

USA MINING & CONSTRUCTION

MECHANIZED ROCK EXCAVATION WITH ATLAS COPCO - NO. 1 / 2015



RIGSCAN * SMART DRILLING * PIT VIPER

Atlas Copco

“

It's our job to make sure the Atlas Copco brand promise stays true for you.”



ATLAS COPCO IS ALWAYS developing product lines for the mining and construction industries. We never stop seeking new ways to help our customers succeed.

For me, this is most evident in the innovations in our services. It's our job to make sure the Atlas Copco brand promise stays true for you, and it's an exciting job.

The feeling is shared by all of our personnel in each and every one of our strategically located regional stores. And now that the stores have newly redesigned websites, it's more convenient than ever to review equipment listings, service options and programs wherever you are, at any time that works best for you. Visit the mining and construction stores at www.atlascopcoustores.com.

In this issue of Mining & Construction USA we introduce you to one of our most successful service innovations: the RigScan, rig-specific equipment audit. In a user-friendly report, it gives detailed descriptions of any needed repairs or maintenance items with clear photos. It's the most thorough health check a rig can get. After you receive the report, you get to make the most well-informed decision about which repairs you want done and whether your technicians or ours will perform them.

Read on about various examples of product innovations and customer successes that we're proud to be a part of. Please enjoy this edition of M&C USA with my sincerest wishes for your own continuing success.

Rob Root

Vice President of Product Support and Mining Stores
Atlas Copco Mining, Rock Excavation and Construction USA

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NEWS



MINETRUCK MT42 GETS OVERHAUL

■ The Minetruck MT42 underground hauler was already known for its quick ramp speed and superior maneuverability in narrow shaft operations.

Recent upgrades include an auto-lowering tailgate and a new Tier 4 Final engine. The new tailgate guards against spills and has a reduced dump height.

New options include an electromagnetic retarder braking system that makes it safe to haul waste rock and fill faster down the ramp when conditions permit.

NEW MOBILE APP FOR THE PIT VIPER SERIES

■ Surface mining customers no longer have to look farther than their own tablet or mobile device for news, information and interactive 3D models of Atlas Copco Pit Viper drilling rigs. The app allows users to interact with models to experience them digitally. It also provides information on the DM blasthole drilling rig series and the Atlas Copco Rig Control System (RCS).



ATLAS COPCO MEYCO VERSA

■ Shotcrete operators can meet their demanding productivity requirements with the Atlas Copco MEYCO Versa concrete spraying system. The MEYCO Versa cuts project time while increasing operator comfort and safety.

The self-contained mobile MEYCO Versa concrete spraying system allows wet mix concrete to be applied by a single operator. Low pulsation and high dosing

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accuracy from the Dosa dosing system and data logging feature prevent over-application. Dosa also adjusts liquid accelerator volume and flow instantly during operation.

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Please contact your nearest Atlas Copco Customer Center. See what each location has to offer at www.atlascopcoustores.com

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CO	Denver	866-466-9777
NV	Elko	775-777-2204
TN	Knoxville	888-339-0344
MA	Ludlow	413-589-7439
FL	Miami	954-977-1041
WI	Milwaukee	414-760-1193
TN	Nashville	615-641-3000
AZ	Phoenix	623-780-0200
CA	Sacramento	877-236-0415
CA	Temecula	760-599-9299
AZ	Tucson	520-834-0400

BOOMER M UPGRADE

■ The Boomer M series' recent upgrade gives the rigs not only greater power for both face drilling and rock bolting but even longer service intervals and greater operating safety as well.



For further information, please visit www.atlascopco.us

WIDE SHOES TO FILL

26-foot diameter raise bored hole was an engineering feat for Raisebor, a division of Cowin & Company Inc.

Learn
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Willy Hicks
Drill Superintendent

“**This is an amazing piece of equipment, with its rod handling system. The old way we had to move pipe with a chain hoist. Now we have a modern rod handler. It grips the pipe up to 2,000 psi to thread on the connection.**”

Willy Hicks,
Drill Superintendent

On December 7, 2014, Raisebor, a division of Cowin & Company Inc., completed a 26-foot-diameter raise bore shaft to a depth of 1,440 feet, the largest diameter raise bore ever in North America, and appears to be the largest in the world.

Raisebor performed the record-setting feat at the Jim Walter Resources Number 7 Mine near Brookwood, Alabama, using an Atlas Copco Robbins 123RH C raiseboring machine and multi-modular wing system (MMWS) reamer. The reamer was designed for this job in a collaborative effort with Atlas Copco design engineers.

The project started in 2009 when Rick Sidwell, general manager of Raisebor, started thinking about a larger raise bore. He knew the drill for this job needed to be special. “I see the industry going this way. It’s a safety factor that just makes sense,” Sidwell said. Years of planning and engineering followed.

The mine was sinking this shaft to offer a miner and utility access closer to the working face. It was taking workers

roughly an hour to reach the working face. Nearly 25 percent of each eight-hour shift was lost to commuting. The shaft was needed to make the mine more efficient.

The 1,440-foot-long, 26-foot-diameter raise was actually the third project for the company’s Atlas Copco Robbins 123RH C raiseboring machine. Two earlier, 20-foot raises were just enough for the crew to stretch its legs and get ready for the big pull.

The project was made more complicated than a typical raise by its size. The rebar-reinforced foundation for the drill was a massive 32-foot-deep concrete box built by Cowin & Company Inc. at the surface that required the removal of 2,500 cubic yards of material prior to building the platform. The drill straddled an open box’s 1-foot-thick concrete liner, which was drilled out when the raise bore’s head reached the surface.

Drill operator James Bass said there is more power behind the 123RH C compared to other units he has used in the past. “I can feel more power and better control. And when I make a correction, there’s almost an anticipation

of my actions. I can feel the changes in the formation as it happens and change the drilling parameters smoothly and as necessary.”

The formation’s high angle fractures with varying changes throughout the formation made it difficult to ream.

“Because the head is so wide, I could be pulling through hard and soft formation at the same time,” Bass said. “Pulling slowly through it, though, I can feel the torque change. The rpm and force show constantly on the control panel, and I hear and feel what needs to be adjusted more than I see it.”

