

DEEP HOLE DRILLER

QUENCHING A RECORD DROUGHT

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CALIFORNIA **PAGE 10**

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ILLINOIS **PAGE 17**

AN ATLAS COPCO
PUBLICATION FOR
THE DRILLING
PROFESSIONAL

NO. 2, 2015

Atlas Copco



The US Deephole Business Line:
Experience You Can Count On

Atlas Copco is more than reliable equipment. It's highly skilled people, each of us willing to put our industry experience at your service. For instance—I earned a mining engineering degree, but as mining jobs were scarce when I was starting out, I worked as an offshore oil and gas field service technician involved in directional drilling and formation evaluation. I've been in deep hole drilling ever since, working coast to coast in various positions of management and sales in water well, geothermal, exploration and oil & gas. Working on both the contractor side and manufacturing side has given me a broad view of the business.

Now as U.S. Business Line Manager for Deephole Drills of Atlas Copco Drilling Solutions, I oversee the water and oil & gas businesses. I rely on a tremendous group of people—our deephole team. They have over 135 years of industry experience between them. That's why our customers are getting the best possible sales, service and support.

Frank Chickey covers water well product support for all of the eastern U.S. while his son, Ron, covers the western U.S. Ray Kranzusch is product manager for oil and gas and also handles product support. Together they provide technical training to personnel in our stores, our dealer locations and directly to our customers. They work closely with our engineering team and are involved with product development and support.

Behind the scenes, Kiki Sample handles order processing, invoicing and used equipment. Shelley Maddux manages government sales and contracts. We all work closely with and in support of, 11 regionally based sales representatives who cover deephole products.

Read on to learn how we work together with our customers on their projects. Let us know how we can help you.

Tom Moffitt
Business Line Manager Deep Hole



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DEEP HOLE DRILLER IS PUBLISHED BY
Atlas Copco Drilling Solutions
2100 N. First Street
Garland, TX 75040
Telephone:
+1 972-496-7240

PUBLISHER Justin Cocchiola
Justin.Cocchiola@us.atlascopco.com

EDITOR Scott Ellenbecker, scott@ellcom.us
Editorial production, design and layout:
Ellenbecker Communications
30124 State Highway 264
Round Lake, MN 56167 USA
507-945-0100

Free Subscriptions: www.deepholedriller.com
Changes to Address: subscriptions@ellcom.us

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Keeping the San Joaquin green

In California's record drought, Scott Belknap Well Drilling works Atlas Copco TH60 deep-hole drills to keep San Joaquin Valley crops healthy »





Whether it's a TH60 with 40,000-pound pullback, like this one, or a TH60 DH with 70,000-pound pullback, the rig is typically compact enough to fit in between crop rows. No lemon trees had to be removed or were harmed as this crew drills 6-inch test holes with a drag bit on rotary mud at three locations on this property.

» **F**or more than a decade, one dry spell after another has taken a toll on ground water resources along the United States's West Coast. The water deficit is particularly severe in California's Central Valley, one of the most productive agricultural regions in the world. Some of the worst conditions exist in the region called the San Joaquin.

Demand for irrigation water wells throughout the San Joaquin Valley is so great that Scott Belknap Well Drilling, headquartered just south of Fresno in Dinuba, has increased its labor force from 10 employees just two years ago to almost 50 today—and Belknap is still growing.

Yet even in times like these, owner Scott Belknap said he would never take new employees straight to a rig's operator console—not until they understand the land here, his customers and the best practices established by his company. “We train our drillers from the ground up, through every step. Regardless of experience, we'll only hire drillers as hands first. We won't put them on drills until they've been trained to our way of doing things as drill helpers first.”

Belknap has eight drillers he trusts as trainers for operator candidates. At least six of Belknap's 13 drill rigs are drilling at any given time.

The company has had to increase its drilling fleet, turning to the Atlas Copco—Sacramento store three hours' drive north of Belknap's headquarters.

Belknap's first experience with an Atlas Copco rig was his Uncle Bill Belknap's TH60. The first Atlas Copco rig he owned himself was a new T2W. Since that first acquisition Belknap has added a used Atlas Copco T3W and two new TH60 water well rigs, one of which is a deep-hole (DH) version with pullback capability of 70,000 pounds (311 kN). Belknap has ordered another TH60 DH, which will replace the T2W as it rotates out of service.

Belknap said he had no complaints with



“ The TH60 is probably the most popular rig in its class in the U.S. right now, and without question, it's been highly successful for our customers.”

Tom Moffitt

Business Line Manager for
Atlas Copco Deep Hole Rigs



the T2W, with its 30,000 pound (133 kN) pullback capability and similarly sized carrier. But he prefers the TH60, a long-running favorite of American water well drillers.

Tom Moffitt, business line manager for Atlas Copco deep hole rigs in the U.S., said, “The TH60 is probably the most popular rig in the U.S. right now, and without question, it’s been one of the most successful. For Scott, the TH60 DH gives him more than twice the pullback of his T2W, which covers just about any depth and diameter his crews need to drill and case for his agricultural customers. Yet it’s compact enough to get into their fields without moving trees or damaging the crops.”



To keep drills boring wells, Belknap uses portable compressors for development so rigs aren't tied up between drilling jobs. Here compressor operator Nick Molina uses one of Belknap's four Atlas Copco XAVS 400 JD7 compressors to flush sand and silt from a new well. The 400 cfm, 200 psi compressors with Interim Tier 4 compliant engine delivers air to the bottom of this 400-foot well through an injection hose hung to 390 feet. Clearing wells of silt and sand can take anywhere from two hours to two days or more.



▲ Drilling manager Scottie Belknap, owner Scott Belknap holding granddaughter Genivieve, and Marilyn Belknap holding granddaughter Marilyn.

◀ The Belknap family has been drilling in California's San Joaquin Valley since 1927. Drought conditions are worse now than for any generation before them. Shown is an old business sign from Scott's father's business.

