



KALTECH
SENTINEL

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A TECHNICAL SERVICES COMPANY



WELCOME

By combining imaging technology with liner wear-monitoring hardware, the Sentinel system reveals live information from within a mill without the need to pull the feed chute or have personnel enter inside. Viewing and recording live imagery of a running mill, measuring the wear of a liner, assessing the internal conditions, and checking or setting the charge level, are all now possible in real time without

the need to isolate any plant or equipment. Access to this information presents new opportunities for improving operational metrics, reducing running costs, and provides a detailed empirical basis for liner-life prediction and maintenance planning.



ON GUARD

The Kaltech Sentinel is the safest and most efficient tool for capturing internal mill conditions through the use of empirical data and live observation. As a custom designed and engineered mill monitoring system, the Kaltech Sentinel is permanently installed to enable remote viewing and monitoring of the condition and wear of mill liners. It consists of two main components: the Sentinel Camera Unit (SCU) and the Electronic Bolts (eBolts).

A large industrial SAG mill is shown in a close-up view. The mill is a massive, cylindrical structure made of heavy metal, with a weathered and rusted appearance. It is mounted on a complex steel support structure. A camera unit, the SAG/AG Sentinel Camera Unit (SCU), is mounted on the feed chute of the mill. The camera unit is a black, rectangular device with a lens and some sensors. The background shows a clear blue sky and some green foliage, suggesting an outdoor industrial setting.

SAG/AG SENTINEL CAMERA UNIT (SCU)

CONCEPT OF SYSTEM

The SCU uses the latest technology in high-definition imagery within a custom designed housing, permanently affixed to the feed chute to provide a live audio in a running SAG mill and video feed from inside a stationary SAG mill. This enables remote monitoring of the condition of the shell and discharge liners and mill charge.

eBOLTS

CONCEPT OF SYSTEM

The electronic bolt (eBolt) is a wear indicator bolt which communicates directly with the Kaltech Sentinel software. This provides live remote monitoring of the thickness of liners in both SAG and Ball mills.

By extending the bolt heads and inserting the Sentinel technology into standard steel liner bolts, the extended head of the eBolt wears down as the liner wears, and reports predetermined wear events while the mill is still running.

By utilising the correct array of eBolts spread out over the known high-wear areas on the shell and feed end liners, the eBolts capture the broad and singular wear events and reports them directly to the user via the interactive software platform.





