

Atlas Copco Exploration Products

ExcORE diamond tools



Sustainable Productivity



Excore

- reducing exploration drilling time

An exploration driller's livelihood is dependent upon the efficiency of his drilling equipment. Core in the box determines the drilling company's revenues and the driller's compensation. That's why drillers are always looking for diamond drill bits with faster penetration rates and longer service life. At Atlas Copco, we have developed a new product range based on the latest in diamond drill bit technology – the Excore.

Best from the best

Atlas Copco is renowned as a leader in exploration drilling. With extensive experience of what is really required in the field, and unique expertise in metallurgy, the company has brought an international team of drillers, engineers and metallurgists together to produce its best diamond bit yet. The new Excore bit line is a combination of the best of decades of experience from previous diamond bit ranges and the latest in manufacturing and metallurgy techniques.

After a rigorous two-year testing phase in six countries, with thousands of meters drilled under varied conditions, we can say that Excore is a series of diamond drill bits in the absolute top range of what is available today. The operating range of each diamond bit has been substantially increased, which results in fewer bits required on the job site by the drilling contractor to cover a wide range of drilling conditions and simplifies bit selection for the driller.

Exceptional productivity - outstanding service life

With Excore, we have taken proven Atlas Copco designs and developed them further. We engineered new matrices and optimized crown profiles. By calculating the right balance between these variables we have achieved bits with exceptional



penetration rates as well as extended service lives in the toughest of drilling conditions.

Now, with the new Excore bit line, a contractor can drill both faster and deeper and spend less time changing drill bits. Strenuous field tests over the past two years have shown the new Excore line will outperform in the toughest of drilling conditions.

The bits cutting ability has been improved compared to existing bit ranges, which allows a higher penetration rate or a lowered weight on bit (WOB) when the formation demands it.

Also, in very hard rock, a better penetration rate can be achieved with less pressure, which in turn gives a lot of advantages. Lower weight on bit results in less hole deviation and more exact extraction of core. Lower WOB also gives less wear and tear on the entire rig and ITH equipment. On the other hand, when rock conditions allow the driller to push for maximum penetration rate, the Excore bits will exceed the drillers expectations. All in all – Excore allows the driller to optimize penetration rate and bit life for the best result in any rock condition.

A longer bit life results in less frequent bit changes and consequently also less time tripping rod. That factor alone saves a lot of time for the driller and more time can be spent on actual drilling than on pulling rod.



Metallurgical expertise for better cash flow

One of the reasons Atlas Copco is recognized as a global leader in exploration drilling is our expertise in metallurgy. Our engineers have designed the new Excore bits utilizing the latest in metallurgical techniques. The resulting new proprietary Atlas Copco matrices along with state of the art manufacturing processes means that we can guarantee exceptional performance as well as Atlas Copco quality and consistency.

The metallurgy and design of the Excore bits also enables the bits to cover a wider range of applications compared to its predecessors.

A broader operating span for each diamond bit, results in increased drilling efficiency and simplified bit selection.

Drillers can reduce the number of diamond drill bits usually required to tackle different rock conditions in their operation, without losing performance.

On site this means that there is less need to pull rods to change bits for changes in rock formations.

Off site the logistics and purchasing is streamlined. Often one bit type can replace several other types at the drill and on the shelf. This of course improves both productivity and cash flow at the same time.



More performance - less bits

As each Excure diamond bit covers a wider range of applications, fewer bit types than before are needed to do the same job.

This makes bit selection much simpler for the driller and reduces the number of bits needed on the job site. It is easier for less experienced drillers to select the optimal bit for the job.

This not only improves productivity, but also reduces the risk for failing to meet deadlines for the drilling contractor. The Excure series of new matrices combined with optimized crown profiles have been categorized into three types of drilling applications to simplify the bit selection for the driller.

As the Excure bits provide superior performance in a wider range of formations, it becomes easier for the driller to find the best bit for the job, meaning the new range is more forgiving.