» Driller immigration

Belknap's Atlas Copco rigs enable him to operate under some of the most demanding environmental regulations drillers face anywhere in the world. During this time of crisis, however, California has temporarily relaxed its emissions requirements. This has permitted many out-of-state drillers to bring their rigs to California.

With so much work to go around, new competition hasn't slowed them down. Belknap's TH60 crews are working nearly every day. "We have good drillers," he said. "They'll stay out as long as we let them. They're that hungry for it."

Belknap is a third-generation driller. His father and uncles had separate drilling businesses under his grandfather, who first started drilling here himself in 1927. Though independent of each other, the businesses shared a common shop near where Belknap's headquarters are today. Scott's own son, Scottie, is the fourth generation of Belknap to take his place in the family business. He has come up from helper to driller to become the company's drilling manager. Belknap's oldest son Mark relocated from Southern California to step in and help manage the company's finances and administration.

“Our customers are the reason we drill. We're not just drillers but are right here farming alongside them.”

Scott Belknap
Owner, Scott Belknap Well Drilling



Farmers greatly appreciate how Belknap's TH60 and drilling crews minimize disturbance to crops such as these lemon trees.

The Belknaps know this land and how to drill it. And their relationship with agriculture customers goes much deeper than simply serving their well needs. Belknap is himself a farmer, describing his family's operation as middle-sized for the San Joaquin Valley. "A large operation" he said, "is probably anything 1,000 acres or more" (4,000 ha).

Belknap raises mostly walnuts, almonds and cherries, with some land dedicated to citrus production, including the Halo brand of small citrus.

"Our customers are the reason we drill," said Belknap. "We're not just drillers but are right here farming alongside them."

Belknap said that's similar to his reason for staying with Atlas Copco. The Sacramento store is committed to the customers of this region, providing rapid responsiveness backed by the nationwide Atlas Copco support network.

"Then there's Joe," Belknap said, referring to Atlas Copco's Joe Beloso, whom the Belknaps got to know not just as a salesman but as a friend during the initial purchases. "If Joe tells me something about equipment, I listen. We trust what Joe says."



Joe Beloso
Atlas Copco Sales

and to maintain.

"We don't need a map to tell us that 7 miles that way, you'll be drilling in 'Old Faithful,' getting 1,000 gallons per minute, but 10 miles this way, you'll be lucky to see 20 gpm" (3,800 vs. 76 L/min.).

Newcomers can get into trouble trying to keep up with the boom in water well work Belknap said: "Another driller promised a customer a 1,000 gpm well. We knew that a well drilled at the location would only yield 40 gallons per minute (150 L/min.). We could have given the customer correct information about what to expect there and then designed and priced the job right for him."

Belknap said newcomers often bring techniques and tooling that aren't the most effective for drilling here.

Belknap's deep roots

Belknap began his drilling career on a cable tool rig. "A cable tool is a great way to learn the formations."


For almost 90 years Belknap's grandfather and uncle, and now he and his sons, have been drilling for customers on this land. So Belknap doesn't solely rely on the groundwater survey charts that his own drilling logs helped to form

In the field

On this day, Belknap's 40,000-pound TH60 (non-DH model) was sending down a 6-inch drag bit to prove the depth of granite bedrock in three locations for this lemon orchard.

The farm's owner has an existing well in this orchard with unknown development history that goes to 165 feet (50.3 m). Even with water conservation strategies that include removing older, thirstier trees to replace them with younger growth, failure of the older well could ruin the crop. A second well was requested as a precautionary backup as well as supplemental irrigation supply.

Exploration was performed with a 6-inch (152 mm) drag bit through top soil and alluvium "as fast as she will go," said driller Wayne Tincup. By noon Tincup and fellow driller Theodoro Rodriguez had logged bedrock depths of 125, 145 and 150 feet (38 m, 44 m, 46 m) in the three locations and were awaiting word from the owner which one he would like to develop.

Once the location had been chosen, the TH60 drillers completed the top of the well profile to the granite bedrock. They cased and sealed the bore with bentonite clay from the surface to 25 feet (7.5 m). Then they switched to a down-the-hole hammer to drill through the granite to the sandstone aquifer. After 10 hours of development, the customer's backup well was producing clear irrigation water for the orchard's driplines. 

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Mixing oil and water

Two Craig Energy Atlas Copco RD20 deep hole rig crews from the oil patch bring drought relief to California farms

The advantage of a nationwide customer service network seems obvious: manufacturer support is close at hand wherever you drill. However, an often over-looked value is how it connects operators and customers. Atlas Copco was able to put a shallow water well driller in touch with an energy driller to reach water in one of California's driest area. Together they have become a model for the drilling community, a lesson with value beyond machinery and tooling.

All along California's Central Valley, water well drillers have been racing to keep pace with demand and getting rigs capable of performing the task. Atlas Copco salesman Joe Beloso got an inquiry from Scott Belknap, owner of Scott Belknap Well Drilling in Dinuba, California, about trying an Atlas Copco RD20 for water well drilling. Belknap's customers needed up to 28-inch-wide (711 mm) wells drilled to depths as great as 1,200 feet (3,660 m) in complex soil environments.

The mobile, self-contained deep hole RD20 rig is engineered with 120,000 pounds of pull-back (533 kN) capability for the oilfield but is compact enough for agricultural and municipal water wells.

Beloso called his colleagues Tom Moffitt, Atlas Copco business line manager of deep hole rigs, and Ray Kranzusch, product manager for oil and gas drill rigs. Coincidentally, Kranzusch had been working with Denver-based Craig En-

ergy, who was interested in work in California. Kranzusch recognized a mutually beneficial solution and introduced Craig Energy to the Belknap group.

Joe Maguire is Craig Energy's general manager of Bakken region oil and gas operations. Maguire said Craig Energy has used its RD20 for a variety of applications, from presetting casing in oil wells to drilling ventilation shafts and creating grouted pilings, as well as drilling numerous water wells.