Average drilling parameters put 2.5 rpm of head rotation at the pipe. The average thrust was from 350,000 to 700,000 pounds, with torque at or below 350 klbf. The system operates off two hydraulic systems, with RCS-based monitoring, for high machine availability.

An external loop cooling system maintains optimum drive and thrust system temperature. The drill runs on a 480-volt drive pack and a 700 hp hydraulic motor turning the drill string.

Drilling operator Eric Todich agreed ▶



▲ Raisebor's James Bass operates the 123RH C raiseboring machine from the quiet comfort of its remote operator station.

◀ Rick Sidwell, general manager of Raisebor, a division of Cowin & Company Inc.

with Bass's assessment of the controls, saying, "The reaction with the 123RH C raise drill is quicker, yet it takes time to adjust after the command. This is almost a safety factor." He said the control allows for adjustments in the formation as needed, so there isn't damage to the drill or drill string.

The machine's anti-jamming feature also prevents damage. When rotation pressure moves into the red range on the control panel, rotation backs down. "The programming on this drill is really Johnny-on-the-spot accurate," said Bass.

At one time there was a 20-foot-long, 5-foot-thick rock that broke free from the face, causing a delay in drilling. It took time to lower the cutting head and replace cutters that were smashed, but people were never in harm's way.

Drill Superintendent Willy Hicks said the drill performed well throughout the project. He gave quite a bit of credit to the operators who kept an eye on the

controls and made the process look easy.

On average, the drill advanced at 5 ½ inches per hour, but formation changes made drilling speed inconsistent. The formation could show a foot of coal then 4 inches of sandstone. In a 24-hour period, two shifts might have 8 to 10 feet of advancement. This was a little ahead of the preplan estimates of 3.7 feet per shift or 7 feet per day. Drilling advanced better than projected throughout the project.

"This is an amazing piece of equipment, with its rod handling system," Hicks said. "The old way we had to move pipe with a chain hoist. Now we have a modern rod handler. It grips the pipe up to 2,000 psi to thread on the connection."

The design of the MMWS reamer, nicknamed the "Moose," was based on the largest existing reamer in Atlas Copco's raise bore tool line. It consists of a 48-inch-wide core and two 48-inch-wide intermediate wings. Up to eight

outer wings extend the cutting capacity to 26 feet.

The outer wing design was intended to allow efficient cleaning of the head, which uses five-row Standard Magnum cutters paired with 1-inch spacing. The wings were designed to be removable to make underground transport easier. It can be operated with as few as four wings. Raisebor discovered that a six-wing configuration was optimal for keeping the head clear of rock build up.

The 14.1-inch Atlas Copco Secoroc cutters each weigh over 300 pounds. Of the 50 cutters used, 35 cutters went the distance. The 15 that needed to be replaced were only changed because they had been damaged by the large rock fall on the head.

For Sidwell, the objective throughout the project was not to lower the head unless absolutely necessary. The process could have taken two weeks of advancement because tripping up and down



▲ Atlas Copco Secoroc cutters for the raise bore reamer.

◀ The reamer was assembled custom to Raisebor's needs.

would take that much time.

Sidwell worked with Atlas Copco to develop the head. "Atlas Copco respected my input. We discussed what needed to be done to make it better. We put extra wing cutters where I felt they were required and I appreciated the flexibility demonstrated by Atlas Copco."

The cutting face is so wide that for each rotation of the inside cutters, the outside cutters will rotate 22 times.

However, the cutters showed little wear regardless of location on the face. Rotation speed can be set at the control from 0 to 50 rpm while the pilot is drilling and from 0 to 7 while reaming. The crew found the sweet spot to be 2.5 rpm while reaming the shaft.

Vent holes were drilled parallel to the 15-inch pilot hole for two reasons. First, since the raise bore drill cut through multiple coal seams on its way to the

surface, it was important to ventilate it and flush water over the cutters to suppress sparks that could light methane gas. Water also cooled the cutters.

Secondly, within 300 yards of the new drill shaft, large intake fans were sending thousands of cubic feet of air per minute to the face of the mine's workings. With the addition of the vent holes, air drawn down the holes by the intake fans increased gas ventilation. Prior to breaking through the surface, these fans were regulated down to prevent a large influx of dust.

The MSHA regulation was for less than 1 percent methane on the bit face. To dilute the potentially hazardous gas in the coal seams, air from portable compressors was used in addition to supplement the mine's ventilation system, sending air at 1,700 cfm down the annulus of the drill string.

The Atlas Copco Robbins 123RH C raiseboring machine is technically rated for making 10- to 20-foot-diameter holes. Raisebor's achievement has proven much larger holes are possible. ■



RigScan



a health check that keeps you running

Atlas Copco developed Rig-Scan as a diagnostic tool for the equipment that it builds. RigScan is now available in the U.S., revealing the full picture of equipment health.

Working hard in tough environments requires mining and construction equipment to have strength and endurance. RigScan is an advanced audit service that gives participants a

full look at the equipment's condition. Cutting-edge diagnostic tools used by OEM-certified technicians capture the whole picture of equipment health.

After a RigScan audit is performed, customers receive a comprehensive, easy-to-understand report that prioritizes recommended actions to take, listing them from most critical down to routine preventative maintenance. Any safety issues are emphasized and made very clear.

Mitch Peltomaa, Mining and Rock Excavation Service Contracts Manager, said, "At Atlas Copco, we build equipment that helps operations get their jobs done. We build the equipment and we know how to care for it. A RigScan expert can advise our customers whether any issue found needs immediate attention or if it can wait and just needs continued monitoring."

Through early detection of potential

RigScan in practice

Road Machinery & Supplies in Savage, Minnesota, wanted to give a customer a complete health picture of its blasthole rigs. As a new Atlas Copco distributor, the RMS crew also wanted to learn more about the equipment they carry. Atlas Copco suggested a RigScan audit.

Atlas Copco spent about a half day running diagnostics on each rig, revealing many details about the three DM45 blasthole rigs used by a quarry drilling company.

