



DIAMOND PRODUCTS CATALOG



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HISTORY

Boart Products

Our diamond products were originally developed by Anglo American Corporation in the 1930's as a way to commercialize industrial-grade diamonds for the world's leading diamond producer. Boart Products led the research and development program which enabled practical and reliable manufacturing of diamond coring bits.

Early Success in the Copper Belt

The first Boart bits off the line were put to use exploring for copper in Zambia and gold in the Orange Free State, South Africa. The early success of these bits paved the way for widespread adoption of the technology within the industry.

Longyear

In 1938, the Longyear contract drilling department started using Cast Set diamond bits. Almost immediately after Longyear had the bits in the field, the sales department started receiving inquiries from around the world regarding the availability of the diamond bit.

As our surface-set diamond bit technology developed, Longyear brand bits were put to use around the world. In the 1960's, the Longyear™ Q™ wireline took the industry by storm and opened the door for widespread adoption of Longyear drilling tools and consumables.

CASTSET CORE BITS



COST LESS BECAUSE THEY
ARE MECHANICALLY SET

YOU GET

MORE CUTTING POINTS
MORE CORE
GREATER FOOTAGE AT
LOWER COSTS
STRAIGHTER HOLES

Longyear

Revolutionary Engineering

1974 was an important year for Boart Longyear. Boart International became the sole owner of Longyear. With the new found technical talent and capital investment from Boart International, Longyear became the leading manufacturer of diamond bits.

BIT HISTORICAL TIMELINE

1930

1930s: Diamond bit technology developed by Boart Products

1940

1938: Longyear™ Cast Set diamond drill bits launched

1949: Key manufacturing partnership formed to produce Longyear™ bits

1950

1950s: Powder metallurgy first applied to surface-set diamond bits

1970

1955: Longyear develops drilling system for NASA

It was during this transition when engineers in North Bay, Ontario secured a reliable source of high-performance synthetic diamonds which triggered the development of a completely revolutionary bit design – the impregnated-diamond bit. With decades of powder metallurgy experience behind them, Longyear engineers set out to develop a new crown which consisted of synthetic diamonds evenly distributed throughout a composite matrix. This new design could drill further and faster than surface-set bits and it cut through much harder material. By 1980, 75% of our Canadian-produced bits were of the new impregnated type and Longyear was manufacturing diamond bits in more than eight countries.

Continued Innovation

Today, there are many marketers of diamond bits and very few of those companies have invested in bit development. Boart Longyear is dedicated to the development of diamond bit technology. You can see it in our recent designs—such as the patented Stage™ waterway—and you can trust us to deliver continued innovation.



1980

1978: Synthetic diamond bits developed by Longyear Canada

2000

2002: Alpha Bit™ titanium-coated diamond technology launched

2010

2010: UMX™ line is launched

2007: Stage™ waterway design is launched

PRODUCT RANGE

Impregnated Diamond Bits

Impregnated diamond bits are used for cutting holes in medium to ultra-hard formations. A variety of types are available to maximize drill life and penetration.

The crown is made up of metal powder and diamond matrix that wears away during the drilling process and exposes new layers of diamonds, renewing the cutting points.

Stage™ Waterways

The innovative Stage™ waterway design pushes the envelope by allowing the tallest crown height in the industry. The Stage waterway design lets you spend more time drilling and less time tripping rods.

Armed with substantial driller feedback and the goal of producing the best bit on the market, Boart Longyear engineers set out to expand the Stage waterway design. The bit provides a new benchmark for reliable, cost-effective productivity in any ground condition. The new design features an expansion of our patented window design to improve productivity, a revised window layout to increase strength, and our patented Razorcut™ face design which provides the driller with a ready-to-cut bit right out of the box and provides excellent tracking to maintain straightness while drilling.

In addition to the design changes, the Stage waterway option is now available in both 16mm and 25mm impreg depths. For very soft and broken ground conditions, Stage is now available in a face discharge configuration.

UMX™ Bits

Ultramatrix™ (UMX™) bits are an innovative and versatile line of diamond coring bits using patented technology. With several technologically advanced features, the bits make diamond coring more efficient than ever before. UMX bits are engineered to drill faster, last longer, and out-perform existing bit technology in a wide range of drilling conditions and ground formations.

Alpha Bit™ Series

Introduced in 2002, the Alpha Bit™ Series still sets the benchmark for productivity in hard rock, relative to other traditional impregnated bits. Incorporation of coated synthetic diamonds, an industry first, retains diamonds in the matrix longer. Prolonged adhesion allows more of the diamond surface to be exposed, enabling faster cutting and longer life. Alpha replaces natural diamonds in the gauge keeping with a unique pattern of thermally stable diamonds, another industry first, improving stability and wear resistance.



AU Design No. 332218; CA Design No. 136438; CN Design No. ZL201030248719.X; PE Design No. 2690; US Patent No. D630,656; ZA Design No. F2010/1030; ZA Patent No. 2012/01878; Patents Pending US Patent Nos. 7,695,542; 7,975,785; 8,146,686; 8,191,445; 8,783,384; AU Patent Nos. 2007342231; 2011226850; 2011226849; 2012211429; CA Patent No. 2671193; CN Patent No. ZL200780050729.8; Patents Pending.

SPECIALTY BITS

Directional Bits

Directional bits are used with down hole motors to steer the drill string in different directions.



Wedge Bits

Wedging bits are made to set wedges in the bore hole to alter the drilling direction. Offered in both chamfered, radius, and Stage 2 versions.



Polycrystalline Compact Diamond (PCD) Bits

PCD bits are made for cutting softer formations at high penetration rates. They typically have round PCD cutters that can be replaced, extending the life of the bit.



Thermally Stable Diamond (TSD) Bits

The TSD bit is used for fast penetration in soft/medium rock formations. TSD's are a cost effective alternative for large stone surface set and PCD bits.



Surface Set Coring Bits

Surface set coring bits are typically used for higher penetration rates than impregnated bits in softer formations. They utilize a single layer of natural diamonds set in a hard matrix.

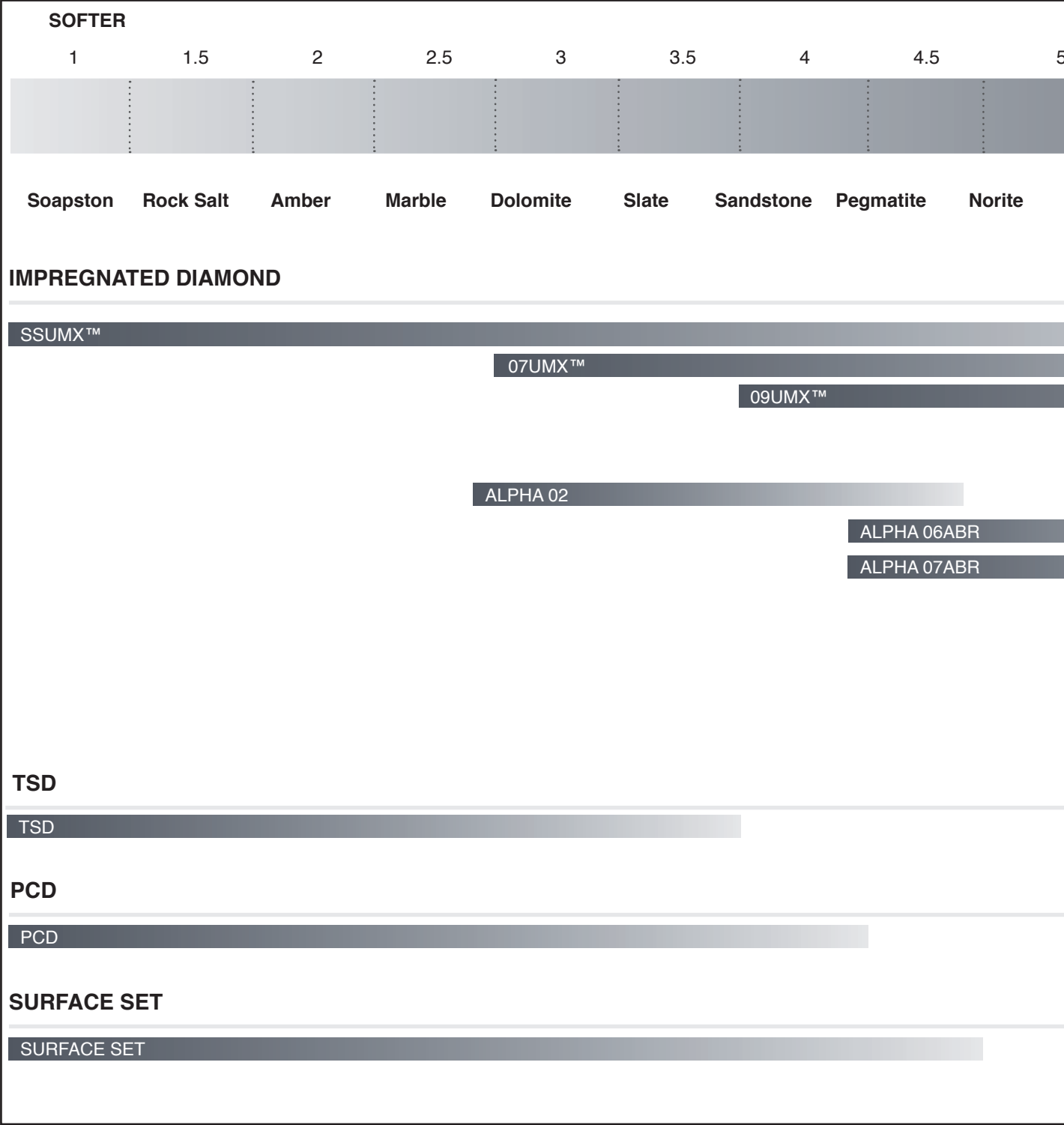


Carbide Chip

The carbide chip bit is a general purpose bit for geo-technical applications used primarily in soft formations. This is a cost effective alternative to carbide tooth bits.

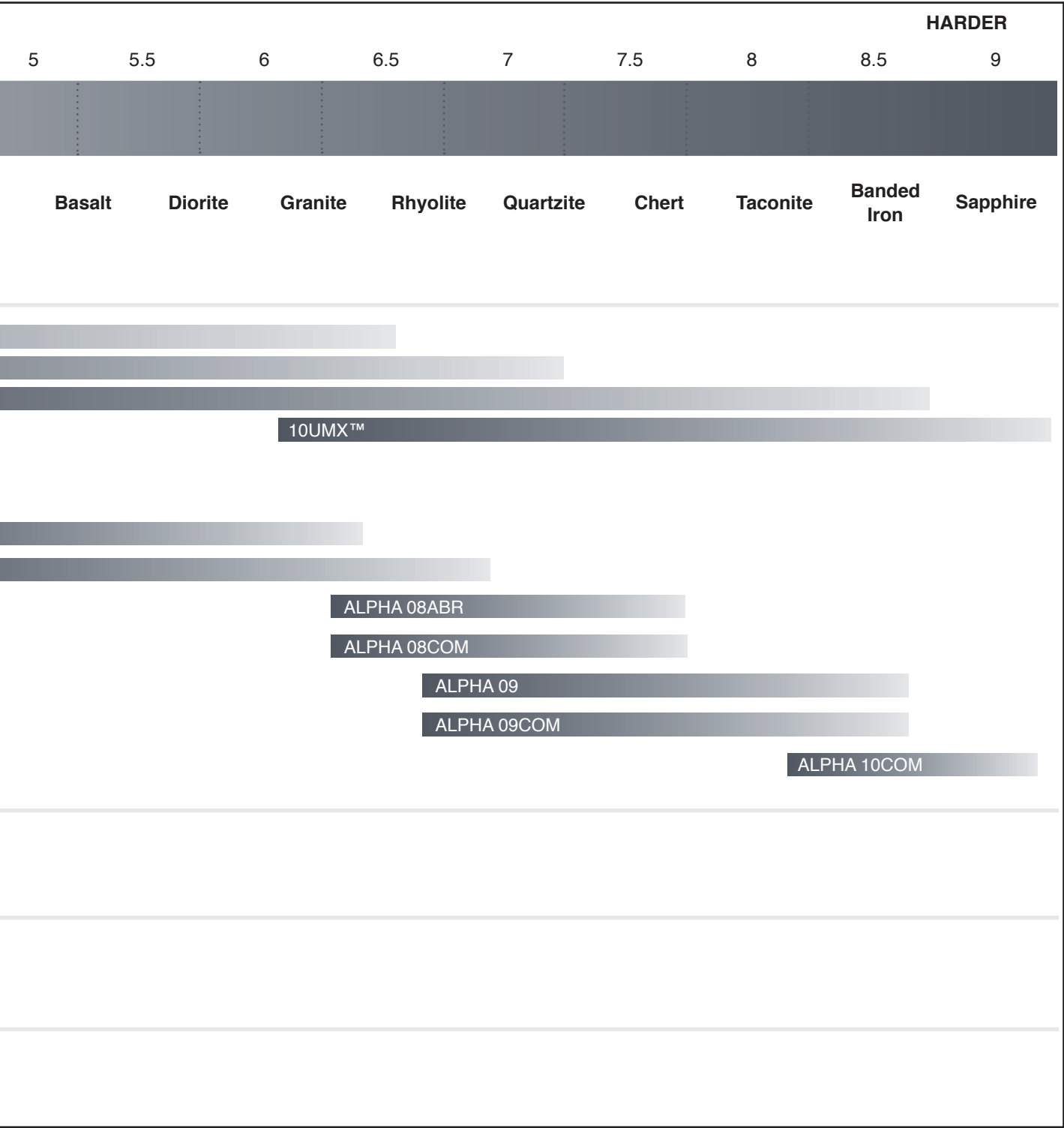


BIT RANGE CHART: MOHS SCALE OF HARDNESS



Conditions are often encountered where formations change repeatedly within a very short interval of drilling. Under such circumstances, select a bit that cuts the hardest of the expected formations, and adjust drill rates as abrasive rock is encountered to protect the bit from excessive wear rates.

For additional details about bit selection as well as custom exploration bits, please contact your local sales representative.



