

MINING & CONSTRUCTION

MECHANIZED ROCK EXCAVATION WITH ATLAS COPCO – NO 3 / 2012.

Mexican masters of mining

Tunnels ease traffic on India's highways

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Atlas Copco



We are currently celebrating our 60th year of operations in Mexico and next year will be Atlas Copco's 140th year in business. Back then, in 1952, things were certainly different. Hard, manual labour, extreme temperatures, vibration, noise, accidents and injuries were a way of life.

Since those dark, backbreaking days, there has been an amazing transformation. Today's mining industry is a fantastic environment characterized by automation, efficiency, high productivity, low energy consumption, ergonomic design and not least, safety.

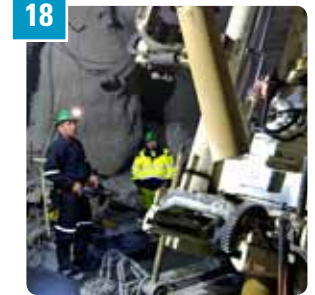
As you can read in this issue of M&C, the great mines of Mexico, such as the Fresnillo mines, are typical examples of this process of modernization and mechanization – and we are proud to be a part of it.

But that doesn't mean we can sit back and rest on our achievements. In the current economic climate, it is more important than ever to find more efficient ways of doing things and support our customers in their efforts to find sustainable solutions.

Like many other parts of the world, Mexico's minerals and metals continue to be in high demand and we are responding in all areas.

Innovation and commitment to the long-term needs of the industry has been the driving force for success in Mexico over the past 60 years. We intend to remain just as dedicated for the next 60 years and beyond with an even stronger focus on safety and the environment.

CARLOS CAICEDO
General Manager, Mining and Rock Excavation
Atlas Copco Mexico



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SAFETY FIRST

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On schedule: Atlas Copco service technician Abhoy Biswas with the Atlas Copco Boomer E2 C.

“Our suppliers must have technical competence and advise us of our options.”



C. Sridhar, Managing Director of NEC

Choosing a supplier

Navayuga was formed in 2006 and now has more than 1 000 engineers working on projects in India and overseas and says it prefers to work with one equipment supplier per assignment.

Sridhar explains: “When it comes time to procure new equipment, we don’t want to waste time debating which manufacturer to buy from. We want only a 30-minute conversation of a fair cost and an arrangement for when it will be delivered. That’s it.”

Several critical factors influences this decision. “First and foremost, the manufacturer has to be knowledgeable,” continues Sridhar. “We must be able to trust that the company has expert knowledge to advise us of our options. They must know the work we have to do as well as we do – not just sell equipment. We need

to feel that we trust the company for the value of its equipment and that includes service and support which are excellent with Atlas Copco.”

As an example, Sridhar cites the purchase of a two-boom Boomer equipped with the Rig Control System (RCS). Its speed, precision and output more than offset the additional cost over a direct control system. The Boomer E2 C and XE3 C rigs were good value.

Sridhar concludes: “We are very happy with Atlas Copco for the technical competence and value of their drill rigs, and especially for their after sales support. We consider them to be family.”

The computerized controls make the six Boomer rigs easy to use. In the Qazigund–Banihal tunnels they employ lasers for positioning and set-up. Two alignment plates on the boom are aligned



India's longest tunnel is taking shape

Construction of the longest road tunnel in India is advancing as planned with newly trained operators and equipment.





projects in 18 states in India and four other countries.

Its objective is to transform India's road systems and thereby drive economic growth. Coupled with this, ITNL exercises a broad program of social responsibility (Parivartan) through which it provides education facilities and support for communities along the highways it builds.

IL&FS has awarded the contract to Leighton Welspun Contractors India Pvt. Ltd., on an EPC basis. Using a fleet of seven Atlas Copco drill rigs, the tunnel is being excavated according to NATM (New Austrian Tunnelling Method). The fleet includes four Boomer XE3 C rigs with ABC Total (fully automatic) and

three Boomer E2 C rigs with ABC Regular (semi-automatic).

Vassilis "Bill" Pouloupoulos, North Portal Project Manager, says: "Progress all hinges on one thing – the pace of the

face drilling rigs. If the rigs stop, everything stops. Our crews have the excavation cycle down to 10 to 12 hours and we are improving steadily. We are looking for three blasting rounds per day with two 12-hour shifts and I'm certain we will achieve it."

The tunnel enters and exits the mountain at an elevation of 1 200 m. When complete it will be 14 m wide and 10 m high. A smaller, 6 x 6 m escape tunnel is also being built alongside the main tunnel where Leighton is using Atlas Copco Häggloader 10HR-B loaders for mucking out into 35-tonne trucks. Cross passages will connect the main tunnel to the escape tunnel every 300 m for pedestrians and every 1 200 m for emergency vehicles.

Precision essential

The rock in this region consists mostly of sandy shale, mudstone, siltstone and soft sandstone, and drilling precision is of the utmost importance to avoid the extra costs associated with underbreak or overbreak.

Konstantinos Bastis, South Portal Project Manager, points out that this is where the automated features of the Atlas Copco rigs are proving their worth. A typical example, he says, is the Measure-While-Drilling (MWD) function on the Boomer XE3 C.

Pouloupoulos adds: "This rig has been used at the South Portal to verify what we expected to find in the rock mass. The escape tunnel runs ahead of the main tunnel so the rig is used for probe drilling, checking to see that the rock ahead is what we anticipate."

To meet the requirements, Leighton has developed a skilled drilling crew with the aid of Atlas Copco's Master Driller training program. Three months prior to the project, and before ever seeing a production drill rig, 30 trainee operators completed all three levels of the course – bronze silver and gold – using an Atlas

“ We will be successful because we have put the best people in the right places. ”



Vassilis Pouloupoulos North Portal Project Manager, Leighton Wellspun Contractors

THE STARS

of MINExpo



The world's biggest mining trade show – MINExpo in Las Vegas – was a record-breaking success. Some 52 000 people representing 36 countries attended, roughly 35% more than the previous show in 2008. The equipment and products on display showed why mining is safer, more productive and more efficient than ever. In this respect, Atlas Copco was clearly among the frontrunners, not least for providing a preview of the Pit Viper 311 rotary blasthole drill rig and the new Minetruck MT85 underground truck. M&C takes a closer look at these two outstanding concepts.

A brand new drill rig takes the stage

Pit Viper 311 is the first in what will be a new series of single- and multi-pass rotary blasthole drill rigs from

Atlas Copco. Called the PV-310 Series, the new rigs will be based on the same successful concept as other Pit Viper models

but will cover the 228–311 mm (9–12 ¼ in) hole range, thereby filling the gap between the PV-271 and PV-351 series.

The first rig, the PV-311, is typical of the new range – lighter in weight, more fuel efficient, comfortable, easy to use and service friendly. So what was the driving force behind the development of the rig and what are the main advantages for future owners?

The customer's needs

The process of designing any new drill rig at Atlas Copco always starts with the customers' needs, in this case the need to increase the efficiency of single-pass drilling in the 311 mm hole range with a 110 000 bit load.

The PV-311 offers bit changing above the deck combined with a single-pass depth capacity of 19.8 m (65 ft), or a maximum of 41 m (135 ft) with two additional 35 foot rods in the standard carousel.

The new rig also offers many of the upgrades originally developed for the PV-235 coupled with the successful design elements of the PV-351, including the drilling angle option of 0–20 degrees in 5 degree increments.