Chris Potter, Product Support Specialist for Road Machinery & Supplies said, “These rigs work in tough environments. The RigScan report put everything in perspective. There were some things people in the field might have noticed, but getting this report to the people in the office made a difference. They could see the parts and needs listed in front of them.”

RigScan provided the owner enhanced safety and maximum uptime by identifying and fixing problems in order of importance, starting with the most critical. Road Machinery & Supplies could provide the highest level of customer service to keep its customer’s drill rigs in production.

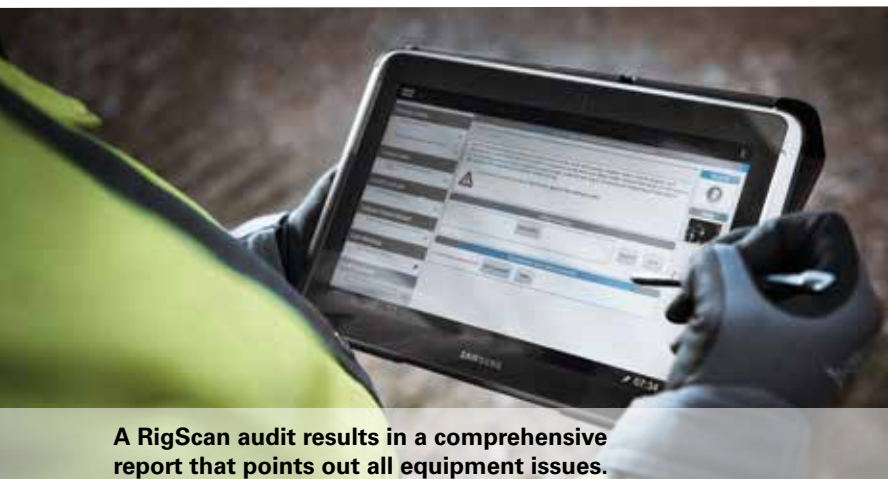


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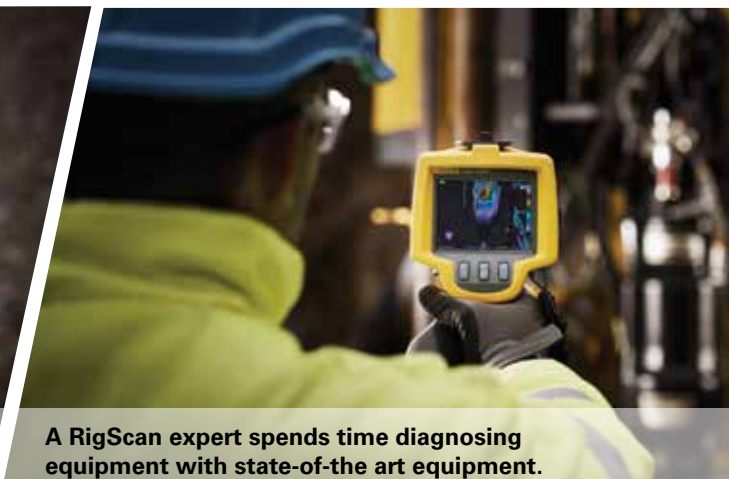
As the equipment manufacturer, Atlas Copco knows the equipment best and what needs to be inspected. We know the life of the components on the machine and which parts wear faster than others. We can identify these parts before they are too worn.

Equipment that works in tough environments must be kept in top running condition to keep safety and production levels up for our customers.”

Spencer Mathews,
RigScan Product Specialist



A RigScan audit results in a comprehensive report that points out all equipment issues.



A RigScan expert spends time diagnosing equipment with state-of-the-art equipment.

hazards, RigScan improves safety. RigScan experts are trained in the equipment’s safety features and are aware of the risks related to the equipment and the workplace. They go through the equipment to detect signs of damage or anything that could cause harm to the people in the working area. For instance, identifying internal leaks, a pressure blockage, or an over-pressurized valve or pump before it fails can

be done while the machine is working, using thermal imaging. This allows Atlas Copco technicians to get a real time view of what is happening without any loss to production, and will ultimately help prevent injuries to anyone around the component.

After receiving their report, equipment owners, managers and operators can plan ahead and schedule needed maintenance well in advance. While

unplanned breakdowns can still occur occasionally, a RigScan report can help minimize downtime and keep operations running at peak efficiency.

Ultimately, Peltomaa said, “RigScan is all about avoiding unplanned downtime. Operations can’t afford to be down for repair or risk safety. With RigScan, they run from a point of knowledge and can do a better job of planning for maintenance.” ■

Atlas Copco—Elko gives Boltec rigs a full physical with

RigScan

▼ Atlas Copco field technician Deven Jantzen explains that RigScan's inspection protocol will not allow an auditor to skip an item. Each must be completed in full before the program allows him to move to the next.



To weather a slump in the gold mining industry, Small Mine Development parked idle equipment in its home office yard outside of Battle Mountain, Nevada. SMD's business model favors holding onto equipment acquired during their busiest times rather than selling it when things slow. Then they don't have to source new rigs when work surges again.

"You can't bid jobs with equipment you don't have," said Mike Schomer,

SMD maintenance superintendent. "The RigScan audit is helping us get assets we already own ready to go back into service so much faster than waiting on a new rig delivery or sourcing a different one for remanufacture."

Two of SMD's Atlas Copco Boltec rock bolting rigs had been idle on the surface, one for nearly two years. They came into the yard fresh from the job where they had been working 24/7. But what repairs and maintenance did they need when they were sidelined? How far

out of OEM specification had their performance fallen? And what had a year of exposure to the Nevada summer sun and a severe winter done to their hoses, electrical components or regulatory placarding and signage?

"If we invested in bringing the rigs back to specification right away," Schomer said, "we'd be allotting a good portion of our capital indefinitely to idle inventory. But we knew the industry would pick up again. So we were looking for the fastest way to get



Matt Roemmich, Atlas Copco lead product support specialist, and Deven Jantzen, Atlas Copco field service tech.

the rigs back into service condition as soon as potential new contracts appeared again.”

