

# DEEP HOLE DRILLER

AN ATLAS COPCO PUBLICATION FOR THE DRILLING PROFESSIONAL — NO. 1 / 2011

## EXTRA SPECIAL RD20 XC for oil field pipe



TH60 gets  
a boost  
of air

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Atlas Copco  
rigs and  
Water for Life

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The Antidote  
to Arsenic

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*Atlas Copco*

## EDITORIAL



As the newest member of Deep Hole Driller's editorial board, I'll take just a moment to introduce myself. My 31 years serving the drilling industry has included experience with waterwell and exploration. Currently I am the Regional Business Manager for Sales in the U.S., Russia, Ukraine, Mongolia and Central Asia.

In this position I've noticed that while the outlook for deep hole drilling in the country is positive, the economy remains soft. With competition tight for any market opportunity, Atlas Copco continues to give their customers the advantage through product development and support.

Our newly upgraded T2W rig is a good example. Its customer-requested options include swing-in external carousel pipe handling and a hydraulic front-wheel assist for getting in and out of tough terrain. It also has an automatic transmission and meets the latest engine emissions standard.

I'm looking forward to working with the Editorial Board. And, as always, I want to thank our customers for their continued support of the Atlas Copco brand, which is dedicated to sustained productivity as their "local, global" partner, in every region.

**Mark Stewart**  
Regional Business Manager  
USA, Canada, Russia, Ukraine,  
and Central Asia

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Free Subscriptions: [www.deepoledriller.com](http://www.deepoledriller.com)  
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# EXTRA SPECIAL

The RD20 XC for oil field pipe >>



*The tophead of the RD20 XC, which has bails and a hydraulically activated elevator rated to 120,000 pounds (54 metric tonnes), is specifically designed for bottleneck pipe handling.*



**T**he timing was right,” said third-generation oil driller Doug Jackson. Jackson owns Jackson Drilling Services, LP of Justin, Texas. His company had won the bid on a surface casing contract with Pioneer Natural Resources. The Atlas Copco RD20 XC, which would be the first of its kind in North America, was a perfect match for the job.

The RD20 XC does something no RD20 before has done: it handles externally upset pipe, also called EU or “bottleneck” pipe. Jackson said for four years he had heard talk and participated in discussions about the use of bottleneck pipe on the RD20. When it was finally a reality, he wanted in. The Pioneer contract was perfect timing to

become owner of the continent’s first XC, which stands for Xtra Capabilities.

Set up northeast of Alvord, Texas, on a clean white pad of rock amid grazing cattle with buzzards lazily floating high overhead, his crews were on their second of three 12 ¼-inch holes. Each was to be cased with range 3 threaded 9 ⅞-inch steel casing to 940 feet (286 meters). The center hole was straight down. The two to the sides were to be angled away from it at 3-degrees.

Delaney Erickson, sales representative from Venture Drilling Supply, said, “This is becoming a common practice, having a rig like the RD20 do the surface casing ahead of a conventional drill.” The surface casing mitigates environmental concerns,

**“**This is becoming a common practice, having a rig like the RD20 set the surface casing ahead of a conventional drill.

---

**Delaney Erickson**  
Sales Rep. Venture Drilling Supply

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such as ground water contamination, sealing off the hole past the point of concern. A conventional drill will move in over the cased holes later to continue drilling through them and then horizontally along specified paths, thousands of feet into the target areas. These holes will be fracked and then packed with sand to allow oil to filter into the wells for collection.

### Clean operations

A newspaper editorial that week had been questioning the impact that all the drilling rigs operating in Texas might have on air quality. Mike Tharp, Jackson Drilling Services drilling supervisor, smiled when he heard this, pointing out the RD20 XC's exhaust was so clean that "you could drive that rig through any major city and the air coming out of it would be cleaner than the air that went into it." He pointed to its large exhaust filtration system. "That rig is clean."

Around the RD20 XC, the company kept a neat layout of logistical support. Large hoses to and from a two-tier settling pit handled the bentonite mud mix they were using to drive their mud motor. The pump was to one side of the rig, the water truck to the other. Tall racks of casing lay along the far fence line. And a flatbed, with its ingeniously simple, home-made hydraulic pipe advancement system, was backed up to the RD20's deck, which was the center of activity.

### Xtra Capabilities

Several differences between a typical RD20 and this RD20 XC were readily apparent. First, there are two large hydraulic makeup and breakout wrenches on the helper's side, as bottleneck pipe does not have the wrench flats that are found on standard RD20 pipe. The wrenches' pedestal mounts include adjustable pin points in two-inch increments



*Oil field pipe and collars lack wrench flats, so a chain wrench can be used when the pipe requires manual manipulation.*

to accommodate a wide variety of pipe and collar sizes.

The table is about a foot lower from a standard RD20, making room for a tapered pipe bowl and slips in the master bushing. With slips in place around the pipe, downward force by the pipe clamps the pipe tighter in the bowl, preventing the pipe from dropping back into the hole during makeup and breakout.

The tophead itself has bails and a hydraulically activated pipe elevator attached to it that is rated to 120,000 pounds (60 tonnes) and is specifically designed for bottleneck pipe handling. Jackson Drilling Services uses a short pipe adaptor in the elevator to facilitate quick hookups with the pipe from the flatbed after their hydraulic pipe advancer pushes it forward from the flatbed and up at an angle for hookup.

Jackson also purchased the optional directional drilling brake system. The dual-caliper disc brake has more than 8,000

ft-lb of rotational torque available to freeze the drill pipe in place while the RD20 XC continues to pump mud at up to 3,000 psi. The slight bend in the mud motor will then influence the direction of travel. Sensors within the directional drilling section pieces send information back up through the mud, which becomes its conductor. The signal is read on a small panel giving azimuth (compass direction) and inclination. There is no limit to direction, only to radius, and that's controlled by the amount of bend in a particular mud motor.

### Why bottleneck?

Erickson explained the preference for external upset pipe. One hint is in its nickname, "oil field pipe." It is found almost everywhere here in the midst of oil country.

