



SIEMENS

Ingenuity for life

SIMINE Loader for Wheel Loaders

How to tackle the toughest hard-rock
mining applications

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SIMINE Loader for Wheel Loaders adds efficiency, precision, and productivity to your mining, material handling, and loading jobs



Your challenge:

Our customers in the mining business face the challenge of developing and managing safe, efficient, technology-driven, low-cost mining operations. They have a responsibility to their shareholders to provide a superior return on their investment, and they have a commitment to their customers to provide a reliable mineral supply. To meet these challenges, they need to continuously strive to reduce the production cost per ton of material moved. They have to seek out a competitive edge wherever possible, implementing breakthrough innovations based on proven technologies. Our customers demand innovative machines with the highest possible yield, reduced maintenance costs, methods for continuously improving the productivity of their equipment and a more efficient use of power.

Our solution:

SIMINE Loader for Wheel Loaders is our high-performance solution for supplying the global mining industry with drive systems for electrically operated wheel loaders. 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 wheel loader operates completely trouble-free, operating 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 end user, this results in greater flexibility for their applications, environmental protection, and significant savings on operating costs. We at Siemens have proven many times that deep system integration results in reduced energy demand with simultaneously improved machine performance. SIMINE electric wheel loaders in various size categories will make a consistent contribution to the commercial success of your mining operation.

Good reasons for SIMINE Wheel Loader

- Higher productivity
- Lower energy demand
- Environmentally friendly
- More favorable working conditions in the mine
- Better mine yield
- Enhanced vehicle operation
- Reduced maintenance expenditures

Good reasons for SIMINE Loader

Higher productivity

Solutions that make wheel loaders work faster and more efficiently using electric drive systems not only save energy costs, they also increase productivity. The typical duty cycle for a wheel loader consists of loading bulk material at the muck pile, reversing and going forward to the idling mine truck, while simultaneously lifting the material up and dumping it onto the truck. When this process is speeded up by a powerful electric drive system, the result is shorter cycle periods, which means that more material can be loaded in a reduced time and that your productivity gets a boost.

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.

More favorable working conditions deep in the mine

Electric wheel loaders create more favorable working conditions for machine operators and mine personnel in underground mining operations as a direct result of reduced noise, heat, and particulate emissions.

Better mine yield

An upshot of using electric drive systems is that 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.

Reduced maintenance expenditures

Compared with diesel-mechanical drives, diesel-electric drive systems require less maintenance effort, which means more operating hours between scheduled downtimes and in turn, higher availability. Softer and smoother driving also means less maintenance expenditures for the vehicle and the road; the outcome is a longer vehicle lifecycle and overall lower operating costs. Siemens engineers expect maintenance expenditures to be approximately 15 percent lower with diesel-electric wheel loaders compared with conventional diesel loaders.

Environmentally friendly

Diesel-electric drives are more environmentally friendly than both diesel-mechanical and diesel-hydraulic drives because diesel engines run at a constant speed, which lowers their noise, heat, and particulate emission of diesel exhaust. Full-electric drive systems further decrease the loader's environmental impact, with losses in the drive system reduced by approximately 90 percent, cutting the overall energy demand of the vehicle in half. Both options, of course, enable braking energy to be harnessed. Of all mining vehicles, wheel loaders benefit the most from this advantage because they're operated in short, frequent cycles consisting of multiple acceleration and deceleration maneuvers.

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.



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

Diesel-electric Wheel Loader

The drive system of a typical diesel-electric wheel loader consists of a generator coupled to a diesel engine, power electronic components, electric motors, and planetary gear boxes inside the rims.

The generator converts the mechanical power from the fixed-speed diesel engine into electrical power. Rectifiers feed this power to the DC link, and from there IGBT inverters channel all available power to the electric motors.

Both rectifiers 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. The water-cooled permanent-magnet synchronous motors boast the highest efficiency in their class combined with extreme ruggedness and an encapsulated design.

