

The world's first ore-grinding mill with frozen charge shaker starts in Brazil

New Standards For Productivity

In December 2008, Siemens started up the world's first ore-grinding mill with the frozen charge shaker function at the Rio Paracatu gold mine. With the help of this solution, which is integrated in the Simine^{CIS} Mill GD gearless mill drive, charge that has become "frozen" to the mill's inside shell can be removed quickly and efficiently. This reduces maintenance times and costs considerably.

MINING ^

Rio Paracatu Mineração's Morro do Ouro mine is an open-cast operation owned by the Kinross Gold Corporation. The mining site is near the historical gold-digger city of Paracatu, around 220 km to the southeast of the capital, Brasília. Rio Paracatu Mineração is the largest active single gold mine in the world in terms of ROM (run-of-mine) processing and uses modern technology to increase its production. As part of the expansion project, Siemens supplied a Simine^{CIS} Mill GD gearless drive system with 20,000 kilowatts of rated power. With a diameter of approximately 12 m and a length of around 7 m, the new SAG (Semi-Autogenous Grinding) mill is one of the largest mills in the world.

First step: Detect the frozen charge and avoid damages

When maintenance has to be carried out, grinding mills used in mining installations have to be shut down for several hours or even days. In this time, the remaining mill charge can easily solidify, firmly attaching itself to the shell of the mill. This is called "frozen" (i.e., hardened) charge. When the mill is restarted, there is a danger that the frozen charge will not detach itself from the mill shell immediately, but will initially be lifted up by the mill and then dropped from a great height. The resulting damage to the mill can be severe. To detect firmly attached charge in good time and switch off the mill, Siemens developed a frozen charge protection function for gearless mill drives of the type Simine^{CIS} Mill GD. In normal operation the charge starts sliding after the mill reaches an angle of between 40° and 70° and the load torque decreases. This decrease in torque is monitored and used by the frozen charge protection to stop the mill



before falling frozen charge damages it. This prevents damage but does not automatically eliminate the frozen charge. Frequently, the material does not break up and remains stuck to the mill's shell. Only with labor-intensive mechanical means such as jackhammers or pressurized jets of water can the firmly attached charge be removed. This is time-consuming work, which causes loss of production.

Second step: Remove the solidified charge and increase productivity

With the help of the "frozen charge shaker" function integrated in the Simine^{CIS} Mill GD system, deposits can be loosened by causing the mill to move systematically. To do this, the operating personnel initiates the mill drive's frozen charge shaker mode from the local control desk. Defined forward and reverse movements of the mill lift the charge to a less critical angle



Simple control of the inching and creeping modes lets the operator quickly set up mill maintenance procedures.

and move the mill in a harmless range with varying speed and acceleration. The angle and movement are designed to break the frozen charge and remove it from the mill body. The motor is the same one that is used for grinding. The frozen charge shaker avoids production from being interrupted for the removal of a solidified charge attached to the mill shell. This prevents the mill from being damaged as a result of charge falling down in an uncontrolled manner and simultaneously reduces maintenance times considerably. Given that production is worth thousands of dollars per hour, maintenance cycles costing several million dollars can be avoided.

Next steps: New projects in Zambia and Chile

At the Equinox Copper Ventures Ltd. of Zambia, Siemens equipped two ore-grinding mills for the Lumwana copper project with gearless Simine^{CIS} Mill GD drive systems. The frozen charge shaker function will also be used there. The Lumwana copper mining district is around 220 km west of the Copperbelt in Zambia's North-Western Province. A SAG mill and a ball mill will be used to grind the ore.

At Los Bronces, part of the Anglo American Chile company, Siemens supplies a 22 MW gearless drive for a 40-foot SAG mill and two 16.4 MW gearless drives for two 26-foot ball mills. Thanks to this development project, Los Bronces will be one of the biggest copper and molybdenum mines worldwide. The gearless drives are designed to provide mill drives with the lowest possible power consumption and are equipped with the frozen charge shaker function. ■



The first gearless mill drive with a frozen charge shaker

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