Not only is it widely available through any number of suppliers and is more familiar to oil field hands, it allows unrestricted flow of mud through its upset connections. »



*The RD20 XC handles this job's range 3 threaded 9 7/8-inch steel casing with ease.*

» “Flush-jointed RD20 2 7/8 I.F. pipe is only about 2 inches wide inside the joint to make room for the threading,” Erickson said, while external upset joints allow mud to flow unrestricted throughout the string’s continuous internal diameter.

#### **Quick learning curve**

On this job Jackson has both his day and night shift crews onsite working together. This dual training ensures procedural consistency, keeping both crews on the same page as they learn the rig. Mike Tharp said that the crew picked up on the RD20 XC very quickly.

“Since November [2010] they’ve only used it on about four jobs,” Tharp said. Watch them now after they connect a section or two. They’re really something to


see once they get their rhythm.”

And as parts of an organic machine, each man fluidly stepped in and stepped back in rapid, synchronized motion, whether for drill pipe sections or for casing. The RD20 carriage system seemed always to be in motion, as if controlled by computer routine. But it was not a computer: it was inputs from the driller, Hip Figueroa, whose hands never left the operator’s levers and whose eyes never left his crew except to glance at his gauges, seemingly unaware of the occasional splashes he received during makeup that gradually turned him into mud statue of light gray bentonite.

Jackson echoed Tharp’s observation, saying, “This is only about their eighth hole with this rig and they have it down.”

Figueroa, who has been with Jackson

Drilling Services for a little more than five years, smiled when he was asked about rate of penetration: “Fast as it will go!” Then he added that the crew in training was “averaging a 30-foot section of pipe in 11 minutes, including connection time.” That averages out to 2.7 feet (.8 meters) per minute. The longest time was 17 minutes, again including connection time. They are drilling “through topsoil, sandy clay, red and gray shales, and occasionally soft to hard limestone,” said Tharp.

Jackson Drilling Services drilled and cased the three 940-foot (286 meters) holes in just a week’s time before moving off the site. The holes were immediately cemented by a separate contractor, ready for the conventional rig. 



A man wearing a yellow hard hat, sunglasses, and a light blue short-sleeved shirt is operating a piece of yellow drilling equipment. He is standing outdoors in a wooded area with green trees in the background. The equipment has a "NOTICE" sticker and a "SAFETY" sticker on it.

# AS IF BY CHANCE

## A DRILLER YOU'VE JUST GOT TO MEET

**M**any drillers loyal to the Atlas Copco brand are walking in their father's footsteps, even their grandfather's and great-grandfather's. Their stories are rich with the history of the industry.

Then there are those who catch you by surprise because their stories are so varied, rich as history itself. They come into drilling almost as if by chance. Such is the case of John Dufford, a World War II Marine fighter pilot and founder of the five-man, single-rig Dufford Drilling Company in Glastonbury, Connecticut.

An avid sports fan and athlete, retired Lt. Col. Dufford, who just celebrated his 90th birthday in February, tries to make it to the 40 or so slow-pitch softball games his team plays a year. He said he's not as good as he used to be, and that those younger pitchers can really throw fast, but he loves to play.

To put the word "younger" in context, consider that it's a 55-and-over club. Dufford also played hockey with his children into his mid 80s and he still tries to skate at least once a year.

His involvement in college sports and completion of his Penn State engineering studies were interrupted abruptly by World War II, during which he flew Corsairs. He flew with famous Marine fighter ace Joe Foss, served at Guadalcanal, and was stationed 14 months in the Pacific Marshall Islands. In between tours he married his wife of 64 years. >>





(top) A Marine naval pilot who flew Corsairs in WWII, Dufford went on to achieve the rank of Lieutenant Colonel after a long career with the Reserves.

(above) Dufford is featured as part of a display at the Penn State All-Sports Museum.

“Everything just keeps improving. Today I get 1,000 feet out of a bit and another 1,000 feet if we regrind it.”

**John Dufford**  
Founder, Dufford Drilling Company

» Dufford worked as an engineer for world leader in aircraft design and manufacturing Pratt & Whitney where he designed a nuclear engine for aviation. The project was cut short by advancements in airborne refueling capabilities, rendering his project unnecessary and too expensive to continue. In 1955 he moved up to their Maine plant.

It was during this time he dabbled with the idea of managing a drilling company on the side. He acquired a Navy cable rig, “Baby,” intent on hiring someone to run it, but he had not anticipated that his employees would need constant training and supervision. He left Pratt & Whitney to tend to his drilling company full time. “I question that sometimes,” he said, “whether I should have stayed on with them.”

Two years after he began work with Baby, he got a Kelly drive rig and used an air-powered hammer with it. The rig’s air was too weak for the 120-psi hammer, he said, so he mounted an auxiliary compressor on a truck. He got 130 psi from the combination.

“That worked out pretty good,” he said, getting him from 1960 to 1963, “but it did have its problems. I couldn’t control rpm, and the Kelly bar wasn’t loose enough, so I had problems with bit wear.

“Then I got the Ingersoll-Rand T3 (TRUCM3) with air rotary drive. It was flexible. I mean, if I hit a hard spot, it would slow down and then build back up. I could change speed, had better control of rotational speed, it was more flexible. Now they’re all hydraulic, of course. On my first drill, I was getting 10 feet a day if I was lucky, and now I was getting 10 feet an hour.

“Then button bits came out. They were amazing!” He had been using “big slugs on carbides that you had to regrind every 25 to 35 feet, depending on the granite you were in” until he received a couple carbide button bits from the factory to try out for a month or so.

“Boy what a difference that made. We were testing them, you see, so I really pushed it. I used them for 200 feet without touching them. I was getting 50, 60 feet an hour, and in softer rock 100 feet an hour.

“Everything just keeps improving. Today I get 1,000 feet out of a bit and another 1,000 feet if we regrind it.”

Dufford said that on a 6-inch bit in the conditions he drills, he will lose 1/8 to 1/4



“ [T4s] were unbelievable. Heavy machines. Could go real deep.”

**John Dufford**  
Founder, Dufford Drilling Company

inch in 2,000 feet. He might grind it another time to get 3,000 total feet from it, but if he's busy, he said, he won't stop to do that.

The evolution of rigs has impressed him just as much as improvements in hammers and bits. When he bought his first T3, he said, "I told the guy, 'If it will do what you say, I'll take it.' The next day we drilled with it and I bought it. Four months later I bought a second one."