Maguire said: "We had considered making cold calls to potential California customers based on our own reputation, which we've done before. But it's so much better working under an established water well contractor like Belknap, whose family has been working in California agriculture for almost a hundred years. They have a relationship with the land and with their customers. They are a part of the region's business community. Through Atlas Copco we established a relationship in California that can offer customers a high level of value and unique service."

Reverse Circulation (RC)

The switch from drilling in the oil patch to drilling water wells didn't require a major change in tooling or technique, and Kranzusch recommended adapting the RD20 for reverse circulation. There was however, a learning curve for the team. The marriage of Belknap's water well drilling know-how at shallower depths in the region, with Craig Energy's deeper-well drilling experience throughout the western United States in various geological formations using the RD20, accelerated the process.

First designed for exploration using air rotary in the 1970s, a burst of tooling innovations made reverse circulation possible for nearly every kind of drilling in any kind of drilling conditions. In this area of California, it means using rotary mud in the first 50 to 150 feet (15 m to 46 m) of unconsolidated sediment through granite bedrock at its bottom.

Maguire explained the benefits of using reverse circulation for water wells versus conventional mud drilling: "When you drill for oil using what we call 'direct drilling technique,' you actually want mud to cake the hole walls. It helps maintain the hole walls as fluid and cuttings flush up the annulus until you can case it off from the aquifer to isolate it from the



7 × 4 dual wall pipe is often used in flooded reverse circulation technique because it allows the introduction of air to the hole bottom for efficient fluid and cutting returns up the drill string. Craig Energy has a few tricks for preventing clogging, which frustrate some flooded RC drillers in deeper holes and heavy clay formations.

bore. Reverse circulation lets you drill in an aquifer without reducing the flow of water as desired in a water well."

Maguire, his drilling crew leaders and Craig's partners at Belknap worked together to analyze the target formation geology, the drilling methods and the well design objectives to establish the optimum method and process for completing the highest quality and performing wells in the region.

As for maintaining wall stability, RC can actually be more effective in certain formations than conventional mud drilling. "It's because all your cuttings go up the pipe, not against the hole wall," Maguire said.

Fluid return filled with cuttings is a prime cause of hole wall deterioration. But the drilling fluid in an RC situation has no cuttings in it. It is merely present in the annulus, migrating toward the bottom of the hole where it will be siphoned up the pipe, so there is also much less agitation.

Siphoning is assisted by injecting air at the hole bottom. The air reduces fluid density in the pipe. The difference in hydrostatic pressure between the fluid column outside the pipe and the less dense fluid inside it causes the fluid to percolate up the pipe, carrying cuttings with it.

Maguire gave an analogy that demonstrates the principle: "Blow air into a straw in a full glass and then take your mouth away quick. Watch how the straw siphons fluid out of the glass. Reverse circulation works just like that."

Air injection

The most common way to introduce air is dual wall RC pipe, available in a variety of sizes indicated in its naming convention. For instance, 7×4 dual wall pipe consists of a 4-inch-diameter (102 mm) tube inside a 7-inch-diameter (178 mm) drill pipe.

Cobble in the formation can be a problem for RC pipe, Maguire said, but his crews haven't run into much cobble here: "The Valley has some areas of really hard clay within five feet or so of the surface—but with the RD20 we drill right through them."

Kranzusch said RC drillers using dual wall pipe here do not have much trouble with clay balling up on the bit and plugging the returns, a problem encountered by drillers using a conventional flooded reverse system.

The capabilities of the RD20 coupled with the experienced Craig crew allow the company to provide a level of well design and completed performance for the California agricultural water market.

Those who drill deeper holes, as Craig Energy is doing, also would typically run into trouble with cutting evacuation. "A thousand feet or more of rock cuttings is a lot of stacked weight for RC to hold up," he said. "Chips begin to fall back on themselves, pile together, making heavier masses. Then they choke off circulation."

But Kranzusch had some ideas how to overcome clay and move cuttings in >>



The 100-degree temperature and dry air, like the RD20 rig itself, are reminiscent of the Permian Basin. But this is not the oil patch. It is a large dairy operation south of Bakersfield, California. On the horizon, dairy cattle huddle together in the shade of thin awnings as this RD20 waits for permitting of a 1,200-foot, 28-inch agriculture well. The well will be drilled using a variation of flooded reverse circulation technique Craig Energy pioneered.

the deepest holes. He consulted with engineers, Belknap, Craig Energy and industry drilling experts to refine the tool string. The modifications successfully eliminated the clay and cuttings-weight issues.

The drill string adaptations also sped things up. Kranzusch was on hand as one of the Craig Energy crews drilled an initial 17 1/2-inch-wide (445 mm) bore to a depth of 1,200 feet and then opened it to 28 inches. Time from start to finish was less than 40 hours. By comparison, conventionally drilled wells here at that diameter and depth take 60 to 70 hours—when drill strings don't clog, and if they don't have to sit on the hole in development for several days to get formation permeability back.

Flooded RC

Craig Energy is using a variation of RC called flooded reverse circulation. It's a

“closed-loop” system, in which the RD20 recirculates drilling fluid without the need for a mud pump or shaker box.

It begins with excavation of a U-shaped pit capable of holding 20,000 to 30,000 gallons (75,700 L to 113,600 L) of water. One side is dug as a narrow, shallow channel to serve as an intake trough. The deeper side of the pit is for collecting fluid as it returns from the hole. Cuttings settle out to the bottom. Clear water nearer the surface of the pit migrates to the intake trough, where it flows back to well bore again.

Turning down the air

An RD20 rig's 1,250 cfm at 350 psi (590 L/s) compressor package greatly exceeds Craig Energy's needs in this application. So Kranzusch instructed the driller how to lower the air compressor's output flow to 600 cfm (283 L/s) and turn the pressure down, running it at 150 to 170 psi (10

to 12 bar). “That means now they're also saving a lot of fuel while drilling these holes,” Kranzusch said.