Early morning sunrise outside the Las Vegas Convention Center: Project Manager Iain Peebles experiences the comfort and visibility of the new cab while trammings the Pit Viper 311 to its display position at the Atlas Copco booth.



The PV-311, pictured above before its debut at MINEexpo 2012, is standard equipped with RCS Basic. This allows customers to start at a low level of automation and later add new functionality as their requirements change. RCS also provides the rig with a number of safety interlocks, protecting both the operators and the equipment.

Customers who are familiar with, or own a PV-351, will recognize these design strengths and appreciate the commonality of parts, and mines already using the PV-351 will see the advantage of adding the new PV-311 to their fleets.

Iain Peebles, Atlas Copco Project Manager, explains: "Our design team focused on maintainability and high productivity for this newest addition to the Pit Viper Series and our design plan targeted lifespan savings for the customer.

"We utilized many proven systems from our other Pit Vipers but made minor improvements to maximize the productivity and reliability of the PV-311 to save customers money in everything from fuel to extra maintenance."

Peebles continues: "We've come a long way since the Pit Viper series was introduced 12 years ago. Today, design technology and tooling has given us a big advantage. The computer modeling used today just wasn't available 15 years ago when my predecessors were first designing the Pit Viper series. We utilized computer drafting, finite element analysis, and structural calculation

tools to optimize the tower structure, minimizing the weight while maximizing the expected lifespan."

Savings in the tower

The tower is a key component for a rotary blasthole rig and Dustin Penn, Atlas Copco's Blasthole Drills Product Line Manager, says the new PV-311 tower will benefit maintenance. "As we have a deeper tower, we have been able to further improve our patented cable feed system. In addition to our auto-tensioning feature we are also using large diameter sheaves with sealed bearings. All that adds up to increased cable and sheave life, plus that this system requires less maintenance."

The upgraded and well proven two-speed rotary head, already used for the DM-M3, provides drill rotation. Penn adds that the new rotary head now operates with larger motors that offer better lubrication for increased spline and main bearing life. Furthermore, the previous head offered just 13.8 kNm (10 183 lb-ft) of torque whereas the new head offers a substantial increase to 17.5 kNm (12 900 lb ft) of torque at low



Easy service and maintenance: Above, the Pit Viper 311 rig's ground level access point and, below, the accessible filter rack.

speed (140 rpm) and 10.2 kNm (7 500 lb ft) of torque at high speed (240 rpm).

Service work around the new tower will be easier, too. Technicians will have the benefit of an access hatch that fully encloses the fiber-grate catwalk along the length of the tower. In addition, a Tower Access Restraint system enables them to secure their harnesses to a cable shuttle so that they are able



Above, the imposing Pit Viper 311 in place at the Atlas Copco booth at MINExpo. Right, close-up of the safety video camera.

» to move throughout the tower area leaving both hands free to carry out their work.

More options

The PV-310 series offers several options in its single- and multi-pass versions, starting with the engine. To match the customer's brand preferences and to meet regulatory demands, the Tier 4 engines are available with the Cat C32 and MTU 16V2000 and Tier 2 options can be provided with diesel engines from Cat, MTU or Cummins. A power pack with electric engine will also be available in the future.

Air compressors are also optional in both Atlas Copco and Ingersoll Rand models. At the outset, Atlas Copco Twin S3 and Ingersoll Rand 2 x 285 mm airends will be available, both capable of delivering 1 400 l/s at 7.5 bar (3 000 cfm at 110 psi).

An optional feature first developed for the PV-235 – the automatic hydraulic clutch – is also available on the new PV-311. The system allows the operator to turn off the compressor with the push of a button when

not in use. To engage the clutch, the operator hits a button on the chair's control panel.

Peebles says: "We found that in some cases over 50 percent of the time the engine is running, the rig is not drilling and the compressor is not needed. By disengaging the compressor during leveling, tramping, changing drill pipe, or idling, the engine uses less fuel. Component life can also be extended by changing the service intervals to actual hours on the compressor." (For more information see *M&C 2, 2012, Technically Speaking*).

RCS as standard

One high-tech feature that is not optional on the PV-311 is the Rig Control System (RCS) which is Atlas Copco's proven CAN-bus electronic control system. RCS Basic is standard and there are optional packages available including AutoLevel, AutoDrill, GPS hole navigation and teleremote control.

Low technology features also contribute



to productivity. The standard diesel fuel tank has a capacity of 2 650 liters (700 US gallons) and provides sufficient fuel for 12 hours of operation. Optional fuel/water tank alternatives are available providing sufficient fuel for the rig to operate for a full 24 hours before it has to stop for refilling.

Control and comfort

No other design feature distinguishes the new PV-311 from other drills in the Pit Viper family more than its cab. It is the result of a year-and-a-half of engineering that incorporates utility and comfort with high-tech control. From the center of the cab, which is fitted with a wall-to-wall, heavy duty removable mat and shaded windows, the operator's seat offers a full view of the platform and work area.

Advanced features include infrared touchscreens that feed drilling data to the operator while additional safety monitors show movement from a ground surveillance


system, and video feeds from closed-circuit television cameras.

Operators will especially enjoy the convenience of an optional refrigerator and microwave while they hum along to their favorite music fed through the USB connection. And they will also stay cool even in the world's hottest mines thanks to the 12 kW air conditioning system which includes a hydraulic compressor and a condenser fan that reduces overall machine electrical requirements.

Control and comfort

The cab's central electronics cabinet offers many benefits for the maintenance

technician. Service access doors open from floor to ceiling giving full access to all electronics. The well-lit cabinet allows open spaces for technicians to maintain the existing equipment and can add new modules and functionality as needed.

Penn concludes that the PV-311 is ideally suited for the copper and coal mines of Chile, Peru, Southwest U.S., Russia and Western Canada as well as the metals mines of Africa and Indonesia. And he predicts that the 90 m (295 ft) multi-pass PV-316 model will be the perfect match for the Powder River Basin in the U.S., Eastern Australia and the coal mines of South Africa, China and India. 

IDENTIFYING PIT VIPER DRILLS

The name Pit Viper represents the newest generation of blasthole drill rigs, leading the industry in features and performance. Existing models in the PV line-up include the PV-235, PV-271, PV-275 and PV-351. The new series is designated "31" which signifies the optimal hole size – 31 cm (12¼ in) diameter range. The last number identifies whether the rig is a single-pass or multi-pass machine. PV-311 is therefore a single-pass rig. When the multi-pass version arrives, the PV-316, it will have a depth capacity of 90 m (295 ft).

A world first in underground mining

Minetruck MT85 is the largest articulated underground mining truck in the world. Planned for launch in 2014, it is designed for demanding conditions and maximum productivity with a high focus on safety, ergonomics and operator comfort.

Ben Thompson, Atlas Copco Product Manager, says: "This truck is designed to fit the same drift dimensions of 50 and 60 tonne class trucks with one essential difference. It will haul 85 tonnes which gives a tremendous productivity boost in terms of fewer trucks and tonnes/kilometers per hour."

Thompson emphasizes that the Minetruck

MT85 truck is also fast and highly maneuverable on ramps and inclines. "This means that fewer cycles need to be made which, in turn, reduces the cost of transport in relation to the amount of material hauled."


Not only that, the Minetruck MT85 truck now gives mining companies a more cost effective way to haul ore in the mine and make it more attractive to go for deeper ore bodies via a ramp instead of sinking a shaft.

