

# Charmec Revo<sup>®</sup>

- Revolution in underground  
explosives charging



DEFINING THE FUTURE  
**UNDERGROUND**

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## CHARMEC REVO® DEFINES THE FUTURE OF EXPLOSIVES CHARGING UNDERGROUND

Explosives charging is one of the most hazardous work processes in modern mining. Easily available ore deposits are depleting, forcing mining companies to go deeper underground where dangers like rock falls and rock burst accidents are increasing. The only tangible way to improve safety is to remove the operator from the high exposure danger zone – the unsupported area of the tunnel.

Charmec Revo significantly improves operator safety by removing the operator from the high exposure area. The remote-controlled robotic arm places the initiating system into the borehole and, in conjunction with the emulsion kit, dispenses emulsion, allowing the operator to remain in a supported tunnel area.

### BUILT FOR PURPOSE

Our design philosophy was to improve operational safety without the loss of productivity. To successfully achieve this, we prioritized the accuracy and speed of the remote charging system in the design, which led to abandoning traditional hydraulic booms and focusing on robotic solutions.

The system is designed for tunnel sizes from 4 x 4 meters to 6 x 6 meters, covering most mining tunnels. The charging manipulator consists of an in-house developed, extremely agile servo-robotic arm – specifically built for the needs of underground mining.

### THE REMOTE LOADING TECHNOLOGY

The servo-robotic manipulator arm is designed to “pick-and-deliver” the priming unit (the detonator-booster package) from the ground level’s reduced exposure area or, alternatively, the priming magazine and deliver it to the face wall. The pick-and-deliver path between the borehole and the home position is automatized. Charmec Revo enables using standard shock tube detonators or a magazine for a semi-wireless or wireless initiation system provided by any explosives supplier.

The charging arm’s ingenious control system is based on inverse kinematics – only the tip of the boom is controlled, enabling fully autonomous movements, like the path between the borehole and the home position. A lot of attention has been put into lowering the learning curve and making operating the arm as easy as possible.

Maps of the drilled boreholes from the drill rigs can be uploaded to the system to locate them in the face wall. Our machine vision system supports operators in finding the drilled boreholes, shortening cycle time. If the information is not available, the machine vision serves as the main operator support for locating the boreholes. Once the borehole is found, the charging hose delivery system will take care of the priming unit and explosive delivery. The system also recognizes plastic lifter pipes and helps with their utilization.

Designed with half a century of expertise in explosives charging.



CHARMEC REVO LF 600 VE STAGE V / IIIA



CHARMEC REVO MF 600 VE SD

The collision avoidance system slows down and stops the arm before contact with the tunnel wall or other obstacles, and the close contact prevention utilizes reliable ultrasound sensors. Additional safety sensors stop boom movement if the operator enters the working area.

The Revo system can accommodate any commercially available wired, semi-wireless or wireless initiating systems. The priming unit can be handled manually or by using magazines provided by explosives suppliers. The initiating system magazine is placed at a platform next to the charging arm, enabling the priming unit’s unique pick-and-deliver method. As with initiating systems, the Revo can be used with all commercial bulk emulsion systems.

### MAXIMIZED PAYLOAD CAPACITY AND TWO CARRIERS

The Revo is built on our state-of-the-art front cabin carrier, powered by either Stage V or IIIA diesel engine options or our battery-electric SmartDrive architecture with zero local emissions.

An impressive load capacity of 6000 kg allows for matrix payloads of up to 4000 kg to be mounted safely on the rear platform, away from all hot surfaces. A large bulk capacity reduces the need for constantly driving back and forth between the charging sites and the explosive warehouse and, therefore, both significantly increases productivity and helps keep the charging machine in excellent working condition.

