



INTERNATIONAL MINING



UNDERGROUND LOAD & HAUL

PUMPS & PIPELINES

DRILLING UNDERGROUND

HEAVY ENGINEERING & WEAR PARTS

MINING RAIL



Load, haul, dump...and charge



As always in our annual round-up of underground primary fleet technology, we take a global view – this time focused on battery electric being the long term industry driver. Paul Moore reports

Just like in surface mining – in underground load and haul, the unmistakable long term trend is towards both autonomous operation and electrification with batteries and everything that goes with that in terms of infrastructure. However, while there are a number of trials and test phases underway, with a few exceptions like Kirkland Lake Gold’s Macassa, Newmont’s Borden and the in-development Glencore Onaping Depth, there are still very few mines designed around full or near full battery electric fleets. That said, many major underground projects are now citing battery electric mining as a considered approach at feasibility stage.

Before getting into battery electric progress, it is good to highlight the fact that Stage V diesel engines still represent a major step forward for underground operators in medium term emissions reduction. As an example, in early 2020, the Toro™ LH517i and LH621i became the first Stage V compliant underground loaders from Sandvik. Earlier this year in 2021, when it introduced the new the Toro™ LH410, this model also got a Stage V engine as a new option, and a wide range of other new features. The company told *IM*: “Currently, more of our loaders and trucks are being outfitted and tested with new Stage V engines. It is expected that we can share more news about product upgrades and new product releases later this year.”

Sandvik follows the European Stage V exhaust emission legislation for off-road engines to reduce the number of diesel particles in the exhaust. The Diesel Particle Filter (DPF) helps to improve air quality underground in the power range 130-560 kW. Passive DPF regeneration takes place during normal operation to minimise equipment downtime. For the larger equipment

in power ranges higher than 560 kW, the requirements are different and therefore the solutions will be different.

Additionally, loaders and trucks with a Stage V engine have built-in fire prevention solutions to reduce the risks relating to fire underground. This equipment is designed with corrosion, heat and water resistance materials, are quieter and fuel consumption is reduced by an average of 3% compared to lower stage engines.

“Our customers are expecting to get value for their investment: a productive, reliable truck or loader with excellent performance and overall low cost of ownership. As there are no uniform standards, this is why extensive customer field tests and following legislation and national certification standards, such as Canmet and

The R1700XE is the first battery powered/zero emissions equipment for the Cat underground hard rock mining LHD product line

MSHA, help us prove that our vehicles meet their needs and are the best in their class. There were more than 10,000 hours of testing in underground mining conditions across multiple customer sites before making the Stage V an available option. The Stage V engines are now globally available as an option on certain Sandvik loaders and trucks; and as described, more and more equipment will have this engine option available.”

Since the successful launch of its Minetruck MT65 in 2016, Epiroc has maintained the Minetruck MT65’s position as the highest



Sandvik continues its program to develop Stage V compliant underground loaders and trucks for the mining industry



JCHX all lithium battery electric 2 m³ underground LHD at Bauma China in Shanghai.

than four hours of continuous loading operations or 70 buckets of ore pass operations. In a 3.2 x 3.2 section, it can complete the ore and waste discharge tasks of 2 sections. A full charge time is 30-40 minutes, and when the workers are on a shift change, the machine can remotely complete more work. The operating cost is about 60% of a diesel LHD of the same class.”

The working environment for the operator is improved significantly as local high temperatures caused by an engine no longer exist; JCHX: “to sum up this product achieved energy-conservation, environmental protection, low breakdown, improved safety and higher economic benefits at the same time.”

The new colour scheme of the LHDs refers to the JCHX flag/logo, while the product has been officially named as “King Ant” with the corresponding Chinese name having been registered at Administration for Industry & Commerce. The red, blue and white used on the body are the basic colours of the Jinchengxin (JCHX) flag. The red stripe shows J when viewed from the back, and C when viewed from the bottom up. The red and blue stripes cross and show X, which stands for JCHX, which is the English abbreviation of the company’s name. The King Ant name reflects the fact that it is an articulated machine, capable of lifting things far heavier than its own weight, implying a strong product carrying capacity.

JCHX adds: “In recent years, as part of government policy and national reform, more attention has been driven to environmental

protection, sustainable mining development as well as green mining technology...redesign and upgrading of mining equipment based on new energy to be clean, zero-pollution, highly-efficient and automated is inevitably a necessity. Under such circumstances we believe our lithium-battery-driven LHD has distinct advantages in terms of safety, environmental friendliness, operational convenience, maintenance accessibility, as well as automation.”

The successful commissioning of the 2 m³ battery electric LHD (which was initially given the name JCY-2 during trials but is now also using the King Ant brand) was achieved on July 8, 2019 at the Lujiang pyrite mine near Hefei City in Anhui Province, which is owned by Anhui Jinniu Mining. At the time JCHX said: “JCY-2 is a battery-driven, free of pollution and highly agile LHD, which is designed and developed for the purpose of minimising environmental pollution, reducing equipment operation cost and protecting employees’ occupational health.”

JCHX says some of the transverse drifts at the Lujiang project are quite long with comparatively small sections, which leads to greater ventilation demands which was the main driver for the JCY-2 machine development. During 2.5 hours of operation at the 8-0 ore pass on the -296 metre level, the battery was reduced from 100% down to 47%; 14 draws (approximately 34 m³) weighing 120 t were loaded with the loading point located 160 m from the ore pass. The fan was not activated during the operation of JCY-2, while the ambient temperature remained unchanged. According to the charging data, it

Getman's A64 underground primary fleet service platform

Getman says its service vehicles are designed to help perform key maintenance and repair functions throughout an underground mining operation, reducing the need for other production and production support vehicles to return to the workshop and helping maximise the time those vehicles spend in production and development roles. Part of Getman’s A64 product platform, its underground service vehicles protect operator safety through their purpose-built designs. Getman’s A64 Service Lube Vehicle offers three standard tank layout variations ranging from four to five tanks. They also may be customised for more or fewer tanks, based on specified requirements. All lube vehicles feature pressurised grease service, compressed air service, and include convenient delivery hoses with nozzles on heavy-duty spring return reels. The A64 Service Mechanic Vehicle offers a fully customisable mobile workstation and comes standard with toolboxes, compressed air service, a heavy-



Part of Getman’s A64 product platform, its underground service vehicles protect operator safety through their purpose-built designs

duty crane, deck space, and storage compartments for transporting replacement parts and work lights. Available racks for oxy/acetylene tanks, grease services, and vice clamps are available upon request. Additional equipment may be mounted based on specific needs. The A64 Service Fuel Vehicle includes a single 2,000 gallon (7,571 L) tank for refuelling operations underground and includes internal tank baffling for improved performance during tramming. The high-rate delivery function includes a delivery line and nozzle mounted on a spring return reel for improved operation. Alternate tank sizes are available for enhanced manoeuvrability. The company told **IM**: “Getman A64 Service Vehicle’s purpose-built design keeps safety at the forefront. Features such as crane stabilisation eliminate the need for operators to physically handle heavy loads. All daily vehicle services and checkpoints are accessible from ground level and work areas are well-lit to ensure proper luminosity during servicing functions. Outward facing sight gauges are visible from ground level, and all mounted equipment is located on the perimeter of the rear deck, minimising the need for climbing on equipment.”