It’s electric

Battery loader creates a better work environment for operators at Atacocha mine in Peru – and improves productivity. Pages 46–47
With a heritage that dates back to 1873, Epiroc was formed out of Atlas Copco’s mining and construction business, and builds on proven expertise, quality and performance.

In April, we completed the acquisition of New Concept Mining, a manufacturer of underground rock reinforcement products. This also relates to safety. Every year, the average mine is getting deeper as commodities are extracted, increasing the need to solve our customers’ key issues – including requirements to reduce operating costs, increase productivity, increase utilization of equipment, reduce environmental impact, and enhance health and safety conditions.

WE RECENTLY LAUNCHED our second generation battery-electric underground vehicles, consisting of heavier trucks, loaders and rock reinforcement rigs. Customers are showing strong interest, and no wonder since switching from diesel to battery power means less noise, heat and exhaust fumes – a much healthier work environment. In addition, the operational costs for underground work drop when going electric since less money is spent on ventilation while still improving productivity.

IN THIS ISSUE you can read in-depth about safety in our industry, and much more. Happy reading and stay safe!

On my radar
Productivity partner
We work closely with customers to jointly develop the best solutions for specific needs.

Agility in product development
We are shortening our time from concept to ready product.

Workforce of the future
Our industry will need top talents in such areas as automation and artificial intelligence to meet the challenges. How do we, as an industry, ensure that we attract the workforce of the future?

About Epiroc
Epiroc is a leading productivity partner for the mining and infrastructure industries. With cutting-edge technology, Epiroc develops and produces innovative drill rigs, rock excavation and construction equipment, and provides world-class service and consumables.

The Group in numbers
Epiroc employs more than 14,000 people in more than 150 countries.

Enjoy!
Helena Hedblom
Senior Executive Vice President, Mining and Infrastructure

Epiroc Group
– get to know us better

Our innovations
Mining and mining support
Underground mining, surface mining, exploration, quarrying, well drilling, oil and gas

Energy and CO₂
MWh energy from operations
Cost of sales (SEK million)

Transport CO₂
MWh energy from operations
Cost of sales (SEK million)

Divisions and reporting segments
Equipment & Service / Tools & Attachments

Rock Drilling Tools
Dedicated to rock drilling tools worldwide

Hydraulic Attachment Tools
Dedicated to hydraulic attachment tools for carriers

Rocktec
Dedicated to technology solutions, and drives the automation and interoperability expansions for Epiroc’s divisions

Drilling Solutions
Dedicated to a wide range of rotary drilling equipment

Mining and Rock Excavation Service
Dedicated to parts and services aimed at maximizing customers’ productivity

Surface and Exploration Drilling
Dedicated to rock and exploration drilling equipment

Underground Rock Excavation
Dedicated to a wide range of tunneling and mining equipment

The company was founded in Stockholm, Sweden, and has passionate people supporting and collaborating with customers in more than 150 countries.

“Productivity and safety hand in hand”

Epiroc will always prioritize safety. One example is our automation solutions, such as remote-controlled drill rigs. They enable people to work away from dangerous areas – a win-win for customers as it boosts both safety and productivity.

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Safety

Safety at work has grown in importance over the years and a holistic approach is a must if you want to reach the desired level. Safety culture and systematic work are touted as being vital ingredients in order to avoid weak links.

26–41

[FEATURE]

The Safety Issue

Safety

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26–41

FACETOFACE

Out of the danger zone

Pre-split drilling can be risky in certain parts of a mine. To increase safety, Anglo American has introduced Epiroc’s BenchREMOTE system at its El Soldado mine in Chile.

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INNER WORKINGS

Smother spraying

Enhanced boom and pump, along with improved final concrete quality, makes the MEYCO MES a powerful and flexible choice for concrete spraying in large tunnels. YIT is more than happy with its performance at the Ljøkelsvatn power station.

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OUR CHALLENGE

“They loved the machine”

Rock reinforcement is a bottleneck that needs to be addressed. Epiroc came up with pumpable resin and a modified rock bolt that might soon be a thing of the past.

44
Welcome to Epiroc, Fordia!

Epiroc had a fantastic start to 2019 with the acquisition of Fordia, a well-known Canadian manufacturer of exploration drilling tools. This serves to strengthen Epiroc’s offering in the exploration segment.

“Positioning in the exploration market is crucial for Epiroc, and the addition of Fordia’s brand equity and great reputation will solidify our position in the exploration business,” says Arunkumar Govindarajan, President Rock Drilling Tools at Epiroc.

Fordia was founded in Montreal, Canada in 1977. Founder Clement Paquet and his assistant first ran the company as an independent operator and then acquired the business in 1994.

Fordia has around 240 employees, sales in more than 70 countries, and factories in Canada and China. The company’s sophisticated technology with production precision of a controlled-atmosphere furnace has been crucial to this success.

Epiroc and Fordia will continue building both companies, and the parties will join forces to provide customers with the best possible products and services in the exploration market.

“Both Fordia and Epiroc customers gain a new dimension of business as our two companies come together, getting the full offering from both sides. Fordia’s agility and customer focus are now backed up by some serious muscle power, and the future is bright as sparkling diamonds,” says Arunkumar Govindarajan.

Fordia also considers the acquisition a great success. Denis Landry, General Manager at Fordia and VP of Exploration, Rock Drilling Tools at Epiroc, elaborates: “Fordia and Epiroc coming together puts us in a position to become global leaders in the industry, and we will see more innovation within diamond drilling in the future.”

Boomer key element in quartzite quarry

**VALS QUARTZITE** of the highest quality is the trademark product of Truffer AG. The natural stone is extracted in the company’s own quarry and then processed in a factory in Vaia, Switzerland. Since 2017, Truffer AG employs a Boomer E1-DH in the quarry. It’s exotic in the quarry business, and the machine – equipped with the high performance BUT46 boom – is able to drill holes up to five meters in length.

**PowerROC T25 DC** vital at high altitude

**THE WORLD’S HIGHEST** observatory is being constructed on the summit of Mount Chajnantor in Chile, more than 5 600 meters above sea level. To dominate the huge boulders that sometimes block the path, earthmoving specialist Montec is using a PowerROC T25 DC drill rig when building the road to the observatory.

**5 600 meters**

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Epiroc and Ericsson cooperate on mining wireless technology

Epiroc and Ericsson cooperate on mining wireless technology
Turning up the heat

ROC-DRILL JOINS THE QUEST FOR COPPER WITH THE HELP OF COPROD TECHNOLOGY

At a mine in the north of Australia, Roc-Drill is joining the quest for copper with a pair of Epiroc SmartROC CL rigs. But here, hours from the nearest town and in a place where temperatures can inch towards 50 degrees Celsius, man and machine are pushed to their absolute limits.
“I hear Julius Dam has spilled you have eight hours to leave,” Jones says, idling his Landcruiser on the Leichhardt River as a bank of freshwater crocodiles crosses a weir in front of him. “Otherwise, you’re stuck.”

This is the wet season in Australia’s north and storms can appear out of nowhere. We experience it firsthand when a dark bank of clouds causes an early end of shift. Jones whisking us away from the pit in a line of LVs, orange lights flashing. A black curtain of rain and wind and dust rushes in the other direction, stab of light entering everything.

