René Chacon, ABB, Switzerland, details how gearless mill drive systems and digital services have helped to increase production at a West African gold mine.

URITED PRODUCTION

he Tasiast gold mine is an opencast operation located in northwestern Mauritania on the west coast of Africa, approximately 300 km north of the capital city of Nouakchott. It is owned and operated by Kinross Gold, a Canadian-based senior gold mining company with mines and projects in the US, Brazil, Russia, Mauritania, Chile and Ghana. Kinross' focus is on delivering value based on the core principles of operational excellence, balance sheet strength, disciplined growth and responsible mining.

The company recently initiated a phased expansion of its operations at Tasiast. Phase One significantly expanded production capacity and is also expected to reduce operating costs.

On 1 August 2018, Kinross announced that construction was complete and that first ore had gone through the semi-autogenous grinding (SAG) mill. Since then, the mill throughput increased from 8000 tpd to 12 000 tpd, representing a 50% increase. The mine estimates the average annual production of gold to be 409 000 oz/yr through 2027.

Phase One added incremental crushing and grinding capacity to the existing carbon-in-leach (CIL) circuit, which includes an oversized SAG mill and gyratory crusher. For this expansion project, Kinross selected ABB to provide a 26 MW gearless mill drive system (GMD) for the mine's 40 ft SAG mill, as well as other drives, electrical infrastructure equipment and a long-term service agreement (LTSA).

GMDs improve process throughput and reliability while saving energy

GMDs were selected for this project instead of ring-geared mill drives (RMD).

The GMD solution eliminates several critical mechanical components that are used within a conventional mill drive system. By mounting the rotor poles directly onto the mill flange, the mill itself becomes the rotor of a synchronous machine. This means that the torque transmission from the machine to the mill body happens without any mechanical components, such as gearboxes, couplings, pinions or ring gear.

"By eliminating all these mechanical components, the customer is saving over 1.5% in energy costs. At an operation of the size of Tasiast, these savings can be substantial," said Marcelo Perrucci, Global Product Manager for grinding solutions at ABB's mining business unit.



Figure 1. Concentrator under construction.



Figure 2. Upper stator quarter.



Figure 3. The SAG mill installed.

In addition to this, ABB gearless mill drives are equipped with Roebel bars in the winding. Patented in 1912 by ABB (BBC then) Engineer Ludwig Roebel, this copper bar concept offers lower losses by having more copper in slot compared to alternative technologies, such as multi-turn coils.

Onsite conditions and environmental factors, such as intense heat and humidity, were taken into consideration when designing this solution. The availability-centred design ensured maximised equipment and process uptime.

ABB's single pole mounting design ensures that a perfect alignment is met, making sure the air gap is constant across the mill circumference.

Cooling units located on the bottom of the machine facilitate maintenance and ensure that in an unlikely situation where there is a water leakage, liquid will not enter the machine.

ABB's gearless mill drive offering is part of the innovative ABB AbilityTM MineOptimize portfolio. MineOptimize is a framework that encompasses optimised solutions, developed engineering, digital applications and collaborative services to help mining companies achieve the most efficient design, build and operation of any mining and mineral processing facility. With digitalisation at its heart, ABB Ability MineOptimize provides the ideal platform to reach top performance levels in today's market conditions. Optimised solutions, for example, fully integrated electrical, automation and instrumentation systems in one collaborative environment saves time and eliminates risks. This ensures key data is shared with the right systems and people at the right time to achieve the best results. The robustness of this system allows for operation under the most extreme environmental conditions, such as high altitudes, varied climates and remote locations.

Perrucci explained: "For example, the solution delivered to Tasiast has a frozen charge remover function, which helps operators to release frozen charges stuck on the mill liners avoiding the physical intervention of the operator inside the mill."

Air gap sensors installed around the stator check for any abnormalities in the air gap and automatically provide alarms to the operators in case a foreign object is found or in case there is any issue with the electrical supply to the mill. In addition, ABB has also supplied the innovative double-sided air gap supervision, which aims to detect foreign objects on both sides of the pole length and will allow advanced analytics, such as pole axial alignment.

Advanced digital services keep equipment in top form

With the critical mill drive equipment in place, ABB and Tasiast collaborated on the service and maintenance strategy that would best serve this operation and maintain top equipment performance. The customer chose an LTSA, which is supported by a lifecycle manager and includes proactive scheduled monitoring and maintenance, as well as remote diagnostic and troubleshooting services. This range of services also includes training and facilitates the transfer of best practices to the local mine maintenance teams during the term of the agreement. "An LTSA is an efficient and cost-effective way to manage the lifecycle needs of complete drive solutions and reduce the overall cost of maintaining them. It combines one or more services into an agreement customised to meet site-specific requirements for predictive, preventive and corrective maintenance," said Venkat Nadipuram, Global Product Manager for grinding services at ABB's mining business unit.

Remote monitoring

The services provided at Tasiast include a digital application where ABB experts monitor the equipment remotely and provide predictive maintenance reports to ensure continued and efficient performance.

As part of the ABB Mining Care global standardised service agreement framework, the services delivered to Tasiast provide remote assistance which includes access to the 24 hr/d supportline. They also include troubleshooting with on-demand, 24 hour remote access and technical support from ABB mining process specialists. The operations team at the mine has access to a global network of experts who can access the system and check equipment status from anywhere in the world; which is especially important in more isolated locations. This makes problem identification and resolution much quicker to help prevent costly production interruptions.

Equipment health checks

Another service proactively monitors the assets' health to see how the drive system is working and provides periodic maintenance reports throughout the year. On a quarterly basis, ABB experts review key system data and provide a comprehensive health report for the system. The reports include expert analysis with data trends and recommendations for preventive maintenance actions to prevent potential failures. This helps identify potential issues well before they ever get the chance to become problems. A single page 'executive summary' at the beginning of the report highlights any urgent actions that need to be taken and provides a concise overview of the health of the system. The reports use analysis of long-term historical figures, as well as real time resolution snapshot data to give a holistic view of the actual system health.

ABB Ability predictive maintenance services for grinding provide online condition monitoring; this new digital application monitors important rotor and mill KPIs, which are specifically developed to support individual customer needs. This technology monitors the entire drive system and recommends preventive and predictive maintenance activities to keep the process running smoothly.

Looking ahead

As production continues at full capacity, ABB is working closely with the onsite team at Tasiast to ensure peak performance for the grinding process equipment to meet the mine's business targets.

Joel Desmeules, Construction Manager for the SAG mill, at Kinross, commented: "We are pleased with the ABB team's professionalism and competence, and are looking forward to working with them on more projects in the future." GMR