SYSTEM OVERVIEW

Q™ & Q™ TK SYSTEM



1. Reaming Shell

2. Stop Ring

3. Core Lifter

4. Core Lifter Case

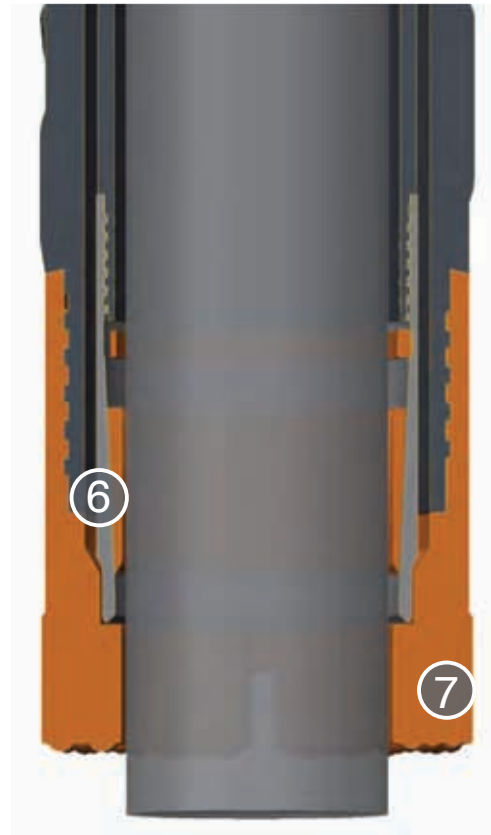
5. Core Drilling Bit

Genuine Q™ double tube wireline systems are ideal for use in most drilling conditions and are available for application in standard DCDMA hole sizes (A, B, N, H, P).

QTK systems are optimized to allow for a larger core sample while retaining the same hole, low fluid pressure, and robust inner and outer-tubes. QTK systems are offered here in the A, B, and N* sizes.

*NQTK also known as NQ2

Q™-P SYSTEM



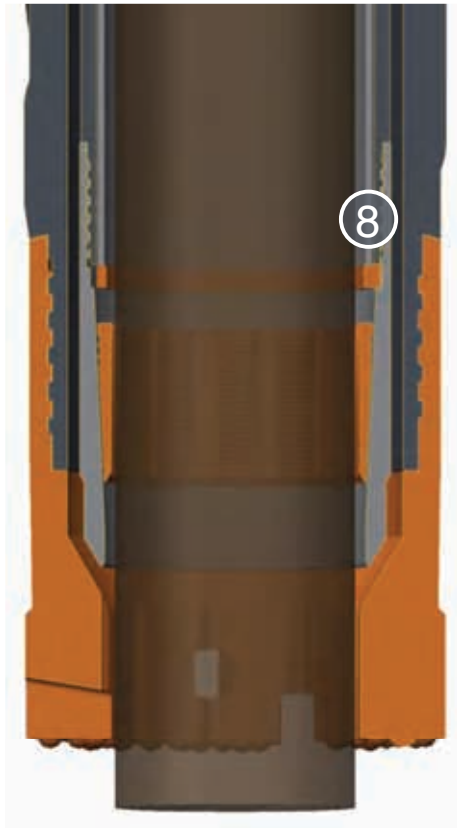
6. Core Lifter Case

7. Q™-P Core Drilling Bit

The Q-P system is similar to the Q and QTK double tube systems but includes a specialized core lifer case and bit. These components enable change in the water flow by creating a seal which routes water flow to the face of bit, away from the inner-tube – further improving core recovery.

Q is a trademark of Boart Longyear.

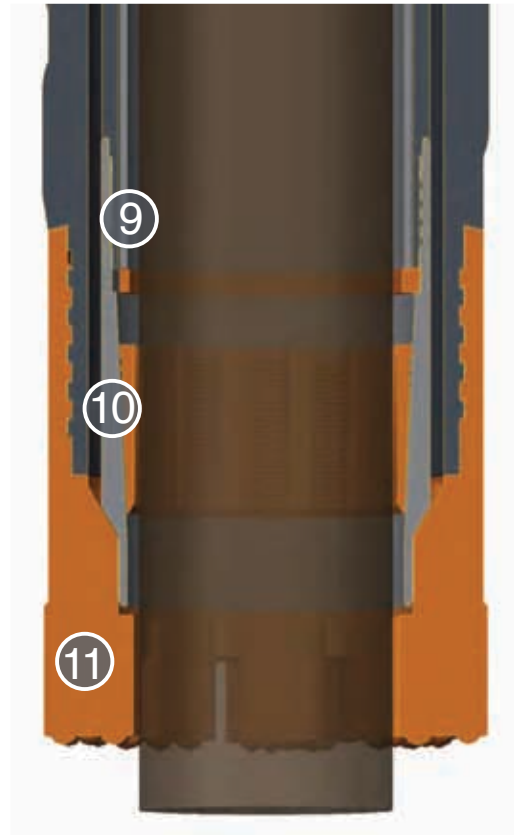
Q™ 3 SYSTEM



8. Inner Tube Liner

Q™3 wireline systems consist of the same groups as the Q and QTK but utilize a third tube called an inner-tube liner or split tube. The liner is placed inside the inner-tube. Q3 systems enable integral core recovery when drilling coal, clay bearing, or highly fractured formations. The liner, or split tube, retains the core sample in its received state for easier loading into sample trays or for storage and subsequent presentation to the geologist. The Q3 system is only available in surface configurations and is available in N, H and P sizes.

Q™ TT SYSTEM



9. Inner Tube Liner

10. Core Lifter Case

11. Q™ TT Core Drilling Bit

The QTT system is similar to the Q3 system but includes a specialized core lifter case and bit. These components enable change in the water flow by creating a seal which routes water to the face of the bit, away from the inner-tube – further improving core recovery.

Q is a trademark of Boart Longyear.

DIAMOND CORING DRILL BIT GAUGES

Compared to most core drilling systems, Q™ systems provide maximum performance, balancing drilling fluid and cuttings management with reliable inner and outer tubes.

The Boart Longyear nomenclature and hole sizes are based on the globally accepted Diamond Core Drilling Manufacturers Association (DCDMA) "W" series. Also note that the DCDMA specifications were adopted into ISO3551 (1992) and British Standard BS4019 (1993) Rotary Drilling Equipment.

Size	Core Diameter		Bit OD Diameter STD		Bit OD Diameter RSG		Bit OD Diameter OS		Hole Volume	
	in	mm	in	mm	in	mm	in	mm	(gal/ 100 ft)	(L/ 100 m)
Q™ Wireline										
BQ	1.433	36.4	2.345	59.6	2.360	59.9	N/A	NA	22.7	282
NQ	1.875	47.6	2.965	75.3	2.980	75.7	3.032	77.0	36.3	451
HQ	2.500	63.5	3.763	95.6	3.782	96.1	3.830, 3.895	97.3, 98.9	58.3	724
PQ	3.345	85.0	4.805	122.0	4.827	122.6	4.950	125.7	95.1	1180
Q™ Thin Kerf										
AQTK	1.202	30.5	1.875	47.6	1.890	48.0	N/A	N/A	14.6	181
BQTK	1.601	40.7	2.345	59.6	2.360	59.9	N/A	N/A	22.7	282
NQTK*	1.995	50.7	2.965	75.3	2.980	75.7	3.032	77.0	36.3	451
Q™ Triple Tube										
NQ3, NQTT	1.775	45.1	2.965	75.3	2.980	75.7	3.032	77.0	36.3	451
HQ3, HQTT	2.406	61.1	3.763	95.6	3.782	96.1	3.830, 3.895	97.3, 98.9	58.3	724
PQ3, PQTT	3.270	83.1	4.805	122.0	4.827	122.6	4.950	125.7	95.1	1180
Conventional										
LTK 48	1.390	35.3	1.875	47.6	1.890	48.0	N/A	N/A	14.6	282
LTK 60	1.732	44.0	2.345	59.6	2.360	59.9	N/A	N/A	22.7	451
All dimensions, weights, and volumes shown are nominal										

*NQTK also known as NQ2

Q is a trademark of Boart Longyear.

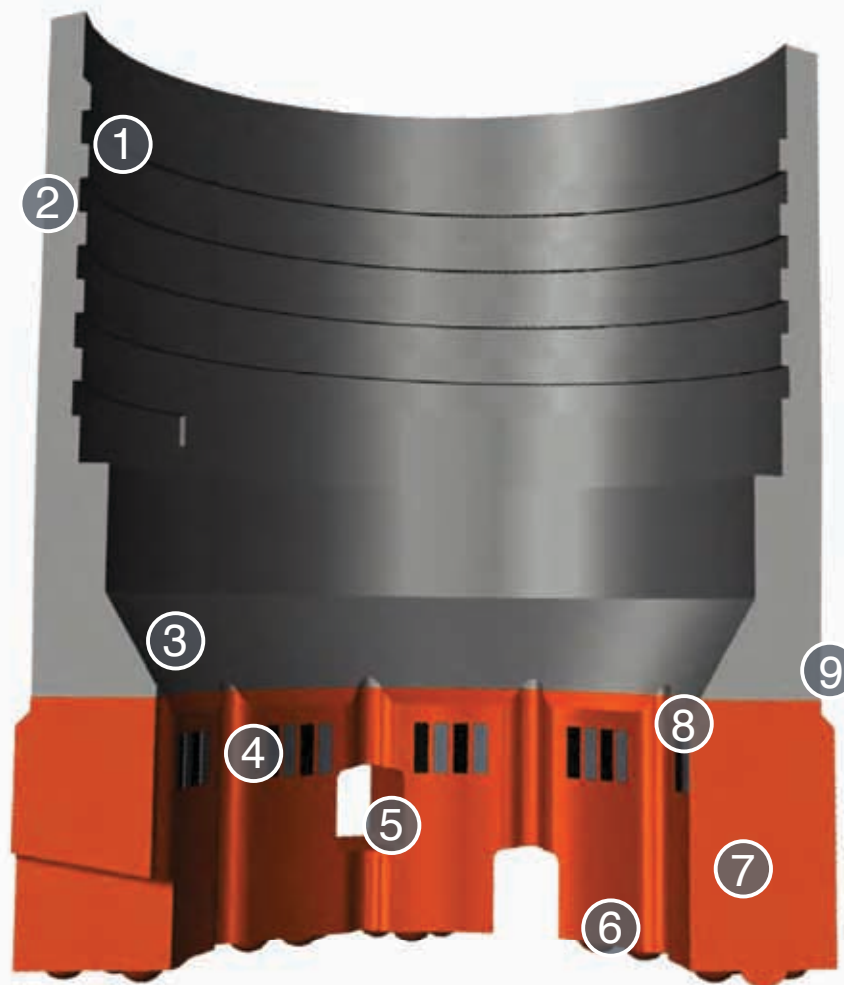


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UMX™

IMPREGNATED DIAMOND BITS

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IMPREGNATED BIT FEATURES



1. Threads

The threads are precision cut industry standard bit threads.

2. Bit Shank

The bit shank is made of high-quality steel and machined in small batches to maintain manufacturing standards.

3. Core Lifter Case Seat

The core lifter case seat supports the core lifter case when breaking core.

4. Tungsten Carbide And TSD* Pins

The pins protect the integrity of the crown.

5. Waterways

Waterways control the fluid around the cutting edge of the bit.

6. Bit Face

Razorcut™ design is ready-to-cut right out of the box and improves tracking and balance in the hole.

7. Crown

Available in an extremely wide variety of formulations, the crown is the cutting edge of the bit.

8. Throatless

Older designs had a small counterbore in the inner diameter (ID) at the start of the crown, referred to as a throat. This feature could accumulate material and accelerate ID gauge loss and has been eliminated in new designs.

9. Taper

Newer designs of bits have a taper on the outer diameter (OD) to smooth the transition of cuttings from the waterways up the hole, improving flushing.

*Thermally Stable Diamond

STAGE™ WATERWAYS



Twin-Taper™ Window

Dramatically improves flushing, forcing debris through the windows while keeping the bit face clear and reinforcing the inner diameter.

- Increases the surface area of the inner diameter of the bit resulting in wear resistance in all ground conditions
- New window geometry prevents debris from clogging the windows
- Windows feature rounded corners to increase strength
- Window distribution has been refined, increasing crown strength



Window Layout

Window distribution and shape have been redesigned for optimum performance in any ground condition.



Razorcut™ Face Design

The patented design is ready-to-cut right out of the box and improves tracking and balance in the hole.



Crown Height

- 16mm crown height for shallow holes
- 25mm crown height delivers the most productive bit in the industry – longer lasting, faster cutting, and great stability at any hole depth.

Face Discharge (not pictured)

Face discharge improves core recovery in soft and/or broken ground.