High capacity compact

The Minetruck MT85 has a high capacity but fits a small "envelope". It is 3.4 m wide and 3.5 m high, easily fitting into drifts of

6.0 x 6.0 m. And despite its length (14 m), it has an impressive turning radius of 44 degrees, which is largely thanks to its electro-hydraulic steering of the rear axle which gives maximum maneuverability.

Modularity and options

The Minetruck MT85 truck also offers a high degree of modularity and options. The dump box can be tipped at the side of the vehicle as well as at the rear. There are also two tailgate configurations (hinged either at the top or at the bottom), three engine alternatives (535, 760 or 1010 hp) as well as four-wheel or six-wheel drive to fulfill different customer's needs or mine requirements. 



A world first at MINExpo: The new Minetruck MT85, which will be introduced from 2014, has a capacity of 85 tonnes and is designed to increase productivity in underground operations at the same time as it improves safety and protects the environment.



Insight On



MINING



Behind the scenes at MINExpo 2012, a group of top executives representing the mining sector at Atlas Copco took time out for a roundtable discussion with M&C on the issues facing the industry and also shared their own visions for the future.

It was an impressive event, to say the least. A record number of suppliers and visitors from around the world all gathered in one place for three intensive days of interaction. As Greg Boyce, Chairman of the U.S. National Mining Association, said “it was the largest single assembly of mining equipment in history and the sheer scale of this showcase is a testament to the state-of-the-art technologies being used right across the industry.”

But although advanced technology has enabled the industry to modernize beyond recognition, it remains a tough business, strongly influenced by the ups and downs of the global economy and one where the struggle to maintain profitability is a constant challenge.

New climate, new priorities

As the buzz of the Las Vegas show was in full swing, M&C took the opportunity to sit down with a group of senior mining executives from Atlas Copco to get their views on the industry’s prerequisites, requirements and future direction.

The discussion focused mainly on opportunities, technology and growth in relation to the recent boom period that is unparalleled in mining history. However, as the

global demand for minerals and metals is now showing signs of slowing, largely as a result of reduced demand from China, other priorities are fast coming into play.

Bob Fassl, Senior Executive Vice President at Atlas Copco and President of the business area Mining and Rock Excavation Technique, put the current climate into perspective. “These are uncertain times for most mining companies and suppliers,” he declared. “The consensus right now is to be more prudent and that means both mining companies and suppliers will need to cut spending and work on efficiencies.”

Atlas Copco is well equipped, he said, to help companies adjust by offering long term solutions that provide greater efficiency and mechanical availability. But although today’s situation will no doubt spark cost cutting drives, all executives agreed that it will also stimulate increased interest in automation and mechanization.

Fassl said: “I expect the demand for mined products to remain and that the current slow-down will correct itself in time, just as it has always done in the past. We will continue to offer cost effective solutions and provide products that benefit downstream returns.”

Mining companies are increasingly looking for equipment that will go deeper, drill faster and produce ore more efficiently. Lower cost per drillmeter or excavated tonne is the name of the game. Good examples of this are the new Minetruck MT85 and Pit Viper 311, both of which generated great interest at MINExpo (*see pages 12–15*).

Focus on technology

David Shellhammer, President of Underground Rock Excavation, pointed out that Atlas Copco is introducing new products such as the Minetruck MT85, the largest articulated underground mine truck in the world because “mines need to move more material with less effort. In addition, we are working on mechanical excavation projects that will reduce the number of machines needed to perform the same job.”

Shellhammer also cites another important factor that is driving the focus on new technology – the need for skilled operators. “I see the lack of skilled labor as the biggest challenge facing our industry along with equipment safety,” he said. “Mines are going deeper, which results in the need for better roof stability and also brings attention to the hotter conditions.



The expert's view: Top row, from left, David Shellhammer, President, Underground Rock Excavation, Peter Salditt, President, Drilling Solutions, Victor Tapia, President, Geotechnical Drilling and Exploration. Bottom row, from left: Johan Halling, President, Rock Drilling Tools, Bob Fassl, Senior Executive Vice President and President of the Mining and Rock Excavation Technique business area and Andreas Malmberg, President of Mining and Rock Excavation Service.

We take this into consideration when engineering products and we are working closely with our mining customers to accomplish this.”

Andreas Malmberg, President of the most recently formed division, Mining and Rock Excavation Service, agreed with Shellhammer’s assessment and pointed out that a close relationship between mining companies and suppliers is key.

“With a division now totally focused on service we are able to expand our product offering to meet our customers’ expectations,” he said, referring to the development of new products such as Rig Scan (*M&C 2/2012*) as well as expanding audit programs and preventive maintenance packages that will sustain a higher level of production for all equipment.

Malmberg continued: “We have more than 30 000 Atlas Copco rigs in operation around the world and we can provide customers with everything from parts support to training programs as well as remote monitoring services. The point is, we are in a position globally to provide what they need. Products such as these allow better planning and forecasting. It’s not about being reactive, it’s about better planning. Our customers want to make money on their

machines, which means every machine must be in good working order.”

Training is an investment

Operator training is a major issue for the mining industry and especially for medium and small sized companies. As a result, it is high on the Atlas Copco agenda, too. As Victor Tapia, President of Geotechnical Drilling and Exploration, points out: “Training is an investment in a company’s future. Ninety percent of our customers in geotechnical drilling and exploration are small businesses and supporting new equipment training is critical for their success.”

Although Tapia’s organization is focused on exploration, he notes increased demands for ground engineering products. Along with innovations that make drilling more efficient and safer, his division is developing exploration rigs that can go deeper and reduce time in the hole.

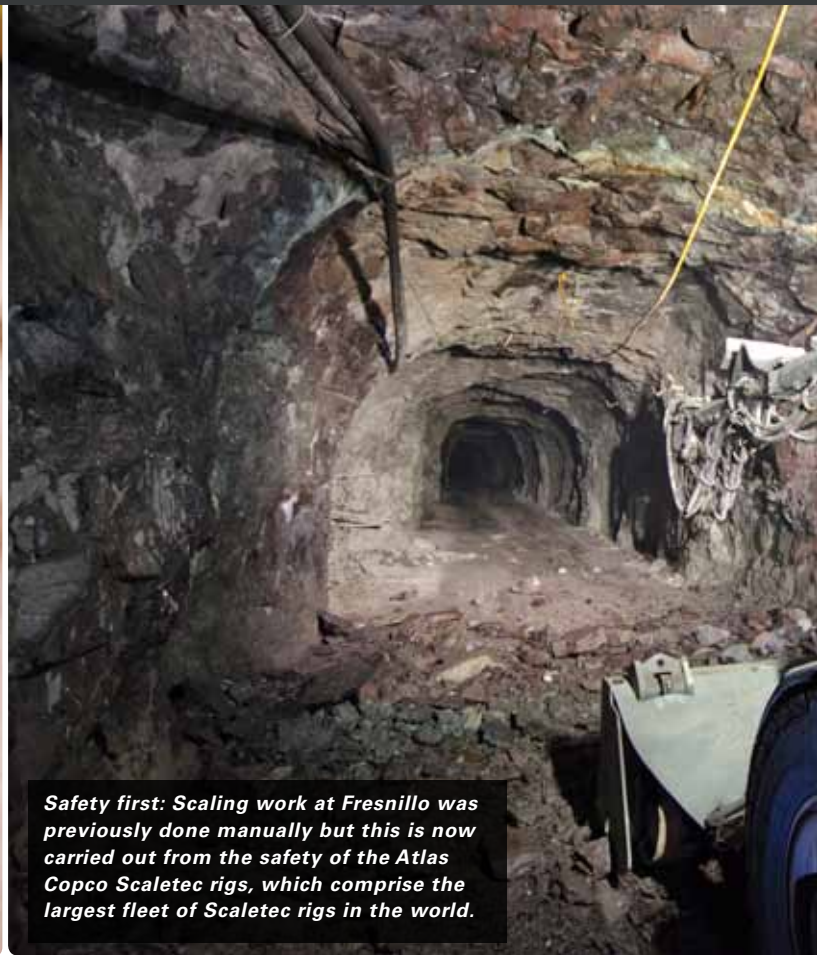
Taking the topic a step further, Johan Halling, President of Rock Drilling Tools, applies it to the area of consumables. “Someone who doesn’t know consumable products may think all tools are alike but we are making constant improvements that focus on penetration rates and life cycle costs,” he said. And he confirmed that the