“Five weeks ago, a years-long drought broke here, creating a vast inland sea. We experience it firsthand. ‘And then it rains and it’s the mud. ’”

The earth is soft and progress slow, with sodden clay regularly clogging up the drill bits. Operator Glen Hoyle takes care to collar his holes, expertly mixing the gray earth like a cake batter. It’s time consuming and chew through water, but it’s worth it.

“It will be a couple of days before the bomb crew get here,” Hoyle says as he locks the CL into auto and lets it go to work. “The last thing you want is all that earth falling back down your hole. They’ll mark it up as a refusal.”

In some ways, Hoyle is simply biding his time. One of Roc-Drill’s 12-strong fleet of trusty SmartROC D65s would be just as capable on this soft terrain. But peer into the pit and you see what the SmartROC CLs are here for — the harder bedrock with its rich deposits of copper.
“Once we get to that harder rock, we’re going to get consistent pen rates. They’re really good machines”

Mark Killip
Mining Engineer, Malaco Leichhardt

In GOOD HARD ROCK, this and a D65 together? It would flog it to pieces,” Hoyle says. “Hard rock is where these go really well.”

Still, the penetration rates for this kind of earth are already high, and the SmartROC CLs are paying off in other ways. With a wider rod, the rigs can carry a smaller compressor to clear their holes, meaning a smaller engine and some eye-popping savings on fuel – “maybe half of what the 65s use”, Graeme Jones says. At Crusader, where temperatures can climb towards a whopping 50 degrees Celsius (112 degrees Fahrenheit) deep in the pit, it has other benefits. “With a smaller compressor, your engine isn’t working as hard,” Hoyle adds. “That’s keeping pressure off the engine. Here, you need all the help you can get. It’s as hot as hell!”

OTHERWISE, THE SmartROC CL rigs drill straight and true, something not lost on Mark Killip, Mining Engineer for Malaco Leichhardt. Killip was already impressed by Roc-Drill’s ability to mobilize to site so quickly, and speaks effusively about the new rigs.

“Those COPROD drills are fantastic,” he says. “For being able to get really good, consistent drilling on a range of grounds, they’re great. They have GPS, which takes away the hazard of putting people in the field. If there’s a slight change in ground conditions and it moves a couple of hundred millimeters, the GPS automatically accounts for that. Once we get to that harder rock, we’re going to get really consistent pen rates. They’re really good machines.”

Then again, with Roc-Drill breaking them in you’d perhaps expect nothing less. “We don’t mind being pioneers,” Deveth says. “These machines might not reach their full potential if introduced by another company. We don’t allow that to happen.”

“We’ve got a great reputation,” he continues. “There’s not one job where we haven’t been under budget for the client. We strive to continually cut costs for our business and these can be passed on to our clients. That’s what sets us apart. That’s why we have CL drills.”

Crusader Mine

Epiroc and Roc-Drill

Roc-Drill’s relationship with Epiroc spans 25 years. Roc-Drill has one of the largest fleets of Epiroc crawler drills, including the new SmartROC CL rigs, along with various other boomerhammers, DTH and rotary drills. The large fleet offers parts to be readily shared between rigs and models, ensuring high equipment availability.

In the early 1990s, Crusader was an open cut and underground mine with a rail line to Mt Cuthbert, 25 kilometers (over 15 miles) away. Crusader was most recently mined for oxide deposits over 20 years ago. Malaco Leichhardt reopened the mine in early 2019, focusing on copper sulfide ore mining.
Central London is one of the busiest metropolitan areas in the world, and the Bank & Monument station complex one of its most hectic hubs. The Bank and Monument stations are located 360 meters apart in the City of London district, surrounded by narrow, heavily trafficked streets and an abundance of weekday-occupied offices. During rush hour, more than half a million commuters pass through the stations, with a large number of them making use of the tunnel system connecting the two.

Construction company Dragados was awarded the contract for building new tunnels as part of a large reconstruction project, enabling the station complex to handle 40 percent more passengers. All this combined to pose a considerable challenge for Dragados and Construction Manager John Comins.

What have been the major challenges?

“First of all, working inside the city. Getting materials in through congested traffic and removing water and electricity services in the streets meant that it took us a year to get down to where we could actually start work on the new tunnel. We also had to find a solution for ventilating the tunnel – we couldn’t do much down there without it.”

In what way did ventilation pose a problem?

“We needed an exhaust system to extract dust and heat away from our people, but there were no sufficiently large areas on the surface for the fan and ducting in a traditional single-fan system. We were also limited by the space within the tunnel as there are some bottlenecks to contend with. A single-fan system wouldn’t suffice in the long run.”

How did you solve it?

“Epiroc suggested a multistage four-fan system that we could activate step by step as we got further in to progressively improve the ventilation as needed. The smaller fans are relatively compact, so we could fit them into the only area available: a steel gantry we built over King William Street.”

Has that solution been satisfactory?

“The efficiency of the fans is brilliant. They’ve been running continuously since the beginning of 2017, but have needed no spare parts and no maintenance beyond the basics. In short, ventilation has been the least of our problems. But our environmental team has been very conscious about the sound levels – I suppose we’re not helping the city noise much. And the cost of running all four fans at full capacity has been quite high. But we’ve throttled them back to 70 percent efficiency and that has helped greatly with both issues.”

With the help of Epiroc, construction company Dragados could implement a tunneling ventilation system for the Bank station reconstruction within the confines of the bustling City of London.
Anglo American had for some time been looking at how to introduce remote-controlled equipment to its El Soldado mine in order to reduce the exposure of personnel to risks such as rockfalls and challenging weather conditions.

Epiroc’s BenchREMOTE system for operating surface drill rigs remotely proved an ideal fit for the vital job of presplit drilling which must be carried out in the riskiest parts of the mine.

Mining & Construction sat down with Anglo American’s Hernán Rodríguez and Epiroc’s Francisco Campos to find out how Epiroc was able to implement a solution to the mining company’s challenges.

What was the challenge facing Anglo American at El Soldado?

Hernán Rodríguez: “El Soldado is an open pit mine located on a steep mountain slope, which means we are always looking for technologies and innovation to help us address the particular geomechanical conditions of the mine.”

Have you worked around these conditions?

HR: “We have a radar system to detect potential rockfalls, but normally we know that it could take hours, days, and even weeks for them to occur, depending on the speed at which the rock is moving. So there is a period of time in which we could deploy our equipment in the area. However, we don’t want to expose our employees to any level of risk. So two years ago, we looked at the problem afresh and realized that during this period we could continue working in these areas.”

REMOTE-CONTROLLED DRILL RIGS GET WORKERS OUT OF THE DANGER ZONE

When Anglo American was looking how to carry out drilling at its El Soldado mine in Chile without exposing workers to rockfalls and other risks, it found the solution in Epiroc’s BenchREMOTE, a remote operator station for surface drilling operations.
“Automation increases productivity, takes better care of the motor and reduces fuel consumption, but the most important advantage is the ability to remove the operator from the line of fire.”

In Focus

Anglo American

Anglo American is a leading global mining company with a portfolio of mining operations and undeveloped resources. Its primary products are diamonds (through De Beers), copper, platinum group metals, iron ore, coal and nickel. El Soldado is an open pit copper mine located in central Chile 132 kilometers north of Santiago.

It produced around 52,700 metric tons of copper in the form of concentrates and cathodes in 2018.