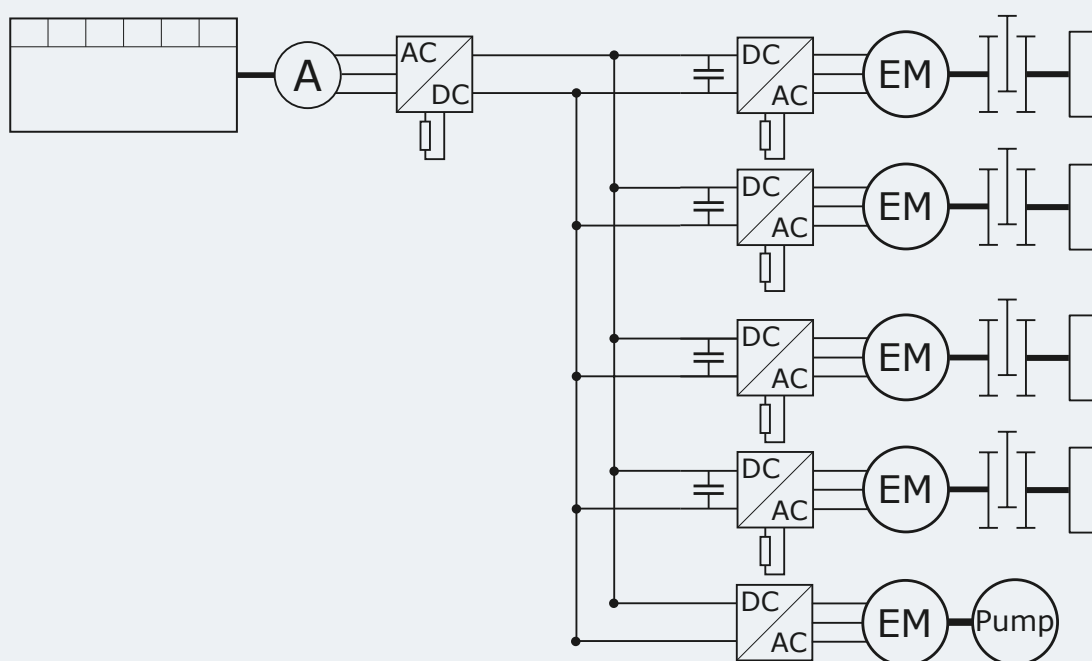
Specifically designed for harsh environmental conditions and tough duty cycles, the motors enable powerful digging and high vehicle speeds, which maximize productivity

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.

Ultra-class Diesel wheel loader traction system schematics



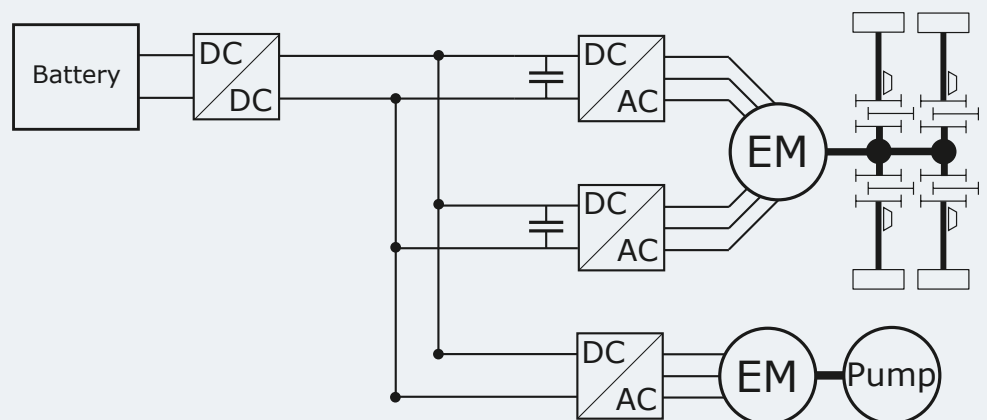
Full-electric Wheel Loader

Powered by batteries, SIMINE full-electric Wheel Loaders feature emission-free operation and the smoothest operational behavior available.

With today's battery technology, enough energy can be stored to power the vehicle for an entire work shift. This means that all-electric wheel loaders are able to operate within the operational structures of most mining operations.

Compact DC/DC converter units create a stable and well-balanced DC link voltage from the varying battery output voltage. The drive system between the DC link and the wheels is identical to that of SIMINE diesel-electric loaders. As a result, identical parts and maintenance routines enable an easy operation of mixed fleets.

Small and medium battery Wheel Loader traction system schematics



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