



# RELIABLE MOTORS FOR HEAVY-DUTY CONVEYOR SYSTEMS

**As heavy-duty conveyor systems need a high level of reliability, synchronous motors are the ideal choice for powering them, according to engineering experts at ABB, as they eliminate the need for gearboxes, increase the uptime and availability of the overall system, and reduce maintenance costs.**

Mining companies are increasingly turning to heavy-duty conveyor systems to transport ore and other materials due to remote operating locations, greater transportation distances and higher throughputs. These conveyors play an essential role in production, which means they have to deliver extremely high levels of uptime.

As Jouni Tervaskanto, product manager for synchronous motors at ABB, explains. “Synchronous motors can supply the power and torque needed in heavy-duty applications. They operate at lower speeds than induction motors and can therefore drive the conveyor pulleys directly, without the need for gearboxes and couplings. Gearless operation makes the conveyor system

much more reliable.”

Gearboxes contain parts that can wear

lubricate and maintain gearboxes.

Efficiency is increased because the

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down and the failure of just a single component can cause a site’s entire production to stop. Using synchronous motors without gearboxes increases reliability, availability and the lifespan of the equipment.

Gearless operations also bring other advantages, says Tervaskanto. “Maintenance costs are reduced because there is no longer any need to inspect,

friction losses between gear components are eliminated. Gearless drive systems need less instrumentation and they also fit into a smaller footprint, which is very important when space is restricted.”

**Designing the motor to match the conveyor**

Each heavy-duty conveyor system is unique. The type of ore or other material

transported, belt lengths, gradients, angles and overall clearance in tunnels determines the kind of conveyors used. Varying ambient conditions also impact on choice. High altitudes can mean extreme temperature swings, for instance. Low temperatures and low humidity levels all influence the kind of conveyor needed.

By tailoring each motor for its specific application, the highest levels of reliability and the longest possible lifetimes can be achieved. “Designing a motor to match the exact needs of an individual conveyor system requires broad application and industry know-how on the part of the motor manufacturer,” says Kulchada Sanguannam, ABB sales manager for mining motors. “At ABB, for example, the engineering team takes a wide range of parameters into consideration in their design work.”

### Design considerations

Typically, the following five points need extra attention when designing motors for mining conveyor systems: bearings, frame, mounting, protection class and excitation.

In addition to the normal configuration with two sets of bearings, motors can be designed with one or even no bearings (bearingless or ‘overhang’ design). In the latter case, the conveyor pulley and rotor are mounted on the same long shaft. These special bearing configurations are preferred by some conveyor manufacturers to optimize the overall system. Reducing the number of bearings helps to increase reliability, but it can only be done if the conveyor itself is sufficiently robust and installed on a strong base.

The motor frame can be tailored for easier transportation in tunnels and other areas where space is restricted. This requires the motor manufacturer’s R&D and engineering teams to have

advanced finite element method (FEM) tools to calculate material strengths and ensure that the modifications are made safely without compromising the strength of the frame in critical areas.

Motor mounting arrangements are designed on a case-by-case basis. One advantage of large synchronous motors over induction motors is that their larger air gap makes them more tolerant of rotor movement.

IP class (ingress protection) is important in conveyor motors because mines are typically dusty, humid and corrosive environments. ABB’s synchronous motors for conveyors have protection up to IP55. Air entering the synchronous motor is filtered, and the frame is designed to avoid leaving any openings where unfiltered air could enter. A high IP class makes cleaning the external surface easier, with no risk of dirt being washed inside the housing

The overall reliability of industrial electric motors, and especially motors that are deployed in tough conditions like mines, is heavily dependent on the quality of the insulation system. The MICADUR® Compact Industry (MCI) system, used in ABB’s large synchronous motors, is based on vacuum pressure impregnation (VPI) and has proven extremely reliable in even the harshest environments. It has been in use at ABB for several decades and gone into tens of thousands of large motors and generators.

Logistics and assembly should also be taken into account at the motor design stage. Transportation of large items of equipment like motors involves special arrangements, particularly if the mine is in a remote location with limited access. This can be solved by transporting the rotor and stator separately to reduce the weight of the individual packages.

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and damaging the motor.

Excitation for conveyor motors is usually supplied by direct current taken from the conveyor system’s variable speed drives. The DC is fed to the rotor via brushes and slip rings – components that are sensitive to environmental conditions. The motor manufacturer should optimize the choice of brush material (for example, silver), to ensure that brush wear is consistent and stable, and that replacement needs can be anticipated well in advance. This requires application experience and know-how covering the behavior of brush designs and materials in different conditions.

### Further considerations

Factors specific to each application – like temperature and humidity conditions – should be taken into account by the design team and resolved in collaboration with the conveyor manufacturer and customer.

Other items can also be designed to be removable to help with transportation.

Where a legacy conveyor motor is reaching the end of its operating lifetime, it may be possible to design a ‘drop in’ replacement - even when the original drawings are no longer available. ABB can often design replacements for motors from other vendors, too. Advanced engineering tools like FEM are used to tailor for a precise fit and ensure high reliability.

Heavy-duty conveyor motors play a crucial role in any mine’s operations and if support is needed it must reach the site fast. The motor manufacturer should be capable of responding from a local support unit.

ABB has supplied equipment for mining conveyor systems around the world. The largest of these systems extend to several kilometers, include very steep gradients, and can carry more than 10,000 tons of material per hour. [www.abb.com/motors&generators](http://www.abb.com/motors&generators)