demand for rock drilling tools remains buoyant, despite the general slow-down. “In fact, we are seeing an increase in demand, especially from the mining companies of Africa and South America,” he continued. “We have 12 factories around the globe producing rock drilling tools and even though these are tough economic times in some areas, the demand for these products will continue to be strong.”

Working hand in hand

In terms of size, the largest piece of innovation on display at MinExpo was the new Pit Viper 311 rotary blasthole drill rig, produced by Atlas Copco Drilling Solutions. Peter Salditt, President of the division, pointed out that the cab design, controls and monitoring equipment “puts more power into the operator’s hands”.

Salditt reflects: “We are making great strides in technological advancement. Rigs are more efficient and safer while providing greater productivity. The Pit Viper 311 development is another milestone in the successful range of Pit Viper drills, and the continuous improvements are a testimony to the success of working hand in hand with our customers to help meet their objectives.”



Safety first: Scaling work at Fresnillo was previously done manually but this is now carried out from the safety of the Atlas Copco Scaletec rigs, which comprise the largest fleet of Scaletec rigs in the world.

Silver star: The Fresnillo Mine is on track to meet its production target of 65 million ounces of silver per year.

FRESNILLO'S

Mexico's sterling performer is well equipped to ramp up production

Mexico's Fresnillo PLC, the world's largest primary silver producer and one of the world's most successful mining companies, is on track to reach new production targets at its Fresnillo Mine with Atlas Copco equipment playing a key role in the process.

On the open plains of Zacatecas State in central Mexico, the Fresnillo mining company is going full steam ahead with a new, major expansion plan. The goal is to ramp up production from today's 8 000 tonnes per day to 9 200 t/d in 2013 and to 10 000 t/d in 2014.

Dating back to the days of the Spanish colonialists, the Fresnillo Mine has been

in operation since 1554, and the ore mined here is generally believed to have been used to finance the advance of Spanish imperialism from the 16th to the 19th century.

These days, the mine is known mostly for its high productivity and profitability and for reporting high yields of high quality silver and gold over the past two decades.

The reason for this, as M&C discovered

during a recent visit, is not hard to see. The mine has consistently invested in new technology that has not only made operations more efficient but also increasingly safe. It is also easy to see where the lion's share of this technology comes from, or as Mine Superintendent Antonio Gonzalez puts it, "We are a 100 percent Atlas Copco mine."

Long term relationship

The Fresnillo-Atlas Copco relationship began as long ago as 1947 when the mining company first entered the Mexican market. Today, it uses more Atlas Copco equipment



In control: During M&C's visit, a Scaletec operator demonstrated how the rig is used to scale the walls in the drifts and remove loose rock in new stopes.

SILVER continues to shine



Symbol of freedom: This Mexican coin known as Libertad reflects the success of the silver mining industry.

than any other mine in the world. The extensive range of products includes Boomer and Simba drill rigs, Scooptram loaders, Minetruck trucks and Robbins raiseborers.

Among the more recent investments is a fleet of 11 Scaletec MC/DH scaling rigs – the largest fleet of its kind in the world – as well as an RB700 XD breaker used in the mine's new underground crusher station.

In addition to this, Gonzalez confirms that about 30 new units of Atlas Copco equipment are scheduled to arrive at the mine over the next four years.

The Fresnillo operation advances on

multiple faces at the rate of 3.4 km per month and employs three mining methods – cut and fill, bench and fill and sublevel open stoping.

Focus on San Carlos

A good share of the mine's production will come from the new operations in the San Carlos section with its current projection to produce 30 million tonnes of ore. "We expect 70 percent of the mine's overall ore production to come from the San Carlos area next year, or 5 000 tonnes per day," says Gonzalez.

Fresnillo's multiple raiseborers also contribute to the mine's efficiency, the most recent being the Atlas Copco Robbins 34RH C QRS. These are used to open slot raises as well as for improving the mine's ability to install short utility raises for ventilation, water and electricity.

During M&C's visit, the Robbins raiseborer was being used to bore a ventilation shaft from the surface. This raise, which was being bored at an 86 degree angle, was expected to take about one month to complete.

The 279 mm pilot hole was estimated



Breaking news: The RB700 XD breaker at work in the new rock crushing zone.



Safety and comfort in haulage operations: The Minetruck MT43 takes a pause during mucking out operations.

In addition to increasing the quality of the stopes with the Scaletec, the mine is also improving safety by reducing its truck fleet by up to 50 per cent thanks to an increase in the number of new shafts.

Raiseboring efficiency

Superintendent Gonzalez says new ore haulage shafts in the San Carlos zone will help the mine to reduce costs. "To bring ore to the surface today by truck costs 32 dollars a tonne. With our new haulage shafts, the rate drops to one dollar per tonne," he says. These shafts are now in use and working well and the savings are reported to be considerable.

Developed and implemented over the past four years, one twin-shaft, 2 x 3.6 m diameter, 565 m deep raise was conceived by the planning and engineering department as a better way to move ore.

Mine Planning Manager Francisco Queiroz de Macedo explained: "We took the idea into long term planning discussions and it all made sense. Having large shafts that could be excavated with a raise bore would be more efficient, faster, cheaper and, above all, safer."

By "safer" Queiroz means they wouldn't have to put people in a shaft sinking environment. "There was not the constant exposure to falling rock, or having to lift men and equipment from the shaft. Also, no blasting means no unwanted rock fragmentation," he said.

The only time men were exposed to potential risk was the shotcrete phase and if bolting was necessary. As there was little

rock disturbance, faults or fragmentation, systematic bolting was not needed.

Queiroz said attempting these raisebore shafts made sense in Fresnillo's mining situation as they had the existing infrastructure in place. "I'm guessing it would have cost twice as much to sink traditional shafts. This wouldn't be the same situation with a greenfield project where no previous infrastructure exists."

The lowest point of the shaft was at the 570 m level. Above that were five additional existing points that would break up the lifts to manageable levels.

The longest raises which were surface raises, were 240 m long. "The first were the longest simply because we had to get to the existing mining infrastructure," Queiroz said.

The future ore lift system was designed to be a cable system, so accuracy was essential. Queiroz continued: "We needed a tolerance of less than 0.5 percent for each raise. The first raise of 240 meters was off less than 0.05 percent."

Twelve raises

The first step was for the Atlas Copco Robbins 73RH C raiseboring machine to drill a 298 mm pilot hole. Queiroz said: "We could simply drop a plumline down the hole to know how accurate each hole would be. Corrections could be made with each lift if necessary."

