Secoroc Rock Drilling Tools

ELEMEX OVERBURDEN DRILLING SYSTEMS

Atlas Copco

Elemex
– mastering the elements

Casing advancing is one of most popular piling methods for foundations in urban areas. Over the years, Atlas Copco has successfully introduced special overburden drilling systems like Symmetrix and Odex, designed for efficient casing installation with DTH drilling. Today consultants are increasingly interested in utilizing DTH hammers in foundation construction. At the same time they are concerned about the environmental impact of using compressed air among existing structures, risking air leakage and overdrilling. To meet this challenge, Atlas Copco has developed a new system and is now proud to present Elemex™ overburden drilling system for flushing control.

DTH drilled foundations
Use of DTH drilling systems, like Symmetrix, for advancing casings in to the ground gives plenty of benefits compared to conventional piling techniques in foundation construction. By drilling and installing the casings in one single operation, systems like Symmetrix provides high productivity, straight holes, deep hole drilling capacity, just to mention a few of the benefits.

DTH drilling in urban areas
Foundation drilling and underpinning works are frequently carried out where existing foundations are sensitive to any kind of disturbance in their immediate surroundings. When the ground conditions are tough with hard rock or boulders, or if the pile requires rock socket casing, then drilling with DTH is the least disturbing and most efficient foundation method available.

Challenges in sensitive ground
DTH drilling in foundation works gives one great challenge – controlling the removal of cuttings from the hole with compressed air. The flow of compressed air needs to be strong enough to transport the cuttings up to the surface but must not escape into the surrounding ground or remove excessive soil. This issue is most demanding in sensitive ground conditions. In clay, air from the DTH drilling can escape to surrounding working foundations and weaken the adhesion between soil and load-bearing elements. This brings a risk for sudden settlements. In sand, excessive flushing can unconsolidate the ground, decreasing the capacity of existing friction piles, which in turn might cause pile buckling and result in settlements of buildings.

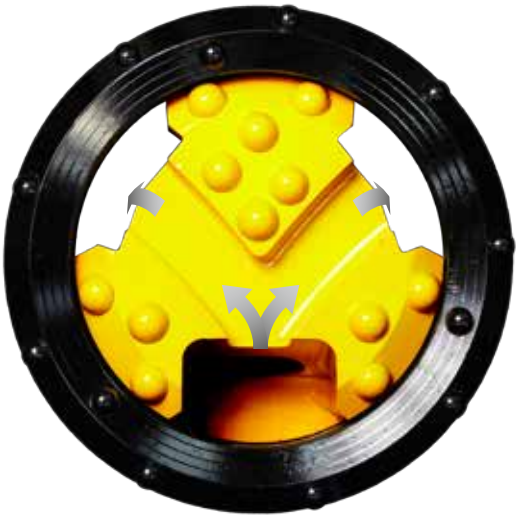
Controlling air - a tough task
Controlling air escape puts high demands both on the drill rig operator and the drilling system itself. Conventional DTH drilling systems push air straight into the ground, which is a feature derived from rock drilling applications where the rock face needs as much air as possible to be cleaned efficiently. However, overburden drilling conditions make the situation much more complex. Flushing should be just intense enough to get cuttings out from the hole, but not more. The operator needs special competence and experience to manage the air flow, and the rig needs to be equipped with an air control valve within easy reach.

Turning science into safety

To meet these challenges, Atlas Copco's design engineers have devoted time and effort to optimize the drill bit performance and air flushing for sensitive applications. The new and reliable Elemex system for controlled flushing was invented by combining comprehensive field experience and testing with air flow simulation and analysis. Together with some of our most dedicated customers, Atlas Copco has designed this product to take on the most sensitive projects, and Elemex is already proving itself on the field.

Atlas Copco Elemex system

The Elemex system minimizes the air escape to the surrounding ground as the high pressure air never faces the ground directly. The unique concept behind the Elemex design is built on redirection of the air flow. Once the air reaches the bit face, it is blown against the extended ring bit walls which redirects the flow across the face. This way, the air pressure is decreased just enough to allow an efficient flushing of the bit face without escaping to the surrounding ground. The extended ring bit closes the drilling area and keeps the air in the flushing grooves. The dimensioning of the ring bit extension is optimized to make the system strong and sturdy. The extended ring bit also has another positive effect to the performance, as the pilot bit life is substantially prolonged.



Foundation drilling with DTH is frequently carried out in urban areas, close to people and existing structures.

Gentle yet tough

By utilizing the Elemex system, you can take on the toughest challenges and the most sensitive projects. Not only do you get peace of mind from knowing that neighbouring structures are kept intact and people around the worksite are safe, you also get all the benefits from DTH drilling for maximized productivity. Elemex is gentle on the surrounding but tough on the boulders that might come in its way.

A conventional DTH drilling system directs the compressed air from the flushing grooves straight into the ground with a high intensity, causing the air to rapidly spread to surrounding foundations.

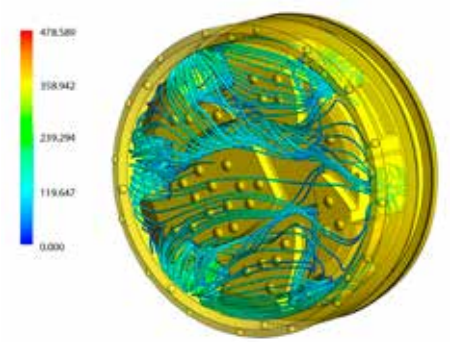
The extended ring bit wall of the Elemex system redirects the air within the drilling area. This decreases the air pressure just enough to get an efficient flushing. The intensity of the air that reaches the surrounding soil is significantly lower.

