly impact motor performance and lifespan. Continuous waveform recording allows for the detection of these events as they occur, providing valuable information on the conditions that may lead to operational issues or equipment damage.
3. **Diagnosing Operational Anomalies:** In this case study, issues such as cavitation and impeller locks were identified. Continuous waveform recording helped diagnose these problems by providing clear evidence of the electrical disturbances associated with mechanical issues. For example, a sudden change in current or voltage could indicate a mechanical blockage or cavitation event, allowing for timely intervention.
4. **Ensuring Comprehensive Protection:** By continuously monitoring all waveform signals, this Analyzer can ensure that protection systems are not only reactive but proactive. It allows for real-time adjustments to protection settings based on the actual operating conditions, thereby enhancing the overall protection and efficiency of the motor and the system it operates within.
5. **Supporting Detailed Analysis and Optimization:** The detailed data from continuous waveform recording supports in-depth analysis of the motor's performance under various load conditions. This information is crucial for optimizing motors' operations, ensuring their ability to handle increased demands without compromising safety or efficiency.

Overall, continuous waveform recording provides a comprehensive and detailed view of motors' electrical and operational conditions, enabling precise diagnostics, effective problem-solving, and optimal system protection and performance.



About the writer

Moisés M. Bizinoto, Specialist Electrical Engineer for Nexa Resources, mining company in Vazante, MG, Brazil, has extensive expertise in energy efficiency and maintenance engineering. He oversees over 60 electrical substations, underground mine fans, and various pumping systems.



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