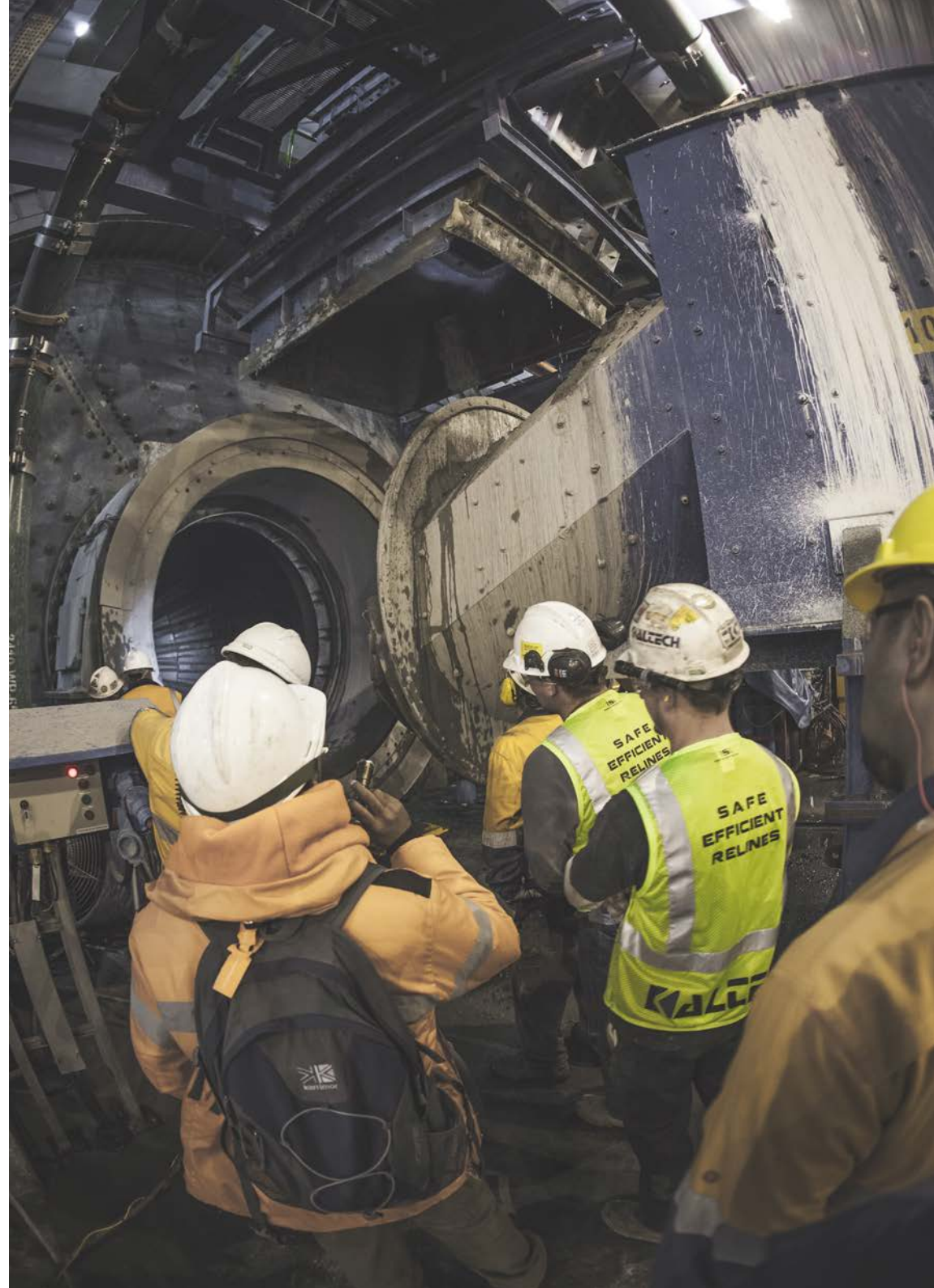
MILL AVAILABILITY

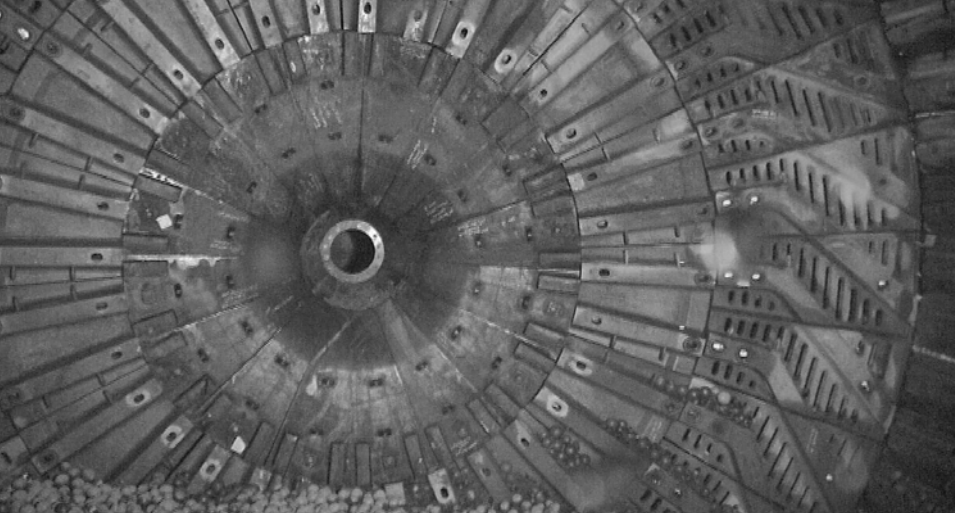
Mill availability remains one of the most significant markers of efficient mill operation, and a key performance indicator for many concentrator managers. The SCU provides the ability to significantly reduce the mill downtime required to perform mill or ball charge inspections. Rather than losing several hours of mill availability for each mill inspection due to the extensive isolation and safety procedures required to perform it, the SCU can eliminate the requirement for

people to enter the SAG mill during an inspection, reclaiming dozens of additional hours of mill availability and associated revenue each year, in addition to freeing up considerable man hours. By incorporating an exhaust fan on the discharge trommel, it is possible to see clearly into the mill and complete an inspection using the SCU and restart the mill in less than 20 minutes.

ELIMINATION OF SAFETY RISKS

Anytime a mill inspection is required, safety risks are introduced. The mixing of people and plant necessitates the use of extensive procedures and protocols to manage the risks associated with entering the mill. With an SCU in place, these safety risks are eliminated, guaranteeing an incident- free inspection.





MILL MONITORING

The current SCU viewing area includes 80% of the charge, 50 - 66% of the shell liners, and up to 100% of the discharge liners. This provides value by enabling the inspection of:

- Discharge grates (evidence of cracks, aperture size)
- Shell liners (wear rates, evidence of cracks)
- Potential spotting of tramp metal
- Ball charge level, composition and size distribution



CHARGE LEVEL

Maintaining an optimum charge in a SAG mill remains one of the fundamentals for efficient mill processing. If the charge level or the ball to charge ratio is incorrect, breaking liners and/or increasing power consumption is inevitable and can only result in degraded mill efficiency.

To minimize reline time, it is critical to set the charge height at an optimum level. Setting the charge level too high or too low can significantly affect the duration of the mill reline.

The SCU enables operators to confirm the charge level and composition within minutes of a mill stop, and without the need to pull the feed chute.

TROUBLESHOOTING THE MILL

Reoccurring problems experienced by mill operators typically include changes to key personnel, changing liner suppliers and/or designs or changing ore types throughout the mine life. A resolution to these repetitive issues can be found by utilizing the SCU historical data to optimize decision making.

Similarly, starting production in a new SAG mill, particularly when transitioning the mill from the initial testing period to full capacity, brings teething issues that have to be addressed. Preserving the condition of the liners is the primary challenge. Typically, regular (sometimes weekly) mill inspections are required to monitor the charge and liner condition. Utilizing the SCU during these early mill days can reduce the risk of liner and mill damage, significantly decrease mill downtime through quick mill inspections, and consequently speed up the process of bringing the mill up to capacity.





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