MATT ROEMMICH, underground product support technician based at Atlas Copco–Elko, said, “When SMD approached us, we recommended a RigScan audit. The audit gives them a thorough OEM inspection. It identifies everything and will label each as a critical safety or performance issue, a mandated regulatory concern, all the way down to cosmetic items. That helps the customer prioritize what they want done and create an exact budget for the project.”

That first inspection was done on SMD’s rig at the Atlas Copco–Elko customer center. Schomer was so impressed with it that he ordered a second RigScan. The second was conducted in the SMD yard. A RigScan inspection can be performed anywhere, since it requires minimal equipment.

Atlas Copco field service tech Deven Jantzen conducted the 251-point RigScan audit for this specific Boltec model with Roemmich. The Boltec showed 8,137 hours of run time. Roemmich believed it had turned over at least once, representing closer to 18,137 hours.

At the operator’s control panel, Jantzen accessed digital information

from the Boltec’s Rig Control System regarding control input tolerances, recording such things as milliamps required to move the boom or begin rotation. He entered these as answers to the RigScan checklist items.

Next to this rig was a pre-RCS 1996 Boltec. Jantzen and Roemmich demonstrated how the same audit could be performed by manually inputting data indicated on its gauges. To see if the boom’s hydraulic requirements were within tolerance, for instance, Jantzen noted a hydraulic pressure reading as the boom responded with the action he called for.

As Jantzen came across an out-of-spec issue, he photographed the concern. He typed out the recommended corrective action and moved on to the next item to check.

The full audit took the mentor-trainee duo about a shift and a half to complete. However, Roemmich believes it will eventually be possible for a single RigScan tech to complete a full 251-point 2007 model Boltec checklist in a single shift, given enough practice with the system.

The inspection is only the first step of an audit. Roemmich said, “I take that rig-specific inspection list back to the office to match failed items against

the rig’s parts manual. Some just require action by the mechanic, to adjust something, for instance.”

Others require replacement parts or service kits. “I’ll try to find economical choices for the customer to look at in addition to new parts—from the Atlas Copco exchange program, for instance. We back remanned parts just as we do new ones. The customer can get a RigScan discount if they buy parts from us or contract us to do labor, but they have the part number and can source the parts themselves, if they choose.”

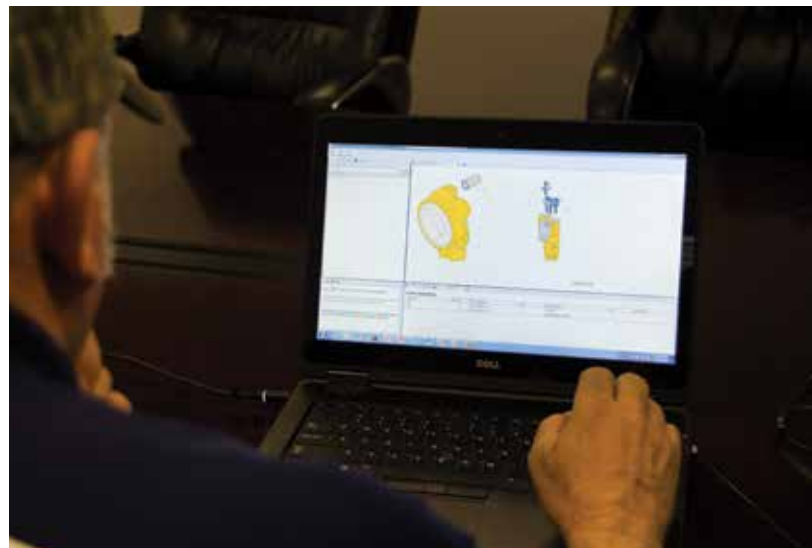
Roemmich provided Schomer with a 188-page, reader-friendly, itemized report covering all 251 inspection points. Schomer received a hard copy in a three-ring binder, as well as an electronic copy on a USB memory device. Roemmich also sent Schomer an email with a web address to download the report.

Schomer said, “It would be an overwhelming amount of information, but the RigScan audit report is presented so logically organized that it’s actually easy to use.”

The report was organized with a table of contents and indexes to information of highest interest. The list was prioritized by category, critical safety items first. Each item explained what



RigScan in process.



Once the inspection is completed, Matt Roemmich matches the audit to the specific parts manual, giving part numbers and pricing.

needed to be addressed, gave OEM specifications to perform and evaluate completed work, and noted the OEM recommended techniques for performing the installation or repair. It provided SMD everything needed to make the most informed decision how to proceed, even whether to assign the tasks to its own service department personnel or let Atlas Copco technicians service its rigs.

“I’d say I got a good deal on the audit, considering the labor I got from Atlas Copco,” Schomer said. “My service staff is busy. To do an inspection as thoroughly as Atlas Copco’s techs did, I would have had to pull my staff off their other duties to comb that rig for days. Then we’d have to research part numbers and source them. Although I’m confident they would have caught many of those same critical issues, they couldn’t have gotten them all, not like this RigScan audit does. Maybe we would have gotten half of what the audit caught.”

Roemmich explained why even the best technicians won’t catch every point: “SMD’s technicians are great at what they do. But most of their day-in/day-out attention is on performance. They keep those rigs working. I know SMD’s techs. They definitely would have caught a lot of these items. Would they know that a mandated safety label or informational label was missing? That’s a potential citation. MSHA can even order the rig out of service until the

label is replaced. So that’s unscheduled downtime we just prevented.”

This is what Roemmich sees as the biggest values RigScan provides his customers: “It’s about keeping the rig productive, reducing downtime. Schomer also values the wide array of choices RigScan provides him that let him create a project with known expenses. “If you ask me the financial incentive for doing this, it’s that I can establish a precise budget,” Schomer said. “Obviously, I want all the critical safety and important performance issues done. But I can choose which items to address in addition to those and stay within a budget that we set.”