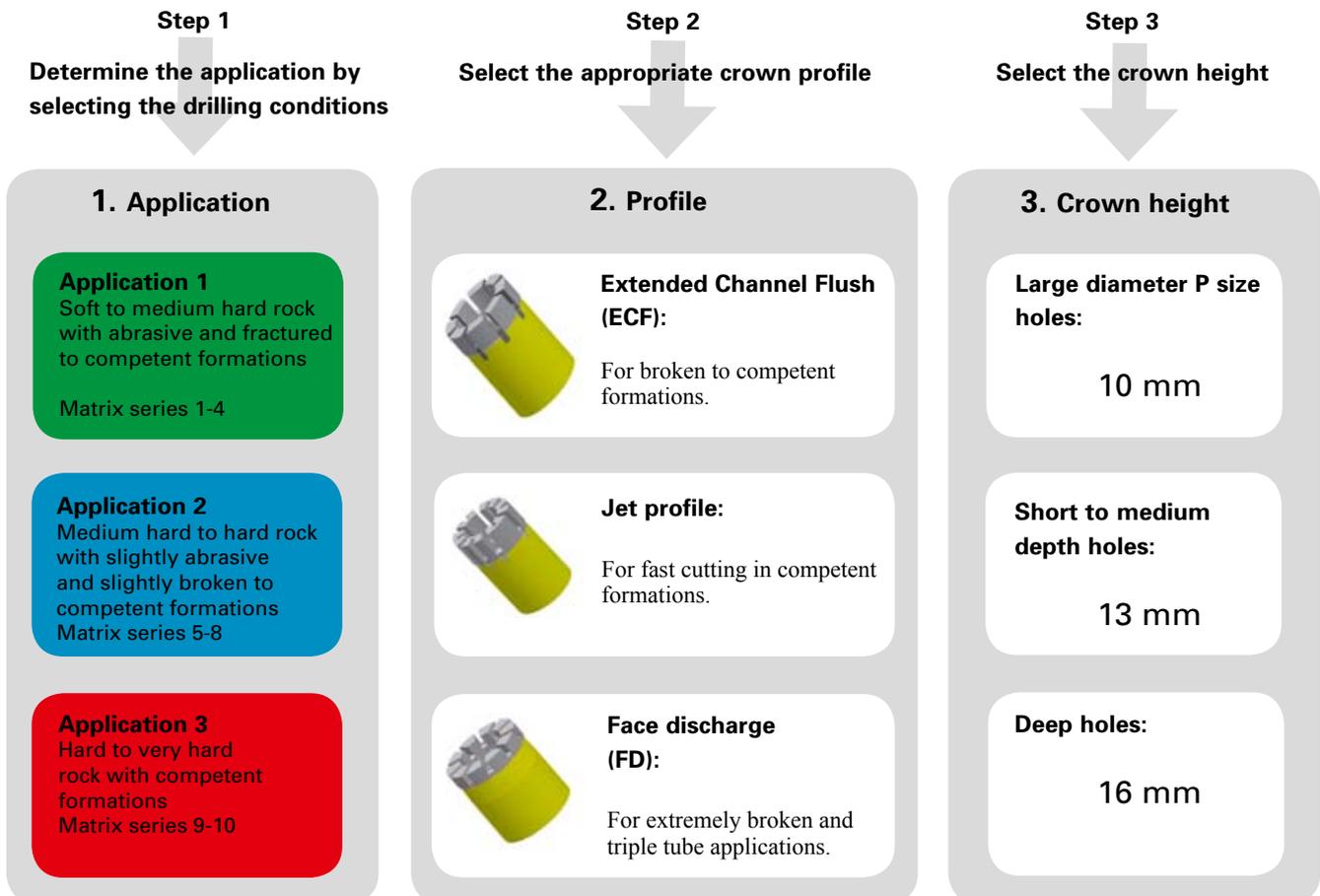
The Excure bit line is divided into three applications:

- Excure for soft to medium hard rock with abrasive and fractured to competent formations (Matrix series 1-4)
- Excure for medium hard to hard rock with slightly abrasive and slightly broken to competent formations (Matrix series 5-8)
- Excure for hard to very hard rock with competent formations (Matrix series 9-10)

Each Excure type is available in various crown designs like the Extended Channel Flush (ECF) for broken to competent formations, the patented Jet profile for fast cutting in competent formations and Face Discharge (FD) design for extremely broken and triple tube applications.