Six lifts were made for each shaft for a total of 12 raises. Of the 12 raises, only one exceeded the tolerance level at 0.7 percent and this was because of slight deviation caused by a fault at the lower end of the

raise. The other 11 raises had less than the required 50 cm limit.

Queiroz said: "We have been doing raiseboring for a long time, more than the 15 years I've been here, so the practice is not new to us. But this was much more interesting than your average raiseboring project. We think Atlas Copco Robbins raiseborers are very good machines."

The future of the new 3.6 m shafts is to take them even deeper. These would be bored over the next three years, planned to be opened in 2013 and 2015.

THE FRESNILLO GROUP

Fresnillo PLC holds the largest precious metals reserve in Mexico and currently operates seven mines – two advanced development projects, five exploration projects and an extensive portfolio of prospects.

Besides the famous Fresnillo underground silver mine, the Fresnillo Group includes:

- ▶ Saucito (underground primary silver mine, in operation since 2011)
- ▶ Ciénega (underground gold mine, in operation since 1992)
- ▶ San Ramón (satellite for the Ciénega gold mine, in operation since 2011)
- ▶ Herradura (open pit gold mine, in operation since 1997)
- ▶ Soledad-Dipolos (open pit gold mine, in operation since 2010)
- ▶ Noche, (open pit gold mine, in operation since 2012)

Headquartered in Mexico City, the company is listed on the Mexico and London stock exchanges and is on track to meet its goal of 65 million ounces of silver and 500 000 ounces of gold per year by 2018.

THE GOLDEN HAMMERS of LA HERRADURA

Secoroc rock drilling tools get top results in tests



Upsizing the holes: The larger DML HP in the foreground on the bench with the DM45 HP.



The open pit gold mine of La Herradura Penmont in the northern state of Sonora, not far from the U.S. border, is improving its productivity through a combination of upgraded drill rigs and new rock drilling tools.

The La Herradura Penmont Mine, which is jointly owned by Fresnillo plc and Newmont USA, has been successfully mining its gold since it opened in 1996.

Current production is around 190 million tonnes a year, largely due to the productivity of its DM 45 HP (high pressure) drill rigs from Atlas Copco, and more recently, a transition to the larger DML HP. Now the mine is making further improvements by introducing new rock drilling tools.

Following successful tests with two Atlas Copco QL 85, DTH (down-the-hole hammers) equipped with 216 mm bits, the mine has decided to switch to the “golden hammers” along with rotary drill pipes and accessories from Atlas Copco Thiessen.

Drilling in gneiss quartz cuadrostatic



A trust in the brand: Mine Manager Jose Arturo Arredondo Morales.

rock, the DML rigs increased their penetration rate by 15–20 percent thanks to the hammer. According to Carlos Alberto Torres Gamez, Mine Drill and Blast Chief, the service life of the hammer also increased by 30 percent compared with the previous equipment.

As a testimony to the performance of the equipment, this combination is now to be used throughout the operation by La Herradura contractor SECOPSA, one of Mexico’s leading open pit mining contractors.

According to Mine Manager Jose Arturo

Arredondo Morales, Fresnillo’s trust in the Atlas Copco brand lies at the heart of La Herradura’s success. He says: “We benefit from Atlas Copco’s quality products, support and commitment.”

Larger holes

Although the DM45 HP is capable of drilling the desired 8 m bench height, opting for the larger DML HP allowed the mine to increase the hole diameter to 216 mm.

The holes are drilled in a 5.5 m by 6.5 m pattern to a total depth of 9.2 m, including 1.2 m of subdrilling. An Atlas Copco ROC L8 (now named FlexiROC D60) is used to drill 140 mm diameter pre-split holes on double benches with a total depth of 16 m.

The penetration rate averages 34 m per hour/rig and an average production of 28 holes or 2 520 meters drilled per shift. The waste-to-ore ratio is 3–1, producing 0.5 million ounces of gold in 2011.

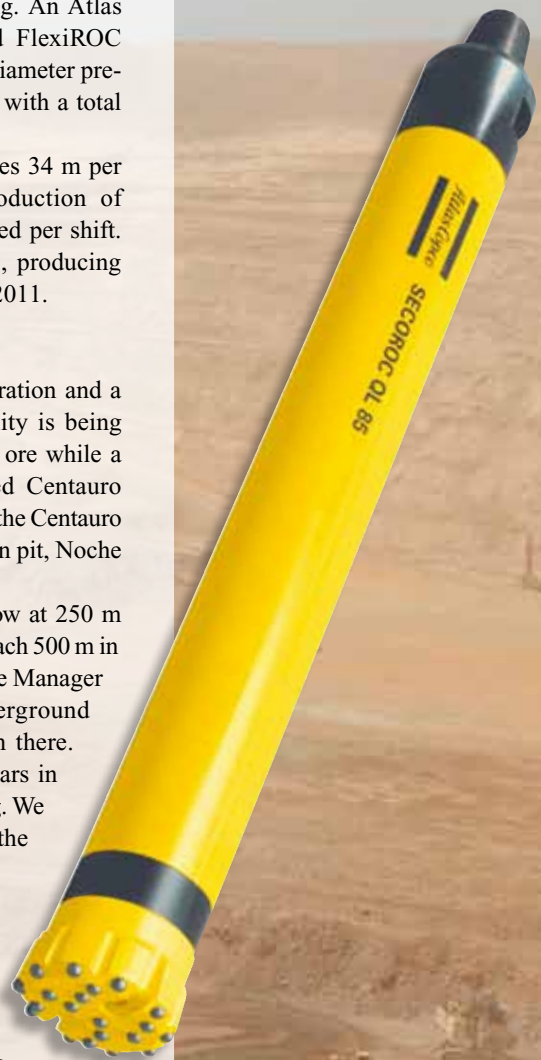
Getting ready for growth

The mine has five pits in operation and a new sulphite processing facility is being built to process better quality ore while a new underground area named Centauro Bajo is being developed below the Centauro Alto pit. In addition a new open pit, Noche Buena, will be added.

The Centauro Alto pit is now at 250 m and it is estimated that it will reach 500 m in eight years. Underground Mine Manager Hector Contreras says underground operations will continue from there. “This mine has another 15 years in it and exploration is continuing. We don’t know the true extent of the reserves yet,” he says.

Equipment for the development process arrived in April 2012. This includes two Atlas Copco Boomer S1 D face drilling rigs, one Atlas Copco Boltec rock bolting rig and three Atlas Copco Scooptram ST1030 underground. The mine also has an Atlas Copco Robbins 73RH raiseboring machine.

A better result: The new QL 85 DTH hammer from Atlas Copco Secoroc .





Discussing the advantages of the Christenssen CS14C drill rig: Santiago Perea of Atlas Copco (left) with Guadalupe Martínez and Javier Cuellar of Compañia Minera Autlan.

