



Gearless mill drives

Go gearless for highest availability,
reliability, flexibility and efficiency

Leading the gearless mill drive evolution

The ABB gearless mill drive (GMD) is the most powerful mill drive system available, combining the highest levels of efficiency, reliability, flexibility and availability.

The gearless mill drive eliminates ring-gear, pinion, gearbox, coupling, motor shaft and motor bearings, used within a conventional mill drive system. By mounting the rotor poles directly onto the mill, the mill itself becomes the rotor of the gearless motor.

Building a track record

ABB's experience in optimizing gearless solutions for grinding applications extends over 50 years, making it the market leader with the largest number of installed units worldwide.

In 1969, ABB commissioned the first GMD for a ball mill at Ciments Lambert-Lafarge, France. The 6.4 MW gearless motor is still operating today and is proving to perform cost-efficiently and with long-term reliability. Significantly, it met the challenge of heat related expansion associated with the dry cement process.

In 1985, ABB delivered the first GMD for mineral processing at an ore mill at Bougainville, New Guinea. Since then innovation has continued with the first GMD for a double-rotating ball mill in Carlin, Nevada, meeting a 160 °C heat challenge at the mill shell.

GMDs have now been supplied for the world's largest autogenous (AG), semi-autogenous (SAG) and ball mills, fulfilling the highest power requirements while operating under extreme environmental conditions.

Focus on the future

Larger ball and SAG mills, with higher installed power ratings relative to the mill diameter, offer higher efficiency and throughput, round-the-clock reliability and the opportunity to mine in remote areas. This makes low ore grades economical to grind.

ABB has delivered some of the world's largest GMDs:

- 22 MW GMD for 28' ball mill
- 28 MW GMD for a 40' SAG mill
- 28 MW GMD for 42' SAG mill

Whether it is size or an installation at the highest altitude (4600 m.a.s.l.), ABB's GMDs are well positioned to contribute to the building of larger and ever more powerful mills.



ABB's gearless mill drive (GMD)

Competence in grinding

For many decades, ABB's optimized mill drive solutions have consistently set new productivity records in cement and mineral applications. The industry's largest installed base benefits from application-specific functionality. This contributes to the most powerful, efficient and productive grinding without the need for mechanics that reduce efficiency and increase maintenance while benefiting from variable-speed control for smooth operation.

Engineers with expertise in research and development through to designing, assembling the ring motor, installing and commissioning the automation and electrical aspects of mill grinding solutions are always on call. During the operation and maintenance of grinding, ABB offers full service and equipment support including predictive, preventive and corrective maintenance and access to genuine spare parts.

The benefits include complete integration of ABB solutions into the plant environment taking into consideration electrical, mechanical and civil

interfaces, as well as the impact of digitalization. As such, ABB is evolving a range of digital solutions that will enable future mining solutions through its ABB Ability™ platform.

The GMD system

The poles of the gearless or synchronous motor (also called wrap-around motor or ring motor) are directly installed on the pole flange of the mill shell, turning the mill body into the rotor. The stator is then wrapped around the mill.

The gearless motor is fed by a cycloconverter which has a rated output frequency of around 5 Hz for the GMD drive. The fuseless cycloconverter is connected to the MV network through three special cycloconverter transformers.

Additionally, a small excitation converter supplies the poles' excitation via the slip rings to the rotor of the gearless motor. Knife switches are installed directly at the motor for both the stator and rotor circuit to make a visible disconnection before entering the motor for maintenance purposes.

ABB Ability™ MineOptimize

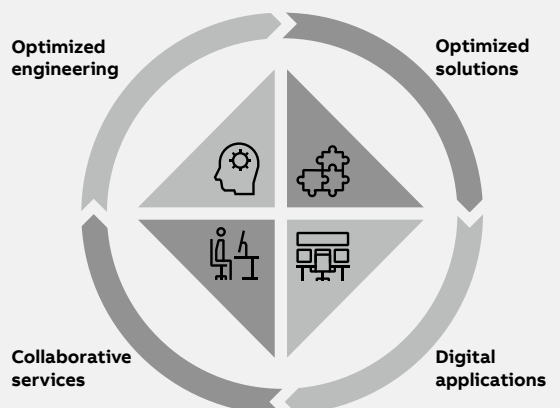
ABB Ability™ MineOptimize is a 4-pillar framework that takes a deep dive into all aspects of a mine to identify ways in which to fine-tune and optimize every process, every sensor and device, every application and every service. The four pillars include optimized solutions, optimized engineering, digital applications and collaborative services.