AU Design Nos. 332257; 332260; 332261; CA Design Nos. 135751; 135752; 135758; CN Design No. ZL201030188519.X; PE Design Nos. 2661; 2662; 2663; US Design Nos. D622,745; D647,114; D647,115; ZA Design Nos. F2010/00748; F2010/00749; F2010/00750; Patents Pending

AU Design No. 332218; CA Design No. 136438; CN Design No. ZL201030248719.X; PE Design No. 2690; US Patent No. D630,656; ZA Design No. F2010/1030; ZA Patent No. 2012/01878; Patents Pending

AU Patent Nos. 2007333850; 2011201711; 2011201710; 2011201709; CA Patent No. 2,671,061; US Patent Nos. 7,628,228; 7,828,090; 7,874,384; 7,918,288; 7,958,954; 8,051,929; ZA Patent No. 2009/03801; Patents Pending

CASE STUDY: STAGE™ 3 BITS

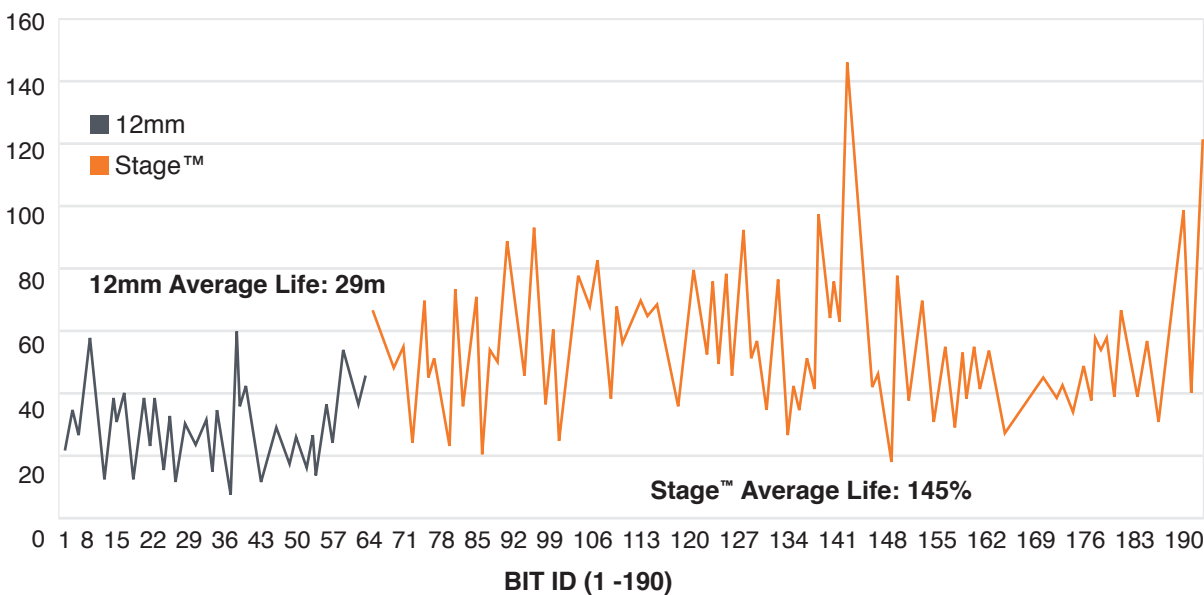
INCREASED BIT LIFE AND REDUCED ROD TRIPPING

Stage™ 3 Coring Bit 8-Month Field Results
After more than a year in the field, the Stage™ coring bit has broken bit life records around the world. The design is quickly being recognized for its cost-saving operational impact.

In Sudbury, Canada, a major mine operation realized same-drill cash savings of more than \$45,000 within an 8-month period – by making the switch to Stage 3 bits.

By increasing bit life, rod tripping is reduced per shift and overall core recovery is improved. Savings are seen as the cost-per-meter falls and drill productivity improves.

Locations: Sudbury, Canada
Site Conditions: “Ultra Hard” Felsic Gneiss
Drilling Method: Up-Hole Drilling
Actual Performance Data
(1 Drill / 190 Bits / 9781M)



Rod-Tripping Cost Savings

Hole Depth	Rod Tripping Time Hrs	Rod Tripping Cost	# Trips w/ 12mm	Cost	# Trips w/ 25mm	Cost	Cost Savings w/ Stage™ 3
50	0.5	\$35.00	2	\$70.00	1	\$35.00	\$35.00
100	0.75	\$52.00	2	\$105.00	1	\$52.50	\$52.50
150	1	\$70.00	2	\$140.00	1	\$70.00	\$70.00
200	1.25	\$87.50	1	\$87.50	0	N/A	\$87.50
Total (Tripping Cost divided by 49 holes)				\$19,722.50		\$7,717.50	\$12,005.00
*All costs reflect individual customer operating and product costs.							

Meters Drilled: 9,781	Total Bit Cost
12mm Est. Total Cost	\$134,000
Stage™ 3 Est. Total Cost	\$101,150
	\$33,650.00
Total Savings (One Drill)	\$45,655 (30%)

UMX™ BITS SERIES

Extreme Performance

Extreme drilling conditions demand extreme performance. An exploration driller's success depends on productivity and the performance of drilling equipment. To meet this demand for extreme performance, Boart Longyear developed the UMX™ (Ultramatrix™) diamond bit series.

UMX™ BIT SERIES

This innovative diamond bit technology uses advanced metallurgy and scientific research, resulting from more than 80 years of field experience. UMX diamond bits have revolutionized mineral exploration. UMX bits drill faster, last longer, and perform in a wider range of drilling conditions and formations. The extended range and versatility of the UMX diamond bits means less tripping out rods and more core in the box.

SSUMX™ BIT

SSUMX™ is the original Ultramatrix bit. This impregnated bit with large synthetic diamonds exceeds the performance and reliability of traditional surface-set diamond bits. Many drillers around the world have reported up to a significant increase in life over their traditional surface set bits, and now the SSUMX is their only choice for surface-set drilling.

07UMX BIT

07UMX is extreme durability. With a durable, resilient matrix designed for use in highly variable ground conditions ranging from surface-set to medium-hard, the 07UMX optimizes the ratio of bit life to drilling production.

09UMX BIT

09UMX is extreme penetration. Featuring advanced technology for a free-cutting matrix ideal for use in medium to the hardest ground formations, the 09UMX is the fastest penetrating bit available in the Boart Longyear line.

10UMX BIT

10UMX is free cutting. The latest addition to the UMX family of bits is a high performance diamond bit with the most free cutting matrix made. It quickly penetrates the very hardest rock formations.



US Patent Nos. 7,695,542; 7,975,785; 8,146,686; 8,191,445; 8,783,384; AU Patent Nos. 2007342231; 2011226850; 2011226849; 2012211429; CA Patent No. 2671193; CN Patent No. ZL200780050729.8; Patents Pending.

CASE STUDY: ULTRAMATRIX™ STAGE™ 2 BIT-09UMX™

LONGER LIFE, FASTER PENETRATION, REDUCED COSTS

Customer: George Downing
Estate Drilling Ltd.

Location: Northern Quebec

Application: Surface Diamond Core Drilling

Vital Stats:

- Achieved more than 200% increase in bit life
- Bit stayed sharp in challenging ground conditions
- Significant reduction in total operating costs

Drilling for iron ore deposits in the very remote area of Schefferville in Northern Quebec, Downing Drilling drillers face very tough ground conditions. Typical ground formations are 70% Iron Ore with bands of chert that are very hard and abrasive. The diamond bits the drillers had been using were not providing the life they needed to be competitive, and they were not staying sharp in the hard formations.

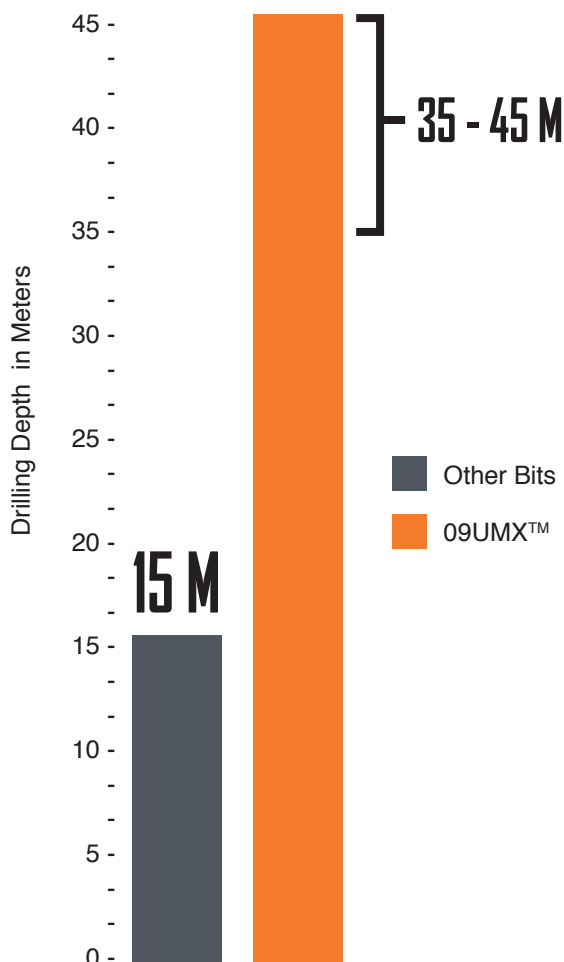
200%

Increased
Bit Life

“We are proud to say that Boart Longyear makes an amazing bit for our hard ground conditions. The 09UMX Stage 2 bits cut steady, offer long life, and hold consistent without any abuse on our rigs.”

**Matt Mactavish,
Drill Foreman,
Schefferville Quebec**

INCREASED BIT LIFE



The 09UMX™ bits achieved an average 200% increase in life over the other bits in the same ground conditions. In addition, the bits stay sharp, and the drillers were able to maintain the proper torque on the rigs while sustaining a continuously sharp bit. While the drillers had been reaching an average 15 m of life with their previous bits, the 09UMX Stage™ 2 bits consistently achieved a bit life of 33 m – 45 m per bit. The 09UMX Stage 2 diamond bit is now their bit of choice for all Iron Ore exploration projects.

CASE STUDY: ULTRAMATRIX™ STAGE™ 3 BIT- 07UMX™

FEWER BITS, LESS TRIPPING

Product: 07UMX™ Bit, Stage™ 3
(25mm Crown Height)

Location: Southwestern United States

Application: Surface Diamond Core Drilling

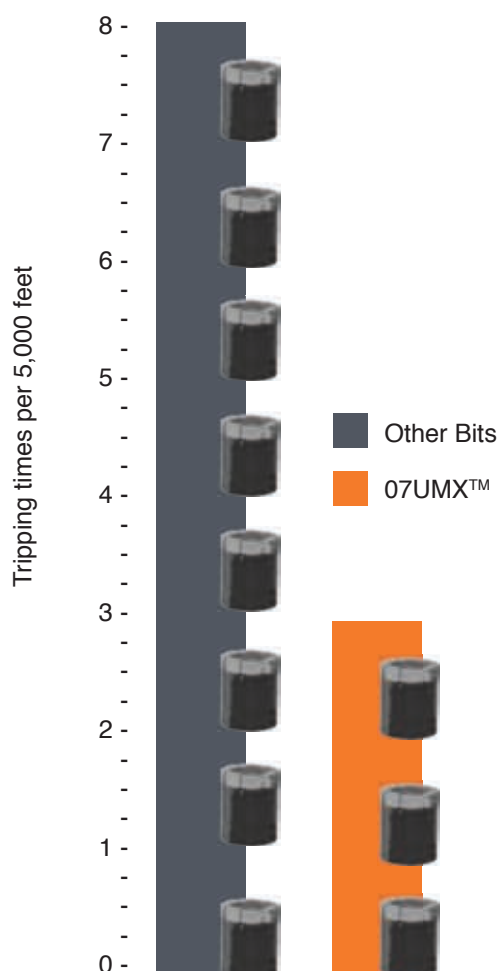
Vital Stats:

- Reduced tripping frequency by more than 300%
- Increased depth drilled per shift by more than 100%
- Significant reduction in total operating costs

Core drilling contracts in the large open pit copper mines of the Southwest United States are very competitive. Drillers need to be fast and efficient, putting more core in the box in less time, to win profitable contracts. The challenge at this test site was twofold. First, find a bit with an extended life capable of significantly reducing the number of times the drillers must trip their rods. Second, find a bit that was highly versatile with increased penetration rates through all of the ground formations encountered throughout the 5,000 to 6,000 foot holes.



LESS TRIPPING, EFFICIENT DRILLING



300%

Reduced
Tripping

“With the 07UMX Stage 3 bits, we now trip rods three times in a 5,000 foot hole as compared to the six to eight times with our pervious bit. Performance like that is just money in the bank”

SW Zone Coordinator

The new 07UMX™ bit in a Stage™ 3, 25mm, configuration was able to easily penetrate all of the ground conditions, and the taller crown height provided three to six times the life of the 12 millimeter bits previously used at the site. The site now averages 1,600 to 1,800 feet per bit as compared to 300 to 800 feet with previous bits. In addition, they have more than doubled the number of feet they are able to drill per shift. “It’s all about how often we trip rods, and these bits save a lot of tripping time. We not only get a significant increase in life from the bits, they are so versatile we no longer have to change a bit when ground conditions change.”

—Operations Coordinator

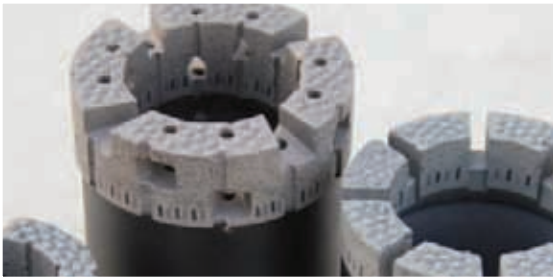
CASE STUDY: ULTRAMATRIX™ DIAMOND BITS-SSUMX™

ACHIEVED 80% INCREASE IN BIT LIFE

Product: Ultramatrix™ (UMX™) diamond core bits

Location: Galilee Basin, Queensland, Australia

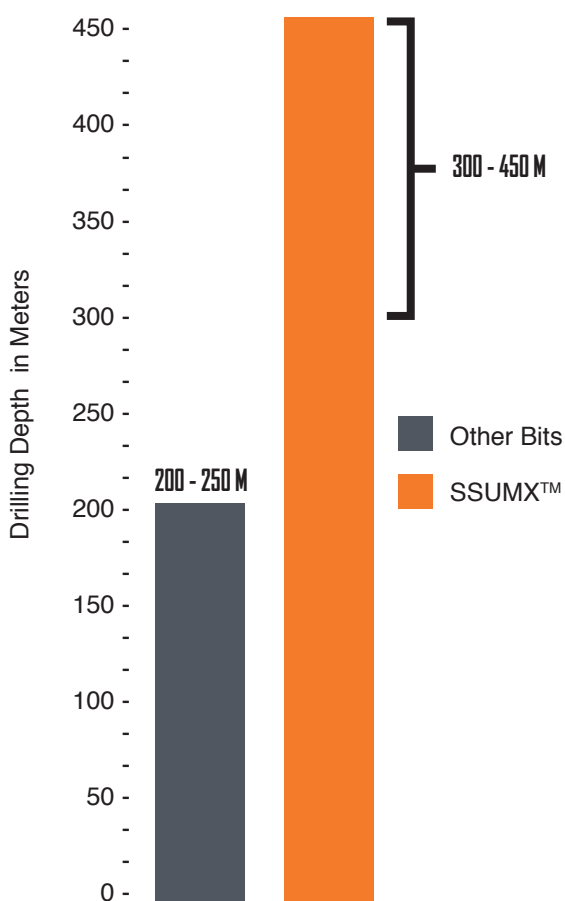
Application: Surface coring exploration (coal)



Vital Stats:

- 44% reduction in cost per bit compared to past surface set bits used
- Achieved 80% increase in bit life compared past surface set bits used
- Increased bit penetration rate per minute by 187%
- Maintained core recovery rate at 97.5%
- Significant reduction in overall operating costs

Increased Bit Life



While performing surface exploration for coal in the Galilee Basin, Queensland, Australia, L2 Drilling was in need of a diamond core bit that would reduce cost, and increase bit life and penetration rates without losing core recovery. Ground conditions presented the greatest challenge. The unconsolidated ground formations caused severe stress on the equipment and caused the surface set bits they were using to wear quickly. Bore holes would have to be reamed multiple times, because the unconsolidated ground would crumble in. When the bit needed to be switched out, the bore hole would have to be reamed to the bottom before starting to drill again.