The partnership between an oilfield contractor and a water well driller has been good for Craig Energy and good for the agricultural customers in California's driest areas. It also works out well for Belknap

Maguire said, “With the urgent need and high demand right now, can you imagine what it would be like to buy a rig your crews aren't familiar with or have to hire new guys for? Then go through a period of trial and error with it? We are RD20 drillers. We already know what we're doing. You can't find a better company to work for, either. We love working with Belknap. And Atlas Copco is the reason we got to meet.”

Craig Energy currently has two RD20 rigs in the San Joaquin. Both are rigged for drilling on flooded reverse circulation. ☉

CHANGING FOR THE **BETTER**

Cable driller discovers TH60's versatility
and sons stick with the change as they
grow their business »





» **T**he service area of Pelke Plumbing and Well Drilling, Inc. extends about 60 miles in all directions through the Upper Mississippi Valley near their Durand, Wisconsin, headquarters. On opposing shores of the Chippewa River, green bottomland contrasts sharply with limestone cliffs. The sudden difference in elevation means that water table depths can vary anywhere from 20 feet (6 m) on one job to over 600 feet (183 m) on another, even if they are only a few miles apart.

A good share of the residential, commercial and agricultural water in the area is beyond the capability of most cable tool rigs.

Company founder, Herb Pelke, had been a cable tool driller most of his career but has stuck with the Atlas Copco TH60 water well drill since first acquiring one in 1995. Pelke purchased a new TH60 in 2014, which is a hydraulically driven top head rotary drill. It is a compact, truck-powered drill that is highly mobile, even on steep roads.

Pelke bought his first TH60 in 1995 by “sheer dumb luck,” he said. “We were ignorant about rotary rigs.” He was not sure what make to try at the time, but considers himself fortunate that the rig he had access to was a TH60.

Pelke said, “One came up for private sale in Madison. It was a 1978, pretty old already. We had to put a lot into it, but it didn’t take much to fall in love with what it could do.”

Herb’s eldest son, John Pelke, said a 30-minute drive along the river made it starkly clear to him: “I was looking out the window, realizing that if we were still cable tool drillers, everything on the right we could drill. Everything on the left we’d pass up—too deep, too rocky.”

John now runs the day-to-day operation while his other son, Jason, manages the plumbing side of the business.



1. Owner's John (left) and Joe Pelke (right) with driller Mike Wittig of Pelke Plumbing and Drilling, Durand, Wisconsin.
2. Driller Mike Wittig favors percussive drilling over tricone rotary. Having found bedrock at 90 feet (27 m), he switched to an Atlas Copco Secoroc QL 80 down-the-hole hammer with 10-inch DTH bit for the top portion of the well to a depth of 300 feet (91 m).
3. The mobile TH60 gets to a job site with the area's limestone cliffs visible in the background.
4. (From left) The Pelke family works together: Joe, John, Herb, Jason.

In 2000 they replaced their original 1978 with a brand new TH60. They added a 7 ½ x 10 Centerline Mono piston mud pump in 2008 to help with certain applications.

Youngest brother, Joe Pelke, is head driller and is in charge of maintenance for their entire fleet along with Mike Wittig who worked his way up in the company from pump installer/helper to experienced driller. John said of the two, "There's no hole they can't drill with that rig. It's got a mud pump, and they've attended mud school training, but of course they prefer to use hammers. They are so much faster, less hassle."

Hammer drilling for the work they do is covered by their Atlas Copco QL 60 and QL 80.

Wittig, who has been with the company for 37 years, compared the newest TH60 with their previous. "Most of the things

I notice are how service-friendly it has become. For instance, I don't have to unlock the jacks to lift the hood. It's simple to change filters. Everything is easier to get at."

He pointed out that the dual purpose, fuel-efficient 600 hp (477 kW) engine is bigger than their previous model's. The Cummins ISX gives them plenty of power to climb the hills with ample power for drilling operations when they are over the hole. Drilling operations for this model can be powered by either the standard single-speed rotary head with torque rated at 5,500 foot-pounds (7,450 Nm) at 145 rpm, or any one of the five optional rotary head packages such as the high-torque, two-speed rotary head that Pelke chose. Their rotary head provides up to 8,000 foot-pounds (10,850 Nm) at 105 rpm or 5,500 foot-pounds (6,780 Nm) at 145 rpm.

"But overall," Wittig said, "it's a TH60. There's not much you want to change."

The current Atlas Copco TH60 model is offered with either a 900 or 1,070 cfm (425 L/s or 505 L/s) air package at up to 350 psi (24.1 bar). Atlas Copco's electronic air regulation system coupled with the machine's load sense hydraulics allow for an efficient drilling operation.

Drillers typically use the TH60 model for holes ranging in diameter anywhere from 4 to 10 inches (102 mm – 254 mm) by removing the table's inner 10 ¾-inch (273 mm) bushings. However, they can bore larger holes and set up to 19-inch (483 mm) casing by removing the table's larger 20-inch (508 mm) outer bushings. The table's two-part design allows the front half to retract and the back half to swing open if additional room is needed.

All in a day's work

Durand's northern latitude offers longer >>

As the property owner looks on, driller Mike Wittig begins the new well. Drilling a new 600-foot well with Pelke Plumbing and Drilling's Atlas Copco TH60 is much easier than calling in a company to rehabilitate the existing tin-cased well, the only thing holding the owner up from completing the sale of this property.



» daylight working hours in the summer. Pelke's drillers make use of all of them. Breaking only for a short lunch between jobs on this day, Wittig drove the TH60 from a residential water well he and Joe had just completed to the next job. The jobs were only 4 miles (6.5 km) apart, but the required depths changed from 60 feet (18 m) to 600 feet (183 m).