One of the four pillars focus on ways to optimize solutions like the gearless mill drive (GMD). Without the in-depth domain knowledge of ABB's engineers and their decades of simply knowing where to look, getting the absolute best return on investment may be missed.

ABB Ability MineOptimize gets the best from a GMD, leading to increased availability and lower lifetime operating costs. It is a combination of

domain knowledge, leading edge technology and vast global and local engineering competence – all under one roof.

Before you select your next grinding solution, get the bigger picture courtesy of ABB Ability™ MineOptimize.



Built-in features

The GMD eliminates the need for ring gear, pinion, gearbox, coupling, motor bearings. Meanwhile, inching and creeping functionalities are provided by the drive control software, making an additional inching motor unnecessary.

The drive system, including the gearless motor, does not require any grease or lubrication, therefore reducing maintenance costs.

The GMD can run the mill with variable speed, in both directions of rotation. This means the grinding process can be optimized at any time during the mine's life. These optimization strategies are often oriented at decreasing the liner wear, thus resulting in reduced overall downtime.

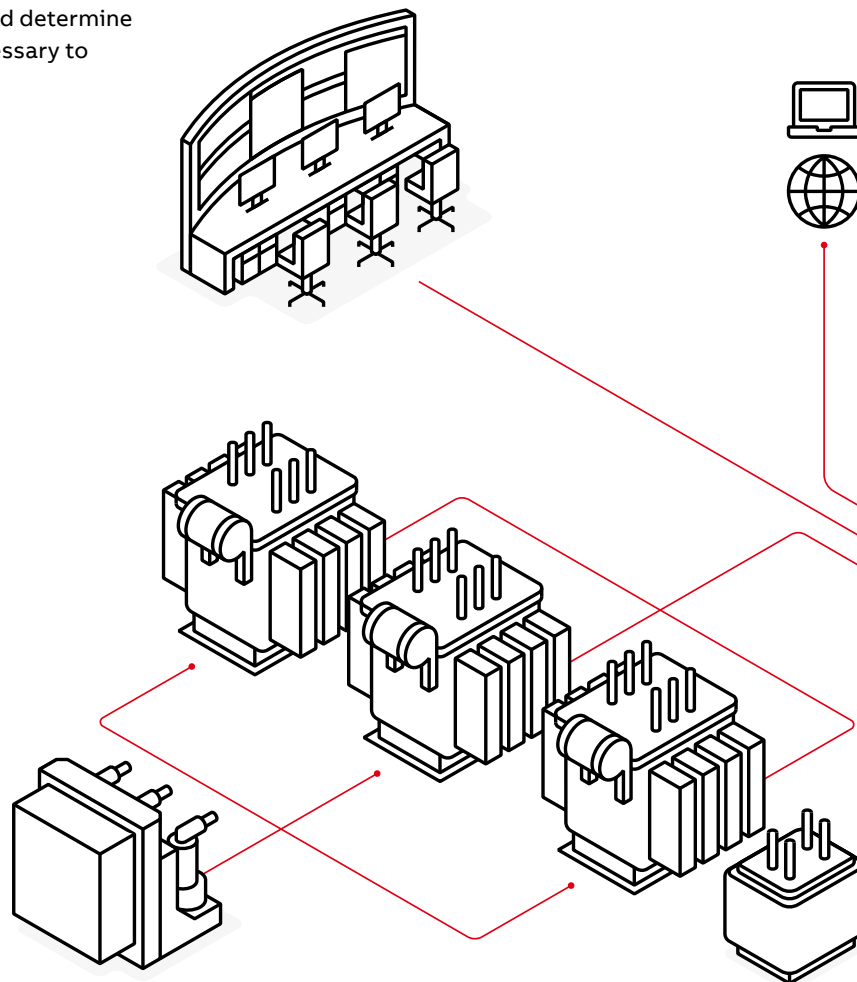
Design rules for GMD

1. The system should always run sub-critical, ensuring that the motor cannot reach the first critical speed, leading to a minimum stiffness requirement. Such is the importance of this essential rule that the stator typically has the highest stiffness.
2. Stator design is influenced by modes of transportation from the factory to the world's mine sites. ABB has successfully overcome size constraints through innovative transportation methods that ensure safe arrival of each motor part on site. Customer and site requirements are integrated into the design and determine the number of stator pieces necessary to simplify the transport.

3. The lower the number of stator parts, the fewer man hours are required for installation.
4. Every split of the stator influences stator stiffness. Without counter measures this would result in a lower natural frequency. ABB has successfully realized GMD projects with both fewer and greater than four stator parts.
5. A thorough analysis of the complete system (mill, pole units, bearings, foundations, interaction between rotor and stator, stator structure and the soil conditions) warrants that all components fit together from a resonance and stiffness point of view.

