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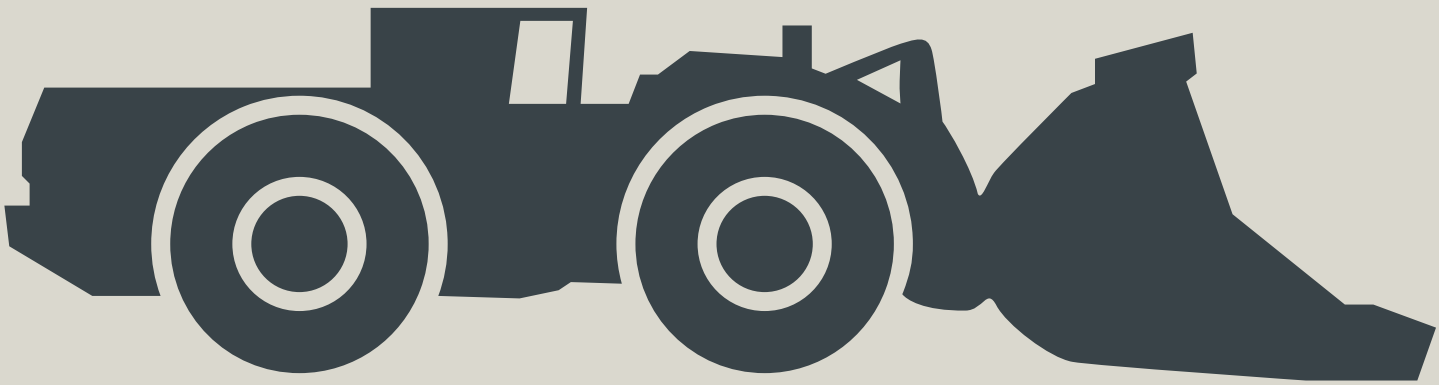
SIMINE Loader for Load Haul Dump Machine

How to make your load-haul-dump jobs more efficient, more precise, and less expensive

siemens.com/mobile-mining

SIMINE Loader drive systems for LHD machines – for tackling the toughest hard-rock mining applications



Your challenge:
Maneuverable, and exceptionally productive front-end loaders for tough hard-rock mining applications. These machines have to be efficient, safe, and reliable. Only machines equipped with advanced drive system technology and sophisticated all-wheel drive systems are able to cope with the harsh environmental conditions that are found thousands of meters deep in underground mines.

Our solution:
The SIMINE Loader for LHD vehicles is our high-performance solution that provides the global mining industry with drive systems for electrically operated load-haul-dump vehicles. Electric machines, for the drive system and for the work hydraulics ensure that the performance features exceed those of conventional machines. At the same time, the LHD operates completely trouble-free, reliably and durably under the toughest mining conditions. Thanks to its electric drive system, the vehicle is exhaust-free and features significantly lower noise emissions. For the operators, this means a safer workplace and a healthier work environment that benefits the overall productivity of the mine. We at Siemens have proven many times that deep system integration results in higher drive system reliability and improved machine availability, lower maintenance expenditure and an overall lower total cost of ownership. SIMINE electric LHDs in various size categories will make a consistent contribution to the commercial success of your mining operation.

Good reasons for SIMINE for LHD

- **High productivity**
- **Robust and reliable**
- **Contributes to more favorable working conditions deep in the mine**
- **Reduces the cost of mine ventilation**
- **Better mine yield**
- **Enhanced vehicle operation**
- **Reduced maintenance expenditures**

SIMINE load-haul-dump machine drive system benefits

Higher productivity

Solutions that make underground LHDs work faster and more efficiently not only save energy costs, they also increase productivity. The typical duty cycle for an LHD in an underground mine consists of loading bulk material in the mine, transporting it to the unloading point, and driving the empty machine back to the loading point for another cycle. Precisely controllable tractive forces for loading as well as high tramming speed are needed in order to reduce cycle time and boost productivity. Providing high torque and a wide range of constant power, SIMINE Loader motors are designed precisely to fulfill this task.