- 64,000 employees
- Founded in South Africa in 1917
- EBITDA in 2018: USD 5.2 billion

More > angloamerican.com

It’s not always sunny at the El Soldado mine. On some days, visibility is restricted by sea mist. But, with remote-controlled equipment, operations can continue as normal.

At El Soldado, we provided one of our best technicians, who is based near the mine, to support the implementation.”

“This has been a big help as we have been able to call on the support team help at any time. Even once at midnight, when our system had failed, we called them, and they were able to fix it. We have now extended the contract so all our personnel can be trained on BenchREMOTE.”

How have operators adapted to the new system?

“At first, we began with just a few workers. They all wanted to try it as it was something new. There were some problems with the structure where the system was installed. Now it is on a truck. The speed of acceptance was very quick, especially among younger workers who have grown up playing videogames. For them, it was natural.”

“Yes, but some workers are resistant to change with new technologies. Another issue is the working conditions. When on the rig, the operator is exposed to the dust, the noise, the vibrations – none of which you feel operating remotely. Everyone appreciates this.”

How are the drills operating now? What impact have they had?

“We are using the rigs in the areas of the mine where we don’t want our workers to be exposed to risks. It has allowed us to continue operating with challenging geomechanical and weather conditions. For instance, we have on average 34 days a year of sea mists rolling in off the Pacific. But, our remote-controlled equipment can continue as normal.”

“Another advantage is productivity, which is more consistent over time. When an operator starts their shift, they are full of enthusiasm, but as the hours pass, it’s normal for their performance to decline. But if the processes are automated, the drilling rate is constant throughout the shift.”

What are you looking to do now with BenchREMOTE?

“We would like to let people operate the rigs from an office rather than from a vehicle. We are having a meeting to discuss the next steps.”

What has been your experience of working with Epiroc during this process?

“The collaboration has been a key point in the relationship so far, and we certainly expect to keep exploring the possibilities this system provides to improve safety in our operation.”

In order to tackle a problem that a client is facing, you need to have more than the right solution. You also need to provide the necessary support to ensure it is properly implemented, and build trust to ensure an effective working relationship.

The right solution

Epiroc’s BenchREMOTE system for operating surface SmartROC drill rigs remotely was specifically designed for safety challenges like the one faced by Anglo American at its El Soldado mine.

High quality technology

Anglo American trusted in Epiroc’s reputation for developing high-quality mining technology, which meant that it could rely on its equipment to operate in the most testing conditions.

Experience

Epiroc had already introduced the BenchREMOTE system in several of the largest copper mines in Chile, so the implementation process in El Soldado was very smooth.

Support

Having an Epiroc technician on hand round-the-clock to provide training and support enabled Anglo American’s drill operators to quickly learn how to operate drill rigs remotely and resolve problems.

More > www.epiroc.com/benchremotetests
Demand for cobalt prompts action

The demand and price of cobalt for use in rechargeable electric vehicle batteries will rise exponentially over the next few years, prompting manufacturers like Ford to either secure access to cobalt mines or lessen their dependency on the element. The Democratic Republic of the Congo (DRC) currently produces 63 percent of the world’s cobalt, with associated problems of slave and child labor, as well as environmental damage.

At a mining industry event in South Africa, Mining.com reports that Ted Miller, Ford Motor Company’s Senior Manager of Energy Storage and Materials Strategy and Research, spoke of switching out cobalt dependency for nickel, while still anticipating a possible future need to participate in cobalt mining or have direct cobalt offtake agreements.

Other battery manufacturers have unveiled plans to recycle cobalt from used mobile phones, and develop lithium-ion batteries with minimum or no cobalt content.

Work-life balance top priority

Mining industry employees and jobseekers prioritize a work-life balance above a survey of almost 800 people conducted by Perth-based Mining People International in January 2019. When asked “What takes priority when you’re searching for your next mining job opportunity?”, a work-life balance was the top choice for almost 40 percent of respondents. Second was career development with 37.8 percent, while salary was third with just 20 percent of the votes.

Kevin Murphy, Senior Analyst, Metals & Mining Research

What happened in exploration in 2018?

What were the major exploration trends during 2018?

“2018 continued most themes from 2017, with increased budgets for most commodities and regions. The only region to record a decrease was the Pacific/Southeast Asia region, where countries such as the Philippines had lower budgets again. Battery metals continued their above-average increase, up 59 percent. Although base metals saw substantial increases, the industry remains focused on gold, which captured 50 percent of global budgets. The industry continues to underinvest in grassroots allocations, which fell to an all-time low of 25 percent of the global budget. The number of active companies exploring increased for the first time since 2012.”

How does this affect the mining business?

“The largest potential consequence to the industry stems from the persistent lack of grassroots investment. Our analysis shows that major discoveries are on the decline, which corresponds with this underinvestment. This could have implications for the long-term supply pipeline for commodities, especially copper and gold.”

What’s the preliminary forecast for 2019?

“Despite a variety of potential headwinds, we still expect a 5–10 percent increase in budgets in 2019.”

Pinpointed

Asteroid probe prepares for mining operations

The Japan Aerospace Exploration Agency (JAXA) reported in February that the Hayabusa 2 spacecraft has touched down on the asteroid Ryugu, wrote Mining.com. The probe will collect samples of the dust by firing a 1.3 gram tungsten bullet into the surface at more than 550 mph, and retrieve up to 10 grams of dislodged debris using a small horn to its underside. The craft is expected to return to Earth with samples in 2020. JAXA scientists hope to get data on water, precious minerals and organic material, all in preparation for future asteroid mining.

Coal loses energy shares to wind and solar in India

Coal as an energy source is losing the race to renewable alternatives in India, with tariff prices for wind and solar becoming hard to beat even for existing coal plants. New coal generators are even less competitive, given higher capital and operating costs. The existing fleet will probably contribute energy for another two decades, but coal as a major future energy source is highly unlikely. India has a plentiful reserve of coal to still be mined, but decreases in demand will likely lead to a steady production drop in coming decades.
Four steps to successful shotcreting

SHOTCRETING is a difficult art form. For optimum results, it is important to have the correct distance and angle, among other things – and to make sure that the concrete is as strong as possible.

1. **Distance**
   - There should be approximately 1.5 meters between nozzle and rock. It is important that the concrete does not rebound, or at least rebound as little as possible.

2. **Flow**
   - It is important for the flow from the nozzle to be good and homogenous in order for the concrete to become strong.

3. **Thickness**
   - The concrete layer can consist of different thicknesses depending on the size of the tunnel and the condition of the rock. In the tunnels for Ljøkelsvatn power plant the layer should be 6–8 centimeters thick.

4. **Angle**
   - The angle between the nozzle and the surface must be 90 degrees.

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A WILD CARD IN DOVREGUBBEN’S HALL

Mobile concrete sprayer transforms tunnel construction into a smoother game for everyone, except perhaps the Norwegian Mountain King.

As the working face of Norwegian Ljøkelsvatn water supply tunnel blasts ever deeper into the mountain, the walls are efficiently being covered in cement by the MEYCO ME5.

HAVING SEEN THE MEYCO ME5’s ability to keep running under extreme conditions in Etne, YIT has decided to allocate the machine to their heaviest upcoming tunnel projects in Norway.