Efficiency

Mills are by far the largest power consumers in a concentrator plant. ABB first selects the most efficient design and then optimizes it. The sophisticated single-turn winding system ensures that stator winding losses are minimized. In addition, the rise of motor temperature is relatively low, resulting in a low thermal expansion and a lower resistance of the copper windings, hence translating into lower losses. A further reduction of losses is achieved by minimizing the number of semiconductors in the cycloconverter.



Poles

ABB's poles are designed as single pole unit. This enables greater precision through individual adjustments. The single pole unit automatically eliminates a potential failure by not having an additional pole assembly unit. ABB's center plates, pole bolts and mill flange act together without welded parts as an efficient spring system. This ensures that the transfer of torque from pole to mill flange is only by force of friction and not by shear force of the pole bolt.

Windings

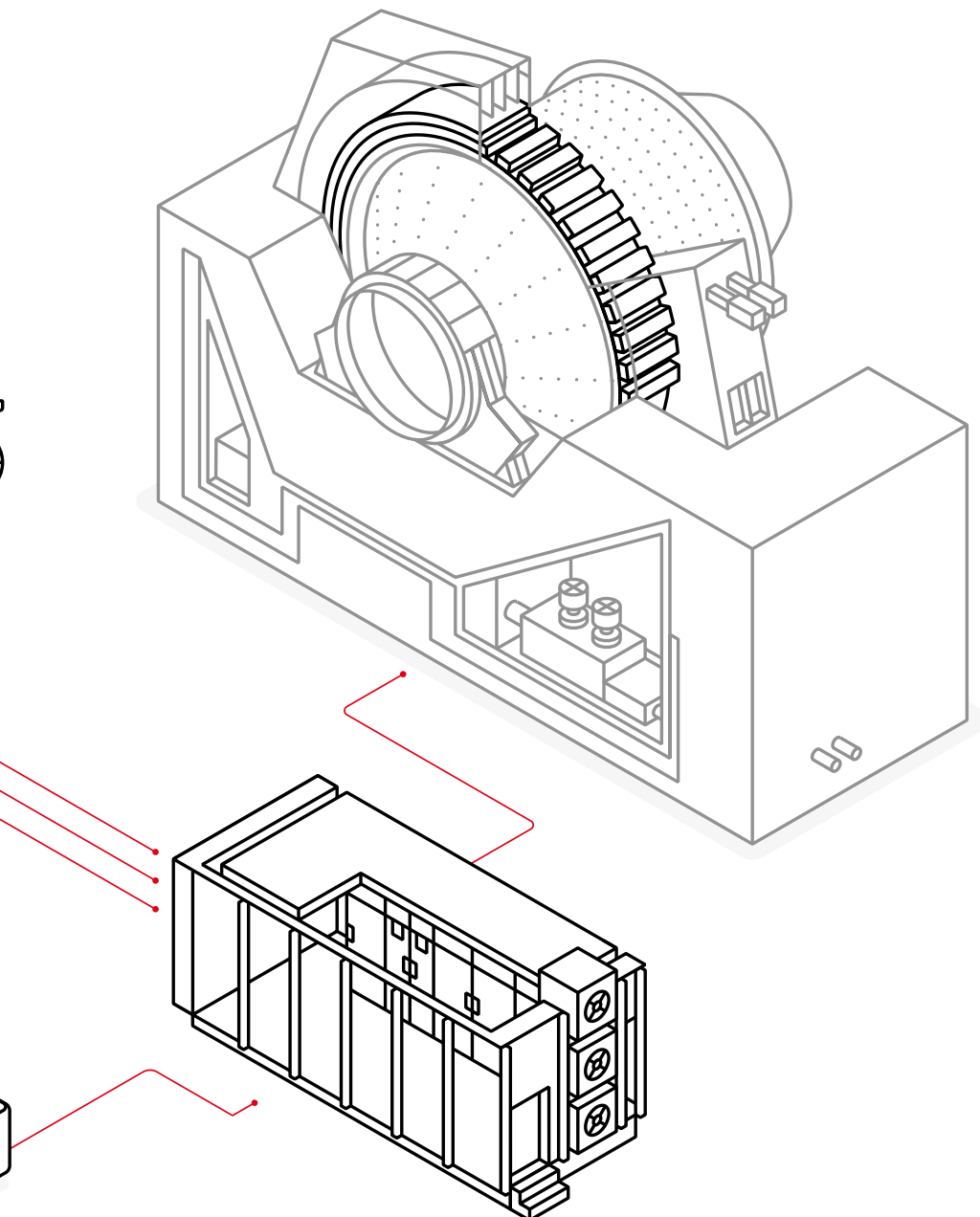
ABB's single-turn windings eliminate the possibility of the catastrophic inter-turn failure by default. They make it possible to have real motor differential protection. ABB uses a full continuous vacuum pressure impregnation (VPI) system for both the winding in the slot and for the overhang portion. The windings work on site at the stator joints is drastically minimized with the sophisticated winding design.