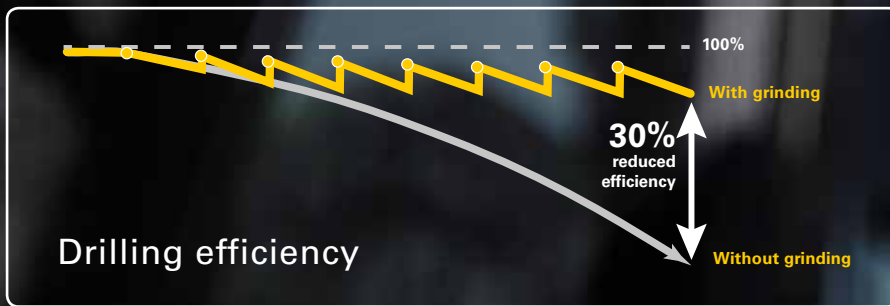


Core drilling in the beautiful Molango mountains with Atlas Copco drill rigs: Right, Carlos Cuellar holds the pipe while Pablo Guzman removes a core sample and places it into the box.



How sharp rock drilling tools put money in the bank

Drillers looking to lower their running costs don't have to look much further than the buttons on their drill bits. Sharp bits make money. Worn bits lose money. It's as simple as that.



Grinding pays: In this example, a 500 m hole in hard rock can be accomplished in 15 hours. If the bits are re-ground at 60 m intervals, efficiency is maintained. If the bits are systematically worn down and then discarded, penetration and total efficiency decreases.

By Bo Persson, Product Support, Atlas Copco Secoroc

There are no rules that say drill bits must be resharpened. Once they have been worn down, they can simply be thrown away and replaced by new ones. In fact, that's common practice among many drillers around the world. However, with every bit they throw away, they also throw away a great deal of money.

In order to drill a hole effectively, all drill bits need to be kept in good shape throughout the drilling process and to understand why this is so important we need to first look at the way a drill bit is designed.

The button bit, for example, which is the most superior variety, is equipped with a number of tungsten carbide buttons arranged in a special way on the bit head to effectively crush and break the rock. These buttons have either a spherical or ballistic design and are well tested to give optimal penetration rate, life length and hole quality.

Naturally, the amount of wear that these

bits can sustain differs depending on the rock conditions but our recommendation is that they should be kept sharp at all times to give optimal penetration.

Impact on drilling efficiency

It is worth noting here that a worn bit reduces the impact energy at the bottom of the hole which can not only loosen the threaded joints in the drillstring but also creates excessive heat which destroys the joints. In addition, as the buttons begin to wear down and become flat, the size of the space used to evacuate the cuttings is also reduced, which means the cuttings have to be recrushed into smaller particles. And last but not least, a worn bit makes it much more difficult to drill a straight hole, and straightness is of course essential for optimum blasting and fragmentation.

While all of these factors are obviously important, it is the overall effect that worn bits have on the efficiency of the whole

drilling operation that really counts. We have studied the impact of worn bits in a large variety of drilling scenarios and the results show that drilling with sharp bits improves total drilling efficiency by up to 30% per year, taking all cost factors into consideration.


Keeping them in shape

Having established that sharp bits pay off, what's the best way to keep them in good shape? As a rule, the time to regrind a bit is when roughly one third of the button has been worn away. When half of the button or more has gone, it is "overdrilled". We estimate that an overdrilled bit causes penetration to drop by as much as 30–40% and that the life of the drillstring components is reduced by the same percentage.


Bits are reground using either grinding cups or grinding wheels, with the wheel being by far the best choice. When the cup becomes worn, it goes flat and cannot




Overdrilled: Half of the button has gone and its service life is over.



Time to regrind: One third of the button has been worn away.



Ideal shape: The button is perfectly sharp and provides maximum rock penetration.



restore the button to its optimal condition, especially if it is a ballistic button. To compensate for this, the cup has to be changed more often and the cost of regrinding then becomes unreasonably high.

The wheel, on the other hand, has a diamond coating on a steel base, so when it begins to wear, the diamond grains first lose their cutting edge and ultimately come off completely. Throughout the process, the wheel keeps its shape and is therefore able to restore the buttons to their optimal condition until it is completely worn out.

Grinding bits is not difficult but a good knowledge of bit design and an understanding of why the bit should be reground is essential. For example, a bit may last for 500 drillmeters with good penetration – a job that can be done in a couple days. But if the bit is not reground, the penetration rate decreases dramatically and it will take much longer to complete the job.

A bit that is reground as recommended will complete 500 m in 15 hours, drilling at 35 000 revs (1 000 000 blows). If the

bit is not reground, the driller will often assume that he can continue with the same bit until the required depth is reached. In fact, although the bit will actually last for 15 hours (with the same revs and blows) it will drill only 350 m in that time due to the decrease in penetration rate.


To continue drilling another 150 m with a worn bit might not be possible or will lead to an even greater loss of penetration and dramatically reduce the life of the equipment, not to mention the extra expense for wages, fuel and maintenance and other costs that come with having to drill longer than necessary on each hole.

The bottom line

Now let's look at how this affects the other components. With five rods in the drillstring, 5 000 drillmeters can normally be completed in 90 hours. With a decrease in penetration of 30% (at 210 000 revs and 6 000 000 blows), the service life of the drillstring, including rods, shanks and couplings will be reduced to only

3 500 drillmeters during the same period.

In addition, if the driller's contract runs for a long period of time and he consistently loses penetration rate due to worn bits, he will need to get help to fulfill his commitment, perhaps this will mean engaging another rig and an additional operator, causing even more expense and less profit on the bottom line.

We estimate that it costs approximately USD 0.15 to grind one button so our recommendation is clear. Insist on regrinding bits before they become overdrilled. Only properly sharpened bits can do the job they were originally designed to do. 



Bo Persson is a member of the tophammer team at Atlas Copco Secoroc, in Fagersta, Sweden, specializing in grinding technology.

NICE RIDE IN NAPLES!

How raiseboring engineers beat
the "booms" in new deep metro





Raiseborer in action: Tunneling engineers use an Atlas Copco Robbins 53RH raiseborer machine to install a series of openings that will relieve the air pressure inside the new subway that runs 30-40 m below the city of Naples. Top left, a completed opening.

» When it comes to rail transport underground, the new subway lines deep beneath the city of Naples have become something of a benchmark. Here, the air pressure is high, but the trains will swish through without a single “boom”.

The bustling city of Naples is every bit as fascinating below ground as it is on the surface. The city’s subway stations, designed by leading international architects, display contemporary works of art to inspire travellers as they make their way to their various destinations.

But when the subway had to be expanded recently, engineers found that loose ground conditions and the many archeological sites and historical buildings that had to be preserved, made it impossible to extend the old

routes on the same level. Instead, the new system had to go deeper.

Beating the piston effect

In most subway systems, trains thrust a wall of air ahead of them and also suck in a torrent of air behind them as they speed through a tunnel. This creates a vacuum which often results in a “boom” sound that experts call “the piston effect”.