Combining these features with different available crown heights, from 10-16 mm, means there is an Excure for every core drilling application.

How to select in three easy steps:





Matrix Series

Rock group	Formation description	Rock type
● 1 - 4	Soft to medium hard Very abrasive to slightly abrasive Very fractured to slightly broken	Unmetamorphosed or weakly metamorphosed shales, Sandstone and limestone
● 5	Medium hard Abrasive Moderately fractured to slightly broken	Limestone and dolomite. Weathered granite and gneiss. Serpentinite and metaperidotite.
● 6	Medium hard Moderately abrasive Moderately fractured to slightly broken	Unmetamorphosed or weakly metamorphosed diorite, Gabbro, peridotite and gneiss. Basalt, andesite.
● 7	Medium hard - hard Moderately abrasive Slightly fractured to competent	Metabasalt, amphibolite. Metamorphosed diorite and gabbro. Diabase.
● 8	Hard Slightly abrasive Competent	Quartz rich skarn. Granite and pegmatite
● 9	Very hard Slightly abrasive Very competent	Metamorphosed granitic rock and quartz rich gneiss.
● 10	Extremely hard Non-abrasive, fine grained Very competent	Chert and jasperite. Quartzite. Highly metamorphosed volcanic.

Crown profiles

		Crown designs								
		ECF			Jet			Face Discharge (FD)		
		10	13	16	10	13	16	10	13	16
	Matrix series									
Application 1	1-4	x*	x					x*	x	
Application 2	5-8		x	x		x	x	x*	x	
Application 3	9-10		x	x		x	x			

Crown profiles are available in industry standard diameters.
* P size only

More core in the box for Protek

Renströmsgruvan, one of the Boliden underground mines, is one of the deepest mines in Sweden. Core drilling is done at various levels of the mine to define the zones of interest.

Protek Norr AB is a Swedish drilling contractor which handles the core drilling at the 850 meter level on behalf of Boliden. Most of the Protek drillers have been working for the company for many years and have good knowledge and long experience of diamond core drilling.

Experience that counts

Jerry Hedman is a core driller with many years of experience from surface as well as from underground core drilling. Jerry started his drilling career in the mid 80's and has been working underground in Renströmsgruvan since 1995.

“When working a long time in the same mine, you get very familiar with the geological formation and you know what to expect from your drilling tools,” says Jerry.

For about a year, Jerry has been drilling in a zone where the geological formations vary. In this formation the life of a normal diamond drill bit was about 100 meters. When drilling a



900 meter hole he must pull the drill rods out of the hole 8 times to change the drill bits. Rod running, or rod handling, is a heavy and unproductive operation, during which drilling time is lost. Rod running is an operation which every driller tries to avoid as much as possible.

“It is the meters of core in the box that matters to us. Rod running is just a waste of time and leads to unnecessary and heavy work,” says Jerry.

Productivity increase needed

In order to increase the productivity and to decrease the unproductive rod running time it was clear that a new drill bit was needed. Ingemar Larsson, Atlas Copco's sales engineer in the mine, suggested a test of Atlas Copco's new diamond drill bit – Excore with a Jet profile.

“When Ingemar suggested this bit I hoped that it would perhaps last 150 – 200 meters,” says Jerry.

The first Excore drill bit tested had a service life of 326 meters and the best Excore bit in the test had a life of 347.5 meters. Very good results which mean, that with Excore, Jerry only had to do 2 rod running operations, instead of 8, per hole. The result is less time spent on rod running, less fatigue on the drilling equipment as well as on the drillers and a higher productivity.