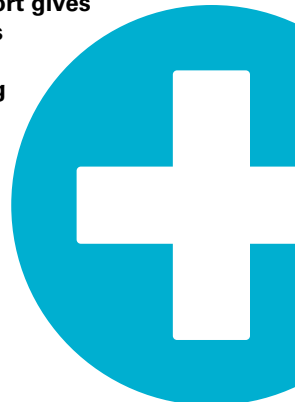
Schomer said SMD will likely be using the service again in the future.

Roemmich believes that regularly scheduled RigScan audits do much more than return a single rig to OEM specifications: “RigScan is basically a great tool to help Atlas Copco support products from cradle to grave. When we do the next RigScan, we’ll see what’s changed, what’s wearing out, and find the cause to improve life expectancy of rig components.”

RigScan is available for Atlas Copco mining equipment through Atlas Copco customer centers nationwide. Roemmich has performed them so far for his customers’ Boltec rock bolting rigs, Boomer face drilling rigs, Minetruck haulers and Scooptram LHDs. ■



SMD Maintenance Superintendent Mike Schomer likes the choices his 188-page RigScan report gives him. The report groups items that failed OEM specifications allowing Schomer to create a precise budget that addresses critical safety issues and critical performance issues but select which lesser concerns he wants addressed.





Choosing the right DTH TOOLS

Best value is determined by application, specific conditions and product support

The wide range of applications and drilling conditions suitable to down-the-hole pneumatic percussion technique requires consideration of more than one type of tool to drill efficiently and profitably. A variety of factors, from hammer size to determining whether or not an economy hammer represents the best value, all figure into the hammer's overall cost of operation on a given job.

CHOOSING THE CORRECT HAMMER

The selection of hammer size is largely determined by the hole diameter and type of rock formation. The optimum blasthole range for DTH drilling is 3 ½ to 10 inches. Smaller holes are typically drilled with a top hammer rather than

DTH hammer, and larger holes generally use rotary drilling technique, mainly with the focus on hole straightness.

As a general rule, the smallest hole diameter a DTH hammer can drill is its nominal size. A 4-inch hammer is optimally designed to drill a 4-inch hole. The closer the hole diameter is to the hammer's diameter, the more restricted the hole's evacuating airflow is. Drilling holes at the nominal size leaves adequate space for cuttings to evacuate the hole up the annulus between the hammer and drill pipe diameters and the internal diameter of the hole's wall.

Maximum bit size for production drilling is the nominal hammer diameter plus 1 inch. For instance, a 4-inch hammer's maximum bit size is regarded to be 5 inches in diameter.

MATCHING THE HAMMER TO THE CORRECT PIPE DIAMETER

Pipe diameter should be close to the hammer diameter to provide optimum flushing, reducing the chances of getting stuck in the hole.

Key features to look for in high-quality DTH pipes are durability, accuracy and manageability. Pipe (tubes) made from cold-drawn tubing provide a superior surface finish and tolerance compared to tubes made from hot-rolled tubing. A better finish reduces the risk from metal chips from the tubes, called scaling. Scaling that flows through the hammer is a major cause of premature hammer failure.

Construction quality is at least as important as design. Friction-welded joints add strength. Heat treating the threads of



▲ Secoroc DTH Hammer and Drill Bit



▲ Secoroc DTH Rocket Bit



▲ Secoroc RC 50



▲ Secoroc DTH Flat Front Bit

end-pieces ensures optimum durability and strength of the thread profile, which results in longer thread life. Preserving the thread profile keeps coupling and uncoupling smooth, without adding time to the average rate of penetration – in other words, the cost per foot to complete holes.

In most applications, standard API threads are the best choice, although adapter subs and crossover subs are available to support any setup.

SELECTING THE CORRECT BIT

DTH bits are manufactured to match the shank and diameter of the hammers. The bodies of quality bits are precision machined from alloy steel, heat treated to a specified hardness, providing surface compression for fatigue resistance, and then fitted with precision carbide buttons.

A variety of bit designs and configurations are available for all rock types, focusing on rock psi hardnesses and application conditions. Bit life and the rate of penetration are the most important criteria in selecting the right bit for a particular application.

Convex-faced, ballistic-button designs are preferable for fastest cuttings removal. This bit design cuts clean with minimal re-crushing, making it ideal for soft to medium, non-abrasive formations.

In hard and abrasive formations, flat-front designs offer best bit life, especially those that feature strong gauge rows with large spherical buttons that are easy to regrind and maintain. An alternative in these conditions is a concave design with spherical buttons.

Concave bit faces work well in medium to hard, fractured formations. In this type of application, a concave bit minimizes hole deviation.

PREMIUM OR ECONOMY

Probably the most fundamental question is whether one needs a reliable, low-cost hammer or a premium hammer. Buying more than one less-expensive hammer to achieve the same drill feet of a single premium hammer is false economy. However, premium hammers that offer maximum rig productivity are not necessarily the best value at every drilling job.

Premium hammers are generally a

better value in production work. A manufacturer's premium hammer features state-of-the-art technology to deliver maximum productivity and profit through superior longevity and reliability. They are designed to be easily serviced and rebuilt. Premium hammers will provide the greatest external wear resistance. Its internal components will likely feature wear and corrosion protection. Its useful life can be extended through multiple rebuilds, replacing only typical wear points rather than the whole hammer.

The word "economy" should not be confused with "inferior" in the term "economy hammer." This class of hammers represents a different strategy for lowering cost of operation in certain applications. Economy hammers are based on simplicity and serviceability, resulting in lower operating costs. For instance, such hammers might be used for deep hole operations, providing higher power outputs, but also feature selector valves to maximize air compressor productivity. Quality non-premium hammers can be rebuilt at least once and feature modular components, snap-in cylinders, a reversible casing, and backhead saver sleeves.

APPLICATION CONSIDERATIONS

Manufacturers design DTH hammers to address the challenges presented by the full array of rock types and applications. For deeper hole applications, hammers are designed to work with different air requirements as bailing velocity requirements change. This allows greater volumes of flushing air for hole cleaning than what is required for optimum hammer performance. Quarry and mining hammer designs may feature heavy-duty chucks, wear sleeves, and backheads fitted with tungsten carbide buttons for wear protection in harsh and abrasive conditions.

The following applications present different factors to be accounted for in your hammer selection.