Hence, when the company started working in Etne in the fall of 2018, Epiroc managed to deliver a MEYCO ME5 on short notice, replacing an older rig. Lined up among two Atlas Copco drilling rigs, three haul trucks and several smaller construction machines, the MEYCO ME5 plays a crucial role in speeding up tunnel building, which will never be fast enough for customers.
“After a maximum of three dynamite blasts, and cleaning and pigging of the walls, all other machines and personnel pull back while the ME5 enters the bottom of the tunnel, but only for three hours, tops. Then everyone returns to prepare the next blast,” Reknes says.

Thanks to a computer-guided dosing system, touchscreen adjustment of spraying mixture, and a fixed boom with flexible head for speedy auto application, the MEYCO ME5 allows for a virtual one-man show. As we meet YIT’s Ronny Johnsen on his way to maneuver the mobile rig down the steep tunnel, we get the operator’s own account:

“The rig works in a simple way, and counting from the very first day, I haven’t experienced any problems using it,” Johnsen states. After steering the rig for two months out of a projected two years of building the Etne power station tunnel, Johnsen has started to customize his MEYCO ME5.

“To avoid cleaning the rear pipe intake after every round of concrete, we’ve made our own fittings and hoses,” he says. Johnsen is currently running at 70 percent of the MEYCO ME5’s output capacity, while at the same time wasting less than seven percent of the concrete input.

“My plan is to work even quicker while keeping waste to a minimum,” he says. While Mining & Construction’s photographer immerses himself in mud to get a clear shot at the nozzle smoothly applying concrete to the tunnel ceiling, we can almost hear the rumblings of the Mountain King preparing to defend his underworld against the unrelenting arrival of the MEYCO ME5.

YIT Group

YIT GROUP IS the largest Finnish and Northern European construction corporation, holding markets in Northern and Eastern Europe. YIT has over 10,000 employees and recorded combined annual revenues of 3.8 billion euros in 2017. YIT Norway holds a leading position within paving and infrastructure, specializing in tunnel construction with a focus on power plants and road projects. In 2018, YIT merged with Lemminkäinen and significantly improved its capacity in paving, tunnels and road maintenance.

Ljøkelsvatn power station, Etne, Norway

In November 2018, builder SKL commissioned YIT to build a 5 kilometer 22 m² water tunnel and a power station inside the mountain, with a capacity of 163 GWh.

YIT uses one MEYCO ME5 concrete spraying rig from Epiroc to cover and reinforce the entire tunnel wall and ceiling.

The new power station is a rebuilding of two older stations from 1920 and the 1950s, respectively.

Planned delivery: 2021

More: yitgroup.com

Dependable mobile concrete spraying

The MEYCO ME5 is designed for underground construction projects with medium to large openings. The machine incorporates a precise dosing system and powerful concrete pump, with minimal pulsation, to distribute concrete continuously, quickly and evenly.

1. 360 degree injection nozzle system delivers high quality mix.

2. Sturdy telescopic boom (Compacta+) with load optimized design and a patented linear play free slide system.

3. 2 x 1000 liter container for liquid accelerator.

4. ROPS and FOPS certified cabin.

Tomasz Kowalkowski
Manager of Machinery and Equipment, YIT

Ronny Johnsen
Operator, YIT

MeYCo Me5

Dependable mobile concrete spraying

Plastic parts are formed for the highest cement output rate, currently operating at 70 percent of the MEYCO ME5’s capacity.

The tunnel face in Ljøkelsvatn, western Norway.

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More: yitgroup.com

Dependable mobile concrete spraying

The MEYCO ME5 is designed for underground construction projects with medium to large openings. The machine incorporates a precise dosing system and powerful concrete pump, with minimal pulsation, to distribute concrete continuously, quickly and evenly.

1. 360 degree injection nozzle system delivers high quality mix.

2. Sturdy telescopic boom (Compacta+) with load optimized design and a patented linear play free slide system.

3. 2 x 1000 liter container for liquid accelerator.

4. ROPS and FOPS certified cabin.

Tomasz Kowalkowski
Manager of Machinery and Equipment, YIT

Ronny Johnsen
Operator, YIT

MeYCo Me5

Dependable mobile concrete spraying

Plastic parts are formed for the highest cement output rate, currently operating at 70 percent of the MEYCO ME5’s capacity.

The tunnel face in Ljøkelsvatn, western Norway.

The new power station is a rebuilding of two older stations from 1920 and the 1950s, respectively.

Planned delivery: 2021

Ronny Johnsen
Operator, YIT

YIT GROUP IS the largest Finnish and Northern European construction corporation, holding markets in Northern and Eastern Europe. YIT has over 10,000 employees and recorded combined annual revenues of 3.8 billion euros in 2017. YIT Norway holds a leading position within paving and infrastructure, specializing in tunnel construction with a focus on power plants and road projects. In 2018, YIT merged with Lemminkäinen and significantly improved its capacity in paving, tunnels and road maintenance.

Ljøkelsvatn power station, Etne, Norway

In November 2018, builder SKL commissioned YIT to build a 5 kilometer 22 m² water tunnel and a power station inside the mountain, with a capacity of 163 GWh.

YIT uses one MEYCO ME5 concrete spraying rig from Epiroc to cover and reinforce the entire tunnel wall and ceiling.

The new power station is a rebuilding of two older stations from 1920 and the 1950s, respectively.

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No one should get hurt when performing their daily duties. The essence of safety at work is quite simple – but there are challenges along the way. Social and psychological factors have to be given attention in tandem with physical measures, and globalization can be a double-edged sword.
The safety puzzle

When the work gained momentum, it largely focused on identifying and eliminating mistakes. Nowadays, it is also important to build a healthy culture. The view of safety has changed over the years – and new challenges are waiting around the corner.

If you had to venture a guess, when would you say the term “safety culture” came into being? Can it be traced back to the industrialism of the 19th century? Did it arise when the Western world was getting back on its feet after World War II?

The correct answer is 1986. After investigating the Chernobyl nuclear accident, the International Atomic Energy Agency, IAEA, found that a poor safety culture was a contributing factor. In other words, taking a holistic view of safety and risks in working life is a relatively new concept, even if safety work generally predates this. Research in this field gives you a quick picture of its development.

"From the 1800s to the post-World War II era, there was great focus on safety and technology, and physical design," says Marianne Törner, researcher in Occupational and Environmental Medicine at Sahlgrenska Academy, University of Gothenburg.

"The focus then began to shift to what role the individual played in the accident occurring, and in the 1970s and ’80s, there was a lot of research into interaction between humans and technology."

The research eventually influenced legislation. For example, the International Labour Organization, ILO, adopted the Occupational Safety and Health Convention in 1981. Since then, the concept of safety culture has been introduced, and holistic thinking has grown in importance.

"Humans are social beings and are good at working together," says Marianne Törner. "We learn from each other, draw conclusions and create a shared view of what applies. Culture is a social infrastructure within organizations and groups, and explains why people act the way they do."

The creation of a safety culture leads to the creation of a safety climate, which has been described as a group’s shared perception of policies, procedures and practices in relation to safety. It is here that managers play a key role. The rules must be perceived as relevant, and managers must communicate that safety is something that is valued.

"They should show that the organization cares about the individual’s safety and well-being, and also appreciates the employees’ contributions," says Marianne Törner. "Each individual should be given responsibility with reasonable conditions. This increases the likelihood of having employees who are ready, willing and able to work for safety. And it needs to be okay to sometimes fail."