Fully electric charging arm with 6 degree of freedom

Place for semi-wireless or wireless priming unit

Ultrasound sensors, camera for machine vision, and work lights

Normet charging hose handling technology

Operator safety area sensor

GUI for arm control and charging process

Servo control drives

Normet borehole opening and cleaning technology

Normet ECM or external emulsion unit

Possibility for BEV charging or electric operation with diesel unit

FOPS/ROPS approved ergonomic cabin

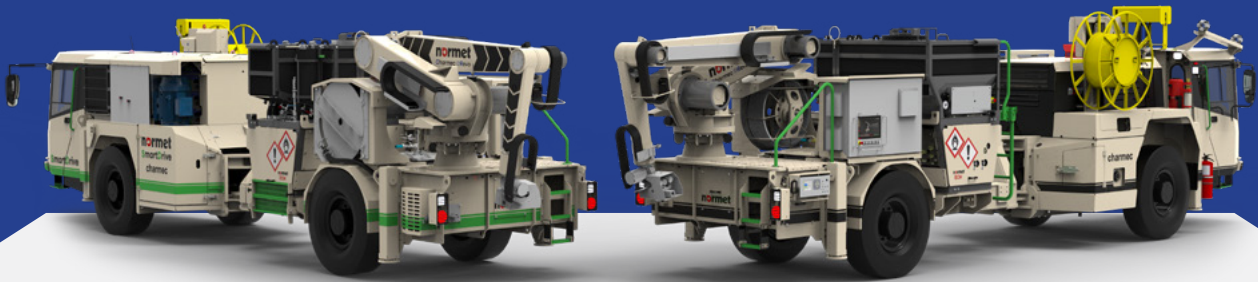
Available with BEV or Stage V/IIIA diesel powerline

Total payload 6 tonnes, maximum bulk payload 4 tonnes

### KEY BENEFITS OF CHARMEC REVO®

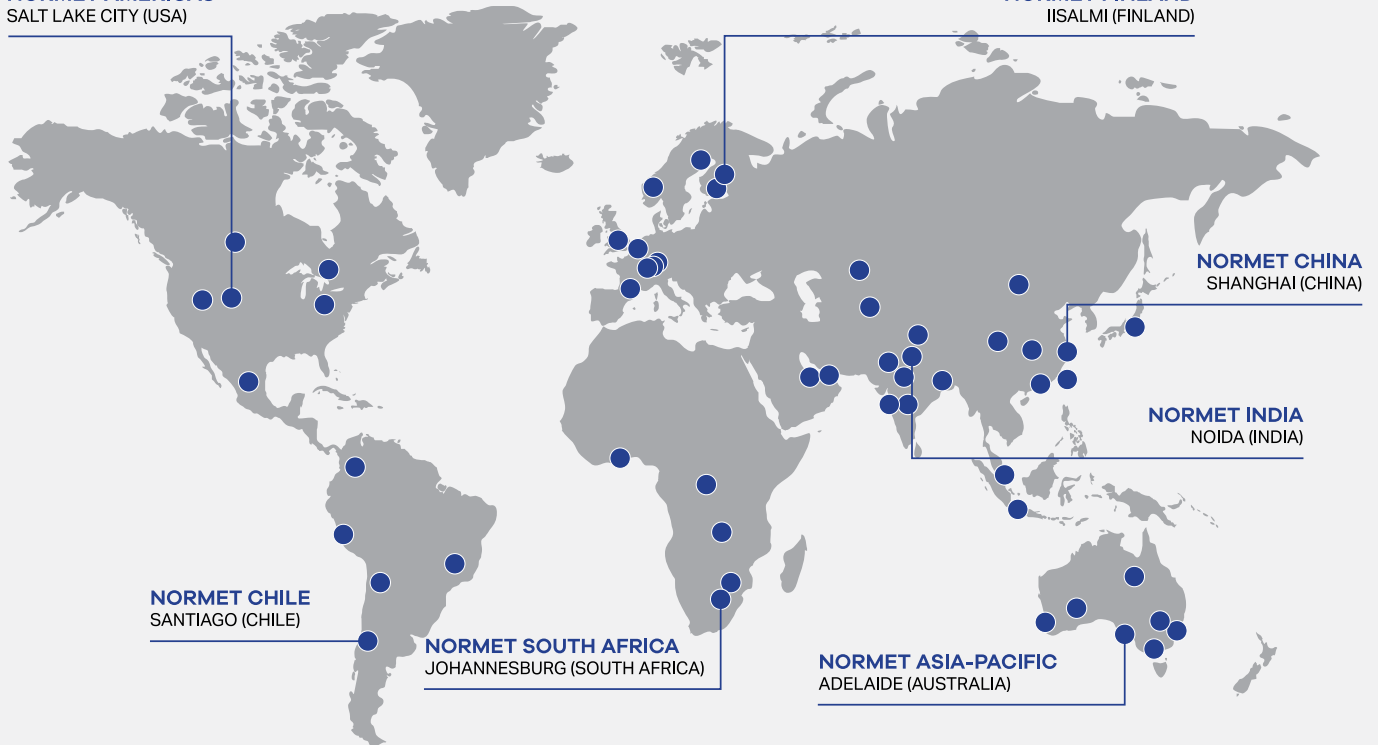
- Significantly improved operator safety and ergonomics
- Safe design with the charging system far away from the diesel engine's hot surfaces or the BEV's batteries
- Adaptable for all bulk emulsion and initiating systems
- Excellent access to challenging rock strata conditions and previously impossible areas
- High payload capacity for maximized productivity





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