



SIEMENS

Industrial Solutions and Services

Completely Integrated Solutions
for the Mining Industry

SIMINE^{CIS} TR

More drive, more productivity

Your Success is Our Goal

The right choice for more productivity:

AC drives from Siemens.

SIMINE^{CIS} – Completely Integrated Solutions for the Mining Industry

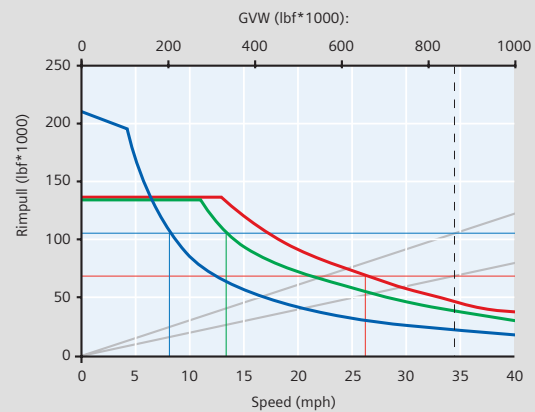
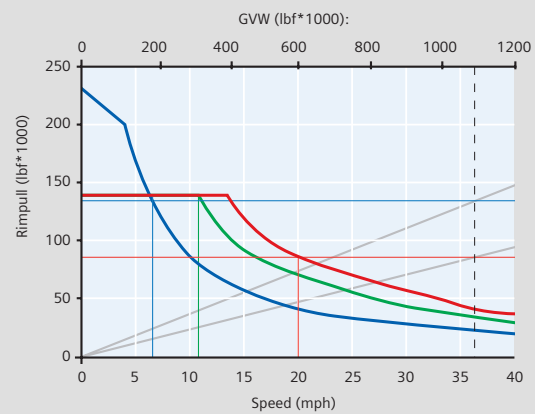
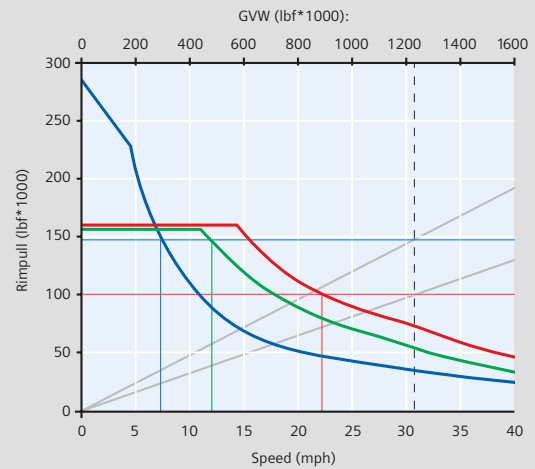
As a comprehensive industry-specific solution for the mining industry, our SIMINE^{CIS} product family integrates all the products and services you need for sustained maximization of your plant's performance.

For each particular task, a solution has been defined that

- **horizontally** improves all production processes – from excavation to beneficiation
- **vertically** integrates the company's information flow end-to-end, helping corporate management to make better-founded decisions
- and **chronologically** enables optimized maintenance and comes with assured further development over the whole life cycle of your plant.

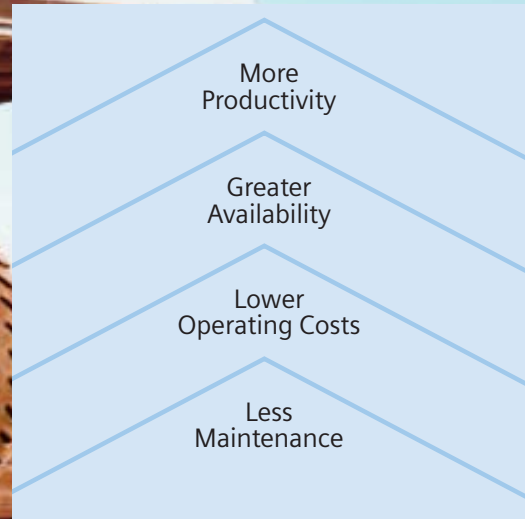
Due to this unique combination of horizontal, vertical and life cycle dimensions, our solutions all carry the genes of an exhaustive and sustained plant productivity in their very core.