QUARRY

Quarrying projects are long-term jobs that will easily outlast the hammer. Frequently replacing hammers would be cost-prohibitive. Drillers who are

seeking the highest productivity or who are drilling in abrasive formations should consider choosing the most reliable and productive premium hammers on the market.

Dimensional stone quarrying demands consistently straight holes. DTH hammers offer more precision to hole straightness than top hammers. Dimensional stone operations typically drill smaller size holes of 3 ½ to 4 inches in limestone, granite and marble. Though premium hammers might still offer better value in this non-abrasive application than non-premium models, in some instances non-premium hammers will be the better value.

MINERAL EXPLORATION

Mineral exploration generally requires robust hammers capable of running high pressures, often in dirty, remote environments. Operators tend to prefer simple, reliable designs in this application.

Reverse circulation with specialized DTH hammers is less expensive than diamond coring technique. The RC hammers use the same engineered technology and components as standard DTH hammers, but use RC tubes with inner and outer walls for direct airflow to allow the cuttings to pass up through the pipe to a cyclone for collection bags, rather than the typical hole cleaning up the hole's annulus. RC hammers are used for both deep hole exploration drilling and in-pit grade control applications.

GEOTECHNICAL

Drilling of foundation, anchoring, monitoring or drainage holes demands simple, reliable, workhorses rather than premium hammers.

OPEN PIT MINING

Like quarries, mining operations typically have high equipment utilization, drilling up to 80 percent of the working day with DTH technique. The typical blasthole drilled with DTH tools in open pit mines is 5 to 8 inches in diameter. Buffer holes regularly run 5 ½ to 6 ¾ inches. Pre-split drilling usually requires hole diameters between 4 ½ and 5 ½ inches.



▲ Secoroc DTH Hammer and bit

Some premium hammers for these applications can now be rebuilt twice before replacement. Drillers who choose premium hammers in these conditions also keep rebuild kits on hand to achieve maximum productivity with the longest tool life possible.

Properly training drillers to recognize and maintain optimum drilling parameters prevents premature failure of hammers, whether premium or economy hammers are used in these applications.

SELECTING A BRAND

Hammer value involves more than component material and design. Additional factors must be taken into consideration as well. First, the market offers a range of quality in both economy and premium hammer selections. The hammer must not only be durable enough to be reliable throughout its anticipated lifespan, but its cost of operation figures in as well. The greater the hammer efficiency, the better the savings in fuel and energy, resulting in lower operating cost per drilled foot.

Additionally, drillers should consider the manufacturer's product support. Is the hammer backed by a reliable network of distributors and/or customer centers ensuring hammer and part availability and technical service, or would a field failure result in extraordinary downtime and expense?

An onsite, pre-purchase consultation from the manufacturer provides the customer with expert advice to assist in the customer's DTH requirements. The value of a knowledgeable product support specialist will also help determine which hammer provides the highest profitability for a given project. The support specialist will often provide technical drilling assistance, as well.

Support technicians who work with experienced suppliers bring with them not only their expert knowledge of the products but firsthand knowledge gained from the collective field experience of their client base. This makes them invaluable assets in the field at no extra cost when the driller needs help to analyze or troubleshoot worksite challenges. ■



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UP AGAINST THE WALL

BenchREMOTE for SmartROC D65 reduces danger in bench drilling

The versatility of the Atlas Copco SmartROC D65 drilling rig keeps it working over rough spots on the bench and right up to the high wall. In order to make drilling safer for operators in these precarious situations, Atlas Copco developed BenchREMOTE. The new remote-controlled drilling package can be added to any SmartROC D65 equipped with Hole Navigation System (HNS).

BenchREMOTE allows an operator to control SmartROC D65 drilling rigs from a remote station as far as 100 yards or more, as long as line of sight is maintained.

Mattias Hjerpe of Atlas Copco headquarters in Sweden spearheaded

the research and development initiative, putting it to the test first at a pit mine in Tasmania, Australia. Already in use in Australia and Chile, the BenchREMOTE remote drilling station for SmartROC D65 is now available in the U.S.

Hjerpe said, “Any SmartROC D65 rig can be upgraded for the standalone BenchREMOTE option. The rig must either have or be upgraded first with HNS. It is also recommended that the rig have a wide-body kit, for improved stability for remote tramming over rough terrain.”

Atlas Copco provides a secure wireless network dedicated to BenchREMOTE communications, so there is no concern of crowding the mine’s own communications infrastructure.

Maurice Hunter, business line manager of Atlas Copco Surface and Exploration Drilling Equipment in the U.S. said, “The main advantage of BenchREMOTE is enhanced safety. But being able to handle up to three SmartROC rigs in parallel also helps increase productivity and operator efficiency.”

BenchREMOTE increases the area within a pit that can be drilled. For instance, Hjerpe said the initial customer had not permitted drilling at some walls in their pit due to high risk of slides. “Providing a remote-control solution for the SmartROC D65 kept operators out of those hazardous areas yet let them drill anywhere in their pit.”

BenchREMOTE also increases productivity by expanding driller capabili-



ties. Hjerpe said, “The remote station does not have to be dedicated to a single machine. It can be programmed for use with up to 10 individual SmartROC D65 drill rigs. Right away we realized it could be possible for an operator to simultaneously control more than one of the rigs from a single station.”

With a multiunit operator station, SmartROC D65 drillers can control up to three SmartROC D65 rigs simultaneously. Single unit stations can be upgraded to multiunit capability at any time.

The BenchREMOTE control station can be installed in any housing the customer provides that will comfortably accommodate an operator seated at the 4 ½-foot-tall unit. It needs floor space

3 feet 8 inches wide by 4 feet long. A remotely placed, rig-less SmartROC D65 cabin would work, as would a shipping container, cabin, truck or trailer.

Regardless of choice of housing, the BenchREMOTE station presents the operator the same controls that are in the operating rig’s cabin. A control monitor displays the drill pattern, while a camera screen shows the driller actual real-time footage of the drilling operation and external rig environment.

