Case note
ACS 1000 variable speed drives reduce energy consumption and operating costs at Australian mill

Grange Resources Limited operates two dual pinion autogenous mills at its Savage River mine in Tasmania. A variable speed drive system has replaced four slip-ring motors and their variable resistance liquid starters, bringing significant energy savings and reduced operating costs.

Savage River mine in Australia, operated by Grange Resources Limited

Integrated iron ore mining and pellet production

Grange Resources, Australia's leading magnetite producer, operates the country's largest integrated iron ore mining production business.

Its Savage River magnetite iron ore mine and iron ore pellet plant are located in North West Tasmania. The mine has a resource of 306 million tons. A reserve of almost 120 million tons extends the life of the mine to 2026.

Once mined, Grange's magnetite iron ore is processed into concentrate slurry before it is pumped to the pellet plant, which produces over two million tons of iron ore pellets annually.

Both, the mine and the plant operate continuously 24 hours a day, seven days per week.

Dual pinion autogenous mills

Grange Resources operates two dual pinion autogenous mills at its concentrator plant at the Savage River mine. The mills are used to crush and grind the iron ore after it has been mined and before it is transferred to a wet magnetic separation process to produce magnetite concentrate.

To sustain the iron ore pellet production, the mills have to operate continuously 24/7.

Highlights

- Energy savings per month: A$ 15,540 (US$ 16,881)
- Reduction of maintenance requirements
- Optimized plant production
- Smooth start of autogenous mills
- Improved power factor

Challenge

The autogenous mills were powered by four slip-ring motors using variable resistance liquid starters. The 2.24 MW motors were installed in 1968 when the concentrator was commissioned.

Because of their age, the slip-ring motors were proving expensive to operate and maintain. The mills had to be stopped every few months as the carbon brushes needed replacing. Furthermore, spare parts were becoming scarce.

The motors and variable resistance liquid starters also caused high transient torques during start-up, which created high stresses on the network and the mechanical equipment.

Therefore, Grange Resources decided to replace the slip-ring motors and the control system with variable speed drive systems and associated switchgear.

Solution

ABB supplied four ACS 1000 medium voltage variable speed drives, each rated at 2.5 MW; high voltage input transformers rated at 2.8 MVA; and UniMix medium voltage switchgear. ABB also supplied DriveMonitor™, ABB's intelligent monitoring and diagnostics system.

Benefits

Energy savings

Mills are one of the biggest energy consumers in a mine. Controlling them with variable speed drives results in significant energy savings.

The ACS 1000 variable speed drive system consumes 310,786 kilowatt hours (kWh) per month (672 operating hours) less than the old system. Multiplying it with the price of A$ 0.05 per kWh results in monthly energy savings of A$ 15,540 (US$ 16,881).

Optimized plant production

By controlling the mills with variable speed drives, plant production is optimized. The operator can easily react to changes in ore characteristic and throughput. There is no need to change mechanical components if the ore characteristics changes.

Also, the speed of the mill is tuned for optimal grinding and maximum throughput, resulting in a more efficient use of the grinding power.

If up and downstream processes require a lower grinding throughput, the mill can be operated at partial load without having to stop the process. Variable speed drives can adjust the speed according to the fill level of the mill.

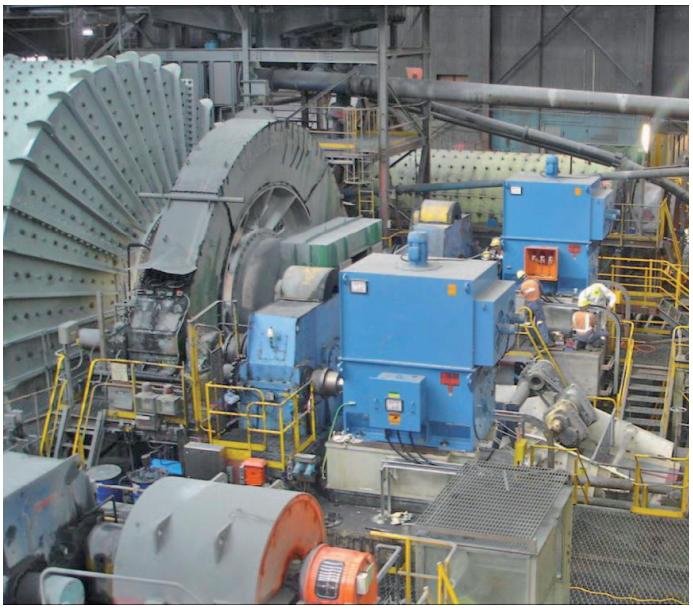
Accurate and coordinated load sharing

With dual pinion mills care must be taken that the load is shared equally between the two pinions. ABB's ACS 1000 variable speed drives have fast direct torque control (DTC) which ensures an accurate and coordinated load sharing. DTC is an advanced motor control method for drives that allows precise control of the motor torque and speed.

Smooth ramp up

Torque pulsations and peak torques, generated by mills during the starting phase, creates high stresses on network and mechanical equipment.

ACS 1000 variable speed drives provide a smooth ramp up of the mill. They deliver high starting torque for the current drawn from the power plant system and have a programmed upper limit to reduce peak current during the start of the mill. The low starting currents and high starting torque enable a smooth start-up of the mill, even when fully loaded.



Two dual pinion autogenous mills are now controlled by variable speed drives from ABB.

Four ACS 1000 variable speed drives, each rated at 2.5 MW, control the speed and torque of the two autogenous mills.

Reduction of maintenance requirements

In the past, the mills had to be stopped several times per year to change the brushes on the slip-ring motors. The new induction motors require considerably less maintenance.

Furthermore, the use of variable speed drives reduces mechanical wear resulting in a longer lifetime of the equipment.

Downtime and production losses can further be reduced with a remote monitoring and diagnostics system which can support maintenance personnel during service and trouble-shooting.

Remote monitoring

The ACS 1000 variable speed drives are equipped with DriveMonitor™, ABB's intelligent monitoring and diagnostics system which allows real time access to the drive using Internet connections. Long-term monitoring functions deliver important information on equipment status, upcoming service routines, trends and input for possible performance improvements.

Other important decision criteria

During the selection of the equipment quality and service life were also considered.

Also the competency of ABB's local organization played an important role in the selection process.

Key data of ACS 1000 product family	
Inverter type	Three-level voltage source inverter (VSI)
Power range	Air cooling: 315 kW – 2 MW Water cooling: 1.8 – 5 MW
Output voltage	2.3 kV, 3.3 kV, 4.0 kV, 4.16 kV (optional: 6.0 – 6.6 kV with step-up transformer)
Maximum output frequency	66 Hz (optional: 82.5 Hz)
Converter efficiency	Typically > 98%
Type of motor	Induction motor

ABB's scope of supply includes high-voltage input transformers rated at 2.8 MVA and UniMix medium voltage switchgear

For more information please contact:

www.abb.com/drives
www.grangeresources.com.au

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