Another example is the book Ten Pathways to Death and Disaster, written by Michael Quinlan, Emeritus Professor of Industrial Relations at the Sydney School of Management. He reviewed fatal accidents in the mining industry and other high hazard workplaces in detail and was able to identify ten pattern causes.

"The pattern was the same in all industries, and the more detailed the investigation, the greater the number of pattern causes that emerged," says Michael Quinlan. "A serious incident can always occur, but the greater the number of safety deficiencies, the greater the probability. Where there are a lot of latent failures or deficiencies in the system, all it takes is a trigger factor to be a disaster to become reality. A lot of lives can be saved by correcting deficiencies."

Michael Quinlan points to the importance of systematic safety work at different levels.

"It is important that the rules are actually followed," he says. "How can a company have really good safety statistics in, for example, but much worse in Africa? I would venture to say that the explanation is weak trade unions, and governments that will do anything to attract jobs to their country."
Håkan Olsson, Deputy Director-General, Swedish Work Environment Authority

He continues: “The safety work has to be well developed, and there must be feedback loops. The mining industry in Australia has a robust system, not just because the mines have their own audit systems. There are also government inspectors and union safety reps, all with great mandate. They can shut down operations if necessary.”

Safety work is at different levels in different parts of the world. In simple terms, you could say that conditions are better in stable democracies. One country that has come a long way is Sweden. Håkan Olsson, Deputy Director-General of the Swedish Work Environment Authority, says that the general development in the field of safety has gone from detailed regulations to an awareness that safety is a complex issue that must permeate all levels.

“If you look within the EU, there are differences depending on whether the work environment authority also has labor law legislation within its sphere of responsibility,” he says. “This is the case in half the EU countries, and in such case these issues are given higher priority than those related to safety and the environment.”

He continues: “In Sweden, employers, authorities and trade unions have traditionally collaborated in work with safety issues, and this has yielded results. But, one should be aware that work environment efforts take time, so it is important that countries that have not progressed as far get both support and a little push in the right direction.”

What future challenges do you see in the field of safety? “Globalization makes the workforce more mobile, so it is important to keep an eye out for companies that turn a blind eye to occupational health and safety to get a leg up against the competition. The legislation must also address new forms of employment and be adapted as jobs change or disappear as artificial intelligence and automation gain ground. Development moves quickly and it is important to look at what impact this has on safety.”

JUST IN CASE

What if something goes wrong?

THINGS DO NOT always go according to plan, so it is important to have a process that regulates how to treat an unwanted event. Within the mining industry, a Trigger Action Response Plan (TARP) is a fairly common tool. In particular, it is used for managing critical situations from a mine operations safety perspective. A typical TARP document sets out a certain set of conditions (or “triggers”) and a set of actions that mine managers and supervisors must follow when these trigger events occur. TARPs also typically include a number of different trigger levels, each with a set of responsibilities assigned to mine personnel to take action on as necessary.
In a dusty and noisy tunnel, Patrik Persson, Service Engineer from Epiroc Sweden, is standing with service technicians and operators next to the Scooptram ST1030 loader. “So, what should we check next?” asks Persson. A service technician points at a safety pin that locks the center hinge and boom. The group of people walk around the loader and carefully check each safety item, such as oil and brakes. Persson explains what condition each item should be in before the loader is turned on, and a safety checklist is ticked.

“For instance, operators must perform a brake test before every shift,” he says.

Seeking out on-site training, Patrik Persson, Service Engineer from Epiroc Sweden, trains technicians and operators next to the Scooptram ST1030 loader at the Oyu Tolgoi mine in Mongolia. Persson discusses the importance of safety checks during machine maintenance to ensure smooth operations.

Sustainable mining requires holistic solutions. It is not just productivity and efficiency that are vital – everything related to safety needs to be in place too. Mining & Construction Magazine visited Oyu Tolgoi mine in Mongolia to find out more about an award-winning collaboration.
As a leading productivity partner for the mining and infrastructure industries, Epiroc delivers products from Product Companies via Customer Centers to end customers. “Epiroc builds safe and reliable machines and we continuously monitor the performance of Epiroc equipment in the field. If safety-related concerns are identified, we immediately take action. The voice of the customer is of utmost importance, and customer feedback is key ‘Safety is an essential part of our culture’,” says Alfred Lawrence. He continues: “Safety always starts with you. It is up to the individual to take the necessary precautions to avoid accidents, which is why we at Epiroc incorporate safety into our culture and always put safety first.”

At Oyu Tolgoi, Epiroc Mongolia provides maintenance services for 32 pieces of equipment: mostly underground drill rigs, but also two new loaders – the Scooptram ST14 and Scooptram ST1030. The team consists of more than 100 people, including managers, supervisors and technicians. “We started with seven machines and 30 people,” says Project Manager Alfred Lawrence. “We have done it safely, having seen a lot of personal development not only in technical skills, but also in Ouy Tolgoi’s safety awareness.”

He continues: “Safety is always the first topic to be addressed at the start of each shift. We discuss safety issues and invite team members to talk about their safety experiences. That’s important to us because we don’t want to see people injured. People have the right to come to work and be safe.”

Oyu Tolgoi LLC requires its contractors to live up to high safety standards. Lost time injury (LTI) is one of the main indicators for safety performance, and each contractor’s safety initiatives matter – adding to the site’s overall safety. Epiroc’s approach has been successful too. When Oyu Tolgoi LLC evaluated safety performance among its contractors, Epiroc received the Safety Recognition award for the first quarter of 2018 and the Best Safety Performance Mining Contractor award for the second quarter of 2018.

“What we call a safety initiative is identifying any hazard and making sure that it doesn’t become a risk to health and safety,” says Alfred Lawrence. “Simple things can often have a big impact. For example, reducing a tripping hazard underground. If someone had slipped, it could have led to anything from a broken leg to a loss time injury.”

After the training for safety checks in the tunnel, Patrik Persson and his service technicians move to another tunnel – a bit wider than the previous one – for brake tests. They pass through the tunnels using their helmet lights not just for light- ing the way, but also for giving signals to make sure there are no incidents when confronting machinery, until they reach the designated spot where they perform brake tests. Patrik Persson stands close to the tunnel wall, the spot designated for people to stand, while other vehicles pass through. He watches the operator driving the Scooptram ST1030 loader and nods his head when the operator stops the loader.

Patrik Persson and his service technicians are an underground workshop. Before entering, they stop in front of a red and white safety barricade ribbon, signaling to technicians inside the workshop with their helmet lights before getting the proverbial green light to go in. Today, there is a sign outside reading “CAUTION! Commissioning OR Live Testing,” written in both English and Mongolian. Inside the workshop, Persson stands next to the Scooptram ST1030 loader with other technicians. They talk continually since the technicians are also eager to advance their knowledge about the loader. Thanks to Persson’s training, the Scooptram ST1030 will be put into operation soon.

Q&A

Christina Lindén
Manager Technical Service, Field Service Operations, Mining and Rock Excavation Services

As a leading productivity partner for the mining and infrastructure industries, Epiroc delivers products from Product Companies via Customer Centers to end customers.

What benefits does Global Field Service bring to Epiroc customers?

Through Epiroc’s technical support we continuously collaborate with customers, Epiroc Customer Centers and dealers to enhance competence in relation to our products and offerings. Our job is to support our customers in achieving outstanding performance.

What are the most common concerns from the customer’s side?