The video screen will display real-time feed from any camera on the rig, even a reverse camera. Owners who prefer additional cameras can add up to two more. The operator can pan, tilt and zoom each camera. The camera setup and its capabilities actually make it

possible to see drilling operations much more clearly at the remote environment than from within the drilling rig itself.

BenchREMOTE offers other benefits to SmartROC D65 owners and operators as well. It reduces time and cost of complicated safety systems in the immediate rig environment. A remote operator’s perspective of the bench is a much more complete overview. The working environment has been placed away from the origin of drilling dust and noise.

The remote operating environment lends itself to side-by-side drilling opportunities. Placing drillers together at a console increases driller competence as drillers watch each other drill throughout a shift and discuss what they are doing. ■

Out of this WORLD

Things rarely go according to plan. That is, until now.

It's been 26 years since the first Global Positioning System satellite was shot to geosynchronous orbit 12,600 miles above the earth. What the Atlas Copco SmartROC T45 blasthole drill rig does with GPS today "is just incredible," said Troy Thiel, Atlas

Copco technical manager for Surface and Exploration Drilling.

The SmartROC T45 is a top hammer surface crawler drill rig suitable for line drilling and blastholes up to 5 inches in diameter for quarry, mining and construction applications. Atlas Copco has given the fuel-efficient SmartROC T45 market-leading advantages of total-site positioning right from the assembly line.

It may be the only rig in its class that comes hardwired with its own site navigation system. "This is what the construction industry has been waiting for," Thiel said. "Total site positioning lets this rig really shine, showing what it's capable of."

Thiel said with a total site positioning system, the SmartROC T45 doesn't just improve blasting economy by enabling more precise drilling; it also significantly reduces costs for pattern planning and layout. He believes almost any drilling company that

uses computerized features based on the Global Navigation Satellite System can see a huge impact on profitability. The GNSS comprises all satellite navigation systems currently operating, including the United States' updated, modernized version of the initial GPS array.

GNSS-guided drilling is just one more way the SmartROC T45 has earned its reputation as low cost to own and operate. Other features include an exceptionally efficient design that has only one third the hoses and cables of other rigs, lowering maintenance costs. Coupled with its fuel economy—the SmartROC T45 uses less than half the fuel of other rigs in its class, Thiel said—no other rig is close, either in cost of operation or cost of ownership.

GNSS NAVIGATION: LESS MONEY IN THE GROUND, MORE IN THE BANK

"We have a customer right now," Thiel said, "who wanted the SmartROC primarily for its fuel economy and data tracking abilities. He knew he'd save money, because the rig lets the driller manipulate the air flow and dust collector. Depending on ground conditions, that can be quite significant. Yet he was still surprised to see how great his fuel savings were. We can't promise this every time, but in the conditions he was drilling, he was able to save half the fuel. One of his quarry clients contractually supplies fuel for drilling. Passing savings like that on to the customer, who do you think that customer wants to keep as its drill and blast contractor?"

Then Thiel suggested, "But now imagine that same contractor spreading out his patterns with total site positioning system."

The SmartROC rig's Autofeed Alignment works with the GNSS system to ensure the rig

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drills each hole precisely parallel to all other holes in the pattern. This capability allows drill-and-blast companies to widen their shot patterns while maintaining control over fracture size, fly-rock and particle velocity. Wider patterns require fewer holes over the same coverage area, saving costs associated with labor, consumables, rig wear-and-tear and explosives.

“Holes cost money,” Thiel said. “Less money put in the ground is more money to put in the bank.”

The reason most drilling companies can’t widen their patterns without the SmartROC, Thiel said, is that it is almost impossible to make parallel holes. “Say the driller is to make 15-degree holes. Tramming hole-to-hole across rough terrain, he’ll never match rig attitude one hole to another, let alone get the boom and rock drill angles right. That’s just too many variables to account for—in addition to variances in a given operator’s performance for any given hole.”

The GNSS-guided SmartROC AutoBoom, however, drills holes relative to the drill plan, not to the rig’s attitude and not to the terrain. In other words, these variables no longer require consideration.

GNSS-guided drilling lets drillers cut down on pattern planning and drilling time, while also saving money in the amount of explosives needed to shoot a job.

To further illustrate this point, Thiel gave an example of what the SmartROC T45 can do to a conventional blasting job. A drilling contractor was required to level the site for a company’s regional warehouse. It would be lowered through multiple “lifts” of 15 feet each down to its specified elevation to 45 feet. Each lift required dozens of blasthole patterns to cover the site.

“Think of how much time this required in planning and surveying,” Thiel said. “Each shot had to be planned and then laid out—physically measured and marked by a survey team so the drillers could identify where the holes were to be drilled. After each shot, they planned the next pattern to meet up with the previous

one. So when the series of shots was interrupted due to scheduling congestion, the contractor had no choice but to set his rigs aside and wait. They stayed idle until the area was freed for them to resume that pattern.”

Thiel said, “Now picture what a couple SmartROC T45 rigs could do in the same situation using total site GNSS navigation. The drill-and-blast engineer would simply plan the entire site and send it to the SmartROC. He’s done. There’s no survey crew to measure and mark the pattern, because the driller sees it on his display, not on the ground.”

If drilling is interrupted at one part of the site, he can take his rig somewhere else on the site to drill. GNSS-guided drilling is accurate to within 3.9 inches regardless of where the rig begins and ends.