80%

Increase
in bit life

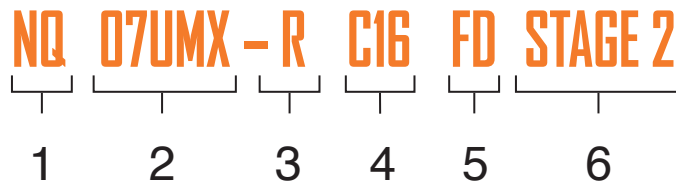
“The SSUMX is so versatile, we changed our drilling methods instead of switching out the bit through various ground conditions”

Trevor Edwards, Manager for
L2 Drilling

The SSUMX™ bit excelled through the various ground conditions, reducing the number of times the drill string had to be tripped out to change bits. Very little outside diameter (OD) wear was observed on the SSUMX when compared to the amount of reaming that was done. The SSUMX also held up well when ground conditions demanded less than optimum water flows. SSUMX bits with 12 mm crown heights were used to achieve an 80 percent gain in bit life while increasing bit penetration rate by 187 percent. Other advantages were seen through a 44 percent reduction in per bit cost and a consistent core recovery rate of 97.5 percent. These benefits resulted in a significant reduction in operating costs for L2 Drilling.

BIT NAMING CONVENTION

Finding the right bit for the job is easy. The naming convention directly corresponds to the description of the bit in the list of part numbers.



1. Size

Bits are available in all standard drilling sizes B, N, H, and P.

2. Matrix Formula

Impregnated bits are available in a variety of different formulas to cover the widest possible range of ground conditions. See page 26 or 34 for additional details about specific formulas.

3. Gauge

Boart Longyear™ bits are available in three standard outer diameter gauge configurations.

Standard gauge (S)
Less than reaming shell gauge (-R)
Oversize Outer Diameter (OS inches)

4. Crown Height

Impregnated bits are available in four crown heights.

9mm (C9)
12mm (C12)
16mm (C16)
25mm (C25)

5. Options

Impregnated bits are available in optional configurations as follows:

Face Discharge (FD)
Tapered Waterways (TW)
Thermally Stable Diamond Pins in Matrix (PINS)

Face Discharge (FD) - recommended for soft and/or broken ground conditions to improve core recovery.

Tapered Waterways (TW) - Recommended for soft and broken ground applications where blocking of regular waterways is possible.

Thermally Stable Diamond Pins (PINS) - Recommended for use in very broken ground conditions to reduce matrix wear.

6. Waterways

Bits are distinct by the number and size of waterways. Each bit lists the number of waterways followed by the size of the waterways in tenths of an inch. Stage™ bits list the number of stages.

UMX™ BIT PART NUMBERS

AQTK

Part #	DESCRIPTION
4055323	BIT AQTK SSUMX -R C16 STG2
4055144	BIT AQTK 7UMX -R C16 STG2
4055145	BIT AQTK 7UMX -R C25 STG3
4055260	BIT AQTK 9UMX -R C16 STG2
4055261	BIT AQTK 9UMX -R C25 STG3
4055358	BIT AQTK 10UMX -R C16 STG2
4055359	BIT AQTK 10UMX -R C25 STG3

BQ

Part #	DESCRIPTION
4054831	BIT BQ SSUMX S C12 5@250
4055324	BIT BQ SSUMX -R C16 STG2
4055096	BIT BQ 7UMX S C12 5@250
4055146	BIT BQ 7UMX -R C16 STG2
4055147	BIT BQ 7UMX -R C25 STG3
4055211	BIT BQ 9UMX S C12 5@250
4055262	BIT BQ 9UMX -R C16 STG2
4055263	BIT BQ 9UMX -R C25 STG3
4055360	BIT BQ 10UMX -R C16 STG2
4055361	BIT BQ 10UMX -R C25 STG3

BQTK

Part #	DESCRIPTION
4054991	BIT BQTK SSUMX S C12 7@187
4055131	BIT BQTK 7UMX S C12 7@187
4055148	BIT BQTK 7UMX -R C16 STG2
4055149	BIT BQTK 7UMX -R C25 STG3
4055247	BIT BQTK 9UMX S C12 7@187
4055264	BIT BQTK 9UMX -R C16 STG2
4055265	BIT BQTK 9UMX -R C25 STG3
4055362	BIT BQTK 10UMX -R C16 STG2
4055363	BIT BQTK 10UMX -R C25 STG3

NQ

Part #	DESCRIPTION
4054833	BIT NQ SSUMX S C12 8@187
4055325	BIT NQ SSUMX -R C16 STG2
4055556	BIT NQ SSUMX -R C25 STG3
4055322	BIT NQ SSUMX -R C16 FD STG2
4054835	BIT NQ SSUMX OS 3.032 C12 8@187
4055432	BIT NQ SSUMX OS 3.032 C25 STG3
4055098	BIT NQ 7UMX S C12 8@187
4055173	BIT NQ 7UMX -R C16 STG2
4055175	BIT NQ 7UMX -R C25 STG3
4055172	BIT NQ 7UMX -R C16 FD STG2
4055174	BIT NQ 7UMX -R C25 FD STG3
4055100	BIT NQ 7UMX OS 3.032 C12 8@187
4055170	BIT NQ 7UMX OS 3.032 C16 STG2
4055171	BIT NQ 7UMX OS 3.032 C25 STG3
4055213	BIT NQ 9UMX S C12 8@187
4055289	BIT NQ 9UMX -R C16 STG2
4055291	BIT NQ 9UMX -R C25 STG3
4055288	BIT NQ 9UMX -R C16 FD STG2
4055215	BIT NQ 9UMX OS 3.032 C12 8@187
4055286	BIT NQ 9UMX OS 3.032 C16 STG2
4055287	BIT NQ 9UMX OS 3.032 C25 STG3
4055537	BIT NQ 10UMX S C12 8@187
4055368	BIT NQ 10UMX -R C16 STG2
4055369	BIT NQ 10UMX -R C25 STG3
4055563	BIT NQ 10UMX OS 3.032 C12 8@187
4055372	BIT NQ 10UMX OS 3.032 C16 STG2
4055373	BIT NQ 10UMX OS 3.032 C25 STG3

NQ-P

Part #	DESCRIPTION
4055606	BIT NQ-P SSUMX S C12 TW FD
4055607	BIT NQ-P 7UMX S C12 TW FD
4055608	BIT NQ-P 9UMX S C12 TW FD
4055609	BIT NQ-P 10UMX S C12 TW FD

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UMX™ BIT PART NUMBERS (CONTINUED)

NQTK*

Part #	DESCRIPTION
4054836	BIT NQTK SSUMX S C12 8@187
4055508	BIT NQTK SSUMX -R C25 STG3
4054838	BIT NQTK SSUMX OS 3.032 C12 8@187
4055101	BIT NQTK 7UMX S C12 8@187
4055178	BIT NQTK 7UMX -R C16 STG2
4055179	BIT NQTK 7UMX -R C25 STG3
4055103	BIT NQTK 7UMX OS 3.032 C12 8@187
4055176	BIT NQTK 7UMX OS 3.032 C16 STG2
4055177	BIT NQTK 7UMX OS 3.032 C25 STG3
4055216	BIT NQTK 9UMX S C12 8@187
4055294	BIT NQTK 9UMX -R C16 STG2
4055295	BIT NQTK 9UMX -R C25 STG3
4055218	BIT NQTK 9UMX OS 3.032 C12 8@187
4055292	BIT NQTK 9UMX OS 3.032 C16 STG2
4055293	BIT NQTK 9UMX OS 3.032 C25 STG3
4055376	BIT NQTK 10UMX -R C16 STG2
4055377	BIT NQTK 10UMX -R C25 STG3
4055378	BIT NQTK 10UMX OS 3.032 C16 STG2
4055379	BIT NQTK 10UMX OS 3.032 C25 STG3

*NQTK also known as NQ2

Q and SSUMX are trademarks of Boart Longyear.

NQ3

Part #	DESCRIPTION
4054839	BIT NQ3 SSUMX S C12 8@187
4055091	BIT NQ3 SSUMX S C12 FD 8@187
4054841	BIT NQ3 SSUMX OS 3.032 C12 8@187
4055092	BIT NQ3 SSUMX OS 3.032 C12 FD 8@187
4055104	BIT NQ3 7UMX S C12 8@187
4055181	BIT NQ3 7UMX -R C16 STG2
4055183	BIT NQ3 7UMX -R C25 STG3
4055142	BIT NQ3 7UMX S C12 FD 8@187
4055180	BIT NQ3 7UMX -R C16 FD STG2
4055106	BIT NQ3 7UMX OS 3.032 C12 8@187
4055548	BIT NQ3 7UMX OS 3.032 C25 STG3
4055143	BIT NQ3 7UMX OS 3.032 C12 FD 8@187
4055219	BIT NQ3 9UMX S C12 8@187
4055297	BIT NQ3 9UMX -R C16 STG2
4055299	BIT NQ3 9UMX -R C25 STG3
4055258	BIT NQ3 9UMX S C12 FD 8@187
4055296	BIT NQ3 9UMX -R C16 FD STG2
4055221	BIT NQ3 9UMX OS 3.032 C12 8@187
4055549	BIT NQ3 9UMX OS 3.032 C25 STG3
4055259	BIT NQ3 9UMX OS 3.032 C12 FD 8@187
4055380	BIT NQ3 10UMX -R C16 STG2
4055381	BIT NQ3 10UMX -R C25 STG3
4055385	BIT NQ3 10UMX OS 3.032 C25 STG3

NQTT

Part #	DESCRIPTION
4054842	BIT NQTT SSUMX S C12 FD 8@187
4054844	BIT NQTT SSUMX OS 3.032 C12 FD 8@187
4055107	BIT NQTT 7UMX S C12 FD 8@187
4055109	BIT NQTT 7UMX OS 3.032 C12 FD 8@187
4055222	BIT NQTT 9UMX S C12 FD 8@187
4055224	BIT NQTT 9UMX OS 3.032 C12 FD 8@187

UMX™ BIT PART NUMBERS (CONTINUED)

HQ

Part #	DESCRIPTION
4054845	BIT HQ SSUMX S C12 8@250
4055326	BIT HQ SSUMX -R C16 STG2
4055318	BIT HQ SSUMX -R C25 STG3
4055535	BIT HQ SSUMX -R C16 FD STG2
4054847	BIT HQ SSUMX OS 3.830 C12 8@250
4055523	BIT HQ SSUMX OS 3.830 C25 STG3
4054848	BIT HQ SSUMX OS 3.895 C12 8@250
4055110	BIT HQ 7UMX S C12 8@250
4055571	BIT HQ 7UMX S C12 8@250 PINS RZ
4055159	BIT HQ 7UMX -R C16 STG2
4055161	BIT HQ 7UMX -R C25 STG3
4055158	BIT HQ 7UMX -R C16 FD STG2
4055112	BIT HQ 7UMX OS 3.830 C12 8@250
4055524	BIT HQ 7UMX OS 3.830 C25 STG3
4055113	BIT HQ 7UMX OS 3.895 C12 8@250
4055156	BIT HQ 7UMX OS 3.895 C16 STG2
4055157	BIT HQ 7UMX OS 3.895 C25 STG3
4055225	BIT HQ 9UMX S C12 8@250
4055572	BIT HQ 9UMX S C12 8@250 PINS RZ
4055275	BIT HQ 9UMX -R C16 STG2
4055277	BIT HQ 9UMX -R C25 STG3
4055274	BIT HQ 9UMX -R C16 FD STG2
4055227	BIT HQ 9UMX OS 3.830 C12 8@250
4055525	BIT HQ 9UMX OS 3.830 C25 STG3
4055228	BIT HQ 9UMX OS 3.895 C12 8@250
4055272	BIT HQ 9UMX OS 3.895 C16 STG2
4055273	BIT HQ 9UMX OS 3.895 C25 STG3
4055544	BIT HQ 10UMX S C12 8@250
4055388	BIT HQ 10UMX -R C16 STG2
4055354	BIT HQ 10UMX -R C25 STG3
4055389	BIT HQ 10UMX -R C16 FD STG2
4055526	BIT HQ 10UMX OS 3.830 C25 STG3
4055391	BIT HQ 10UMX OS 3.895 C16 STG2
4055392	BIT HQ 10UMX OS 3.895 C25 STG3

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HQ-P

Part #	DESCRIPTION
4055581	BIT HQ-P SSUMX S C12 TW FD
4055582	BIT HQ-P 7UMX S C12 TW FD
4055583	BIT HQ-P 9UMX S C12 TW FD
4055584	BIT HQ-P 10UMX S C12 TW FD