For more productivity. More performance. More power. Completely Integrated Solutions from Siemens.



— Propeller
— Trolley
— Retard

Power, Rimpull and Truck Speed: Each drive system has very high tractive effort (rimpull) for pulling away in soft ground, and fully utilizes all available engine horsepower. Additional power available during trolley assist translates into higher on grade speeds. Retard utilizes the full power capability of the AC drive system for the highest safe downhill speeds.



An AC drive system makes your hauler more valuable. Better performance, greater availability, and significant reductions in operating and maintenance costs – it all adds up to more tons for your money.

Siemens makes the most powerful electric truck drives available on the market today. It's our response to the trend – larger trucks, bigger payloads, and faster cycles times combined with low life cycle ownership costs.

More rimpull

To achieve maximum speed on grade, the drive system must utilize all the horsepower today's engines can deliver. The AC drive efficiently channels this power to the ground at all speeds. We deliver high rimpull at stall to power away from the shovel, high speed on grade climbing the ramp, and high top speed running on the flat. Our AC motors accomplish all this because they have no commutator restrictions, like DC motors. With up to 6,000 HP of on-board retard capability, the truck tackles downgrades with confidence, at higher speeds than DC trucks, and with smooth electric braking right to standstill. That's Siemens AC power – in a haul truck drive that sets the standard.

Performance in every detail

AC technology starts with typically 6–7% higher efficiency than DC drives, averaged

over the duty cycle. To that, we add a great array of improved control functions:

- Automatic brake blending provides seamless, single-pedal retard and stopping
- Full-time slip/slide control maximizes traction continuously for peak performance and operator safety
- The retard system automatically keeps the truck within mine speed limits
- Anti-rollback control permits one-pedal operation when stopping on grade
- Automobile-style "cruise control" operates in both propel and retard modes
- Differential torque control enhances turning and reduces tire wear.

Safety first

Operator control translates into safety when it increases the truck's safe operating area. High retard power reduces stopping distances. Automatic speed control holds the truck within the mine's intended operating range. Single-pedal retard operation with continuous slip/slide control and anti-rollback functions help keep the driver in control at all times.

Less maintenance

AC drives bring us closer to the ideal of "no maintenance". Without commutators or brushes, AC motor maintenance simply means lubrication once a year. The heart of the drive system, its power electronics, are inherently maintenance-free, having no

power contactors or components subject to wear. In addition, the Siemens AC drive system features state-of-the-art diagnostics and a modular structure that simplifies repairs and minimizes the Mean Time To Repair (MTTR). Everything counts when it comes to truck availability.

Low operating costs

Increased efficiency, reduced maintenance, and smart controls all lower operating costs. Greater efficiency means lower fuel and oil costs, and AC motors eliminate the costs of brushes and periodic commutator re-builds. Differential torque control for the wheels reduces front tire scuffing and increases tire life. And under normal driving conditions the operator never needs to use the mechanical service brakes, greatly reducing brake wear.

Proven reliability

Siemens AC drives have a worldwide reputation for reliability in open-pit mining, transportation and many other industries. Our AC drive systems power not only electric rope shovels and draglines, but also bucket wheel excavators, SAG mills, crushers, and conveyors for open-pit mining. In addition, more than 15,000 GTO inverter modules, like the ones used on the Siemens haul truck drive, operate in thousands of heavy freight locomotives around the world. Simovert® AC drives are the worldwide standard for variable-speed industrial applications.

Faster, smoother, more efficient –

How it works.

AC drive technology is the perfect choice for open-pit mining because it offers increased performance, low maintenance, and excellent compatibility with the harsh environment.