Reducing mine ventilation effort

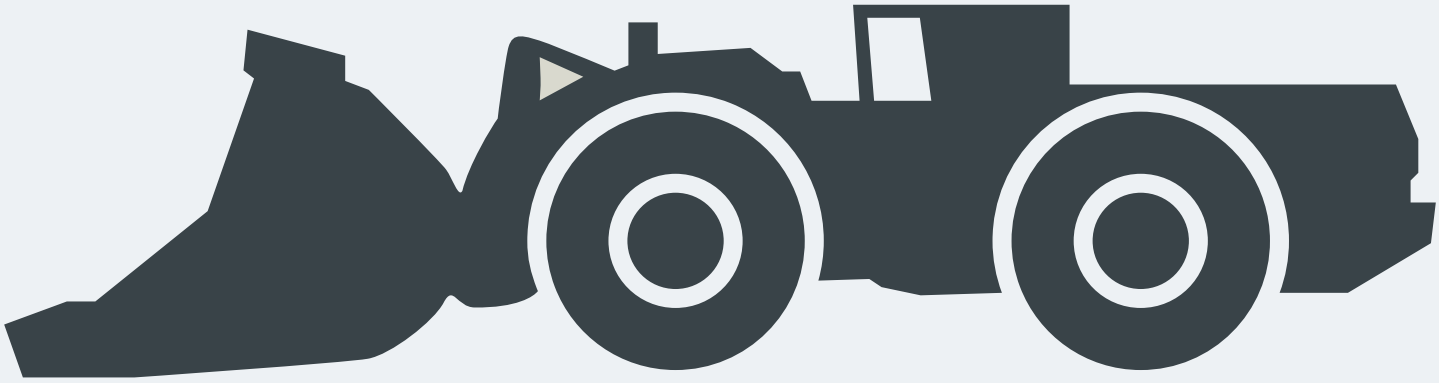
Using electrical drive systems for underground haulage significantly decreases the work involved in mine ventilation. This is an important advantage, because mine ventilation systems normally operate 24 hours a day, 365 days a year and account for 25 to 40 percent of the total energy costs for a mine operation.

Robust and reliable

With over 40 years of mobile mining expertise, Siemens offers you ruggedness by design. Our products have been specifically designed for the harsh environmental conditions that are standard at mine sites. We simplified the machine's design and reduced the number of components in order to minimize causes of failure.

Better mine yield

Electric drive systems allow operators to gain access to ore bodies that can't be mined economically using conventional diesel-powered engines. This enables a much more extensive exploitation of underground deposits. This is especially important because the mineral content of underground deposits is dwindling, and more material has to be extracted in order to keep mineral production constant.



More favorable working conditions deep in the mine

Full-electric LHDs create more favorable working conditions for machine operators and mine personnel in underground mining operations as a direct result of a significant reduction in losses and zero particulate or gaseous emissions from the drive system compared with conventional diesel-driven vehicles. With a much better system efficiency compared with diesel-mechanical loaders, SIMINE Loader drive systems cut the overall energy demand of the vehicle in half and significantly reduce heat emission and ventilation effort.

Enhanced vehicle operation

Electric power enables easy and smooth start/stop operations and less operator strain thanks to precise torque control. Electric drive trains feature a single-speed transmission that eliminates gear-shifting shocks.

Less maintenance expenditures

Compared with diesel-mechanical drives, electric drive systems require close to zero maintenance, which means more operating hours over the vehicle's lifecycle, higher availability, greater reliability, and lower maintenance costs.