HQ3

Part #	DESCRIPTION
4054849	BIT HQ3 SSUMX S C12 8@250
4055445	BIT HQ3 SSUMX -R C16 STG2
4055074	BIT HQ3 SSUMX S C12 FD TW 8@488
4054851	BIT HQ3 SSUMX OS 3.830 C12 8@250
4054852	BIT HQ3 SSUMX OS 3.895 C12 8@250
4055114	BIT HQ3 7UMX S C12 8@250
4055139	BIT HQ3 7UMX S C12 FD TW 8@488
4055166	BIT HQ3 7UMX -R C16 STG2
4055168	BIT HQ3 7UMX -R C25 STG3
4055165	BIT HQ3 7UMX -R C16 FD STG2
4055440	BIT HQ3 7UMX OS 3.830 C12 8@250
4055439	BIT HQ3 7UMX OS 3.830 C12 8@250 FD
4055162	BIT HQ3 7UMX OS 3.895 C16 STG2
4055164	BIT HQ3 7UMX OS 3.895 C25 STG3
4055117	BIT HQ3 7UMX OS 3.895 C12 8@250
4055476	BIT HQ3 7UMX OS 3.895 C12 8@250 FD
4055229	BIT HQ3 9UMX S C12 8@250
4055255	BIT HQ3 9UMX S C12 FD TW 8@488
4055282	BIT HQ3 9UMX -R C16 STG2
4055284	BIT HQ3 9UMX -R C25 STG3
4055281	BIT HQ3 9UMX -R C16 FD STG2
4055231	BIT HQ3 9UMX OS 3.830 C12 8@250
4055232	BIT HQ3 9UMX OS 3.895 C12 8@250
4055278	BIT HQ3 9UMX OS 3.895 C16 STG2
4055280	BIT HQ3 9UMX OS 3.895 C25 STG3
4055387	BIT HQ3 10UMX S C12 FD TW 8@488
4055395	BIT HQ3 10UMX -R C16 STG2
4055396	BIT HQ3 10UMX -R C25 STG3
4055397	BIT HQ3 10UMX -R C16 FD STG2
4055399	BIT HQ3 10UMX OS 3.895 C16 STG2
4055400	BIT HQ3 10UMX OS 3.895 C25 STG3

UMX™ BIT PART NUMBERS (CONTINUED)

HQTT

Part #	DESCRIPTION
4054972	BIT HQTT SSUMX S C12 FD TW 8@488
4054855	BIT HQTT SSUMX OS 3.830 C12 FD 8@250
4054856	BIT HQTT SSUMX OS 3.895 C12 FD 8@250
4055130	BIT HQTT 7UMX S C12 FD TW 8@488
4055120	BIT HQTT 7UMX OS 3.830 C12 FD 8@250
4055121	BIT HQTT 7UMX OS 3.895 C12 FD 8@250
4055246	BIT HQTT 9UMX S C12 FD TW 8@488
4055235	BIT HQTT 9UMX OS 3.830 C12 FD 8@250
4055236	BIT HQTT 9UMX OS 3.895 C12 FD 8@250

PQ

Part #	DESCRIPTION
4054857	BIT PQ SSUMX S C12 10@250
4055327	BIT PQ SSUMX -R C16 STG2
4055409	BIT PQ SSUMX -R C16 FD STG2
4055515	BIT PQ SSUMX OS 4.950 C16 STG2
4055511	BIT PQ SSUMX OS 4.950 C25 STG3
4055122	BIT PQ 7UMX S C12 10@250
4055186	BIT PQ 7UMX -R C16 STG2
4055187	BIT PQ 7UMX -R C25 STG3
4055410	BIT PQ 7UMX -R C16 FD STG2
4055133	BIT PQ 7UMX OS 4.950 C12 10@250
4055516	BIT PQ 7UMX OS 4.950 C16 STG2
4055512	BIT PQ 7UMX OS 4.950 C25 STG3
4055237	BIT PQ 9UMX S C12 10@250
4055302	BIT PQ 9UMX -R C16 STG2
4055303	BIT PQ 9UMX -R C25 STG3
4055411	BIT PQ 9UMX -R C16 FD STG2
4055249	BIT PQ 9UMX OS 4.950 C12 10@250
4055517	BIT PQ 9UMX OS 4.950 C16 STG2
4055513	BIT PQ 9UMX OS 4.950 C25 STG3
4055403	BIT PQ 10UMX -R C16 STG2
4055404	BIT PQ 10UMX -R C25 STG3
4055518	BIT PQ 10UMX OS 4.950 C16 STG2
4055514	BIT PQ 10UMX OS 4.950 C25 STG3

PQ3

Part #	DESCRIPTION
4054859	BIT PQ3 SSUMX S C12 10@250
4055519	BIT PQ3 SSUMX S C12 10@250 FD
4055124	BIT PQ3 7UMX S C12 10@250
4055189	BIT PQ3 7UMX -R C16 STG2
4055191	BIT PQ3 7UMX -R C25 STG3
4055520	BIT PQ3 7UMX S C12 10@250 FD
4055188	BIT PQ3 7UMX -R C16 FD STG2
4055579	BIT PQ3 7UMX OS 4.950 C16 FD STG2 RZ
4055239	BIT PQ3 9UMX S C12 10@250
4055305	BIT PQ3 9UMX -R C16 STG2
4055307	BIT PQ3 9UMX -R C25 STG3
4055521	BIT PQ3 9UMX S C12 10@250 FD
4055304	BIT PQ3 9UMX -R C16 FD STG2
4055405	BIT PQ3 10UMX -R C16 STG2
4055406	BIT PQ3 10UMX -R C25 STG3
4055522	BIT PQ3 10UMX S C12 10@250 FD
4055407	BIT PQ3 10UMX -R C16 FD STG2

PQTT

Part #	DESCRIPTION
4055312	BIT PQTT SSUMX S C12 FD TW 10@546
4055588	BIT PQTT SSUMX OS 4.950 C12 FD TW RZ 10@546
4055126	BIT PQTT 7UMX S C12 FD 10@250
4055339	BIT PQTT 9UMX S C12 DD TW 10@546
4055338	BIT PQTT 10UMX S C12 DD TW 10@546

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ALPHA BIT™ SERIES

Using coated synthetic diamonds to increase diamond exposure, Alpha series bits cut faster and last longer than other traditional hard rock bits. The Alpha series also contains the often imitated magnum gauge protection for increased stability and wear resistance.

Alpha Diamond Bit Series Formulas

02

The 02 is designed to cut soft formations and large grain medium formations with excellent bit life. The 02 is also a good choice for cutting concrete with reinforcement.

06ABR

The 06ABR is a general purpose formula for cutting formations in the medium-hard range. The 06ABR also works well in formations of variable hardness.

07ABR

The 07ABR is made to cut medium-hard formations. The 07ABR is a good choice for formations that have a mixture of medium-hard and soft then hard conditions. This is the most versatile of the variable condition formulas.

08ABR

The 08ABR is a general purpose bit for cutting hard formations. It is also a good choice to improve drilling production of soft then hard formations.

09

The 09 is a free cutting formula for cutting very hard and ultra-hard formations. This is a good choice when drilling medium-hard formations with a low torque drill rig.

09COM

The 09COM is designed for higher production in fine-grained very hard formations.

10COM

The 10COM is made to cut ultra-hard fine grain formations. This is an alternative when drilling very hard formations with a low-torque rig.



ALPHA BIT™ SERIES PART NUMBERS

AQTK

Part #	DESCRIPTION
4052531	BIT AQTK 07ABR EC S 6@125
4052439	BIT AQTK 08ABR EC S 6@125
4052189	BIT AQTK 09COM S C12 6@125
4054337	BIT AQTK 09COM -R C25 STG3

BQ

Part #	DESCRIPTION
4052061	BIT BQ 02 S C9 7@155
4053105	BIT BQ 06ABR S C12 8@187
4052007	BIT BQ 07ABR S C12 6@187
4053357	BIT BQ 08ABR S C12 8@187
4054359	BIT BQ 08ABR -R C25 STG3
4054361	BIT BQ 08COM -R C25 STG3
4051791	BIT BQ 09 S C12 8@125
4054570	BIT BQ 09 -R C16 STG2
4054363	BIT BQ 09COM -R C25 STG3

BQTK

Part #	DESCRIPTION
4052532	BIT BQTK 07ABR EC S 8@125
4054554	BIT BQTK 08ABR -R C16 STG2
4054348	BIT BQTK 08COM -R C25 STG3
4054349	BIT BQTK 09 -R C25 STG3
4052287	BIT BQTK 09COM S C12 8@125
4054350	BIT BQTK 09COM -R C25 STG3
4052288	BIT BQTK 10COM S C12 8@125
4054352	BIT BQTK 10COM -R C25 STG3

NQ-P

Part #	DESCRIPTION
4055606	BIT NQ-P SSUMX S C12 TW FD
4055607	BIT NQ-P 7UMX S C12 TW FD
4055608	BIT NQ-P 9UMX S C12 TW FD
4055609	BIT NQ-P 10UMX S C12 TW FD

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NQ

Part #	DESCRIPTION
4051708	BIT NQ 02 S C9 8@250
4051822	BIT NQ 02 S C6 FD 10@125
4053232	BIT NQ 06ABR S C12 8@250
4054576	BIT NQ 06ABR -R C16 STG2
4054368	BIT NQ 06ABR -R C25 STG3
4053249	BIT NQ 06ABR OS 3.032 C12 8@155
4051978	BIT NQ 07ABR S C12 8@155
4054577	BIT NQ 07ABR -R C16 STG2
4054369	BIT NQ 07ABR -R C25 STG3
4052163	BIT NQ 08ABR S C12 8@155
4054580	BIT NQ 08ABR -R C16 STG2
4054372	BIT NQ 08ABR -R C25 STG3
4051743	BIT NQ 08ABR OS 3.032 C12 8@155
4054582	BIT NQ 08COM -R C16 STG2
4054374	BIT NQ 08COM -R C25 STG3
4051757	BIT NQ 09 S C12 8@155
4054583	BIT NQ 09 -R C16 STG2
4054375	BIT NQ 09 -R C25 STG3
4052053	BIT NQ 09COM S C12 8@155
4054584	BIT NQ 09COM -R C16 STG2
4054376	BIT NQ 09COM -R C25 STG3
4054378	BIT NQ 10COM -R C25 STG3

NQTK*

Part #	DESCRIPTION
4053016	BIT NQTK 02 S C9 8@187
4055541	BIT NQTK 06ABR S C12 8@155
4052555	BIT NQTK 07ABR S C12 8@155
4054590	BIT NQTK 07ABR -R C16 STG2
4051432	BIT NQTK 08ABR S C12 8@155
4054593	BIT NQTK 08ABR -R C16 STG2
4054398	BIT NQTK 08ABR -R C25 STG3
4054595	BIT NQTK 08COM -R C16 STG2
4054400	BIT NQTK 08COM -R C25 STG3
4054596	BIT NQTK 09 -R C16 STG2
4054401	BIT NQTK 09 -R C25 STG3
4052703	BIT NQTK 09 EC OS 3.032 8@155
4052118	BIT NQTK 09COM S C12 8@155
4054597	BIT NQTK 09COM -R C16 STG2
4052702	BIT NQTK 10COM EC OS 3.032 8@155

*NQTK also known as NQ2

ALPHA BIT™ SERIES PART NUMBERS

NQ3

Part #	DESCRIPTION
4053020	BIT NQ3 06ABR S C12 8@155
4054784	BIT NQ3 06ABR -R C16 FD STG2
4053163	BIT NQ3 07ABR S C12 8@187
4054382	BIT NQ3 07ABR -R C25 STG3
4053298	BIT NQ3 08ABR S C12 8@187
4053960	BIT NQ3 09 S C12 8@155

HQ

Part #	DESCRIPTION
4051706	BIT HQ 02 S C9 8@313
4053100	BIT HQ 02 S C9 FD 8@250
4052654	BIT HQ 06ABR S C12 8@250
4054615	BIT HQ 06ABR -R C16 STG2
4054407	BIT HQ 06ABR -R C25 STG3
4053695	BIT HQ 06ABR OS 3.830 C12 8@375
4052882	BIT HQ 07ABR S C12 9@187
4051726	BIT HQ 07ABR S C12 8@250 PINS
4054616	BIT HQ 07ABR -R C16 STG2
4054408	BIT HQ 07ABR -R C25 STG3
4052653	BIT HQ 08ABR S C12 8@250
4051925	BIT HQ 08ABR C12 S 8@250 PINS
4054619	BIT HQ 08ABR -R C16 STG2
4054411	BIT HQ 08ABR -R C25 STG3
4055542	BIT HQ 08ABR OS 3.830 C12 8@250
4054489	BIT HQ 08ABR OS 3.895 C25 STG3
4054621	BIT HQ 08COM -R C16 STG2
4054413	BIT HQ 08COM -R C25 STG3
4052968	BIT HQ 09 S C12 8@250
4051926	BIT HQ 09 S C12 8@250 PINS
4054622	BIT HQ 09 -R C16 STG2
4054414	BIT HQ 09 -R C25 STG3
4052041	BIT HQ 09COM S C12 12@187
4054623	BIT HQ 09COM -R C16 STG2

Q is a trademark of Boart Longyear.