Rig advancement came fast, too. Dufford searched his memory. The first one he recalled had "125 pounds with 600 feet of air." Only two years later he had a rig that was "160 pounds and 800 feet of air." The next was 200 psi with 900 cfm. A few years after that, he owned a T4 with 1,050 cfm.

"[T4s] were unbelievable. Heavy machines. Could go real deep. But they were a little tougher to move around." So during the hard times of an economic recession he sold them for a price he could not refuse.

"It was winter time. This overseas guy was flying in to look at some airplanes here. Both my T4s were out in my yard. No work. And this guy saw them from his plane, landed, found my number, and wanted to buy one. Just like that. Then he must have called someone he knew needed one, because I sold both within four hours of each other." Dufford replaced them with T3Ws.

Technological advancements, he said, have made drilling so cost effective that it's incredibly cheap to drill a hole compared to years ago. "If I can drill for 20 cents a foot hammer cost, I'm in pretty good shape. But if you don't get that around here, then it starts to hit your bottom line."


Dufford's drilling expertise and experience drew him to be involved with the state drilling association, where he helped



implement by-laws, guidelines and rules and regulations in the industry. He is also the founder and director of the Connecticut Winter Workshop, in which drilling contractors get continuing education.

For a brief time Dufford was the owner of a 90-man drilling operation. During his blasting years he kept about 25 people. In more recent years, for water well and pump installation, he cut back to a 10-man operation. "There're just five of us now," he said.

Dufford summed up his career so far in just three words: "It's been fun."

Atlas Copco is very proud of its long-time affiliation with a man like John Dufford. May it continue for many more years yet to come. 

*Though his company is smaller than it used to be, Dufford is still busy drilling.*





# Water for Life

Atlas Copco rigs drill quality water in Haiti

In 1971 Willis Miller set out to make a contribution in this life that would truly matter. He moved to Haiti where, in spite of living on an island it shares with the Dominican Republic, much of the population lived without access to clean drinking water. For the next 10 years he drilled water wells with several companies, intent on sharing God's love by giving them what has been the most powerful symbol of life for every culture from the beginning of time.

However, with no investment by the primary stakeholders, the local community, they allowed the pumps to fall into disrepair. Then the communities turned again to dirty creeks and backwaters for drinking water. Waterborne diseases and maladies returned. Ten years after he started, Miller went back home to Wapello, Iowa, defeated.

His farmer friend Kenneth Grimm didn't let him quit. Grimm sold farm equipment, rented out 250 acres of land and within three months brought Miller \$30,000 dollars, saying, "You can do it." So Miller returned to Haiti to start his own well-

drilling ministry. For the past 28 years, his operation has continued as a diverse, multid denominational mission that's been so successful that they've just now added another drill rig, an Atlas Copco T2W.

## Origin of Water for Life

Leon Miller, who joined his father in the Haiti mission in 1985, retold the story of how the mission got its name. "We always wanted people to realize the love of Jesus in this. The villagers are so happy when we hit water. They hug you. They kiss you. To the people, the driller is a kind of hero."

In that first year, Leon said, a missionary named Marion Layman, witnessing just such a celebration, remarked to his father, "Water is life. So you should call your mission *Water for Life*." And so his father did, pleased with its Christian overtones.

Today there are several organizations in the world with missions named Water for Life, but there is no real affiliation among them other than that they bear the same name. To distinguish their operation from others, the Millers simply added "Haiti" to

their company moniker, becoming "Water for Life Haiti."

## Strong as ever

Though Leon and his wife came back to give their children a more customary American lifestyle while they grew up, he has been continuously involved with Water for Life for 25 years. Leon's nephew, Troy Miller, has been their primary driller for the past three years. He lives in remote areas among the Haitian people, who provide him with food and lodging during his work. Leon's brother-in-law, Leonard Hochstedler, serves as home office administrator back in Iowa, ordering and arranging shipping for parts and supplies, casing, and pumps, taking care of all the paperwork.

At age 90, Willis is officially retired, though he is still involved with Water for Life Haiti today from his home in Kalona, Iowa.

Prior to his return to the United States, with his uncle Leon to pick up their new Atlas Copco T2W, Troy had just completed the 798<sup>th</sup> 5-inch well. These wells are





drilled in abrasive volcanic rock with some shale at higher elevations, and in sand and gravel formations in the bottom lands. They have drilled to as deep as 800 feet (240 m) or more, but the average well is 125 to 150 feet (38 to 45 meters) deep. Wells drilled closer to the coastlines run the risk of hitting brine, but they have been fairly successful: only 50 of the wells had to be abandoned as dry or too salty.

### Irrigation's impact

Soon after they started their mission, Grimm devised an irrigation plan. There was good soil here with water just 100 feet below it. So they drilled a 10-inch (25 cm) well and installed a diesel-powered turbine to provide flood irrigation from the 900 gpm (3,400 lpm) water source. Once the land was cleared and watered, the people began growing corn, beans, banana trees, and vegetables. Next, Grimm's generous contacts from Nebraska provided 750-foot-long center pivot irrigation sprinklers. The irrigated circle beneath a sprinkler was divided into half-acre, pie-shaped lots for family gardens. They drilled five more of these 10-inch wells.

Irrigation's success meant the people now needed a corn grinder for all the grain they raised. Water for Life provided one, as well as a walk-in cooler for storage, which local fishermen began to use, too, to keep their catches fresh. The benefits

just continued to escalate from there. For instance, with ample water available and more abundant food, children who had been a critical labor force for daily sustenance were now free to attend school.

### Today's operations

One significant difference between today's Water for Life operation and Willis Miller's initial experience drilling in the 1970s is that the primary stakeholders must invest in the project, raising funds for a well. The example given was around 200 Haitian dollars. This may seem nominal by American standards, but it is a significant amount for a Haitian community to raise. And to maintain the wells, Water for Life now has a Haitian crew who operates a service truck with a winch that can go wherever repairs are needed. Repairs also require community funding.

Primary stakeholders now take measures to protect the pump from carelessness and abuse. The result is that pumps last much longer, since community leaders know they will have to come up with the money again. Water for Life will not turn away from need, though. Leon said they know too well that if a village can't fix a pump, the villagers will go back to drinking dirty water and the cycle of disease will begin again.