“The Excore drill bits work very well. They cut the rock very smoothly also when the rock gets harder. It is just a question of a slight increase of the feed force. They are free cutting and very well balanced. I did not have to sharpen the bits manually in the drill hole, which is good since manual sharpening of the drill bit considerably decreases the life of the drill bit,” says Jerry.



Amazing average life

The test proved that the average life of the Excore drill bit was 324 meters which is more than three times the life of the drill bits that Protek previously used in the same formation. This is a considerable increase in productivity - more core in the box in less time!

During the test the drilling was done in the same formations, using the same drilling equipment as well as the same operators as when drilling with drill bits earlier used by Protek.

Calculation on a 900 meter hole showed that with the Excore bit, Jerry only needed a fourth of the time to pull rods.

“I definitely recommend other drillers to test the Excore drill bit,” says Jerry.

	Previous bit	Excore
Bits (m):	100	326
No of bits needed:	9	3
No of pulls to replace bit:	8	2
Time to pull rods (hrs):	16	4

Excore closes the contract for Drillcorp

Drillcorp is a South African based drilling contractor with operations in several countries in Southern Africa as well as in Brazil. In 2009, Drillcorp held a 5 month contract for 46 holes with a total of 20 000 meters core drilling to define the values of a gold mine 250 km west of Johannesburg.

To meet the timeline of the contract, Drillcorp had been running two drill rigs on separate locations to define the values of the ore at 400-500 meters depth.

Challenging ground conditions

As the project started, Drillcorp deployed the same drill bits as used before at other drill sites, but they soon discovered the ground at the mine posed some challenges. The bits did not cut the hard rock as expected and when more pressure was applied it simply lifted the drill rig instead of cutting harder. In harder formations, the drill bits did not cut and became polished.

In addition, the ground was fractured and complicated to drill in without getting stuck. As 10 000 meters had been drilled, Drillcorp managed to get about 30 meters per shift and a bit life of 60-70 meters. This was not enough to complete the contract in time or additional drill rigs would be needed.



Trial of Excore

Atlas Copco Exploration Products Africa then suggested trial of a new bit to Drillcorp – the Excore bit.

The first Excore bit was brought into action with 250 meters left of a started hole. Drillcorp normally would expect to change bits at least three more times for that hole, using at least 6 hours to pull rods on the remaining part of that single hole. The new Excore bit finished the hole without the need for replacement and was able to drill another 52 meters in the next hole. The first test bit showed 302 meters bit life compared to the normal 60-70 meters using previous bits!

“This is an excellent bit, I would recommend it to anyone”, said Willie Smit, site manager. “Especially for the ground conditions we have experienced.”

Drillcorp instantly ordered 20 new Excore bits so that the contract could be finalized within the specified time. Something that would not have been possible without Excore.

Extraordinary results

The first 10 000 meters of the contract had been drilled with a bit life of 60-70 meters as an average and a penetration rate of 30 meters per shift. The last 10 000 meters, drilled with Excore, gave an average bit life of 280-300 meters at a penetration rate of 54 meters per shift.

80% higher penetration rate and more than 4 times longer bit life meant significant productivity improvement!

A calculation shows that for a hole of 500 meters, time saving was:

	Previous bit	Excore
Bit life (m):	65	290
No of bits needed:	8	2
No of pulls to replace bit:	7	1
Time to pull rods:	14	2
Hours Capacity:	30	54
Total time to drill (hrs):	118	74
Total time per hole (hrs):	132	76

This means a saving of 40% of the time needed to drill a 500 meter hole!

Simpler choice - simpler drilling

The fact that one Excore bit type could handle all challenges Drillcorp experienced also made a big difference to them. Previously they needed 6 different bits on the shelf to handle all the formations in the area. These bits could all be replaced by one Excore bit.

This is important from an inventory perspective but also in the operation. “We need bits for hard and soft rock, but we don’t know which until we are in the formation,” Willie Smit explains. “If we need to pull rods to change a bit, it may be for only a few decimeters. It saves us a lot if we don’t need to do this.”





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