The 600-foot residential well with 6-inch bore was an urgent priority for a well installer who had contacted Pelke. Sale of the property was put on hold until the well went in. Its existing well originally passed inspection, but a last-minute repair revealed it had been cased with tin. Fixing a deteriorated tin-cased well can turn into an expensive and frustrating job. It was simpler to drill a new well.

The location chosen for the replacement well was on uneven, sloping ground in a confined space between a garage and a maple tree whose huge limbs supported a tall, wide crown next to the roof. Wittig gently backed the TH60 under the tree until its table opening was dead center over the marker.

Once Wittig set the jacks and raised the mast they were well on their way to locating the underlying limestone bedrock at 90 feet (27 m).

Once at the rock, he switched over to their 8-inch Atlas Copco Secoroc QL 80 with 10-inch DTH bit to drill the top portion of the hole to 300 feet (91 m).

Wittig finished to total depth using a 6-inch Atlas Copco Secoroc QL 60 hammer with 6-inch DTH bit. Wittig and Pelke cased the first 300 feet of well bore with 6-inch pipe.

Pelke had begun drilling this well on a Wednesday afternoon. Casing and grouting were completed Friday morning. The pump and wellhead were set by the installer.

Wittig and Joe Pelke had drilled a 17-inch agricultural water well the week before for a center pivot irrigation system. Not long before that, they were drilling monitoring wells for a sand mining customer. They are also certified geothermal drillers for vertical ground-source heat systems.

John Pelke said he doesn't have to work too hard at finding jobs. "We get calls, and we schedule everything we can. Recently a customer drove an hour and a half to ask him to drill an irrigation well. That's a little farther than we usually go, but not by too much. I think we'll be able to do that one for him." ☉

“ There's no hole they can't drill with that rig. It's got a mud pump, and they've attended mud school training, but of course they prefer to use hammers. So much faster, less hassle.”

John Pelke
Manager,
Pelke Plumbing and Well Drilling, Inc.

Helper Bradley Raymer, driller Dave Elger, Atlas Copco's Clark Herbst and K&K Well Drilling owner Ken Knierim.



IN *depth*

Reaching a deeper aquifer near Yorkville, Illinois, is a job for K&K Well Drilling and their Atlas Copco TH60 water well rigs

As population continues to grow in the Chicago metro area, ground water resources are nearing or exceeding their natural recharge rates causing local communities to begin relying on surface water resources.

Surrounding areas, whose shallower wells in glacial drift aquifers also do not support the continued growth, are turning toward the plentiful deep-bedrock water reservoir known as the St. Peter Sandstone.

Most new residential, commercial, and

agricultural wells in the region have begun targeting the ample resource, as have owners of existing glacial drift wells.

In order to reach this 700 foot deep (215 m) or more aquifer, a powerful top head rotary drill is required which means calling on K&K Well Drilling Inc. and one of their Atlas Copco TH60 water well drill rigs.

K&K Well Drilling is a second-generation family-owned drilling business started by current owner Ken Knierim's two uncles in 1966, Max and Paul. The

two founding Knierims were later joined by their brothers, Phil and Jim. Jim is Ken's father.

K&K grew into a multiple base operation that at one time had 10 different locations and 17 rigs of various makes. As K&K consolidated its offices and acquired increasingly advanced rigs, operations eventually condensed to their Yorkville headquarters. The first TH55 rig led to its successor, the TH60, and K&K has stayed with TH60s ever since.

K&K's Dave Elger, who has drilled for »

» the company 11 of his 14 years with them, said the company drills about 100 wells a year but will probably exceed that in 2015.

Although K&K has looked at other rigs and once had a fleet of mixed brands, the company prefers the Atlas Copco TH60 for its reliability, power and mobility. Drilling in the winter is slower paced which gave the crew time to acclimate to their new 2015 TH60 that they took delivery of in December of 2014. By spring, the 2015 TH60 was hard at work doing daily service.

K&K routinely drills wells ranging anywhere from 60 to 800 feet (18 m to 244 m). Elger said the 6-inch well he drilled on this day would be completed to 700 feet, guaranteeing this new residence's minimum requirement of 20 gallons per minute (75

L/min). Only the first 220 feet needed to be cased, setting the pipe into competent bedrock formation. This Galena Platteville dolomite formation, which is approximately 300 feet thick, is the protective barrier above the water bearing St. Peter Sandstone upper case.

Drilling operations are powered by the TH60 carrier's 600 hp engine. To drill, Elger simply pushes the deck power button located on the dashboard, flicks the PTO switch, and puts the rig into the correct gear. Then, he moves to the driller's console at the back of the rig where he can fine-tune the drill.

"Dave is sort of a perfectionist," Knierim said, referring to Elger's use of the "Murphy screen," a small digital display on the driller's console.

"I'm saving 6 gallons of diesel an hour," Elger said. "And I know I'm saving that because the Murphy screen tells me what I'm using. The way to get the best fuel economy is, I'll dial my compressor back, then adjust the throttle down until I get best penetration at lowest rpm. Lower rpm equals less fuel burn."

Elger said he sets the Murphy screen to display only what he wants to monitor, but it can do much more. "It not only tells me what my fuel rate is, but even things a driller normally can't see from the back of the machine. I like to use it to see things like fluid levels, engine rpms and manifold temperature—as well as fuel economy."

Knierim said K&K can do a wide range of applications, but water wells are their specialty. From drilling and casing, to



pump installations, service, and plumbing. “We’ll do anything water well.”

The TH60 covers all their drilling needs, shallow or deep.

Elger gave an example. “Our deepest well was to 1,140 feet (347 m) with a DTH hammer. And I remember thinking to myself after we cleared the first 1,000 feet, wow, it went through a thousand like it was nothing.”

Elger was drilling mud rotary on the current job, making use of the rig’s onboard mud system. A K&K installation crew followed up to install the pump, add the well head and connect it to the house’s plumbing.

