Equipment Protection in the Mining Industry

ABOUT THE CUSTOMER

- One of the world's largest mining companies, producing copper, gold, and molybdenum.
- Copper is their primary product, critical to electric vehicles, power grids, and renewable energy infrastructure.
- The company prioritizes responsible mining, environmental stewardship, and community engagement, with growing investments in decarbonization and tailings management.
- Publicly listed on the New York Stock Exchange.

ABOUT THE INDUSTRY

Mining facilities consume enormous amounts of energy to power heavy equipment — from chopper rectifiers and portable conveyors to electrically driven excavators and shovels. These systems operate at relatively low voltages but draw extremely high currents, generating intense heat across power electronics, bus runs, connectors, and mechanical drive components.

Without continuous temperature monitoring and timely intervention, hotspots can escalate into thermal runaway events or fires. Continuous thermal monitoring (CTM), integrated with local control systems and alarms, is crucial for detecting abnormal temperature rises early, protecting personnel, and preventing costly downtime or asset loss.

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BACKGROUND

The mining company previously relied on monthly infrared thermography inspections conducted with handheld tools. These inspections required senior technicians, resulting in high labor costs and inconsistent data quality, which was often tied to operator skill.

Because faults **can develop and escalate** between monthly inspection cycles, this method **created gaps in detection**, increased the **chance of unplanned downtime**, and left room for **human error** or **overlooked anomalies**.

By transitioning from a labor-intensive inspection program to a continuous thermal monitoring solution, the company can detect faults in real-time, reduce operational risk, and increase the reliability of its production assets.

OVERHEATING ISSUES

Chopper Rectifiers

Chopper rectifiers provide stable, controllable, ripple-free DC power, which is essential for consistent and high-quality copper deposition. In each feeder room, four rectifiers are stacked on top of each other. Ceiling-level cooling fans are installed, but units located near the floor are vulnerable to restricted airflow.

Capacitors are positioned between the upper bus/ cable terminations and the rollout drawer base, creating heat capture points. While copper cooling tubes assist, they cannot fully offset the heat in confined spaces with elevated ambient temperatures. When overheating occurs,

capacitors may rupture, causing permanent damage to equipment and production disruptions that can cost the company thousands of dollars per day.

Portable Conveyors

Portable mining conveyors often carry onboard diesel generators and step-down transformers to power large motors. When operated at high loads for extended periods, transformer windings, bushings, and nearby cable terminations can overheat.

Once temperatures rise above critical thresholds, thermal runaway or fire becomes possible. Continuous monitoring of absolute temperature and rate of rise is essential for triggering alarms and protective interlocks that can de-rate or shut down conveyors before catastrophic events occur.

INCIDENT SUMMARY

Shovel Bus Bar Meltdown

In the summer of 2025, one of the electrically driven excavators exceeded its design limits, leading to catastrophic thermal stress. The onboard fire suppression system was triggered, forcing an extended shutdown of more than 20 hours.

During this outage:

- **225,000 lbs. of products were lost**
- Repairs totaled **$51,000**
- The unplanned downtime caused an estimated **$2.5 million in revenue loss**

At the time, IR scanning was performed only every 28 days, leaving the potential for thermal issues to go undetected for nearly four weeks. This gap highlights the crucial importance of proactive, continuous monitoring to identify faults in real-time and prevent high-impact failures.

THE SOLUTION

The mining company partnered with the chopper rectifier manufacturer to determine optimal probe locations. Today, GraceSense™ Hot Spot Monitor (HSM) probes are factory-installed on all new equipment, ensuring precise thermal monitoring from the start and significantly reducing operational risk.

By continuously trending temperature data, the HSM provides real-time visibility into abnormal thermal behavior. This capability ensures earlier fault detection, faster notification to operators, and proactive response — preventing equipment damage, downtime, and safety hazards.

ENSURING NFPA 70B COMPLIANCE WITH CONTINUOUS THERMAL MONITORING

Adopting the GraceSense™ HSM ensures compliance with NFPA 70B Chapter 9, Section 9.2.5, which identifies condition-based maintenance and continuous thermal monitoring as best practices. By delivering real-time thermal data and automated alarming, the HSM not only helps facilities meet these requirements but also improves worker safety, minimizes exposure to energized equipment, and reduces the need for manual thermography scans — ultimately increasing system uptime.

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