Larger expenses are paid from donations abroad, such as those for a bulldozer and a »

“ The villagers are so happy when we hit water. They hug you. They kiss you. To the people, the driller is a kind of hero.”

**Leon Miller**

Joined the Haiti mission in 1985

*(photo, facing page) The Water for Life Haiti team drove their new T2W from Milwaukee, Wisconsin, to their home base in Kalona, Iowa, and then to the Clint Madison farm in Arkansas. They tried the rig in various soil and rock conditions before taking the rig to its final destination in Haiti.*

*(above) Arkansas site testing team: Leonard Hochstedler, administrator; Leon Miller, CEO; Clint Madison; Buck White; Troy Miller; Rob Madison; Jerry Sandberg.*



*Troy Miller (at controls) has drilled for three years with his uncle Leon, who served as his helper during the startup procedure in Arkansas. In Haiti they live among the people they serve in the most remote regions of the country.*

» dump truck for opening or upgrading roads to the sites for drilling the wells. Leon said God is surely indicating that he wants their mission to continue, because money for these essential machines comes in when they need it, as now, with the purchase of their new T2W.

### Choosing the T2W

The T2W was well-endorsed by their team's resident equipment specialist, Harold "Buck" White. White first started working on drilling sites with his father when he was 8 years old. By the age of 18, he was a driller himself. During the three years he was a salesman for Ingersoll-Rand in Villa Park, Illinois, he met Leon Miller and sold Water for Life their first drill, a competitor's model.

Now retired, White remains dedicated to what he calls an "awesome, awesome mission," saying Leon's crews "drill wells as real water well drillers, not just churchy people." According to White, these men aren't just visiting missionaries but real drillers, living "out in the middle of nowhere." All told, White has been to Haiti 28 times to help out with their first rig, fine-tuning it, repairing it. He's been familiar with the T2W since its prototype.

### Testing the rig

The rig traveled from Atlas Copco manufacturing in Garland, Texas, directly to Milwaukee, Wisconsin, for performance testing in Atlas Copco's Waterwell Center of Excellence. Leon and Troy came to Milwaukee from Haiti to take possession.

In the unusually cold April the Midwest was enduring, they drove it to Kalona, Iowa, to initiate the startup process of a new rig. Here they put its mud-drilling capability to the test. It had no problem in the rich farmland soil, but they really wanted to try it in rock with their new Atlas Copco TD 40 hammer. Clint Madison's farm near Williford, Arkansas, was the perfect place. He had plenty of rock, and his place was on the way to Ft. Lauderdale, Florida, where the rig would be loaded for shipment by sea.

White had met Clint Madison of Madison Drilling near Williford, also while he was working as an Ingersoll-Rand salesman. Madison has a reputation for being able to fix or fabricate anything, and his farm bears this out with not only his own drill rig but a vast array of machinery, including antique tractors and a tail-dragger airplane. He said he's been "turning wrenches" for Water for Life Haiti for years, and his son Rob has joined him in Haiti to make repairs.

On the Madison farm, Troy quickly drilled through the unconsolidated soil of a low-lying pasture within a shout of the Madison homestead. Then he switched out the tricone to put in the hammer. White and Madison joined Troy at the rig as it worked, and Troy fairly quickly was drilling 2 ½ feet (76 cm) per minute in limestone with a 5-inch (125 mm) bit on the TD 40.

Leon explained that they needed to really put the rig through its paces because once they got it back to Haiti, they would be far from support.

"The pressures are dead on," White said. "I was ready to make adjustments but they didn't need any. They did an excellent job."

### The perfect water well rig

White rapidly listed advantages of the rig: "It's the perfect mud/air rig, just perrrfect! It has faster rotation, 270 for clay; big torque at twelve thousand (12,000 ft-lb / 16,270 Nm); high speed up/down—this thing is awesome! The combination of pullback and pull-down, air or mud; it has a winch...."

Both Leon and Buck agreed that what helped a lot to sell them on the rig is that it will get them in and around the rough back country of Haiti. Leon said, "Not just any rig can handle those roads." Buck agreed, adding, "It would tear the carriages right off a lot of other rigs." For the extra margin of comfort, they did take a precaution of ordering their rig with lifting blocks under the suspension to raise everything another 4 inches. But its big wheels, ample power and small footprint ensured that it would be up to the demanding island environment.

This robust rig is a perfect match for the demanding conditions of their mission in Haiti. ☉

*Donations for Water for Life may either be mailed to: **Water for Life, Box 456, Kalona, IA 52247** or through their online website at [www.wflhaiti.com](http://www.wflhaiti.com)*



# A NEW COMPETITIVE EDGE IN DEEP HOLE DRILLING

Now drillers can *really* tell what goes on inside the hole

By Leif Larsson

The best deephole drillers seem to possess a sixth sense, putting them in a class of their own. They make competent assumptions based on their years of experience about what's taking place at depths greater than 100 meters. At the end of the day, though, these assumptions are at best just educated guesses. What if there were a way to take the guesswork out of it altogether?

We set out to find a way not just to predict what goes on at the bottom of the hole but to actually see it. The result is EDGE, the world's first system for deep hole monitoring.

EDGE is a three-component system that gives a driller continuous, instant feedback about the performance of the hammer as it strikes the bit. It can be fitted to all types of deephole drill rigs that use Secoroc DTH (down-the-hole) hammers. It consists of a sensor, a data processing unit and a rugged 7-inch display screen.

### How it works

The sensor captures vibrations that travel directly from the bit itself through the drill string. It sends these to a PC, which translates these signals into numerical readouts and graphic images on the display mounted next to the drill controls at the operator's eye level. With this display the

driller is always "seeing" the performance of the bit and makes instantaneous decisions based on this real-time information.

In the graphical view, any problems or unexpected changes are displayed with alerts. The driller responds to this feedback, continuously optimizing the drilling process.

### End of "blind" drilling

EDGE significantly impacts the bottom line for the deep hole drilling industry, where equipment loss, trouble-shooting and maintenance have always represented a major portion of the investment. When a new type of rock formation threatens to "shank" the bit, the driller has time to make adjustments before catastrophic failure. Or perhaps the hole is not being flushed properly, and the drill string is in danger of jamming. Maybe a slight vibration is caused by movement inside the chuck due to insufficient feed force, gradually reducing the efficiency of the cutting capacity.