The most common concerns we have received are related to service and maintenance, machinery availability and the environmental impact of our customers’ operations.

How much of your work is dedicated to safety issues?

A significant part of our work is dedicated to safety issues. “Epiroc builds safe and reliable machines and we continuously monitor the performance of Epiroc equipment in the field. If safety-related concerns are identified, we immediately take action. The voice of the customer is of utmost importance, and customer feedback is key. Safety is an essential part of our culture.”

How has Global Field Service developed over time?

As a market leader, we collaborate with our customers to increase safety and minimize the environmental impact of our customers’ operations. We strive, by developing the technologies required to enhance our customers’ operations and by continuously adapting the skill set of our people.

In Focus: Safety first

Safety always starts with you. It is up to the individual to take the necessary precautions to avoid accidents, which is why we at Epiroc incorporate safety into our culture and always put safety first.

Safety is a subject that is both easy and complex. It is easy to understand what it stands for yet complex in how it is applied. Safety precautions differ in different parts of the world. As part of our competence development process, we focus on the safety aspects of the product, such as hazards and the safety features incorporated in the product. One of the main goals of Epiroc’s competence development is to give you the ability to work safely with our products.

At Epiroc, we believe there is always a better way. We are continuously enhancing the competence development process in order to increase safety and efficiency for our customers. Safety starts with you, and that is why we believe that competence development is a vital part of achieving a safe work environment for all.
“Overall, we receive very good evaluation results for our safety performance from our customer among all its contractors”

Bayar Torguud
Business Line Manager, Epiroc Mongolia

Looking for safety hazards and improving the work environment becomes a habit and an attitude each employee has towards their work – not just once a month, but during all working hours. “Overall, our customer gives us a very good rating for our safety performance among all of its contractors,” says Bayar Torguud. “That’s assessment for our employees’ work attitude and their initiatives. They also apply many safety standards to their daily work, such as weekly safety talks and Job Hazard Analysis (JHA), to be conducted before each job for workshop and warehouse.”

The SCOOPTRAM ST1030 loader with its 10-tonne capacity is the second Epiroc loader model to operate in Oyu Tolgoi’s underground mine, the first one being a Scooptram ST14. Patrik Persson thinks that his training sessions have provided useful knowledge for Oyu Tolgoi-based employees. “The training is more about what kind of machine they operate and what kind of functions this loader has,” he says.

According to Jim Barron, Epiroc has mostly provided maintenance services for its drill rigs here at Oyu Tolgoi thus far, but services are expanding with the new loader. “As we develop, we set up more safety procedures to assist technicians and operators rather than just doing a job. We perform more formal documentation and create a hazards analysis report every time. It’s more a case of step-by-step procedures to perform a job safely,” he says.

Bayar Torguud concludes by highlighting the fact that advancing technology requires even more training. “It’s very important to train people to operate machines and equipment in the correct order,” he says. “Advanced machining technology can still lead to risks if things are not operated correctly. For all operators and technicians, it’s crucial to operate and perform machine maintenance in the correct order, to understand signs or warnings and to respond quickly.”

Andrew Curtis
Mine Manager Underground, Oyu Tolgoi LLC

How is safety handled at Oyu Tolgoi?

What are Oyu Tolgoi’s main safety criteria when dealing with contractors?

“We expect all contractors to work with the same high safety standards as the rest of the Oyu Tolgoi operation. They are required to adopt and embrace the Critical Risk Management (CRM) system that Oyu Tolgoi uses to manage fatality risks. The safety of contractor personnel is as important as the safety of our own employees, so we require transparent incident reporting, investigation and injury management, and that the health and wellbeing of all personnel is always put first.”

How do Epiroc and Oyu Tolgoi cooperate on safety?

“We work in close collaboration to identify hazards through risk assessments, hazard reporting, management of change, leadership time in the field and CRM. Every person, from the operator and maintenance technician to the supervisor and leadership team in the organization, has a part to play in the CRM process. Safety is at the forefront of every meeting.”

How has Epiroc’s safety work improved your operations?

“Safety is an outcome of operational control. When the systems and processes used in daily work are well designed and implemented, and work occurs in a controlled manner, the outcome is a safe and productive workplace. Epiroc has implemented 55 initiatives, and has high standards for work area housekeeping and discipline in their working practices. All this adds up to a safe and productive workforce.”
In 2011, the Fukushima plant in Japan was hit by a magnitude 9 earthquake followed by a massive tsunami, ultimately leading to widespread dispersion of radioactive materials and the forced evacuation of 200,000 people. The accident was exacerbated by human error, but the primary cause was that the ESWS system failed due to tsunami-flooded backup diesel generators. This led engineers to try to vent steam to relieve reactor pressure, which in turn blew out the containment walls. Japanese authorities have long-term plans to increase safety, which include coastal levees and emergency power source vehicles on sites.

FEW INDUSTRIES ARE as concerned with safety as nuclear energy production plants. Safety measures are studied meticulously from the very beginning of the planning phases, and take into consideration everything from rock foundation stability, earthquake frequency and grid connections to habitation proximity, insider sabotage and potential terrorist attacks. Still, extraordinary events can make it necessary to perform a scram – a rapid shutdown of the reactor. The procedure involves three major safety steps: shutting down operating reactors, cooling them down to remove heat from the nuclear fuel, and containing radioactive materials. In most plants, over twenty redundant safety systems ensure that these three steps can be performed.

The primary means of breaking the nuclear chain reaction is the insertion of neutron-absorbing control rods into the core. All reactors have some form of backup cooling system. One example, used in boiling water reactors, is a standby system that can rapidly flood the core with a solution containing boric acid in case of problems.

THE NEXT STEP involves cooling the core, which is done by the safety-critical Essential Service Water System (ESWS). This circulates water that cools heat exchangers and other components before dissipating the heat into the environment. In case the ESWS fails, there is a host of emergency core cooling systems, all of which are dependent on electricity. If the plant is cut off from the main grid, there are backup systems in the form of diesel generators, motor generator flywheels and batteries.

THE LAST STEP is containment. The fuel core is contained in a sealed metallic or ceramic layer of cladding, which in turn is contained within the actual reactor vessel. Surrounding this is a primary – and sometimes a secondary – containment consisting of metal and concrete. Ventilation and gas treatment systems catch any airborne radioactive isotopes. And finally, in the unlikely case of a full meltdown, there is a concrete core catching system designed to stop an escaping core from melting through the plant floor.

Nuclear belts and suspenders

The Dukovany Nuclear Power Station is the first of its kind in what is now the Czech Republic. All four reactors are still in operation and the power plant supplies approximately 14 TWhr of electricity to the national power grid annually.

In Focus: Fukushima 2011

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SURVEY

FUTURE SAFETY

Going forward, what do you consider to be the main goals in the field of health and safety at work?

What needs must be met in order for those goals to be reached?

Cecilia Andersson
Work Environment Expert, Svevin (Swedish Association of Mines, Mineral and Metal Producers), Sweden

“We have a zero vision for work injuries, so that’s still the main goal for us. This also includes organizational and social factors that can affect health and safety at work. Another goal concerns safety related to new technical development. Many risks have decreased or even disappeared, but we will have new risks related to the new technology to prevent. We need to be one step ahead and think about new types of risks that may occur with, for example, automated vehicles, remote control and borderless work.”