Cooling

Cooling boxes with water-to-air heat exchangers and cooling fans are located at the bottom of the stator frame. This allows easy access for maintenance while also providing cooling water just below the stator windings. This eliminates the risk of water leakage into the core. With this design, a low temperature rise can be achieved, which minimizes thermal expansion and optimizes efficiency.

Cooperation

With the largest installed base of GMDs worldwide, ABB has extensive experience in dealing with all main mill suppliers. A long history of successful cooperation with them and the respective civil engineers ensures that all mill system components work seamlessly together. ABB achieves this goal by choosing the right partners who also work with the complete operation process in mind.



Network

Network study

The cycloconverter feeding the ring motor creates the typical harmonics and inter-harmonics of a 12-or 18-pulse direct converter. In addition, other utilities in the plant may generate undesirable harmonics towards the network. ABB has the resources, competence and know-how to perform a network study, even for the complete plant. This study deals with harmonics, inter-harmonics and improves the power factor to the required level.

The applicable local standards typically form the basic requirements for this study. Aside from performing the network study, ABB is also your partner for delivery of any hardware filter components you may require.

Mill control and protection

ABB features the most sophisticated cycloconverter to power the gearless motor. It is a well-proven technology which, while having a fuseless design, is short-circuit-proof. The control of the converter does not require speed or position sensors, therefore automatically eliminating a potential failure source. Among the GMD standard features are inching, creeping and frozen charge detection.

Typically, ABB also controls and feeds the mill auxiliaries. Comprehensive protection of the complete GMD system is key to achieve the highest possible availability. This includes state-of-the-art air gap monitoring and the real gearless motor differential protection. Although the design is focused on avoiding short circuits or mitigating their effects, the complete system is still able to withstand any short circuit situation.



ABB Ability™ MineOptimize collaborative services

Enabling future mining

To take full advantage of the internet of things, it is necessary to have a system that supports a flexible, scalable and reliable cloud platform with a range of comprehensive service offerings.

Partnering with an experienced supplier who supports your needs and ever changing site requirements is ABB's answer to minimize risks and increase overall performance through digitalization. Through its global Collaborative Operations Centers, ABB's experts protect your plant throughout equipment lifetime regardless of the location of your mine.

With over 50 years of global experience in grinding solutions, ABB's dedicated experts continuously develop and improve GMDs to match the latest grinding circuit challenges. ABB's GMD solution is part of the ABB Ability™ platform with a customized range of services intended to maximize plant uptime and reduce operating costs.

Service solutions for your grinding mills

For continuous and cost efficient operations, ABB offers a range of services, regardless of where production is located. These services range from phone support to complete long-term service agreements:

- Installation and commissioning
- Remote services, including SupportLine 24 hours x 365 days per year
- Periodic maintenance with scheduled asset audits
- Collaborative services like remote assistance, predictive maintenance and performance optimization through ABB Ability™ platform
- Preventive and corrective services
- Spare parts management
- Customer training based on ABB University approved methods

Portfolio	Service clusters	Services	
ABB lifecycle services portfolio	Extension upgrades and retrofits	Software upgrades	Hardware upgrades
	Spares & consumables	Spare parts lists and parts kits	On-demand spares
	Training	On-site	Classroom
	Technical support & repairs	Emergency on-site support (Technical support)	Start-up support
ABB Ability™ services portfolio	Remote assistance	24/7 SupportLine and troubleshooting	Remote support
	Asset health	Preventive maintenance services	
	Virtual training	Remote learning platform (RLP)	E-learning
	Inspection	Scheduled maintenance	On-demand service
	Lifecycle assessment	Plant lifecycle assessment	System enhancement studies
	Predictive maintenance	Online fault prediction and notification services	
	Cyber security	Periodic assessment & fingerprint services	
	Energy optimization	Energy optimization services	
	Performance optimization	Performance & quality optimization	



Do more
Monitor, control,
secure, manage, apply



Do better
Optimize, simulate,
predict, automate



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