In addition, EDGE also brings improvements to driller performance, both veteran and trainee.

Performance standards for trainees no longer depend on how well a person learns to discern what goes on in the hole "by ear," a talent that is only acquired from

*The complete EDGE system consists of sensor, data capturing and processing unit, a PC with 7-inch display, a magnetic mount cable, a PC mounting device and power cords.*

years of experience.

EDGE also helps the experienced driller's performance. No one stays at peak performance throughout an entire shift. But EDGE enables the experienced driller to remain at peak performance longer. First, it removes much of the exhausting stress that drilling blind for hours at a time entails. Second, it shows drillers a developing trend away from optimum drilling the second they begin to stray from their best work.

And all drillers, regardless of experience, can get back to the optimum penetration rate faster after making a connection because they can see that "sweet spot" on the monitor.

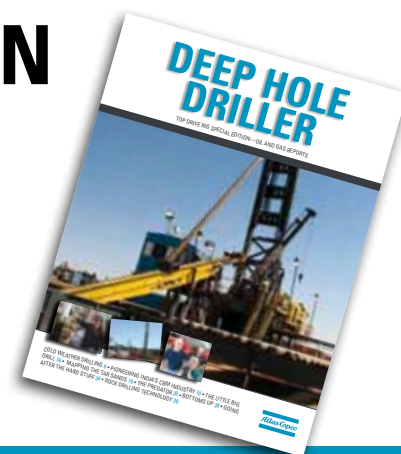
Down-the-hole hammer drilling has traditionally been left to fewer drilling companies because rotary drilling is easier to master and costs less in tooling. EDGE removes these barriers and brings the benefit of percussion drilling to deep hole drilling: quickly acquired and sustainable driller performance and improved penetration rates that mean less time in the hole, fewer tooling issues, and a better bottom line. ☉

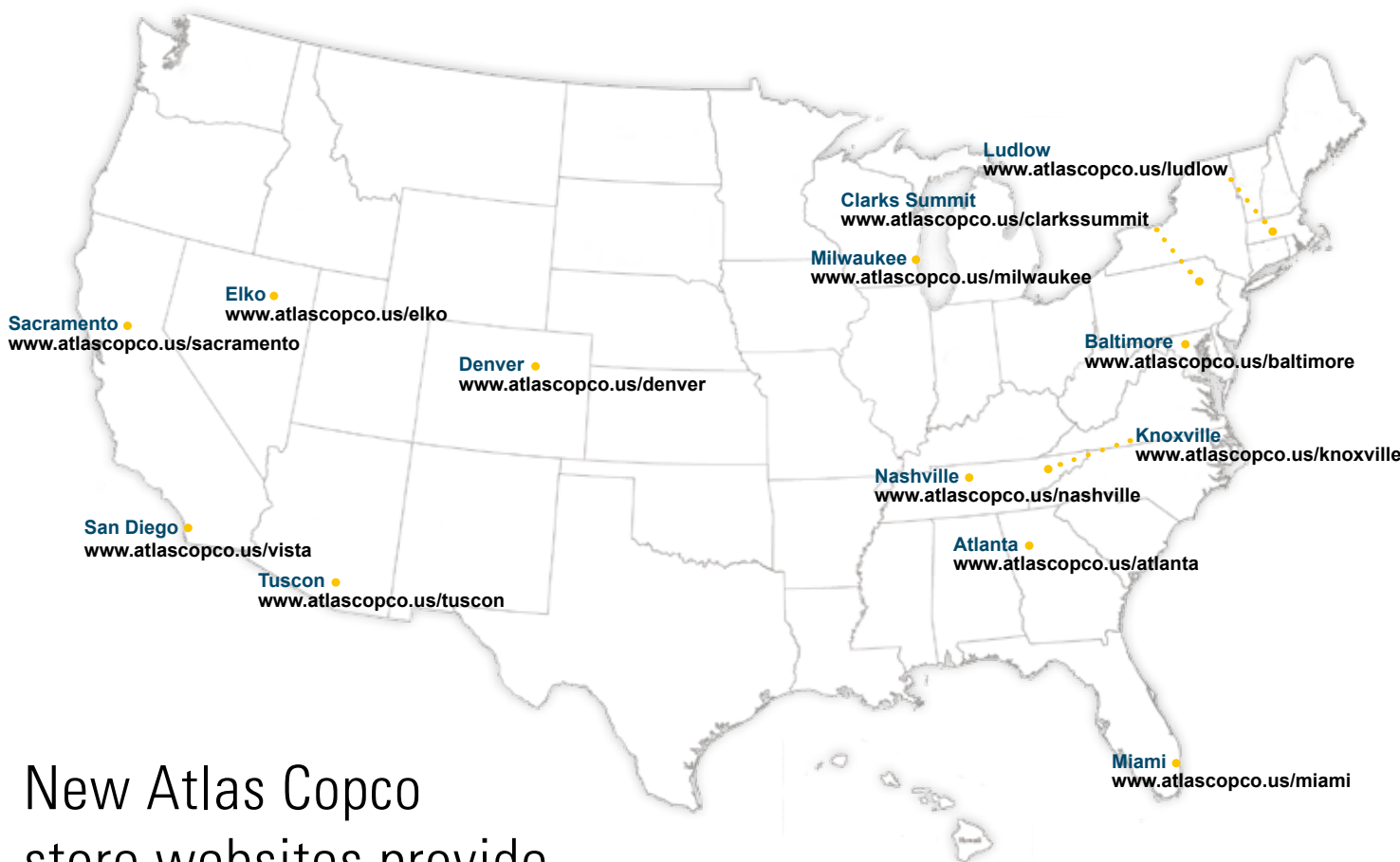


## TOP DRIVE RIG SPECIAL EDITION

Atlas Copco has just released a special edition of Deep Hole Driller full of articles from and about people in the oil and gas industry. From coal bed methane to cold weather drilling—these special reports provide a broad perspective from those active in the industry and drillers themselves. Articles share customer comments on drill rigs, hammers and compressors in differing applications. It also outlines various uses for Atlas Copco products along with specifications of the equipment.