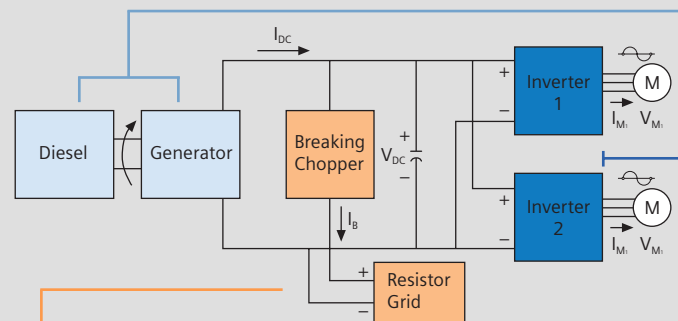
How it works – Propel: The traction alternator converts the mechanical energy of the diesel engine into DC current, charging the DC bus capacitors. The electric power passes through the capacitors to two inverters, which produce AC current for the traction motors. The output frequency and voltage of the inverters is controlled to provide precise motor torque and speed.

How it works – Retard: In retard, the inverters generate electric power by slowing down the motors. Braking choppers, connected to the inverters, channel that power straight into a power resistor grid that continuously dissipates the energy until the truck reaches standstill. So braking is smooth, like driving a car, but without mechanical brake wear.



The AC Wheel Motor:

- Attaches to inside of wheel spindle
- Integrated speed sensor
- Splined connection to drive shaft
- Only maintenance required is to grease the bearings once a year.



BRAKING CHOPPERS AND RESISTOR GRIDS:

Maintenance-free electric braking choppers are used in place of mechanical contactors to connect the powerful grid resistors. The retard pedal initiates immediate and smooth braking action. Capable of dissipating up to 6,000 HP, the retard system improves control and greatly reduces mechanical brake wear.



THE POWER UNIT:

Diesel engine, alternator and rectifier: AC power generated in the alternator is converted to 2,400V DC in the rectifier and flows through the DC link capacitors to the traction inverters.

INVERTERS AND CONTROL UNIT:

The inverters, controlled by a SiBAS™ control unit, transform DC power at constant voltage into AC power at variable frequency and voltage to drive the wheel motors. During retard, the inverters send power from the wheels back to the DC link. The inverters, motors and alternator are cooled by a dedicated electric blower that operates independently of vehicle speed or engine rpm. This maximizes cooling performance and system reliability.

TRACTION MOTORS AND FINAL DRIVES:

Robust, high torque, squirrel-cage induction motors with integrated speed sensors power the two-stage planetary wheel gears.

Siemens AC Drive System Specifications

	Notes	240 Ton*	300 Ton*	360 Ton*
Engine Power	[HP] at flywheel	2540	2550	3380
Trolley Power	[HP] at ground	3770**	3790	4700
Retard Power	[HP] at ground	4670	4690	6035
GVW	[lbm*1000] typical	860	1100	1250
Tire Size	[in] rolling radius	68.4	70.2	72.7
Gear Ratio	Typical, others optional	35.3	35.3	37.33
Gradability	Typical, varies with GVW	24.0 %	21.5 %	22.5 %
Speed Limit	[mph] depends on gear ratio	40	40	40
Drive System	2 AC inverters	IGBT	GTO	GTO
Traction Motors	Squirrel-cage AC	2	2	2
Retard System	2 choppers	IGBT	GTO	GTO
Main Blower	Full-time variable speed	Dual centrifugal with AC motor		
Retard Grids	Standard (max 20)	14	16	18

* Short tons

** Depends on motor and inverter ratings



Efficiency on top:

Boost your productivity with Trolley Assist.

Normally, speed on grade is limited by diesel engine horsepower. If a truck could get more power by connecting to an overhead electric line while going uphill, it could climb faster. The engine would be idling and fuel consumption would be reduced by 95%. Noise and emissions would diminish, and productivity and engine lifetime would rise significantly. This is trolley assist.

Trolley Assist:

How quickly is the investment paid back?

We consider site-specific variables to determine the economic feasibility of trolley assist.

Without a doubt, trolley operation takes some getting used to. But in mines with longer uphill hauls the economics can be particularly attractive – and trolley operation can become an invaluable supplement to the overall mine plan, achieving payback within a few years.

Higher speeds, shorter cycle times, leaner fleets

The Siemens AC drive can produce up to 5,200 HP when operated with an overhead trolley line. This can double the speed on grade and significantly reduce truck cycle times. For example, if the cycle time is reduced by 20%, 32 trucks on trolley produce the same as 40 trucks on diesel.