Ease of use

The Elemex system has a built in simplicity in its mechanical design. No special operator's training is needed to control the air flushing intensity; Elemex takes care of that for you. By redirecting the air from blowing straight into the ground, a more continuous flushing is achieved. This in turn allows the operator to focus on the drilling operation. Unexpected disruptions can be kept to a minimum. Any drilling rig capable of DTH drilling can install casings with the Elemex system.

Sustainable productivity

Not only is the Elemex system ensuring a reliable foundation structure and ease of use - it has also proven to provide an increased speed of installation and straighter holes. When drilling with an old type of underreaming system, overdrilling is a common problem that significantly slows the operation down. It these cases it is not rare that 2-3 times more ground than necessary is excavated which in turn might dramatically alter the ground characteristics, and cause considerable delays to the project.



Flow simulation in the Elemex face design.

The Elemex product portfolio covers casing sizes from 114 mm up to around one meter outside diameter. The systems can be used for installation of both end bearing and skin friction piles.

Unique design

Depending on the size of the system, the flushing channels on the pilot bits have different designs in order to optimize flushing and drilling capacity. With use of Computational Fluid Dynamics Analysis the flow can be visualized in computer models. This way, an efficient design process is carried out before bringing the prototypes to the field for testing.

Testing

After thorough inhouse testing to prove the basic function of the product, the Elemex system was taken to the field to meet the challenging conditions of the real work sites. Working closely together with our experienced customers we have been able to optimize the design. During testing, consultants on the field have measured the ground water level variation, and with Elemex there has been none to show. Neither have there been any settlements of the surrounding buildings recorded.

Elemex - in the field

Above: Piling with the Elemex system next to the old bridge.
Below: Risto and Juhani Välisalo, co-owners Terramek Works.

A new residential area by the water

When the old harbour in Sompasaari, Helsinki was moved to a new location, a large scale project on creating a new residential area by the water front was initiated. The ground engineering works for this new housing area was taken on by E.M. Pekkinen as the main contractor and Terramek Works Oy as sub contractor for the piling works. In the first face of the construction, the concrete plates for roads and infrastructure in the area were built.

Challenging ground conditions

The geological formation in the old harbour is demanding, as the old base material consists of clay with a back fill layer between 3 to 14 meters including boulders and gravel. Below that there is a section of clay, then a moraine layer of between 1-6 meters before reaching the solid bedrock of granite. In this project, each pile had to be drilled 2 meters in to the bedrock to ensure that the pile reached the bedrock and not just a large boulder in its way. The only way to handle these conditions was to choose DTH drilling when installing the piles.

Elemex takes on the challenge

One of the new roads will run under an existing bridge. To be sure to avoid any damage to the bridge foundation, the Elemex system was chosen for the job. According to Juhani Välisalo, co-owner of Terramek Works, this was a good choice - no motions have been measured in the bridge.

"In this project we have been using the Elemex drill bits and our drillers are very happy about the system. They are paid by meter, and we have noticed that the penetration rate exceeds any previous experiences we have had from other casing drilling systems. So we are all very pleased about the new system. When drilling with Elemex, it's easy to see that the flushing is continuously coming out of the casing. We seem to get a very good back flush, even though we are drilling through backfill and boulders."

A close relationship

"Terramek Works has a good relationship with Atlas Copco", Juhani explains. "They have always helped us with the special applications. Even if the job is harder you need to find a way to make a good job and find the solution for it. And that is what we have always been able to achieve. Atlas Copco listens if we get ideas on the field, and we work together to have new ideas tested so the feedback goes well in both directions and we are happy about that."

Other voices of Elemex

Arto Määttä, co-owner Sotkamon Porakaivo, Finland
"We have used the Elemex system for the new foundation works of an existing railway bridge. The ground conditions were tough with clay layers, fissures between layers and sloping bedrock. Train traffic was running at the same time as the piling works were carried out. For this project it was especially important that the ground was not disturbed by air leakage causing settlement and heaving of railway tracks. We selected Elemex for this project so we could do our work without worrying about the air escaping. The ground water level was carefully monitored and no changes were observed during our piling work."

Sari Bäck
Product manager, Atlas Copco
"In the future there is a high possibility that use of compressed air will be banned from urban foundation projects. People are now aware of the risk that such use might have. This new design is the biggest invention for a long time in the foundation drilling market. With the Elemex system we can safeguard the future for DTH based casing installations, with all its benefits, in many urban areas."

Antti Virjula,
Design and Development manager, Atlas Copco Rotex Oy
"When developing a new product the contact with the customer is crucial. Once our in house testing is done, we bring the products out to the field and the feedback we get from the experienced operators help us improve the product. We have to listen to the customers, they know how to drill!"

Jukka Ahonen
General manager, Atlas Copco Rotex Oy
"With the Elemex system we have managed to control the flushing very well. But, on top of that, customers also say that we have managed to get a better working system. We designed this system for the city works, for difficult or sensitive ground conditions, but we also managed to get a system which works better everywhere. It lasts longer, drills faster and straighter – and is also liked by the drillers, who are the key people in this business.

For more information, please visit www.atlascopco.com/Elemex

Sustainable Productivity

We stand by our responsibilities towards our customers,
towards the environment and the people around us.
We make performance stand the test of time.
This is what we call - Sustainable Productivity.

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