To receive your free copy of this Top Drive Rig special edition of Deep Hole Driller, email or call: [diane@ellcom.us](mailto:diane@ellcom.us) or 507-945-0100.





## New Atlas Copco store websites provide localized content for customers

In order to improve communication with customers and provide local, relevant content, all 13 Atlas Copco Construction & Mining (CMT) stores in the United States have launched their own websites. Each site focuses on the strategic product lines, specials and offers, industries and events that pertain to the customers and region that store serves. The sites also link to Atlas Copco’s existing company web site so that visitors can easily access information.

“These sites will provide a source for regional news, as well as a product focus tailored to the localized needs of our customers,” commented Dave Pietrzykowski, vice president of CMT Store Operations for Atlas Copco. “We’ve been working on this project for over a year to make sure that we put together sites that would actually provide something of interest and value for our store customers. And we’ve committed to update these sites every month, to make sure that they stay fresh

and interesting.”

Each site features photographs from that store, as well as a page for local news and events. For example, the local news page for the Denver store reports a recent event at the Colorado School of Mines featuring the new Unigrout Smart A, and a review of the recent Elko Mining Days event is posted on the news page of the Elko site. Each store caters to the industries that make up its clientele. This means that the Sales & Service page details the special service programs provided by each store. In the case of the Ludlow store, their Sales & Service page alerts customers that they have recently added Dynapac rollers, among other equipment, to their service portfolio.

A Products page provides local information regarding which of Atlas Copco’s many lines are carried at that specific location; for instance, the four southeastern stores, all of which feature the Dynapac and Powercrusher lines, or the stores in



Tucson, Elko and Denver, all of which promote underground equipment. The Applications page for each store spotlights a local customer who has used an Atlas Copco solution in the field to good effect. The Contact Us page for each store contains an extensive list of local contacts, phone numbers and email addresses.





Ed Arnold Sr. with an early member of his Atlas Copco fleet, 1972.

# 50 Years and Counting

## A T4-based blasthole company marks 50th year

In May 1976, 29-year-old Ed Arnold and his father, Ed Sr., had just signed the purchase agreement for another Atlas Copco T4 when his father suffered a fatal heart attack. Only a little more than a month later and still in shock from the unanticipated loss of a parent, Edward Arnold Jr. officially accepted responsibility for his father’s company, Edward M. Arnold Drilling Contractors.

Just before Christmas 2009, the Douglassville, Pennsylvania, company celebrated 50 years of successful blasthole drilling for mines and quarries in eastern Pennsylvania. Their fleet of Atlas Copco T4s keeps them competitive.

### Rock roots

Ed Sr. had come to know the quarry business inside and out, having worked his way up to a position as a quarry drilling superintendent for his father-in-law who was a drilling contractor since 1929.

Arnold said his father “was blessed with a good gift for gab,” which had earned him valuable connections in the industry. Ingersoll–Rand gave him his breakthrough moment in starting his own drilling company with a loan for his first blasthole rig in early 1959.

Arnold Drilling Contractors was quickly successful. Ed Sr. started with just one hired hand and one rig but almost immediately added two more men and another rig. Within four years, he hired two more crew members and created a foreman position.

Ed Jr. first worked as a driller for his father at the controls of a T3 from 1965 through 1972. He operated T4s from 1972 to 1985, when he settled into administration. “I still get to touch the machines about a half dozen times a year,” he said.



Although owner Ed Arnold’s role is mostly administrative today, he said he still gets to “touch the machines a half dozen times a year.”

### Switching to T4s

Arnold described his father as always attracted to new technology. He would readily trade up when he had the chance. Throughout the 1960s their Ingersoll–Rand T3 was making 300 feet (91 meters) a day in limestone. When they upgraded to a T4, they more than tripled their progress, achieving 1,000 feet (304 meters) each 10-hour shift at a rate of 100 feet (30.5 meters) an hour.

“T4s have been our money maker since 1972,” Arnold said. Arnold remembers the serial numbers as if they are ancestral names. The first one his father purchased was 11100, the one hundredth machine off the line.

His father bought a second T4, serial number 11303, in 1974. “Dad was sold on T4s because of their versatility and because they maintained a good trade-in value,” Arnold said.

“T4s have been our money maker since 1972.”

**Eddie Arnold**  
Edward M. Arnold Drilling Contractors

## » Rig of choice

Arnold Drilling's five T4s today primarily drill blastholes for aggregate stone quarries, but 2 to 5 percent of its business is water well with some monitoring well drilling jobs now and then. They have drilled limestone for road construction projects and have drilled to remove overburden for coal strippings, such as those along the rich 20-foot thick coal seam that runs from McAdoo to Hazelton. They have also produced rock for Marcellus shale gas sites to develop pads for conventional drills.

Joe Mela, an Atlas Copco sales representative with more than 22 years in the local industry himself, both in sales and as a technician, said a T4's mobility in this area is a huge factor. "After a shift you can run a T4 to another quarry down the road, have it back before the morning shift. Compare this to a rig you need a truck and trailer for."

Right after Arnold's father switched to the T4, it was clear to them that a company could not compete for these quarry contracts

without T4s, not in the 6-inch blasthole range. Quarries depend on the productivity and reliability of the contractors' rigs. Mela added that T4s are by far the rig of choice in this area.

Arnold said that during crunch periods, competition does try to pry business away from him with lower bids and other rigs. But Arnold's clients are wary of such bidders. They know these competitors might keep up at first but worry they are not figuring in maintenance costs and down time in store for them later. So, Arnold said, the quarries don't want to lose production to these lowballers. The quarries do impose penalties, he explained, but that won't help them if they lose orders.

## Keeping good people

The competence and loyalty of Arnold's employees says a lot about his management. His 14-man company includes three office staff and 11 crew members, several with remarkable tenure. In May the company recognized the retirement of 42-year

employee Larry Reinert with a fully-funded Alaskan cruise for him and his wife. Following in Reinert's footsteps is his brother, Mike Reinert, who has himself been working with Arnold for 23 years. Glen Reinert, also a brother, has worked there for 39 years. Larry's son, Clay Reinert, also works for Arnold.