HQ3

Part #	DESCRIPTION
4052207	BIT HQ3 02 S C9 9@187
4053242	BIT HQ3 06ABR S C12 9@187
4051983	BIT HQ3 06ABR EC OS 3.895 8@250
4051973	BIT HQ3 07ABR EC S 8@250*
4054421	BIT HQ3 07ABR -R C25 STG3
4053964	BIT HQ3 08ABR S C12 8@250
4054424	BIT HQ3 08ABR -R C25 STG3
4052945	BIT HQ3 08ABR S C9 FD 8@250
4054801	BIT HQ3 08ABR -R C16 FD STG2
4054634	BIT HQ3 08COM -R C16 STG2
4054426	BIT HQ3 08COM -R C25 STG3
4054066	BIT HQ3 09 S C12 8@250
4052676	BIT HQ3 09 S C9 FD 8@250
4054804	BIT HQ3 09 -R C16 FD STG2
4054505	BIT HQ3 09 OS 3.895 C25 STG3
4054636	BIT HQ3 09COM -R C16 STG2
4054714	BIT HQ3 09COM OS 3.895 C16 STG2
4054716	BIT HQ3 10COM OS 3.895 C16 STG2

PQ

Part #	DESCRIPTION
4053406	BIT PQ 02 S C9 12@250
4051208	BIT PQ 02 OS 4.950 C6 10@250
4053551	BIT PQ 06ABR S C12 10@250
4052974	BIT PQ 07ABR S C12 12@187
4053546	BIT PQ 08ABR S C12 12@187
4054647	BIT PQ 08COM -R C16 STG2
4053692	BIT PQ 09COM S C12 10@250
4054651	BIT PQ 10COM -R C16 STG2

PQ3

Part #	DESCRIPTION
4052548	BIT PQ3 02 S C6 FD 10@250
4053965	BIT PQ3 06ABR S C12 10@250
4053287	BIT PQ3 06ABR OS 4.950 10@188*
4053966	BIT PQ3 07ABR S C12 10@250
4054450	BIT PQ3 08ABR -R C25 STG3
4054660	BIT PQ3 08COM -R C16 STG2
4054453	BIT PQ3 09 -R C25 STG3
4054664	BIT PQ3 10COM -R C16 STG2

COMPETITIVE CROSS REFERENCE

Hardness	MOHS Scale	Characteristic Rocks	Alpha Bit™ Series	UMX™ Bits	Atlas Copco	Fordia	Hayden	Dimatec
Soft	1	Soapstone		SSUMX				
Soft	1.5	Coal		SSUMX				
Soft	2	Rock salt		SSUMX				
Soft	2.5	Amber		SSUMX				
Soft	3	Marble, Shale, Kimberlite	02	SSUMX, 07UMX	3AC	Hero 3	H3	D3
Soft	3.5	Dolomite	02	SSUMX, 07UMX	3AC	Hero 3	H3	D3
Soft	4	Slate	02, 06ABR, 07ABR	SSUMX, 07UMX, 09UMX	7AC	Hero 7	KS5	HR7
Medium Hard	4.5	Sandstone	02, 06ABR, 07ABR	SSUMX, 07UMX, 09UMX	7AC	Hero 7	H6, KS5	HR7
Medium Hard	5	Pegmatite, Pumice	06ABR, 07ABR	SSUMX, 07UMX, 09UMX	7AC	Hero 7	H9, KS5	HR7
Medium Hard		Gabbro, Norite, Obsidian	06ABR, 07ABR	SSUMX, 07UMX, 09UMX	7AC	9-11, Hero 7	H9,KS5	HR7
Medium Hard	5.5	Basalt	06ABR, 07ABR	SSUMX, 07UMX, 09UMX	11AC	9-11, Hero 7	H9	HR7
Medium Hard	6	Diorite, Magnetite, Hematite	06ABR, 07ABR, 08ABR, 08COM	SSUMX, 07UMX, 09UMX	11AC	9-11, Hero 9	H9, H11	HR10
Hard	6.5	Granite	06ABR, 07ABR, 08ABR, 08COM	SSUMX, 07UMX, 09UMX	11AC	9-11, Hero 9	H9, H11	HR10
Hard		Rhyolite	07ABR, 08ABR, 08COM	07UMX, 09UMX	11AC	9-11, Hero 9	H9, H11	HR10
Hard	7	Quartzite, Gneiss	08ABR, 08COM, 09, 09 COM	07UMX, 09UMX, 10UMX	11AC, 13AC	9-11, Hero 11	H11	HR10, HR12
Hard	7.5	Chert	08ABR, 08COM, 09, 09 COM	09UMX, 10UMX	13AC	11-14, Hero 11	H12-14	HR12
Hard	8	Taconite	09, 09COM, 10COM	09UMX, 10UMX	13AC	11-14	H12-14, H14-15	HR12, HR13
Ultra Hard	8.5	Jaspilite, Banded Iron formation	09, 09COM, 10COM	09UMX, 10UMX	15AC	11-14	H14-15	HR13
Ultra Hard	9	Sapphire	10COM	10UMX	15AC	11-14	H14-15	HR13

* Represents average hardness, specific formation can vary plus or minus 1 Mohs.

OPERATING PARAMETERS

This section of the manual is intended to provide guidelines to make the most of Boart Longyear™ bits. A condensed, convenient reference for the selection of suitable drilling guidelines for impregnated bits is provided in the Impregnated Bit Drilling Guidelines following this section.

Rotational Speed

Rotational speed has a direct influence on the penetration rate of bits. If the speed is doubled for a given depth of a cut, the penetration rate also doubles. For this reason, rotational speed is typically set at a fixed value based on the size of the tools being used. If the rig has sufficient torque, the speed can be increased to get higher penetration rates. Conversely, if the head stalls under normal operation, then the speed should be reduced to produce more torque and maintain steady rotation. The exception to this rule is drilling in extremely broken and hard ground. Broken ground is free to move so instead of cutting, the rock is removed by a grinding action. Under these conditions (three body wear), diamond bit wear is extremely rapid and rotational speed should be cut to half RPM and weight on bit sufficient to reach 1 to 2 ipm (3 to 5 cpm).

Quick Tip

- If the head stalls under normal operation, reduce the speed to produce more torque and maintain steady rotation.
- In broken ground, cut RPM in \square and apply sufficient weight on bit to reach 1 to 2 ipm (3 to 5 cpm).

Weight (Force) on Bit

Weight on bit (WOB) is the main method of controlling bit life and penetration rate. The bit weights shown on the chart after this section indicate the range of weights considered normal for a given size of core barrel. If very high bit loads are required to cut the rock, select a higher series bit to prevent increased hole deviation, excessive core barrel, and rod wear, and even down-hole failures. Increasing the bit series normally results in lower bit weights required for the same penetration rates. If weight on bit is too low, both the penetration rate and torque drops, resulting in low life and productivity. This condition is referred to as polishing and describes the phenomenon of diamonds wearing faster than the matrix until the face is flat, leaving no diamonds protruding from the face. Polishing

is caused by the friction and heat accumulating in the diamond as it rubs rather than cutting the rock. If weight on bit is too high, characterized by very little or no increase in penetration rate for additional weight, the result is constant sharpening and rapid wear.

Quick Tip

- WOB is too low if the bit polishes and torque drops. Results in low life and penetration rate.
- WOB is too high if added weight does not increase penetration rate. Results in constant sharpening and rapid wear.

Sharpening of the bit results from burying the diamond in the formation and creating contact between the matrix and formation. The friction on the matrix removes it and exposes new diamonds. Sharpening is beneficial when bit penetration has dropped due to wear on the diamonds but if left in a sharpening mode the bit is consumed very rapidly. As rods are added, force to maintain constant weight on bit will change, so weight on bit must be monitored to ensure consistent bit performance at all depths. The weight of the rods and the down force developed by the hydraulic cylinders provide the force exerted on the diamond bit. Unfortunately, drill rig controls do not display weight on bit but instead display feed cylinder pressure.

The weight on bit or force can easily be found by the following "off bottom" method:

1. Suspend the rods with the hydraulic system in the lowering position.
2. With the drilling motor running at a drill rotation, note the reading on the cylinder feed pressure gauge. This is approximately equal to the hydraulic pump pressure plus the weight of the rods in terms of hydraulic pressure. This is called the "off bottom" pressure.
3. Rotate the rods and feed them down by opening the restrictor valve. As the bit touches bottom, part of the weight of the rods is supported on the bit. This action is indicated by a decrease in the gauge reading. The difference in the gauge readings is the pressure applied to the bit.
4. The pressure applied to the bit multiplied by the area of the hydraulic cylinders gives the force or weight on bit.

5. The bit torque can be measured in a similar fashion by comparing the “off bottom” hydraulic pressure of the rotation unit to the hydraulic pressure while drilling.

Torque

Torque generated by the bit is a function of sharpness of the bit and weight on bit, and results from the diamonds cutting the formation. As such, torque should be viewed as beneficial and an indication of drilling effectiveness. Minimum torque occurs just after bit sharpening has completed and as bit weight is reduced. Maximum bit torque occurs during bit sharpening due to the bit matrix coming into contact with the rock. A simultaneous decrease of torque and penetration rate indicates that the bit is polishing and needs to be sharpened. Torque increases due to sharpening should only be a concern in lost circulation or when sharpening requires water restriction. Due to its wear-resistant matrix and large diamonds, UMX™ bits can drop or stall RPM when sharpening. If RPM drops during sharpening then a lower gear or speed should be used to increase available torque.

Quick Tip:

- Decreasing torque and penetration rate indicates bit polishing.
- Maximum bit torque occurs during bit sharpening. Only be concerned with torque rise when restricting water or in lost circulation.
- Fluctuation in torque, particularly during sharpening is caused by unstable rock fragmentation and/or insufficient rock penetration. Weight on bit needs to be maintained to establish secondary fracturing and stable cutting.
- If the head stalls under normal operation, then reduce speed to produce more torque and maintain steady rotation.
- UMX™ bits can drop or stall RPM when sharpening. If RPM drops during sharpening, then a lower gear or speed should be used to increase available torque.

Penetration Rate

The cutting rate varies as a result of weight on bit, sharpness, bit formula, and ground conditions. Typical penetration rates vary anywhere from 2 ipm to 12 ipm depending on bit formula and formation. As formations become harder, the penetration rate should be reduced to achieve good bit life. In extremely broken, hard, ground, drill at half RPM and weight on bit sufficient to reach 1 to 2 ipm (3 to 5 cpm).

Quick Tip:

- Penetration rates vary anywhere from 2 ipm (5cpm) to 12 ipm (30 cpm) based on bit and formation.
- In extremely broken, hard, ground, run at half RPM and weight on bit sufficient to reach 1 to 2 ipm.
- The penetration rate to prevent polishing mode may be higher in UMX™ bits.

Water Flow

The flow of drilling fluid in the drill hole serves many purposes including the essential cooling of the diamonds, removal of cuttings, and attainment of good bit life. High penetration rates require additional flow to keep cuttings off the bit face, as do higher rotation rates. There is no maximum water flow rate, though at high-flow rates, the bit can be lifted off the rock face, causing it to polish. Free-cutting bits, especially UMX, obtain maximum life and penetration using plenty of water.

Quick Tip:

- High penetration and/or rotation rates require additional flow.
- There is no maximum water flow rate. At high pressures, the bit can be lifted off the rock face, causing it to polish.
- Free-cutting bits, especially UMX™ bits, obtain maximum life and penetration using plenty of water.



Water pressure is not an indication of water flow in positive displacement water pumps.

To calculate water flow, measure pump rpm with a tachometer. Pump output is proportional to output at max speed e.g. FMC LO918 Nameplate, Max Speed: 625 rpm Output Flow: 20.2 GPM Measured rpm of 240 rpm. Output flow is equal to $625 \text{ rpm} / 240 \text{ rpm} \times 20.2 \text{ GPM} = 7.5 \text{ GPM}$

Sharpening

Sharpening, also known as stripping, is the act of conditioning the bit to regain or improve penetration rate. Sharpening of the bit occurs when sufficient weight is applied to create contact between the supporting matrix and the rock. The friction on the matrix removes it and exposes new diamonds. Sharpening is necessary when a new bit is started, if too low a bit has been selected for the rock type or if an impregnated bit has been allowed to slow down and polish. Active sharpening should be done as little as necessary because it reduces bit life.

Quick Tip:

- Add WOB until torque rises, once penetration rate increases, reduce WOB to maintain desired penetration rate.
- Reduce RPM by 1/2, wait until torque and penetration rate rises. Return speed to normal operation.
- If 1 and 2 are insufficient (up-holes, under-powered rigs, or too low a series bit), reduce RPM by 1/2 and reduce water flow. Wait until torque and penetration rate rises. Return speed and water flow to normal operation.
- UMX™ bits have a greater rise in torque on initial sharpening. WOB needs to be held until penetration rate increases. Reduce WOB to maintain desired penetration rate once sharp.



Quick Tip:

If frequent sharpening is required, a higher series bit formula should be selected. Under no circumstances should any acid be used for sharpening a Boart Longyear™ impregnated bit. Also, shutting off the water flow while drilling and waiting for the bit to "bite", is not recommended by Boart Longyear as a method of sharpening due to the likelihood of burning in the bit.

Bit performance and wear will vary due to, and may be adversely affected by, a variety of factors including (i) operator skill and experience, (ii) drilling equipment and techniques, (iii) bit handling, care and maintenance, (iv) varying geological formations and conditions, (v) subsurface structures and hazards, (vi) extreme environmental conditions, and (vii) use of bits outside of recommended operating parameters. Accordingly, except for the limited warranties expressly set forth in Boart Longyear's standard sales terms, Boart Longyear does not warrant or guaranty bit performance or wear. Boart Longyear bits and other products are intended for use only by skilled drill operators and other personnel who have been provided adequate product training. Improper or unintended use of Boart Longyear bits and other products may result in property damage, bodily injury, or death.

IMPREGNATED BIT DRILLING GUIDELINES

Size	Speed	Indicative Bit Weight Range				Fluid Flow Range			
	(rpm)	Low (lbf)	Low (kN)	High (lbf)	High (kN)	Low (gpm)	Low (lpm)	High (gpm)	High (lpm)
Q™ Wireline									
BQ	1,200	2,000	9	5,500	24	6	20	8	30
NQ	950	3,000	13	8,500	37	10	35	13	50
HQ	750	4,500	20	12,500	56	14	50	20	70
PQ	600	7,000	31	19,000	84	20	80	30	100
Q™ Thin Kerf									
AQTK	1,500	1,200	5	3,000	13	3	12	5	20
BQTK	1,200	1,500	8	5,000	20	5	20	7	26
NQTK *	950	2,500	12	8,000	34	9	32	12	44
Q™ Triple Tube									
NQ3, NQTT	950	3,000	14	8,000	36	10	35	13	50
HQ3, HQTT	750	5,000	20	12,000	54	15	55	20	75
PQ3, PQTT	600	7,000	32	18,000	80	22	80	28	105
Conventional									
LTK 48	1,500	1,000	4	2,500	10	3	9	4	15
LTK 60	1,200	1,500	6	3,500	16	4	15	6	23
All dimensions, weights, and volumes shown are nominal									
*NQTK also known as NQ2									

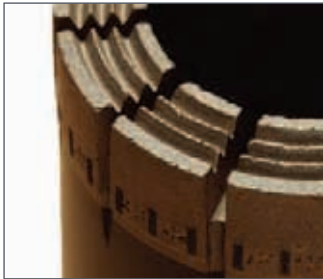


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TROUBLESHOOTING

Much can be learned from examining impregnated bits when they are pulled from the hole. The illustrations and observations in this section can help identify and remedy many common field problems. Normal retirement or discarding of an impregnated bit should take place only after it has been totally consumed. Most Boart Longyear™ impregnated bits have full-depth waterways to allow the bit to be fully consumed. The first indicator that a bit is nearing normal retirement is a rise or kick in pump pressure due to the diminishing depth of waterways. In Stage™ bits, this rise is observed at the transition of each stage. Ideally, an impregnated bit drills steadily with the matrix and diamond wearing away at the same rate.