K&K ordered their 2015 TH60 not only with an integrated mud pump, but also with a water injection system, rod spinner, single rod loader, hammer holders, and a custom

cutaway for their welding station to be flush with the rig’s frame.

The Milwaukee-based Atlas Copco rep working with K&K was Clark Herbst, sales manager for the seven-state Midwest region. “That single rod loader is pretty slick,” Clark said. “In my experience, those who try it never go back to drilling without it.”

For adding pipe on holes deeper than the carousel’s capacity, the single rod loader allows the driller or helper to prepare a drill rod from the rod box while drilling is in progress. When it’s time to make a new joint, the loader simply swings the rod underneath the rotary head for a quick connection. When tripping out of deep holes, the single rod loader allows the operator to remove pipe with the rotary head.

Knierim said: “It not only saves time moving rod from box to mast, we don’t have to stop to rig up a two-part line to trip out. This way we aren’t doing double duty with the split line. We’re running at twice the speed of a split line setup.”

K&K’s other TH60 is a 2001 that is due for some larger service work. Knierim said, “The rig is a machine. Machines eventually need service. And Atlas Copco is right there for us.”

Knierim appreciates the responsiveness of Atlas Copco. “I might only send a text message. A moment later, Clark texts right back. He’s on it just that quick.” If the machine can’t be brought to Atlas Copco’s facility, then a service technician is usually at the rig the same or very next day. “That’s what I like most about Atlas Copco.”





Get on *the map*

Oil and gas drillers set world records with
Atlas Copco down-the-hole bits while
PDC bits make noteworthy runs

Atlas Copco Secoroc now holds all-time world records in 41 categories of Hart Energy's Drillbit Records—24 for superior rate of penetration (ROP) and 17 for single-run endurance in down-the-hole hammer bits.

Gene Mattila, business line manager for Atlas Copco Rock Drilling Tools, said Hart Energy's drilling data from the country's oil and gas basins is the most comprehensive and reliable documentation of tool performance in the country. Drillbit Records lists different types and sizes of bits in three categories—single run drill feet, cumulative drill feet and ROP.

"These records are important gauges to demonstrate penetration and reliability in the various stratigraphies, setting the bar for product development, and assuring consistency of product performance and service," Mattila said. "Speed and reliability are the two most dominant factors that affect overall drilling time and costs, as well as contribute to improved safety exposure, and reduced energy."

"Our U.S. customers have been especially successful with our 12 ¼-, 8 ¾- and 8 ⅞- inch directional nudge work in the northeastern United States," said Justin Kieffer, technical services engineer for At-

las Copco Mining, Rock Excavation, and Construction.

"Customers using down-the-hole hammers for their nudges are saving money by finishing wells faster, which lowers their daily rig operation costs on each well," Kieffer said.

Many of the Atlas Copco Secoroc records in the Hart Energy listing were set within the Marcellus and Utica shale plays. Records for 8 ¾- and 8 ⅞-inch bit sizes commonly attained runs of 3,000 or more feet (915 m), depending on formation conditions.

For example an 8 ¾-inch bit drilled 5,288 »

WORLD RECORD SUPERIOR ROP

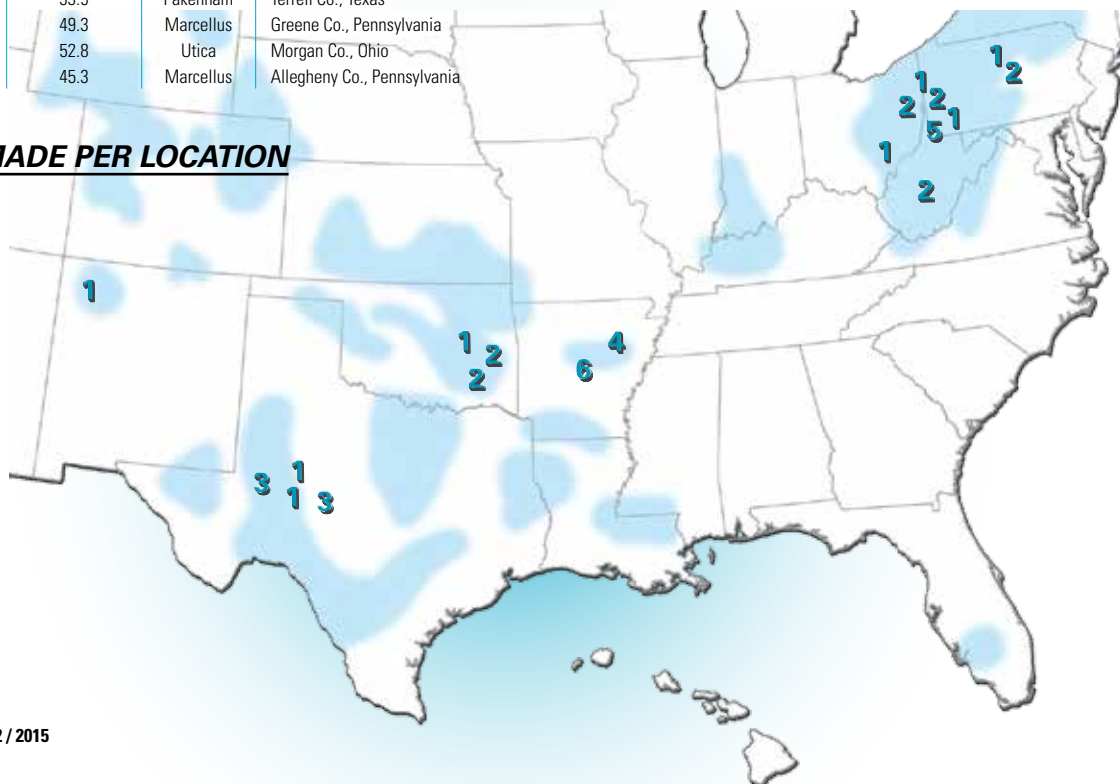
Bit Size	Footage	ROP (in ft./hr.)	Field	Location
4.875"	9,940'	58.6	[wildcat]	Edwards Co., Texas
5.000"	6,911'	68.4	[wildcat]	Texas
5.750"	4,000'	61.5	Wolfcamp	Terrell Co., Texas
7.250"	6,911'	68.4	[wildcat]	Crocket Co., Texas
8.250"	1,020'	116.5	Blanco Mesa Verde	San Juan Co., New Mexico
8.750"	1,211'	403.7	Utica	Carroll Co., Ohio
9.000"	1,325'	85.5	Fayetteville	Faulkner, Arkansas
9.250"	1,110'	92.5	Fayetteville	Faulkner, Arkansas
9.375"	1,214'	202.3	Fayetteville	White, Arkansas
9.625"	1,735'	315.5	Fayetteville	Faulkner, Arkansas
9.875"	2,138'	534.5	Fayetteville	White, Arkansas
10.625"	1,348'	192.6	Marcellus	Lycoming Co., Pennsylvania
10.875"	1,551'	156.7	Marcellus	Tioga Co., Pennsylvania
11.000"	2,831'	171.6	[unnamed]	Latimer Co., Oklahoma
12.250"	1,678'	279.7	Utica	Carroll Co., Ohio
13.500"	1,191'	61.1	Marcellus	Beaver Co., Pennsylvania
14.000"	381'	63.5	Red Oak	Latimer Co., Oklahoma
14.750"	1,715'	228.7	Fayetteville	Faulkner Co., Arkansas
16.000"	1,460'	97.3	Marcellus	Nicholas Co., West Virginia
17.500"	1,003'	250.8	Marcellus	Greene Co., Pennsylvania
20.000"	1,060'	33.9	Pakenham	Terrell Co., Texas
22.000"	1,036'	49.3	Marcellus	Greene Co., Pennsylvania
24.000"	301'	52.8	Utica	Morgan Co., Ohio
26.000"	204'	45.3	Marcellus	Allegheny Co., Pennsylvania