However, it is not the noise that is the greatest concern but the vibrations

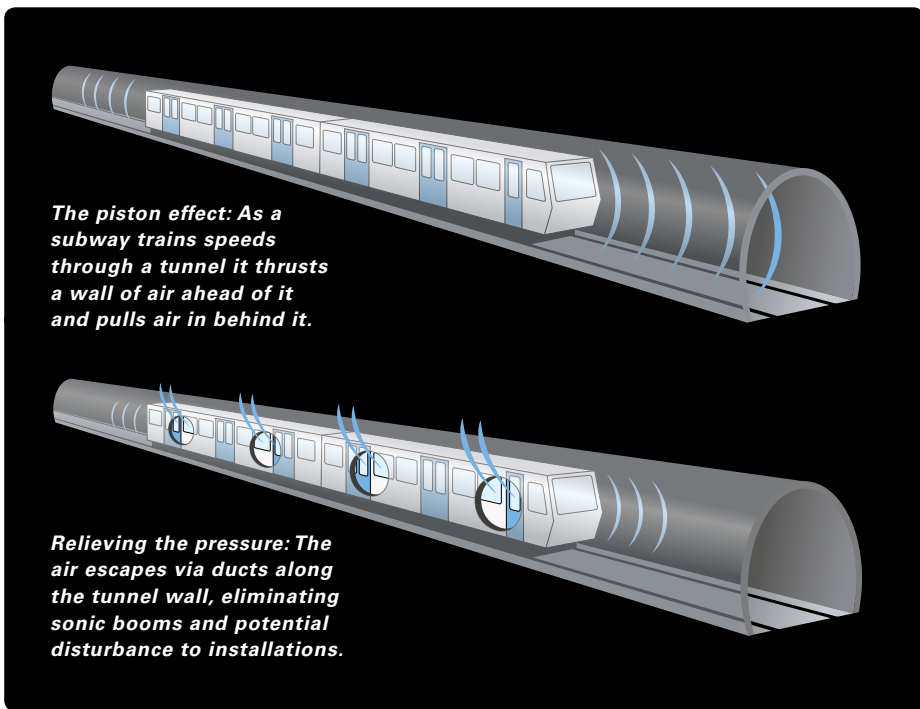
created by the “booms” which may cause disturbances. Naples’ new Line 1 extension, which will run from Dante station to the Garibaldi Central Station to link up with Line 6 at City Hall Station, is being constructed 30-40 m below ground level and 20-30 m below the water table.

At this depth it was estimated that the new tunnels will have an average pressure of 3 bar (43.5 psi, 300 KPa) which is enough to create a piston effect that could possibly endanger the stability of the subway platforms, stations and other installations.

The solution was to try and relieve this pressure by allowing it to dissipate through strategically placed openings, installed



Drilling the pilot hole: A 311 mm hole is drilled in the tunnel wall where the relief duct is to be placed. On the opposite side, a reamer is attached to the drillstring and, pulling back to the raiseboring machine, the opening is reamed to a diameter of 3.5 m.



horizontally between the parallel tunnels (see drawing). To do the job, contractor Sudmetro, working with geotechnical specialist Icotekne, decided to employ raise boring technology from Atlas Copco.

Vittorio Manassero, Technical Director of Icotekne, explains: “These openings connect the two main tunnels and are intended to mitigate the piston effect caused by the passage of subway trains.”

Efficient and safe

Manassero explained how the area around the perimeter of each opening is first cement and chemical grouted and reinforced with rock anchors. The Atlas Copco Robbins 53RH raise boring machine then takes over, initially

drilling a pilot hole of 311 mm in diameter.

The machine’s reaming head is then raised on a special trolley and assembled onto the drill rod and then back-reamed to the machine, reaming up the hole to the desired diameter.

The raisebored openings which are 3.5 m in diameter, are then PVC sealed and lined and vary in length between 5.5 m and 7.5 m.

The Robbins 53RH raiseborer has an installed capacity of 255 kW, a maximum reaming thrust of 3 350 kN and a maximum torque of 156 kNm. The drill rod is 286 mm in diameter and 750 mm long, while the reaming head weighs 12 tonnes and is equipped with 18 cutters.

Paulo Foppiani, Managing Director of

Icotekne, explains: “The Atlas Copco raiseborer was a very good choice for this job. Apart from the excellent technology which makes it easy and fast, it is also good from a safety point of view as it eliminates the danger of falling rock, fumes and the presence of operators in the hole while work is going on.”

So far, a total of 16 raisebored openings have been completed at five stations along the new Line 1 route (at Toledo, Municipio, Università, Duomo and Garibaldi). And when the new line opens in 2013, it will be known as Metro dell’Arte, linking strategic areas of the city to Naples central railway station. (See raiseborers in action on the Atlas Copco YouTube channel.)

FINE BOLTING IN FINLAND



New Boltec rig reaches new heights at Kemi Mine. The Kemi chromium mine in Finland is an impressive operation with an equally impressive fleet of drilling equipment. When it comes to rock bolting, it is setting the same high demands.

The Kemi Mine, located at the northern end of the Bay of Bothnia between the towns of Kemi and Tornio, is a highly developed and technically advanced mine. It has been successfully extracting high grade chromium for the world's steel mills since the 1960s.

An open pit for most of its life, Kemi went underground in 2003 and from then on it has consistently used equipment from Atlas Copco to meet its ore production target which currently stands at 1.3 million tonnes per year.

Owned and operated by the Outokumpu Group, Kemi's fleet includes Boomer and

the robust BUT 45 boom and can be operated using both electricity and diesel power.

Up until the end of October it had been used to install 34 163 bolts with 120 to 130 bolts installed per 8-hour shift. Operator Markku Paakkolanvaara clearly sees the new model as a big improvement. He tells M&C: "I am very satisfied with it – especially with the boom which feels much more stable than the previous rigs and gives me a better, longer reach.

"We have only had to use the diesel engine a few times in locations where we needed to patch up after infrastructure had been removed and where we needed holes

in part due to the improved quality of components such as the slide pieces and bearing housings which he says will last longer.

Top of the class

According to General Manager Antti Pihko, the collaboration with Atlas Copco has been fruitful in many other ways beyond the supply of high-technology mining equipment.

"The rigs are of high quality and I think the after-sales services – rig service and spare parts – are top of the class," he says. "One vital factor has been the strong will and ability of Atlas Copco to engage in joint development work with our mine and to take on new challenges. Mutual innovativeness has marked this collaboration from the very start."

Keskitalo adds that the service life of the rigs at the Kemi Mine is, on average, five years, after which they are sold on and replaced. "Technology advances continuously and we strive to stay on top of the technical developments to reduce the higher maintenance costs associated with having older equipment," he says.

Kemi's almost vertical chromium deposit is approximately three km long and 40 m wide. The deepest point of the mine is currently at 600 m. The mineral reserve is 126 million tonnes (estimated to 1 km) and it believed to descend more than two kilometers.

It is therefore not surprising that Mine Manager Pihko emphasises that all decisions at Kemi are made with an eye to the future and the possibility of going deeper.

“One vital factor has been the strong will and ability of Atlas Copco to engage in joint development work.”



Antti Pihko General Manager, Kemi Mine

Simba rigs for drilling, Boltec and Cabletec for rock bolting and Diamec for exploration – all of which have been highly praised for high precision and productivity. Now the mine has received a further boost through its latest acquisition, the Boltec EC EH-DH drill rig.

This new bolting rig, which arrived on site in December 2011, represents the most advanced bolting technology on the market. It is also the first Boltec to be equipped with

for power lines and water pipes. It otherwise works fine using electric power."

Contract Supervisor Ari Keskitalo is also impressed by the performance of the new Boltec and its BUT boom. He says that for him the rig is "beyond compare", especially in fast bolting when bolts are installed in large quantities.

In addition, he believes that service and maintenance costs will reduce significantly,



Making a difference: The new Boltec EC EH-DH in action at Kemi Mine.



Kemi Mine, the only chromium mine in the EU, is undergoing intensive expansion and renewal of the entire production chain with investments in new infrastructure, equipment and manpower.

Great changes are also taking place on the surface with a doubling of the capacity of the concentrator plant and a new ferrochrome furnace that will be the world's largest.