Mike Reinert was working this particular day as driller Rick Kline's helper. Kline has 34 years with the company. They were working with Arnold Drilling's newest T4 on a 50-foot sandstone bench at an aggregate quarry harvesting stone for a road construction project.

Specs for this shot called for 3,300 total feet (1,005 meters) with 59 blastholes ranging from 54 feet straight down in the 12 by 12 foot pattern to 58-foot deep on the 20-degree angled holes. An Atlas Copco QL 60 with a 6 1/2-inch bit running on 350 psi gave an average 125 to 130 feet (39.6 meters) per hour, which is well inside the 100 to 175 range they usually see from the various rock conditions they drill.

*Helper Mike Reinert (left) and driller Rick Kline (right) take a brief moment to pose in the rain after changing out the bit. Then they are back at it, making 125 to 130 feet per hour.*







*Mike Reinert dresses the carbide buttons on one 6-inch bit to prepare it for its return to drilling.*

Hole diameters vary with the customer's requirements, so they carry along a QL 50 in their service truck, as well as 5-, 6- and 6 ½-inch bits.

**Bottom line**

Arnold recorded his best year from his five rigs in 2005 with over 1,176,168 feet (35,8496 meters) drilled. The recession of December 2007 slowed him down for two years, but the company made it through and, he said, "2009 and 2010 weren't too bad." As for this year, he produced a drill record showing the company doing over 29,809 feet a week.

More than 50 years, good employees, a solid relationship with its quarry clients, and smart business decisions have kept Edward M. Arnold Drilling Contractors in business. Atlas Copco T4s have done their part to keep him profitable. "T4s have made me a very comfortable life," said Arnold. ☉



*Ed Arnold, back right, with his son Jeff, granddaughter Sara Marshall, grandson Bradley, and one of Ed's T4s. Not pictured is grandson Austin, 18, who represents the 4th generation of Arnolds in the drilling business.*





# The Antidote to Arsenic: Rotary mud drilling

**A** surging rural population brought boom times for residential waterwell drilling in eastern Wisconsin. For companies like Leo Van De Yacht Well Drilling of Green Bay, it has long been their bread and butter—even after the discovery of arsenic in the Fox River Valley’s aquifers in 1987. They are well skilled in the technique for getting past the poison to the clean drinking water below.

## Poison in the well

The discovery of inorganic arsenic in this area’s groundwater came about almost by accident, resulting from a routine feasibility study for a proposed landfill northwest of Oshkosh. The mineral content survey showed arsenic in five of the eight wells to be above federally accepted minimums.

That prompted the Wisconsin Department of Resources (WDNR) to conduct studies of the cause and extent of the arsenic problem, which continued into the year 2000 and beyond.

The U.S. Environmental Protection Agency (EPA) classifies arsenic as a carcinogen. Long-term exposure may also cause medical issues such as cardiovascular disease, immunological disorders, and diabetes. Drinking water with high arsenic levels may also cause more immediate symptoms, such as stomach pain, nausea, vomiting and diarrhea. The federal government limit for arsenic in potable water sources is 0.010 mg/L, or 10 parts per billion.

Though there are treatment systems for arsenic-contaminated water, it’s much

more desirable to find water sources that do not require treatment. In the Fox River Valley, the solution wasn’t farther away, just further down.

Department of Natural Resources (DNR) researchers established an “Arsenic Advisory Area” with a buffer zone over a buried geology called “St. Peter Sandstone” from southwest of Oshkosh to just west of Green Bay. Although arsenic has been found in wells throughout the state, the principal zone of concern lies over this formation.

## Fanning the flames

The highest concentration of arsenic-rich mineralization is present at the top of St. Peter Sandstone layer. The farther down one samples below it, the less contaminated the



water. Researchers determined that when drillers got past this aquifer into a lower aquifer above the Cambrian sandstone bedrock, the water was within acceptable standards. This is the target of waterwell drillers in this region today for both public and private wells.

In 2004 the DNR took several steps to mitigate the problem. They published land charts marked with casing and grouting depth minimums that drillers must comply with. They made it mandatory to report well geography for each drilling. And they placed restrictions on drilling technique: drilling must be done by rotary mud only.

Since arsenic is released by the oxygenation of sulfide minerals imbedded in the layer, experts believe that the introduction of high volumes of air into this formation during drilling greatly exacerbates the problem. Furthermore, they believe once initial oxidation occurs, the process is self-sustaining and this constant release of arsenic, once triggered, will inevitably find its way to the ground water.

### Equipping for success

Always a forward-looking company, Van De Yacht has a demonstrated history of staying ahead of the game, investing in new tooling and remaining diversified to sustain their profitability.

Troy Van De Yacht, who succeeded his father Leo as owner in 2000, had been drilling with him since 1986, when he was 14 years old. Leo started the company in 1963. He was 17 years old when his parents, who were intent on finding each of their 12 children a secure job, saw an advertisement for an old cable drill.

He worked that rig hard enough to afford a kelly-drive rig in 1965. Upgrading to an Ingersoll–Rand rotary tophead in 1967 established the company as leading-edge pioneers in the industry. His success sold him on the brand, which continued through its acquisition by Atlas Copco. The company remains an avid customer of Atlas Copco to this day, upgrading rigs



*Keith Zuleger (left) and Dan Smith (right) sample grindings to determine the formation they are in. They keep careful documentation of their observations and report them to the state's well log.*





on schedule to maintain their competitive edge, such as with their most recent acquisition, the newest version of the T3W.

One thing Troy has noticed about the new T3W is that the cables last so well. As a rule of thumb Troy brings his equipment into the shop when temperatures fall below zero to spare his crew and to make use of the time for maintenance. They rebuild mud pumps and tophead swivels, replace hydraulic and compressor filters, and, generally, re-cable the rigs. But three years into service, the new T3W's cables show no signs of wear. He attributes it to this version's larger sheaves and its cable tensioner.

Their current fleet includes a 1995 Atlas Copco TH60, a 2001 TH60 with a casing hammer mounted at Atlas Copco Milwaukee's Water Well Center of Excellence, and the 2008 T3W. These three rigs have enabled them to handle just about any drilling application within their operating area, including municipal "blended" water wells, elevator ram shafts, larger diameter pre-construction piling, and vertical geothermal installations. And they are skilled experts in arsenic preventive well drilling techniques, having adjusted to the new regulations without missing a beat.