WORLD RECORD SINGLE-RUN ENDURANCE

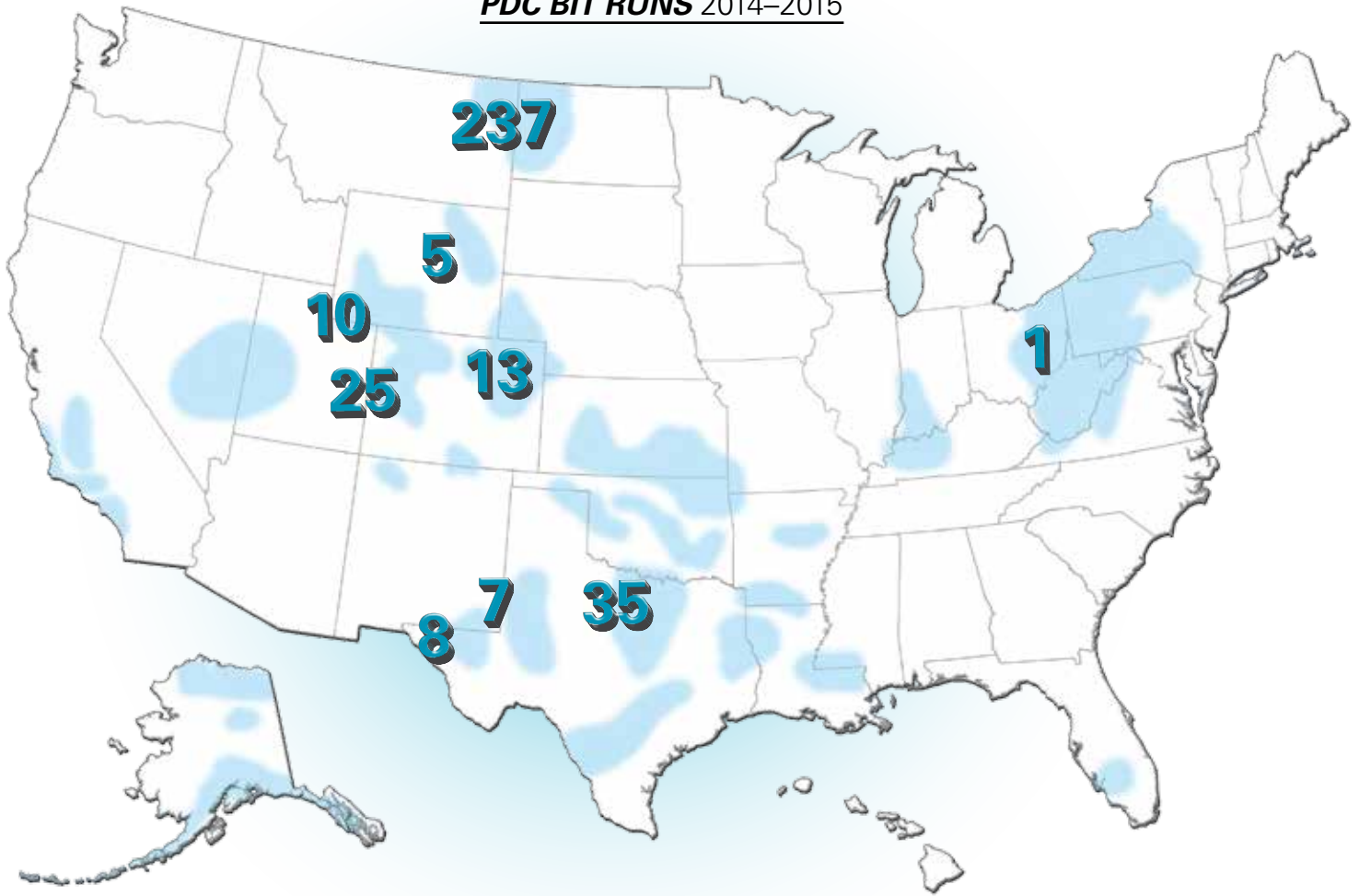
Bit Size	Footage	ROP (in ft./hr.)	Field	Location
4.875"	9,940'	58.6	[wildcat]	Edwards Co., Texas
5.000"	6,911'	68.4	[wildcat]	Texas
5.375"	1,664'	21.8	Sercer	White Co., Arkansas
5.750"	4,000'	61.5	Wolfcamp	Terrell Co., Texas
5.875"	6,308'	59.5	Atoka	Atoka Co., Oklahoma
8.250"	2,783'	64.7	Marcellus	Lycoming Co., Pennsylvania
8.750"	12,480'	74.7	Altizer	Val Verde Co., Pennsylvania
8.875"	4,675'	137.5	Marcellus	Greene Co., Pennsylvania
9.000"	1,325'	85.5	Fayetteville	Faulkner Co., Arkansas
9.250"	1,110'	92.5	Fayetteville	Faulkner Co., Arkansas
9.375"	1,214'	202.3	Fayetteville	White Co., Arkansas
10.875"	1,704'	52	Marcellus	Fayette Co., Pennsylvania
14.500"	1,426'	79.2	[unnamed]	Hughes Co., Oklahoma
16.000"	1,460'	97.3	Marcellus	Nicholas Co., West Virginia
22.000"	1,036'	49.33	Marcellus	Greene Co., Pennsylvania
24.000"	440.0'	36.67	Marcellus	Greene Co., Pennsylvania
26.000"	380.0'	33.04	Marcellus	Allegheny Co., Pennsylvania