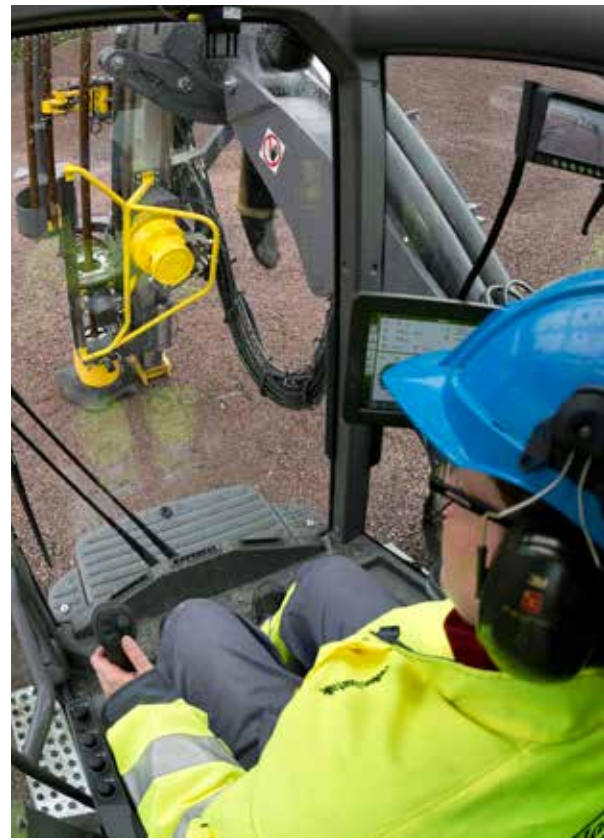
Since the operator doesn’t require visual cues from the ground before him, Thiel said it also means no time is ever “wasted repainting shots” after a snow or heavy rain.

BEGINS WITH AN EFFICIENT DRILL

GNSS guidance is just one more way the SmartROC T45 saves drillers money through efficiency. Its inherent fuel economy means drillers do not have to stop their rigs during a shift to refuel. Less downtime results in faster completion.

SmartROC rigs also have a Progressive Drill Control system. Progressive Drill Control adjusts drilling parameters to changes in drilling conditions as formations gradually become harder or softer or in the instant encounter with a void. This reduces deviation and is gentler on the tooling and rig. Extended life of consumables reduces operational costs even further, job after job.

For almost any drilling company, Thiel said, the SmartROC T45 creates the perfect financial scenario: it offers a lower cost of ownership and operation while raising the standards for a “smart” operation. ■



GPS AS PART OF GNSS

GPS WAS THE FIRST of what are now collectively referred to as the Global Navigation Satellite System (GNSS). The GNSS currently comprises the United States’ updated, modernized version of the initial GPS array; the European positioning satellite system called Galileo; and Russia’s reconstructed GLONASS. All of the satellite systems were designed to be technically inter-operative. Positioning packages formerly referred to as GPS systems are now commonly marketed as GNSS-based navigation equipment.

The Atlas Copco SmartROC T45 comes with its own ready-wired GNSS-guided site positioning capability. However, its third-party protocol feature allows almost any GNSS package on the market to be installed on the rig.

Third-party protocol enables an aftermarket positioning system to receive information directly from the SmartROC T45 rig sensors for the most accurate information.

PIT VIPER 311

makes the grade

Atlas Copco's new Pit Viper 311 has successfully completed field testing at a copper mine in the U.S., confirming the value of many of its key design features





Quiet and comfortable: The cabin of the PV-311 was especially appreciated by the operators.

Maureen Bohac
Product Manager, Atlas Copco

The latest member of Atlas Copco's blasthole rotary drill rig range—the Pit Viper 311—has recently completed a six-month field test at a copper mine in the southwestern region of the United States.

The result: A+ on all counts.

The prototype PV-311 went into service at the mine with the focus on cooperation between mine personnel and Atlas Copco engineers to test modifications that would help increase productivity and efficiency. The PV-311 drilled 10 ⁵/₈-inch and 12 ¹/₄-inch diameter holes—the largest hole this rig can drill—on benches 49 feet high.

The 10 ⁵/₈-inch holes were drilled to a depth of 56 feet 6.5 feet of subdrill, while the 12 ¹/₄-inch holes were drilled to a depth of 65 ¹/₂ feet with 10 feet of subdrill.

Five different drill patterns were used depending on the location of the test in the pit. The rig typically completed 35 to 40 holes amounting to 1,197 feet drilled in a 12-hour shift. The average availability was 90 to 95 percent.

The rock encountered in the mine is typical of most copper applications, not homogeneous and with a compressive strength around 250 to 300 Mpa.

Atlas Copco Secoroc tricone/DTH bits were used with each bit lasting 2.5 to 3 days.

The prototype rig was subsequently purchased by the mine.

Maureen Bohac, Product Manager, Large Blasthole Drills, at Atlas Copco says: “The PV-311 had no trouble managing rough conditions while consistently hitting its targeted depth and maximizing the quality of the hole drilled.

“One of the contributing factors was that the PV-311 is designed so that the bits are changed above the rig's deck, even while single-pass drilling a 65 ¹/₂-foot deep hole. This enabled the operators to focus on making and breaking the pipe connections each time. In addition, this prototype included our optional hydraulic clutch, which is designed to reduce fuel consumption during non-drilling operations and this had a big impact. Another factor that influenced fuel efficiency was the autodrill functionality

of the rig's RCS” (Rig Control System).

Fuel efficiency was approximately 20 percent better than other rigs on the site. On top of this, the PV-311's quiet and comfortable cab proved to be especially appreciated by the operators.

“The new cab on the PV-310 series is one of the things operators are most excited about,” continued Bohac. “The cab has a fully adjustable and elevated chair with joystick and cab controls and an excellent view with larger windows and mirrors, well placed so the operator can see what's going on at ground level and in front of the rig.”

The PV-311 is now production drilling at mines on three continents in applications including copper, coal and iron. ■

PIT VIPER 311

DESIGNED TO FILL a gap between the PV-270 series and the largest blasthole drill offered by Atlas Copco, the PV-351, the PV-311 can drill in soft and hard rock formations, operating at the lower end of the PV-351 and the upper end of the PV-270 series.

A multi-pass version of the PV-311, called PV-316 is now under development. The PV-316 will drill to a depth of 295 ft using a 5-rod carousel with 50 ft drill pipe. The PV-316 will match the flexibility

required for cast-blasting operations in coal mining.

The two-speed hydraulic rotary head (currently used on the DM-M3), delivers 12,880 ft-lb of rotation torque at 140 rpm and 7,000 ft-lb at 240 rpm.

Hydraulic cylinders drive the cable feed system, and the patented automatic cable tensioning system reduces cable and rotary head guide wear by continually keeping the rotary head aligned and taut, reducing unscheduled maintenance time.

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