More productive, more reliable: How the AC drive system works

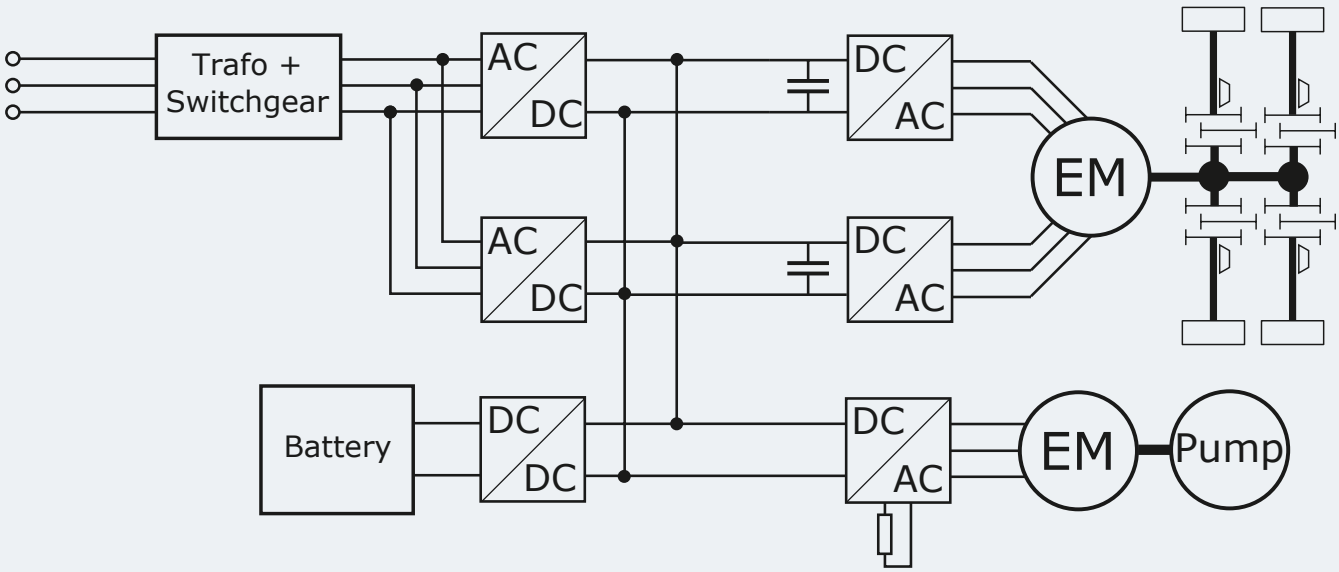
Incoming AC power from the trail cable is going to the shared DC link with rectifiers using Siemens' AFE (active front end) technology. The AFE is in effect an inverter "turned around." While the inverter uses a constant DC bus voltage as input and produces a three-phase variable output voltage with variable frequencies, the AFE uses the three-phase line voltage as input and generates a constant DC bus voltage. The AFE control is set to regulate unity or even a leading power factor. This can be used to minimize voltage fluctuation in the mine's distribution system. Thanks to forced commutation and a high pulsing rate, the total harmonic current distortion (THD) is very low – typically less than five percent. AFEs also improve the dynamic response to load changes and are extremely robust in the event of power grid disturbances. Power peaks in the drive system are covered by a battery coupled to the DC link with a DC/DC converter. This configuration also allows the recuperated energy to be stored; in other words, energy that can be harnessed during braking maneuvers to reduce the overall energy consumption of the vehicle.

Inverter

Both AFEs and inverters use the same power modules, which brings down inventory costs. The IGBT inverters transform DC power at constant voltage into AC power at variable frequency and voltage to drive the electric traction and auxiliary motors. During braking, the inverters send power from the motors back to the DC link, contributing to reducing the vehicle's overall energy demand.

Motor

The water-cooled permanent-magnet synchronous motors boast the highest efficiency in their class combined with extreme ruggedness and an encapsulated design. Specifically designed for harsh environmental conditions and tough duty cycles, the motors enable powerful digging and high vehicle speeds, which maximize productivity during each and every duty cycle. Due to the mining-proof design, the motors are virtually maintenance-free for the vehicle's entire lifecycle. There is one motor per wheel on large wheel loaders used for loading ultra-class haul trucks in open-pit mining. Smaller machines are equipped with one central electric motor connected to all wheels. A wheel loader typically brakes four times per duty cycle. During these braking phases, the electrical drive system recuperates the kinetic energy by converting it into electrical energy and applying it to active actors. This significantly lowers the overall energy demand of the vehicle and greatly improves total cost of ownership.



Electric drive system for LHD - application example

More information:
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