Verified by Hart Energy for 2015 Drillbit Records List

RECORDS MADE PER LOCATION



PDC BIT RUNS 2014–2015



feet at an average ROP of 179.49 ft/hr (1611 m, at an average ROP 55 m/hr).

A 12 ¼-inch DTH bit went for 1,955 feet at 252.26 ft/hr (595 m at 77 m/hr).

Drilling contractors and operators provided bit-run sheets with performance data to verify the model, location and drilling conditions for each world record. The information for Atlas Copco products and for tooling from other manufacturers is made available for the benefit of all drillers in the upstream, midstream or downstream energy exploration and production sectors.

“We have solid brand and corporate recognition for our air DTH product line, which has historically provided the fastest and most consistently reliable tools in the industry,” Mattila said. “Holding a multitude of records in the Hart Energy list is evidence not only of our quality oil and gas products but also the professionalism of our sales, service, engineering and production teams, who provide consistency in our performance.”

Mattila added, “I believe we will shortly hold similar records for our PDC line, to which we are bringing the same principles and consistent performance as our DTH bits.”

NOTEWORTHY RUNS WITH ATLAS COPCO PDC

Single bit run data unless otherwise noted

Bit Size	Footage	ROP (in ft./hr.)	Location
7.875"	3,073'	83	Texas
7.875"	3,261'	100.1	Kansas and Nebraska (8 run average)
13.5"	2,034'	394	North Dakota (20 run average)
7.875"	3,846'	55	Martin County / Texas
11"	5,042'	67.2	Texas
9.875"	4,379'	108.1	Colorado
8.75"	923'	132	Ohio
12.25"	4,784'	137	North Dakota
12.25"	3,981'	166	North Dakota
8.75"	5,035'	66.3	Texas
17.5"	1,583'	42	Colorado
12.25"	1,660'	59.3	Texas
9.875"	5,671'	93.7	Colorado



AtlasCopcoMarketplace.com PRE-OWNED DRILLS



Ingersoll-Rand TH60/2004 sn:6820
Location: Sacramento, CA
Tower: 38 ft w/ 29,500 lb pullback
Compressor: 900 cfm / 350 psi
Truck: International Paystar
Truck Engine: 525 hp Cat C15
Mud Pump: 3 x 4 Mission



Ingersoll-Rand TH60/1993 sn:3797
Location: Milwaukee, WI
Tower: 38 ft. w/ 29,500 lb pullback
Compressor: 750 cfm / 250 psi
Truck: International Paystar
Truck Engine: 410 hp Cummins



Atlas Copco T3W/2008 sn:21254
Location: Milwaukee, WI
Tower: 36 ft w/ 40,000 lb pullback
Compressor: 900 cfm / 350 psi
Deck Engine: 580 hp Cat C15
Truck: International Paystar
Truck Engine: 380 hp Cat C13
Drill Hours: 6,850



Atlas Copco T2W/2012 sn:21402
Location: Milwaukee, WI
Compressor: 750 cfm / 300 psi
Tower: 30,000 lb pulldown/pullback
Truck: International 7600
Truck Engine: 475 hp IH Maxxforce
Drill Hours: 607
Mud Pump: hydraulics in place



Atlas Copco T3W/2007 sn:21229
Location: Clarks Summit, PA
Tower: 36 ft w/40,000 lb pullback
Compressor: 900 cfm/ 350 psi
Deck Engine: 475 hp Cat C15
Truck: International 7600
Truck Engine: 380 hp C13
Drill Hours: 4239



Atlas Copco T2W/2006 sn:6982
Location: Milwaukee, WI
Tower: 30,000 lb pulldown/pullback
Compressor: 750 cfm/ 300 psi
Truck Engine: 525 hp Cat C13
Mud Pump: 3x4 Mission



Atlas Copco T2W/2014 sn:21414
Location: Sacramento, CA
Tower: 30,000 lb pulldown/pullback
Compressor: 900 cfm / 350 psi
Truck: International 7600
Truck Engine: Maxforce
Drill Hours: 3,000

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For further information, please visit www.atlascopco.com or contact Atlas Copco AB, SE-105 23 Stockholm, Sweden. Telephone: + 46 (0)8 743 80 00.

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