Marianne Thysen
European Commissioner for Employment, Social Affairs, Skills and Labour Mobility, Belgium

“Europe is a frontrunner in protecting workers against health and safety risks, and we want to keep this up in the future. We should continue updating legislation in line with scientific, advances and keep an eye on new and emerging challenges. In doing so, it is vital that we keep in mind the realities of micro- and small enterprises. They need more support as they face the biggest challenge of putting these rules into practice.”

Jan Johansson
Professor at Luleå University of Technology, division: Humans and Technology, Sweden

“When talking about safety, it is easy to get hung up on technical solutions and automation. I think it’s important to not be that narrow, but instead to broaden the concept of safety to include the creation of attractive workplaces that empower employees and challenge their creativity. Even automated systems need maintenance by humans. By creating a sense of well-being in the workplace you make room for a safety culture to blossom.”

SEVENTHINGS

Want more input on this theme? Three people from different fields give their views to help paint a broader picture.

01

The Peltzman Effect

The tendency to have over-confidence in safety measures, leading to riskier behavior. For example, the introduction of anti-lock brakes in cars actually led to a rise in fatal accidents since people using them felt they could drive more aggressively. People are only as safe as they choose to be.

02

Inoculation

Exposing immune systems to weakened strains of pathogens to trigger antibody production, thus providing immunization, safety was the discovery of the year in 1798. Since the start of vaccination programs, deaths from diseases like measles and smallpox have plummeted.

03

Procedures

A procedure is basically an algorithm for humans. Standardizing tasks – and the systems and processes according to these – guarantees identical results every time, ensuring safety and other factors. Safety checklists are a must in any hazardous environment.

04

Parachutes

A piece of cloth to increase air resistance? When you put it like that, it doesn’t sound overly exciting. But the application of parachute technology to various fields like air safety, space travel andagiter racing has certainly saved numerous lives.

05

Ergonomics

The science of comfort, some say. The study of human interaction with products, processes and systems according to steerers. In any case, ergonomics has greatly helped to reduce human error, increase productivity and enhance safety over the years.

06

Airbags

Airbags have come a long way, from the sometime lethal explosive contraptions book in the 70s to the slick, efficient and life-saving devices surrounding us on all sides in modern vehicles. These days, even cyclists can protect their heads with airbags.

07

Clothes

Ever since humanity migrated from the confines of its ancient African home, we human animals have needed protective gear to shield ourselves from our surroundings; ranging from fur and woolen underwear to body armor, hard hats and diving suits.

08

Safety above all

In the words of Thomas Hobbes, life in the state of nature was “solitary, poor, nasty, brutish, and short.” Here are a few things society has accomplished to make us safer – and one human trait that hasn’t.

More info on safety and health

SEVEN THINGS

Safety above all

In the words of Thomas Hobbes, life in the state of nature was “solitary, poor, nasty, brutish, and short.” Here are a few things society has accomplished to make us safer – and one human trait that hasn’t.

Innovation is essential for progress and for successful business. But how do you accomplish it? Make sure not to miss next issue’s Feature.

Christian Tarras Ericsson  Shutterstock
The daily tasks as an assembly engineer are varied – including production planning, material scheduling and quality issues – causing Jitendra Bhamare to face challenges that he relishes.

“Records are meant to be broken”

Assembly engineer Jitendra Bhamare ensures that the drill rigs in Nashik, India are assembled on time. Last year, he and his team reached the highest production level ever, but he already has his mind set on going further.

“A normal workday for me is filled with different activities; surprises, fun and many times challenges – which I love. Being faced with challenges pushes me out of my comfort zone, sharpens my skills and shifts the paradigm. It inspires me to make the impossible possible. As an assembly engineer, my daily work consists of production planning, material scheduling, quality issues, follow-ups and resource allocations. I am also part of a new product development team and our prime focus is on meeting monthly production targets, using optimal capacity and achieving higher efficiency.

THERE IS A VAST SCOPE of creativity in my daily work. Fixture developments, process settings and building the competence in my team are some of the areas where I can use my creativity to execute day-to-day activities in a smoother and more effective way. The biggest challenge in my work is to achieve set monthly production targets. Customer needs are getting more demanding and production targets are growing. To tackle this challenge, we have implemented flow assembly in our production line. While working on a monthly production plan, we take into consideration the delivery schedule, our capacity and material inflow for the respective month. To maintain a smooth assembly workflow, we make sure that the workload is distributed equally among all the assemblers. Our management has given us tremendous support in establishing this production flow assembly. It certainly contributed to us reaching the highest production of drill rigs from Product Company Nashik in 2018, compared to previous years.

HOWEVER, I BELIEVE that records are meant to be broken, and with dedication and determination we will be aiming for even greater achievements in the coming years. I always accept new challenges and I am sure we will continue to achieve a world-class quality of rigs that are completely customer-oriented and value-adding for all the stakeholders of Epiroc.”

JITENDRA BHAMARE
Age: 32
Job: Assembler, Product Company Nashik, India
Joined the company: 2010
Best part of the job: “Adding the finishing touches to the products that are to be offered to the customers.”

Epiroc’s greatest asset is our employees. We take pride in offering them an outlet for their creativity in order to provide the best possible value to our customers.
Rock reinforcement has become the bottleneck in the drill and blast tunneling process. Mechanized rock bolting drill rigs are usually very efficient in installing rock bolts and mesh. However, with deeper mining operations, increasing rock stresses often lead to increased fracturing of the rock, which leads to difficulties in rock bolting.

In LKAB underground operations in northern Sweden, it can take up to eight hours or more for their cement grouted rock bolts to cure and be able to hold loads from the rock mass. With increasingly fractured ground, the installation of these cement grouted rock bolts is becoming harder to achieve with acceptable productivity figures.

“We started a project at the LKAB mine in Malmberget with the main objective of making the rock bolting process twice as fast as LKAB’s existing bolting systems,” says Peter Bray, Product Manager at Epiroc. “We were pretty much given a blank slate and brainstormed a wide scope of ideas. We then whittled it down to the best approaches that could give reasonable results within a reasonable time frame.”

An existing solution to cement grouted bolts is to replace the grout with resin cartridges, which results in a substantially faster setting time. But the cartridges are difficult to install in fractured ground. What if you could instead inject the resin with the bolt already in place?

“We partnered with resin suppliers to develop a pumpable type of resin with fast setting times and a ketchup-like consistency to prevent the resin from dripping from the bolt hole,” says Peter Bray.

In parallel to the resin work, an existing type of rock bolt – a Self Drilling Anchor, or SDA – underwent modification to allow the pumping of the resin. The SDA bolt is essentially a hollow steel tube with a drill bit welded to the end. It acts like a drill steel during installation and like a bolt when installed in the rock.

A major hurdle to overcome during the development of the pumpable resin system was finding a solution for flushing the resin mixer elements to enable repeated use of the mixers without clogging. After several trials, a simple solution was discovered that provided robust and reliable flushing while maintaining a closed system with no release of unmixed resin. Finally, all aspects of the design were working in harmony.

A modified Epiroc Boltec E machine performed a four-month field test at LKAB’s Malmberget underground iron ore mine between May and August of 2018, with the machine being operated during the day shift. The results achieved were very promising.

“We improved productivity by 64 percent compared to existing cement grout solutions, which was quite acceptable to LKAB. The operators felt that productivity will improve even more once they have more experience with the machine,” says Peter Bray.