### Getting past the bad stuff

The new guidelines have slowed drilling rates down some. Prior to 2004, Troy and his six-man crew were drilling more than

500 wells a year per rig, routinely drilling two 300-foot (91-meter) wells per day. Their personal best, Troy said, was 1,000 feet (304 meters) in one day, using both rotary mud and down-the-hole hammer.

Switching to rotary-mud-only now means that a single well takes up to three days to first drill and case off past the St. Peter Sandstone and then finish drilling to the pink Cambrian sandstone target. However, these wells pay more. So financially, the change has been a wash for them, and the new regulations have not significantly impacted the company's bottom line.

The object of drilling in strata containing embedded arsenic deposits is to do so without unnecessary disturbance, then quickly seal them so that they are not exposed to air and never come in contact with the well's water. Bentonite mud helps a bit, too, as its clay helps seal the walls of the bore from air as it is opened up.

### Case in point

The well in the accompanying photos is a good example of the company's work in the arsenic advisory area. It was drilled to replace the residential well at that site, which tested at 36 parts per billion—more than three and a half times the federal limit. The DNR map specifies that Van De Yacht case the hole to 168 feet at this site and then drill the well to a total depth of 240 feet (73 meters).

*This residential site's existing well tested at 36 parts per billion—three times the federal limit. However, tests of this replacement well photographed as it was drilled by Leo Van De Yacht's experienced, certified crew resulted in the finding "None Detected."*

Using a 9-inch bit on 4 ½-inch pipe, Troy said they drilled, cased and grouted the upper hole one day, then completed the 6-inch lower hole to total depth the following day after a 24-hour cure time for the grout.

As they drill, he said, they are also required to sample and report the geology of the hole to the DNR's well log. At this hole the first 50 feet were clay. From 50 to 120 feet (15 to 36 meters) they encountered limestone with a penetration rate of 22 minutes per 20-foot pipe. At 120 through 240 feet they were into the tell-tale pink cuttings of arsenic-free Cambrian sandstone, advancing 20 feet every 15 minutes.

The results were right on the money. The well is producing 40 gpm and the resulting arsenic level is "None Detected," proof that the technique works perfectly when it's in the hands of master drillers. ☉





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**Atlas Copco TH60/2003** sn:6840  
 Location: Milwaukee, WI  
 Tower: 38 ft.  
 PTO Engine: CAT C15, 565 hp  
 Drill Hours: 7,063  
 Compressor: 900 cfm / 350 psi



**Atlas Copco T3W/2007** sn:21203  
 Location: Tahlequa, OK  
 Tower: 36 ft.  
 Drill Engine: CAT C15, 565 hp  
 Drill Hours: 906  
 Compressor: 1,070 cfm / 350 psi



**Atlas Copco T3WDH/2006** sn:6984  
 Location: Clarks Summit, PA  
 Tower: 35 ft.  
 Drill Engine: CAT C15, 565 hp  
 Drill Hours: 1,495  
 Compressor: 1,070 cfm / 350 psi



**Atlas Copco T3W/2005** sn:6962  
 Location: Clarks Summit, PA  
 Tower: 32 ft.  
 Drill Engine: CAT C15, 565 hp  
 Drill Hours: 2,157  
 Compressor: 1,070 cfm / 350 psi



**Atlas Copco T3W/2003** sn:6776  
 Location: Milwaukee, WI  
 Tower: 32 ft.  
 Drill Engine: CAT C15 w disconnect 565 hp  
 Drill Hours: 6,957  
 Compressor: 1,070 cfm / 350 psi



**Atlas Copco T3W/2002** sn:6753  
 Location: Milwaukee, WI  
 Tower: 32 ft.  
 Drill Engine: CAT C15, 565 hp  
 Drill Hours: 6,562  
 Compressor: 900 cfm / 350 psi



**Atlas Copco T3WDH/2002** sn:6735  
 Location: Milwaukee, WI  
 Tower: 35 ft.  
 Drill Engine: CAT C-15, 565 hp  
 Drill Hours: 12,303  
 Compressor: 1,070 cfm / 350 psi



**Atlas Copco T3W/2000** sn:6547  
 Location: Milwaukee, WI  
 Tower: 32'  
 Drill Engine: CAT 15, 565 hp  
 Drill Hours: 6,680  
 Compressor: 1,070 cfm / 350 psi



**Atlas Copco T3W/2000** sn: 6592  
 Location: Tucson, AZ  
 Tower: 32 ft.  
 Drill Engine: CAT 3406, 465 hp  
 Drill Hours: 10,000  
 Compressor: 900 cfm / 350 psi

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# PRE-OWNED DRILLS



**Atlas Copco RD20 III/2001** sn:6660  
 Location: Denver, CO  
 Tower: 61 ft.  
 Drill Engine: CAT 3412, 735 hp  
 Drill Hours: 13,950  
 Compressor: 1,250 cfm / 350 psi



**Atlas Copco RD20 III/1998** sn:6389  
 Location: Denver, CO  
 Tower: 51 ft.  
 Drill Engine: Cummins QSK 19C, 755 hp  
 Drill Hours: 7,972  
 Compressor: 1,250 cfm / 350 psi



**Versa Drill V2000/2003** sn:1120  
 Location: Milwaukee, WI  
 Tower: 35 ft. 6 in.  
 PTO Engine: CAT C16, 600 hp  
 Drill Hours: 4,443  
 Compressor: 1,070 cfm / 350 psi

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Armania	Yerevan	+374 (00) 10530669
Australia	Blacktown	+61 (0)2-96219700
Austria	Vienna	+43 (0)1-760120
Bahrain	Manama	+973 (00) 17221551
Belgium	Brussels	+32 (0)2-6890511
Bolivia	La Paz	+591 (0)2-2112000
Botswana	Gaborone	+267 (00)395-9155
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Bulgaria	Sofia	+359 (0)2-4893178
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Philippines	Manila	+63 (0)2-8430535 to 39
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For further information, please visit [www.atlascopco.com](http://www.atlascopco.com)  
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