NORMAL WEAR PATTERNS



New Condition



Ideal Wear Pattern

The face wear pattern of an impregnated bit should be relatively flat with slightly chamfered sides. Bit feels sharp, comet tails have formed to support diamonds. Diamonds release from matrix as they are worn. Gauge stays within tolerance.



Normal Retirement

Full depth of impregnation evenly consumed. Gauge stays within tolerance.

IRREGULAR WEAR PATTERNS



Concave Face Wear (Rounded to Inner Diameter)

Cause: Often caused by excessive penetration rate for the RPM used. This can also be caused by core grinding, overdrilling.

Solution: Reduce penetration rate or increase RPM

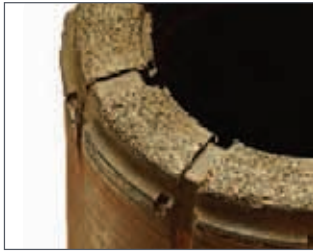


Concave Face Wear (Rounded to Outer Diameter)

Cause: Insufficient water flow

Solution: Check pump and rod string for leaks; increase pump output.

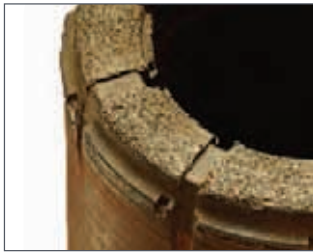
The causes and solutions described in this section are not exclusive lists, but represent common causes and generally effective solutions based on the experience of Boart Longyear and its customers.



Gauge Loss ID

Cause: (A) Overfeeding (B) Broken formations (C) Drilling over lost core (D) Insufficient drilling fluid

Solution: (A) Reduce penetration rate (B) Cement or change to a lower series bit (C) Check core barrel/core lifter/core lifter case (D) Check inner tube length adjustment; check pump and rod string for leaks – increase pump output



Gauge Loss Outer Diameter

Cause: (A) Lack of circulation (B) Bit being reamed down under-size hole (C) Vibration

Solution: (A) Increase coolant flow rate (B) Check reamer shell gauge and replace if under-sized (C) Alter RPM



Excessive Diamond Exposure

Matrix abrades away before diamonds have worn sufficiently, resulting in high diamond exposure and low bit life.

Cause: Caused by overfeeding/over drilling

Solution: Increase RPM, change to a lower series bit, or reduce bit weight



Face Glazed (Diamond Polished and Metal Bound)

Bit does not feel sharp; diamonds flush w matrix; no significant “comet tails” behind each diamond.

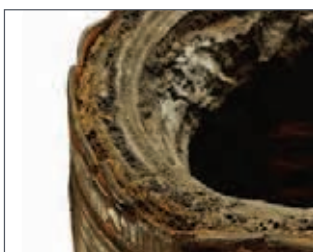
Sand blast face or use other recommended methods to re-expose diamond. If the face glazes repeatedly, change to a higher bit.



Cracked Waterways (Diamonds Polished)

Cause: (A) Excessive bit load; dropped rods; free fall of (wireline) inner tube in dry hole; (B) bit crushed by rod holder, foot clamp or pipe wrench; (C) Pushed down an undersized hole (i.e., reaming shell worn out).

Solution: Review proper operating procedures.



Burnt

Cause: (A) Lack of fluid. (B) Too high of weight on bit being used

Solution: Check pump and rod string for leaks, check inner tube adjustment, maintain coolant flow rates



CASING SHOES

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SYSTEM OVERVIEW



1. Casing & Rod Shoes

The casing and rod shoes are threaded to the end of the outer drill string for penetration through overburden. It assists in seating the outer drill string into the bedrock, providing a tight seal for the drilling fluids to return to the surface. A casing shoe can be used to ream the casing downward when advancing a casing string in an existing hole with the rod string still in place.

The casing shoe inside diameter is flush or has clearance to the inside diameter of the casing which allows free passage of the core barrel through the shoe. Casing shoes are available in standard and heavy duty versions. The heavy duty version has an oversize outer diameter and 6mm crown height.



2. Casing Bits

These are less commonly used and differ from casing shoes in that the inside diameter of the casing bit is smaller. It does not permit the passage of the core barrel due to the overlap of dimensions.

Casing bits are used when deep or difficult overburden is encountered or to ream over rod strings when stuck in the hole.

Casing Advancer Shoes (Not Shown)

The casing advancer shoe is designed much like a typical casing shoe but has an oversized outer diameter which allows for a roller cone to pass through the inner diameter and provides clearance for the extra cuttings generated. Use the heavy duty shoe for this application

CASING SHOES

CSUMX™

The CSUMX™ casing shoe is designed for all exploration and geo technical casing applications. The ability to drill faster with high penetration rates and outperform existing shoe technology in a wide range of ground formations makes the CSUMX ideal for anyone seeking a cost-effective alternative to their current shoe selection.

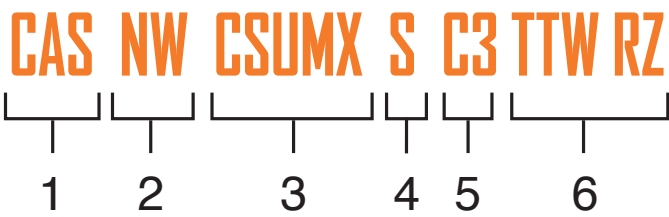
Ultramatrix™

CSUMX impregnated casing shoes feature Boart Longyear's patented Ultramatrix™ formula. Ultramatrix technology enables the use of large synthetic diamonds with an innovative formula, increasing penetration through various ground formations while providing longer shoe life. This optimization couples the high penetration capability with longer shoe life and allows the CSUMX to cut easily from one ground formation to another.



CASING SHOES NAMING CONVENTION

Finding the right shoe is easy. The naming convention directly corresponds to the description of the shoe in the list of part numbers.



1. Case or Rod

Casing shoes are available in both casing (CAS) and rod (ROD) shoe configurations.

2. Thread

Available in all standard drilling thread types as well as a number a region-specific sizes.

3. Matrix Formula

Impregnated casing shoes are available in two formulations. The CSUMX matrix has been designed to manage a wide variety of ground conditions including hard rock. The Devil's Nightmare (DN) is aggressive; it offers high high penetration rates in soils to soft rock formations.

4. Gauge

Boart Longyear™ shoes are available in two standard OD gauge configurations.

Standard Gauge (S)
Oversized Outer Diameter (OS Inches)

5. Impregnated Depth

Casing shoes are currently available in two standard impregnated depths of 3mm and 6mm.

6. Waterway

Impregnated casing shoes offer tapered waterways which improve flushing, forcing debris throughout while keeping the bit face clear and reinforcing the inner diameter.

CASING SHOE PART NUMBERS

AW/BRQ

Part #	DESCRIPTION
4051230	SHOE CAS AW 02 R C3 4@125
EAWB75/6	SHOE CAS AW 16.00CT SEL OS 2.6
4051866	SHOE ROD BRQ 02CS C5 S 6@125

BW/NQ/NRQ

Part #	DESCRIPTION
4055468	SHOE CAS BW CSUMX R C3 TTW RZ
4055560	SHOE ROD NQ CSUMX R C3 TTW RZ
4055488	SHOE ROD NRQ CSUMX R C3 TTW RZ
4055631	SHOE ROD NRQ CSUMX OS 3.105 C6 TTW RZ

NW/HQ/HRQ

Part #	DESCRIPTION
4055464	SHOE CAS NW CSUMX R C3 TTW RZ
4055483	SHOE CAS NW CSUMX OS 3.755 C6 TTW RZ
DNWEVP/6	SHOE CAS NW DN OS 3.875
4055463	SHOE ROD HQ CSUMX R C3 TTW RZ
4055456	SHOE ROD HQ CSUMX OS 3.775 C6 TTW RZ
DHREVP/1	SHOE ROD HQ DN OS 3.875
4011253	SHOE ROD HQ CARBIDE
4055489	SHOE ROD HRQ CSUMX R C3 TTW RZ

HW/HWT*

Part #	DESCRIPTION
4055465	SHOE CAS HW CSUMX R C3 TTW RZ
4055557	SHOE CAS HW CSUMX OS 4.765 C6 TTW RZ
4055482	SHOE CAS HWT CSUMX R C3 TTW RZ
4055437	SHOE CAS HWT CSUMX OS 4.765 C6 TTW RZ
DHJEVP/1	SHOE CAS HWT DN OS 4.875

* Compatible with PHD

PW/PWT

Part #	DESCRIPTION
4055467	SHOE CAS PW CSUMX R C3 TTW RZ
4055485	SHOE CAS PWT CSUMX R C3 TTW RZ
4055484	SHOE CAS PW CSUMX OS 5.790 C6 TTW RZ
4055460	SHOE CAS PWT CSUMX OS 5.790 C6 TTW RZ
4055555	SHOE CAS PWT OS 5.790 SSUMX C12 TTW RZ

SW/SWT

Part #	DESCRIPTION
DSWEVP/1	SHOE CAS SW DN OS 6.930 5@250

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REAMING SHELLS

RSUMX™ Reaming Shell 46
Part Numbers 48

RSUMX™ REAMING SHELL

RSUMX™

Using Ultramatrix™ technology and a new pad design, RSUMX™ diamond impregnated reaming shells are some of the longest lasting available in the industry today. RSUMX is also available with optional heavy-duty blanks and dual pads, making it your first choice in all exploration coring applications.

Enhanced Stability

Featuring large, spiral, diamond ground pads, RSUMX reaming shells increase stability and reduce drill string vibration at the face of the bit. Diamond grinding pre-exposes the diamond and allows tighter size control putting more diamond in contact with the rock, stabilizing the bit. The pre-exposure and reduced size variation maximizes available life.



Ultramatrix™ Diamond Impregnated Pad

Patented technology enables the use of large synthetic diamonds greatly enhancing wear life and eliminating the need for specialty shells in diamond exploration.



Diamond Ground

Outer diameter grinding pre-exposes the diamond and reduces variation in size improving stability and helping to produce the longest lasting reaming shell available.



Heavy Duty

Available with an optional heavy duty blank to prevent undercutting in extremely broken conditions (standard on oversize versions).

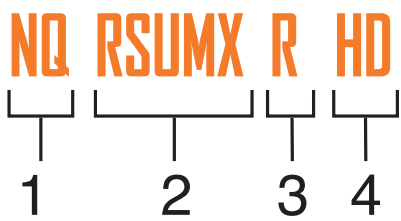


Dual Pad

Available in dual pad 10" configurations for straighter holes when deviation is a concern.

REAMING SHELL NAMING CONVENTION

Finding the right shell is easy. The naming convention directly corresponds to the description of the shell in the list of part numbers.



1. Size

Reaming shells are available in all standard drilling sizes B, N, H, and P.

2. Reamer Type

Reaming shells are available in the RSUMX pad style.

3. Gauge

Reaming shells are available in two standard gauge configurations.

Equal To Reaming Shell Gauge (R)
Oversized Outer Diameter (OS Inches)

4. Options

Heavy Duty (HD)
Dual Pad (DP)



RSUMX™ REAMING SHELL PART NUMBERS

AQTK

Part #	DESCRIPTION
4062857	SHELL AQTK NO PADS
4062921	SHELL AQTK RSUMX R DP

BQ

Part #	DESCRIPTION
4062858	SHELL BQ NO PADS
4062922	SHELL BQ RSUMX R
4063295	SHELL BQ RSUMX R DP
4062283	SHELL AC BQ RSUMX R
4063823	SHELL ROD BQ RSUMX R

BQTK

Part #	DESCRIPTION
4060549	SHELL BQTK NO PADS
4062730	SHELL BQTK RSUMX R
4062751	SHELL BQTK RSUMX R DP
4063168	SHELL AC BQTK RSUMX R
4062079	SHELL ROD BRQTK RSUMX R

NQ/NRQ

Part #	DESCRIPTION
24901	SHELL NQ NO PADS
4062562	SHELL NQ RSUMX R
4063081	SHELL NQ RSUMX R HD
4062938	SHELL NQ RSUMX OS 3.032 HD
4062261	SHELL NQ RSUMX R DP
4062284	SHELL AC NQ RSUMX R
4062286	SHELL AC NQ RSUMX OS 3.032
4063445	SHELL AC NQU RSUMX R DP
4062939	SHELL ROD NQ RSUMX R
4062940	SHELL ROD NRQ RSUMX R

HQ/HRQ

Part #	DESCRIPTION
25248	SHELL HQ NO PADS
4062618	SHELL HQ RSUMX R
4063275	SHELL HQ RSUMX R HD
4062270	SHELL HQ RSUMX OS 3.830 HD
4062935	SHELL HQ RSUMX OS 3.895 HD
4063285	SHELL HQ RSUMX R DP
4063207	SHELL AC HQ RSUMX R
4063453	SHELL AC HQ RSUMX OS 3.895
4062288	SHELL AC HQ RSUMX OS 3.830
4063251	SHELL ROD HQ RSUMX R
4062936	SHELL ROD HRQ RSUMX OS 3.895

PQ/PHD

Part #	DESCRIPTION
26169	SHELL PQ NO PADS
4062272	SHELL PQ RSUMX R
4062925	SHELL PQ RSUMX OS 4.950
4063420	SHELL ROD PHD/HWT RSUMX R

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SPECIALTY BITS

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PCD/TSD	56
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Surface Set Bit Part Numbers	60
Carbide Bits	61
Carbide Bit Part Numbers	62

DHM BITS

Directional Drilling Tools

Downhole motors (DHM) bits are threaded onto downhole motors and used in directional drilling applications. They have reinforced center ports and have an impregnated full face crown.