One of the major advantages of the pumpable resin system is that it requires significantly less cleaning and maintenance compared to cement grout machines, which need cleaning several times per shift.

“It’s very low maintenance. At the end of the shift, the operator simply turned the Boltec off and walked away. They loved the machine, and were very upset when the field test ended,” says Peter Bray.

Pumpable resin with SDA bolts has also been tested with extension drilling out to 15 meters in total bolt length with excellent results. Extension bolting further adds to the flexibility of the system, potentially replacing cable bolting in poor rock conditions.

“In some rock conditions, this machine provides the best solution available,” says Peter Bray.

www.epiroc.com/rockreinforcement

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“In some rock conditions, this machine provides the best solution available,” says Peter Bray.
Electrifying mining

The electric vehicle revolution is coming to mining – cleaner machines will not only reduce the industry’s carbon footprint but will mean workers can breathe more easily.

Rather than a roar, the vehicle only gives out a quiet growl as it advances through the mine’s muddy tunnels. More importantly, there are absolutely no emissions and very little heat.

“I have never seen a machine like this. There is no pollution, no gases,” says operator Yordan Rojas. “It is more comfortable for the operator and everyone else there.”

DIESEL ENGINES CAN emit large quantities of carbon monoxide and other pollutants, which can be damaging to the workers’ health.

“The diesel engine is quite dirty, and the amount of smoke it generates sometimes prevents us from working,” the fourteen-year veteran of Atacocha explains.

“A clean machine also improves productivity,” adds mine manager Rudy Espinoza.

“With the diesel Scoptram, we have to wait thirty minutes for the gases to disperse before we can send in personnel to perform the next task,” the engineer explains. “With this machine, they can go straight in.”

And the electric motor seems just as powerful as the diesel version, notes Rojas.

The one disadvantage is that, unlike a tank of diesel, the battery does not last a whole 12-hour shift. However, changing the battery has proved a cinch – using an overhead crane, Rojas needs just fifteen minutes to remove and replace the battery.

This is the first time one of Epiroc’s electric vehicles has been deployed outside of Canada and it is the first to be operated at high altitude (the Atacocha mine sits more than 4,400 meters above sea level). Unlike diesel engines, electric motors do not lose capacity in the rarified air of the Andes.

Given the advantages, Nexa wants to electrify its whole mine fleet within five years. The problem is that electric versions are not yet widely available for most of the vehicles used in open pit and underground mining.

The Epiroc Scoptram ST7 Battery, an electric version of its narrow vein loader, is testing the next generation of its narrow vein loader.

Tom Azzopardi
Juan Carlos Recalde

|SUSTAINABILITY|}

Canadian team Diamonds in the Rough proves that women can do mine rescue just as good as men.

The teams are assessed based on how they approach problems, whether they use the right equipment and whether they treat injuries properly. The participants must be certified and experienced in mine rescue.

“The team work is the key. We formed a strong bond after only ten days of training and living together, which was crucial for us. I hope we can encourage more women to compete,” says Kari Lentowicz.

THE FACT THAT Diamonds in the Rough ended up in 15th place out of 25 teams made her very proud – but the biggest reward would be for the team’s feat of influencing countries that do not allow women underground.

“Overall, the conditions for women in the mining industry must be improved and comments that women aren’t good enough shouldn’t exist,” says Lentowicz. ☞
Running across America, from Pittsburgh, PA in the east to Cove Fort, UT in the west, Interstate 70 took 36 years to complete. It is one of the biggest public works projects ever undertaken in the United States. The last link involved threading the four-lane highway through the limited space at the bottom of the Colorado River gorge east of Glenwood Springs in Colorado. This involved constructing two 1190 meter tunnels through a building containing lighting and ventilation controls, and excavating approximately 250,000 cubic meters of rock. To ensure efficient drilling, contractor Frontier Kemper decided to switch from pneumatic equipment to hydraulic drilling jumbos. Two Atlas Copco Rocket Boomer H245 rigs were employed, along with Bolbos H1251 rigs for bolting, and the performance was well beyond the customer’s expectations. This contributed to the Hanging Lake Tunnel being completed way ahead of schedule.

Portfolio:
Hanging Lake Tunnel

Epiroc is a new company with a long and rich history, dating all the way back to 1873. In each issue of Mining & Construction, we take a glimpse in the rearview mirror.
OUR CUSTOMERS ARE located all over the world and so are we. There is always an Epiroc office to turn to, making us truly local. At the same time, we are a global enterprise with worldwide resources. We have Customer Centers in 33 regions. In each one, there are one or more Service Centers. All this supports our goal: Count on us to listen, collaborate and deliver the right solutions for you.

AT YOUR SERVICE
Closer than you might think

SOUTH EAST ASIA is one of Epiroc’s fastest growing markets, and the future looks promising. The goal for 2019 is to increase sales in Vietnam, Laos and Thailand through newly appointed distributors TCMP, and Italthai Industrial, as well as the new Epiroc presence in Laos. Epiroc is also on the verge of securing a distributor in Cambodia. Somnath Dutta Majumdar, Regional General Manager Southeast Asia (North), elaborates.

What will the new distributors mean for both your customers and Epiroc?
“Both distributors in Thailand and Vietnam are local companies. Our distributors are closer to our customers and the local market. They understand our customers’ needs and wants, which will improve our ability to service them. The distributors will strengthen our visibility in both Vietnam and Laos, and Epiroc will gain an even better reputation.”

What was important for Epiroc when choosing distributors? Could you describe what process was involved to reach the agreements?
“It took two years before agreements were finalized, and all of our Epiroc business areas were involved. It’s really important to have a common vision and share the same passion in what we do. We have already seen that our new partnerships are delivering results.”

Find Epiroc in your country.
Welcome to the fold

Manually folding an 11-meter long feed from vertical to horizontal position can easily cause damage to a surface drill rig. **Erik Hultgren**, one of the persons behind Auto Feed Fold, explains how the process can now be automated.

**Why is an automated feed folder needed?**

“We wanted to develop a product that could perform feed folding completely without damaging the drill rig. Auto Feed Fold consists of two sensors that tell the software where all parts of the boom and the feed are in relation to the rig. It has primarily been developed as a separate option for surface drill rigs in the Epiroc SmartROC range.”

**How will this product improve your clients’ business?**

“It minimizes the risk of operator mistakes because it avoids damage to the rig that has to be repaired. The product also increases user-friendliness; the machine operator just needs to press a button instead of having to do manual adjustment from the cabin, where sight can be limited. It’s also an advantage when using the BenchREMOTE operator station to remotely control the rig from a distance.”

**What were your biggest challenges during the development phase?**

“It was developing the mathematical model that describes where each part of the boom system is in relation to each other. We also had tough demands for speed because we wanted the folding process done safely without losing valuable time.”

**How can a rig be upgraded?**

“You need a software upgrade, new cylinders with integrated sensors for feed swing and feed dump, and an electrical kit. Initial start-up requires calibration of sensors, start currents and setting the target transport position for all joints. A certified service technician should therefore perform the upgrade.”

**Auto Feed Fold**

- Minimizes damage to the rig
- Developed as a separate option for SmartROC rigs
- An advantage when the rig is controlled remotely with BenchREMOTE
- Currently available for the upgraded SmartROC D65 rig, launched in April 2019