“Taking the line” and other technicalities

In contrast to trucks with DC drive, trucks with Siemens AC drive can connect to trolley at any speed, independent of the trolley line voltage. In addition, trucks can operate at existing line voltages of 1400V–1600V DC or on new, more efficient, high-voltage lines with 2600V. Trucks can even operate in mines with mixed systems, automatically detecting the line voltage when the operator “takes the line”, and switch to either high-voltage Direct Trolley operation or low-voltage Diesel Boost Trolley operation.

Reduced operating and maintenance costs

Loaded travel on uphill grades typically accounts for 70-80% of a truck's total fuel consumption. Depending on the relative cost of electric energy, this can translate into very attractive savings in operating costs. In addition, with engine operating and maintenance costs tied directly to fuel consumption, trolley assist further lowers your cost per ton because the time between engine overhauls may double or more.

One-Stop trolley shopping – from Siemens

Siemens can perform a site-specific evaluation – including haul profile data, cycle times, production requirements and energy prices – and create a cost-benefit analysis for possible trolley scenarios in your mine. Experience has shown that the higher productivity and the reductions in energy and maintenance costs lead to an attractive IRR and payback time of 1 to 3 years. In addition, we can supply all trolley equipment and services – on the truck as well as in the mine. That includes pantographs, overhead lines, substations, and line position sensors – together with financing, maintenance, and service support.



More service, greater availability:

With worldwide
support and
intelligent diagnostics.

Intelligent diagnostics

SiBAS™ monitor program

SiBAS™ control unit continuously monitors important internal signals to prevent failures. In the event of a fault, the fault history and diagnostic and repair information can be transferred with a few mouse clicks to the notebook of the service technician for analysis.

SiRAS™ remote diagnostics

With SiRAS™ remote diagnostics, we can “keep the factory on the truck”. Remote-access hardware and software connects the drive

system to the Internet and allows Siemens service technicians as well as other experts to log on to the truck from around the world for monitoring, troubleshooting and maintenance. Vital signs can be monitored for trends, and maintenance can be planned before failures occur. Software upgrades can be downloaded to the truck and installed during lunch breaks. The net result is a substantial reduction in MTTR, greater system availability, and reduced maintenance costs.



Never far from the mine

Centrally located service resources plus a worldwide and regional service presence are indispensable. That's why you can find us wherever trucks operate in open-pit mines – with our 90 Siemens service centers worldwide, and with specialized haul truck service personnel in the USA, Australia, Canada, South Africa, Chile, and China.

Maintenance at its best

Take full advantage of our professional service capabilities with a customized Maintenance and Repair Contract (MARC). For example, this can include: Parts only, labor supplementing the existing maintenance staff, or even complete coverage with all parts and labor.

Training with expertise

Beginner and advanced customer training classes are held in Alpharetta, GA, USA, throughout the year. Please visit our website for registration and further details.

Prompt help at all times

When something goes wrong, we are ready to help you right away. Simply contact our 24-hour service hotline when any problem occurs. Dial: 1-800-241-4453.

From online monitoring to intervention to troubleshooting – we offer flexible service concepts and highly qualified service personnel to maximize your trucks' availability.

Telefax coupon – request your subscription today

For a free subscription to our informative newsletter, just mail or fax this coupon to the address or phone number listed below. Our newsletter is published three times yearly and is filled with information of interest to mining industry professionals.

Fax: +1 770 740 3669



Your Name

Title

Company/Dept.

Address

City State ZIP Code

Phone

Fax

E-Mail

Please add my name to the newsletter mailing list

For further information,
please contact:

Siemens Energy & Automation, Inc.
3333 Old Milton Parkway
Alpharetta, GA 30005, USA
Phone: +1 800-964-4114 or
Fax: +1 770-740-3480
E-Mail: seainfo@sea.siemens.com
www.siemens.com/mining

The information provided in this brochure contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

Siemens AG
© Siemens AG 2004. All Rights Reserved
SIMINE[®] is a trademark of Siemens AG
CIS = Completely Integrated Solutions

Order No.: E10001-P11-A27-V1-4A00
Printed in Germany
Dispo No.: 21662 K No.: 28500
15412X22 PA 08042.
Subject to change without prior notice