The aim is to be the most efficient chromium mine in the world, despite that the chromium oxide content is only 29%. The investments are being made by Outokumpu Chrome, the world's fourth largest producer of ferrochrome.


Contract Supervisor Ari Keskitalo (left) with Atlas Copco's Tapio Toivonen, Technical Support (center) and Boltec operator Markku Paakkolanvaara.

Celebrating 50 years of raiseboring

WORLD Atlas Copco is the largest supplier of raiseboring equipment worldwide, and there is much to celebrate this year as the world's first successful raiseboring machine, the Robbins 41R, turns 50. The legacy started in 1962 when industry pioneer James Robbins set out to mechanize a hazardous task in mining. With pinned drill tubes and steel cutters, the 1.2 m diameter Robbins 41R was launched and, amazingly, was found to still be working just recently at a site in Morocco.

Since design and manufacturing moved to Sweden, 17 models have been developed in a product range that represents a long line of milestones in raiseboring technology. Recent innovations such as the energy efficient VF drive and Measure While Drilling (MWD) system achieve unparalleled results while providing a safe environment for operators.

Raiseboring is the preferred and most cost effective means of excavating raises in underground projects. Today's best selling raise drill is the Robbins 73RH C which is capable of reaming 1.8–3.1 m diameter holes.


Atlas Copco continues to push the boundaries of raiseboring operations and the Rig Control System (RCS) has placed automation at the forefront of future trends. 



Winning legacy: Top, the Robbins 41R raise drill (1962). Right, the Robbins 73RH C.

Global launch for Chargetec

WORLD A new charging truck from Atlas Copco has been launched onto the world mining market. Chargetec UV2, which made its debut at MINExpo, is a single boom, multi-directional ANFO charging truck.

The truck is equipped with one or two vessels for optimized charging of a full drill pattern and has a high density, high speed capacity of 130 kg per minute. The heavy-duty carrier has articulated frame steering and 4-wheel drive, providing excellent flexibility and maneuverability in narrow drifts. Chargetec UV2 is available with diesel or electric hydraulics and charging vessels ranging from 300 to 1 000 liters. 




Chargetec UV2: One of the most technically advanced of its kind equipped with the latest generation of vessels.

Teaming up

USA To broaden the product range and extend expertise for existing customers in the mining, construction, oil and gas industries, Atlas Copco is to acquire NewTech, a U.S. manufacturer of drill bits.

Based in Salt Lake City, Utah, NewTech develops and manufactures drilling products focusing on rotary PDC (polycrystalline diamond compact) drill bits as well as claw bits for rotary soft rock mining.

NewTech's durable tools are designed to be both impact and wear resistant and the PDC bits are suited to shallow, land-based drilling applications. 

PRODUCTS & PROGRESS

New RC kit for blasthole rigs

Atlas Copco has introduced a Reverse Circulation kit for selected drills from its range of blasthole drill rigs. The kit, which has been developed together with an Australian-based service company, is now available for the Atlas Copco DM45 and DML rigs.


Reverse Circulation (RC) allows the collection of samples during drilling and is considered a high speed and low cost method for in-pit grade control.

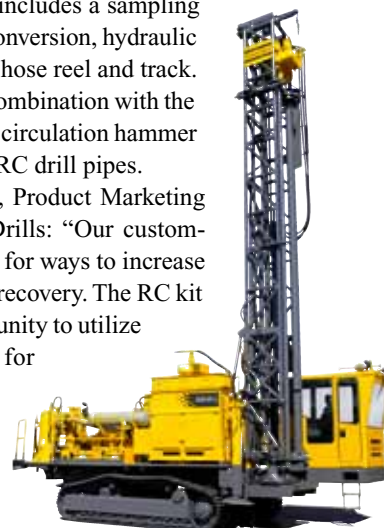
The RC Kit provides a unique opportunity for Atlas Copco customers to expand the capabilities of their current blasthole drills.

The kit integrates with the rig as a "bolt-on" unit and limits the amount of reconfiguration to the drill. It is identical for both

DM45 and DML and includes a sampling cyclone, rotary head conversion, hydraulic controls and modified hose reel and track. It can also be used in combination with the Secoroc RC50 reverse circulation hammer and 114 mm (4 ½ in) RC drill pipes.

Says Matthew Inge, Product Marketing Engineer, Blasthole Drills: "Our customers are always looking for ways to increase their productivity and recovery. The RC kit gives them this opportunity to utilize our blasthole drills for sampling or production drilling."

The first RC kits will go into production in early 2013. 



Bolt-on unit: The new RC kit enables both DM45 and DML drill rigs to be used for sampling as well as production drilling.

IN BRIEF

Underground app now for smartphones

First launched a few months ago for iPads and Android tablets, Atlas Copco's underground app has been launched for smartphones thereby completing the circle for compatibility with handheld devices.

By downloading the app to your phone free of charge, the full range of underground face drilling rigs, loaders, trucks and other equipment is available wherever you are – online or offline – thanks to the ability to synchronize content.

The dynamic app includes a 3D turntable for easy viewing of products from all angles. Apart from technical data, 3D images and video, it also features case stories and a social news flow. The app is available for download through App Store and Google Play.



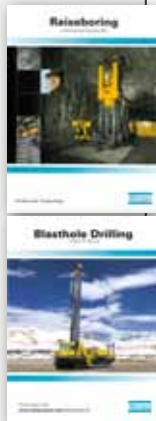
Milestones in Australia

Mining companies in Australia have experienced four major milestones this year in relation to high-tech equipment from Atlas Copco – the 100th SmartROC surface drill rig delivered to Action Drill and Blast; the 100th Minetruck MT6020 truck delivered to underground contractor ACM; the introduction of the Simba E7 C series of drill rigs with delivery of the first unit to Newcrest and the launch of the Scooptram ST14 underground loader.

New reference books – out now!

Atlas Copco's popular series of reference books on rock excavation technology continues to evolve. The second edition of *Raiseboring in Mining and Construction* has been published with case studies that take readers from Mexico's silver mines to the subway tunnels of Italy. Similarly, the third edition of *Blasthole Drilling in Open Pit Mining* is also out consisting of 300 pages of extensive case studies, technical articles, practical advice and the latest product specifications. These reference books provide essential knowledge in each field of drilling and enable cross learning between professionals around the world.

To order: Both titles are available through Atlas Copco Customer Centers worldwide. The Raiseboring edition can also be ordered via miningandconstruction.com whereas the Blasthole Drilling edition is available at atlascopco.com/blastholedrills as PDF.



Expanding in West Africa

Atlas Copco has opened a new Customer Center in Burkina Faso, West Africa. The Center, located in Ouagadougou, offers surface and underground mining equipment, exploration rigs, as well as drilling consumables and related parts and services. "Having this facility helps us get closer to customers in French-speaking West Africa in the mining and exploration segments," says Bob Fassl, Business Area President, Atlas Copco Mining and Rock Excavation Technique. Atlas Copco previously conducted business in Burkina Faso through its Customer Center in Mali.

Action hero: Robbins on Youtube

For an inspiring presentation of the Robbins raise drill range, visit Atlas Copco's Underground channel on Youtube. A new film demonstrates the machines in action and shows the results of 50 years of experience in raiseboring. The Robbins product range meets the needs of a global market and includes 17 models that cover diameters from 0.7–6.5 m with raise lengths of up to 1 000 m. The raise drills are designed for conventional raiseboring, boxhole boring as well as down reaming. www.youtube.com/atlascopcoUG.



WHERE TO FIND US

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