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**Gearless Autogenous/  
Semi-Autogenous Mills**





36 ft. x 17 ft.-16,000 HP Gearless SAG Mill



36 ft. x 17 ft.-16,000 HP Gearless SAG Mill

The sights and sounds of large grinding mills in operation are impressive to even the most seasoned mill operator. Grinding systems are a symbol of the application of brute force to extract mineral wealth from nature and are a major and critical part of any mineral processing facility.

Autogenous (AG) grinding is the size reduction of material in a tumbling mill utilizing the feed material itself as grinding media. Semi-Autogenous (SAG) grinding is the size reduction of material in a tumbling mill utilizing the feed material plus supplemental grinding media. The most common supplementary medium is steel balls.

The History, Application, Testing Procedures, Grinding Circuit Design, and other details on AG/SAG Milling are contained in our AG/SAG Mill Bulletin Form 2001.1.

#### Gearless AG/SAG Mills

Gearless drives (ringmotors) have been used on tumbling mills for several decades. The design features motor rotor elements bolted to a mill shell, a stationary stator assembly surrounds the rotor elements, and electronics convert the incoming current from 50/60 Hertz to about 1 Hertz. The mill shell actually becomes the rotating element of a large low speed synchronous motor. Mill speed is varied by changing the frequency of the current to the motor. The ringmotor can be used to inch and spot the mill for maintenance.

In the early 1970s, maintenance problems related to the application of gear and pinion and large speed reducer drives on long length dry grinding cement mills drove operators to seek an alternative drive design. As a result, several dozen gearless drive cement mills were installed.

The gearless drive design was not applied to mills in the mining industry until the 1980s. The reasons for application of this technology in the mining industry are different from those in the cement industry. Mining applications were not suffering from the same design of maintenance problems with mill drives. The mills were primarily wet grinding and of much shorter length. They were not subject to the severity of expansion and misalignment or the dusty abrasive atmosphere of a cement plant.

Selection of a gearless drive (at some premium in capital cost) had to be driven by other considerations.

These other considerations include:

- VARIABLE SPEED CAPABILITY
- REMOVAL OF LIMITS OF DESIGN POWER  
Gear and pinion drives are practically limited to about 10,000 HP per pinion. At this time, there is no reasonable gear drive alternative for more than two pinions or above 20,000 HP. The best solution is the Metso Gearless Mill.
- VERY HIGH DRIVE EFFICIENCY
- LOW MAINTENANCE REQUIREMENTS
- OFTEN REQUIRE LESS FLOOR SPACE

With the proven use of gearless drive technology, limitation of AG/SAG mill size due to gearing constraints has been eliminated. Metso Minerals is the leading world supplier of gearless AG/SAG Mills.

The experience gained from installation and operation of these mills enables Metso Minerals to offer with confidence mills of up to 35,000 installed horsepower or more. Our engineers welcome the opportunity to assist you with circuit and circuit control design as well as start-up, operation, and optimization of the milling plant. Today a single grinding line with Gear SAG Mill and appropriate Ball Mills can process over 100,000 mtpd.

#### Layout Dimensions

An insert for this bulletin provides general dimensions for these mills and is meant to stimulate the metallurgical plant designer's imagination. The dimensions are sufficient to allow the consideration of a Metso Gearless Mill in a hypothetical plant. The grinding power per ton considerations are the same as for any smaller plant. In many cases, the optimum flow sheet will contain a SAG mill and somewhere near the same power in a ball mill or ball mills.

Suppose your ore requires a total of 20 HP per ton for both, primary and secondary grinding. Consider the possibilities: a 16,000 HP SAG mill and one 16,000 HP ball mill-38,000 tons per day; a 24,000 HP SAG mill and two 12,000 HP ball mills-58,000 tons per day; or a 30,000 HP SAG mill and two 15,000 HP ball mills-72,000 tons per day. It has been proven again and again that the fewer the number of operating mill lines, the lower the capital and operating costs for the beneficiation plant.

The next generation of AG/SAG mills is waiting to be put to use. For additional information, contact Metso Minerals.