Boart Longyear™ directional drilling bits can also be used as an impregnated plug bit.

Impregnated Directional Drilling Bits

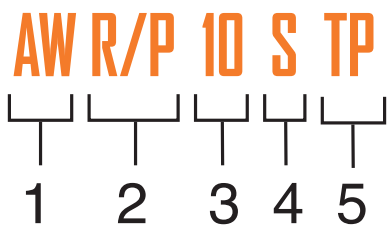
The combination of diamond and matrix determines the performance of an impregnated bit. The simultaneous erosion of the matrix and the diamonds makes the bit self-sharpening. Boart Longyear uses a special matrix which provides optimal performance.

Boart Longyear directional drilling bits feature threaded ports in shank allowing plugs to be threaded to more closely regulate fluid flow.



DHM BIT NAMING CONVENTION

Finding the right bit is easy. The naming convention directly corresponds to the description of the bit in the list of part numbers.



1. Thread

Directional bits are available in a variety standard drilling thread types as well as a number a region-specific sizes.

2. Plug definition

Rod Box (R/B)
Rod Pin (R/P)

3. Matrix Formula

Impregnated bits are available in a variety of different formulas to cover the widest possible range of ground conditions. See page 26 or 34 for additional details about specific formulas.

4. Gauge

Bits are available in three standard gauge configurations.

Standard Gauge (S)
Equal To Reaming Shell Gauge (R)
Oversized Outer Diameter (OS Inches)

5. Options

Where applicable, shank options such as Threaded Shank Ports (TP) are identified here.

DHM BIT PART NUMBERS

BW

Part #	DESCRIPTION
4060285	BIT DHM BW R/P 09COM NQ R
4104650	BIT DHM BW R/P BL19 NQ S TP TP
4104525	BIT DHM BW R/P BL21 NQ S TP TP
4063047	BIT DHM BW R/P 07UMX N R C9 TP
4063107	BIT DHM BW R/P 9UMX N R C9 TP
4063478	BIT DHM BW R/P SSUMX OS 3.032 C9 TP RZ
4063089	BIT DHM BW R/P 07UMX N OS 3.032 C9 TP RZ
4063090	BIT DHM BW R/P 09UMX N OS 3.032 C9 TP RZ
4063140	BIT DHM BW R/P 10UMX N OS 3.032 C9 TP RZ
4104650	BIT DHM BW R/P BL19 NQ S TP TP
4104525	BIT DHM BW R/P BL21 NQ S TP TP
4063009	BIT DHM BW R/P 08ABR N R C9 TP
4060285	BIT DHM BW R/P 09COM NQ R
4063048	BIT DHM BW R/P BL21 N OS 3.032 C9 TP RZ

2 3/8 API

Part #	DESCRIPTION
4062565	BIT DHM 2 3/8 API REG R/P 7UMX 3.895/98.9
4063035	BIT DHM 2 3/8 API REG R/P 9UMX 3.895/98.9
4062398	BIT DHM 2 3/8 API REG R/P 10UMX 3.895/98.9
C00ZAR/1	BIT DHM 2 3/8 API REG R/P 08 3.895/98.9
C00ZUS/1	BIT DHM 2 3/8 API REG R/P 09 3.895/98.9
C00ZAQ/1	BIT DHM 2 3/8 API REG R/P 10 3.895/98.9

NW

Part #	DESCRIPTION
4061297	BIT DHM NW R/P 10 HQ R
4104578	BIT DHM NW R/P BL21 HQ S TP
4063486	BIT DHM NW R/P SSUMX H R C9 TP RZ
4063508	BIT DHM NW R/P 07UMX H R C9 TP RZ
4063509	BIT DHM NW R/P 09UMX H R C9 TP RZ
4063510	BIT DHM NW R/P 10UMX H R C9 TP RZ
4063498	BIT DHM NW R/P 07UMX H OS 3.830 C9 TP RZ
4063499	BIT DHM NW R/P 09UMX H OS 3.830 C9 TP RZ
4063500	BIT DHM NW R/P 10UMX H OS 3.830 C9 TP RZ
4063492	BIT DHM NW R/P SSUMX H OS 3.830 C9 TP RZ
4063469	BIT DHM NW R/P 07UMX H OS 3.895 C9 TP RZ
4063470	BIT DHM NW R/P 09UMX H OS 3.895 C9 TP RZ
4063471	BIT DHM NW R/P 10UMX H OS 3.895 C9 TP RZ
4063477	BIT DHM NW R/P SSUMX H OS 3.895 C9 TP RZ
4104578	BIT DHM NW R/P BL21 HQ S TP
4061297	BIT DHM NW R/P 10 HQ R TP

Q and UMX are trademarks of Boart Longyear.

WEDGING BITS

Boart Longyear™ wedging tools are diamond products that are made to follow wedges set in the bore hole with the intention of altering the hole direction. They consist of surface set wedge reamer, surface set bullnose bits, and impregnated tapered crown core bits. These special profiles are required to avoid drilling straight through the wedge.

Impregnated Tapered Crown Core Bits

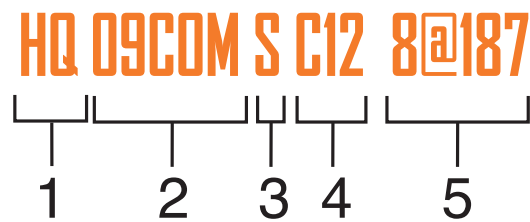
The combination of diamond and matrix determine the performance of an impregnated bit. The simultaneous erosion of the matrix and the diamonds makes the bit self-sharpening. Boart Longyear uses a special matrix which provides optimal performance.

The tapered crown profile is available in a taper varying from 1/4" to 7/16", chamfer (shown) and radius Stage 2.



WEDGING BIT NAMING CONVENTION

Finding the right bit is easy. The naming convention directly corresponds to the description of the bit in the list of part numbers.



1. Size

Bits are available in all standard sizes B, N, H, and P.

2. Matrix Formula

Impregnated bits are available in a variety of different formulas to cover the widest possible range of ground conditions. See page 26 or 34 for additional details about specific formulas.

3. Gauge

Boart Longyear bits are available in in two gauge configurations.

Standard gauge (S)
Oversize (OS)

4. Impregnated Depth

Boart Longyear wedging bits are currently available in 2 standard impregnated depths.

9mm (C9)
12mm (C12)

5. Waterway Size

Boart Longyear wedging bits offer the widest variety of waterway sizes in the industry. The description represents the number of waterways and the waterway size.

WEDGING BIT PART NUMBERS

BQ WEDGE BITS

Part #	DESCRIPTION
4051737	BIT WD BQ 08COM C9 S 8@125

NQ WEDGE BITS

Part #	DESCRIPTION
4055536	BIT WD NQ SSUMX -R C16 STG2
4055357	BIT WD NQ 7UMX -R C16 STG2
4055505	BIT WD NQ 9UMX -R C16 STG2
4055592	BIT WD NQ 08ABR OS 3.032 C12 8@187
4055374	BIT WD NQ 09 -R C16 STG2
4055593	BIT WD NQ 09 OS 3.032 C12 8@187
4106167	BIT WD NQ 09COM C12 S 6@187

NQTK* WEDGE BITS

Part #	DESCRIPTION
4055552	BIT WD NQTK SSUMX -R C16 STG2
4055553	BIT WD NQTK 7UMX -R C16 STG2
4055547	BIT WD NQTK 9UMX -R C16 STG2
4055554	BIT WD NQTK 10UMX -R C16 STG2
4106168	BIT WD NQTK 09COM S C12 6@187

HQ WEDGE BITS

Part #	DESCRIPTION
4106169	BIT WD HQ 09COM C12 S 8@187
4055598	BIT WD HQ 09COM OS 3.895 C12 8@187

WEDGE REAMING SHELL

Part #	DESCRIPTION
4061931	SHELL WD N R/P RSUMX R
4061475	SHELL WD N R/P RSUMX OS 3.020
4102070	SHELL WD N R/P 2A 15/25 OS 3.782
4062911	SHELL WD NW R/P RSUMX OS 3.782
4104555	SHELL WD N R/P 2A 15/25* OS 3.350 INTER/WEDGE HQ

NQ/NQTK*/HQ ID STEP BITS

Part #	DESCRIPTION
4055545	BIT NQTK 7UMX OS 3.032 C12 ID1STP 8@188
4055550	BIT NQTK 9UMX OS 3.032 C12 ID1STP 8@188
4055551	BIT NQTK 10UMX OS 3.032 C12 ID1STP 8@188
4054977	BIT NQTK 10 S C12 ID2STP 8@188
4055052	BIT HQ 09 OS 3.895 C12 ID3STP 8@187
4055051	BIT HQ 08 OS 3.895 C12 ID3STP 8@187

NQ/HQ BULLNOSE BITS

Part #	DESCRIPTION
4101964	BIT NQ 2A 25/35 B/N
4101965	BIT HQ 2A 45/55 B/N

*NQTK also known as NQ2

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PCD/TSD BITS

Polycrystalline Compact Diamond Bits (PCD)

Ideal for drilling in soft to medium sedimentary formations which are homogeneous and competent. The PCD cutters are available in several sizes and are located to yield maximum penetration rate and long life depending on the application. The bits are constructed with a tough, wear-resistant matrix body and gauge reinforcement. As a result, worn cutters can be rotated or replaced allowing the continued use of the bit.



Thermally Stable Diamond Bits (TSD)

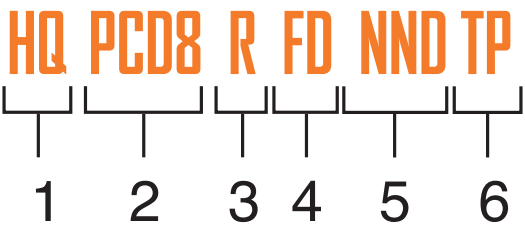
TSD cutters are smaller and generally more robust than PCD cutters. The inserts are set in a tough wear-resistant matrix body and feature broached gauge reinforcements. Cutters are placed to provide full coverage across the cutting face.

These bits are suitable for drilling soft to medium-hard formations depending on the power of the drill rig. The smaller, more robust cutters make this bit usable in rock types that are somewhat harder than those which can be drilled with PCD bits.



PCD/TSD NAMING CONVENTION

Finding the right bit is easy. The naming convention directly corresponds to the description of the bit in the list of part numbers.



1. Thread

Bits are available in all standard sizes B, N, H, and P.

2. Bit Type

Standard PCD and TSD bits are available with either 8mm (PCD8) or 13mm (PCD13) PCD cutters or TSD 6mm (TSD) cubes.

3. Gauge

PCD/TSD
Standard gauge (S)
Equal to reaming shell gauge (R)
Oversized Outer Diameter (OS inches)

4. Waterway Option

Where applicable, waterway options will be identified here.

Double angle (DA)
Face discharge (FD)
Deep ID (DD)

5. No Natural Diamond (NND)

Where applicable, only synthetic diamonds are used throughout.

6. Threaded Ports (TP)

Where applicable, threaded ports are provided to control bypass flow.

PCD/TSD BIT PART NUMBERS

NQ/NQTK*/NQ3

Part #	DESCRIPTION
4012131	BIT NQ TSD R NND
1NQEVA/4	BIT NQ PCD13 R NND
1NYBVC/5	BIT NQTK TSD R
1NTBVC/6	BIT NQ3 TSD R NND
1NTEVA/1	BIT NQ3 PCD13 R FD

*NQTK also known as NQ2

HQ/HQ3/HQTT

Part #	DESCRIPTION
4015989	BIT HQ TSD R
AHQEVA/13	BIT HQ PCD13 OS 3.895
1HTBVC/6	BIT HQ3 TSD R FD
1HTEVA/4	BIT HQ3 PCD13 R
4105835	BIT HQ3 PCD8 S FD
AHTBVC/9	BIT HQ3 TSD OS 3.895
AHTEVA/5	BIT HQ3 PCD13 OS 3.895
1H8EVA/2	BIT HQTT PCD13 R FD

PQ/PQ3/PQTT

Part #	DESCRIPTION
4060230	BIT PQ TSD R FD
APQEVA/2	BIT PQ PCD13 OS 5.00
1PTBVC/3	BIT PQ3 TSD R
4018816	BIT PQ3 PCD13 R FD DA
APTBVC/2	BIT PQ3 TSD OS 4.950
4063862	BIT PQ3 PCD13 OS 4.950
1PTBVC/2	BIT PQTT TSD R FD
4062215	BIT PQTT PCD13 S FD

PLUG/FULL FACE BITS

Part #	DESCRIPTION
4014492	BIT PLUG AQ R/B TSD R
4063457	BIT PLUG BW R/P PCD13 R
3NR0VA/2	BIT PLUG NQ R/B PCD13 R
CNPEVA/2	BIT PLUG NW R/P PCD8 OS 3.782
300TVA/17	BIT PLUG 2 3/8 API R/P PCD13 3.875
4060393	BIT PLUG NW R/P PCD13 OS 3.898
4060554	BIT PLUG NW R/P PCD13 OS 5.000" 13MM
4060662	BIT PLUG NW R/P PCD13 OS 5.500"
4060600	BIT PLUG NW R/P PCD13 OS 6.299" 13MM

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SURFACE SET BITS

Boart Longyear offers surface set diamond bits in a variety of sizes. Surface set bits can be very cost effective in soft sedimentary rocks. Boart Longyear™ surface set bits are produced with stepped profiles, which generate the best performance in soft ground conditions.

Matrix and Diamond Grades

Using advanced power metallurgy technology, coupled with years of field experience, Boart Longyear has developed a high performance matrix that is suitable for virtually all common drilling conditions. This matrix is standard on Boart Longyear surface set products and provides for the highest diamond-holding characteristics. Boart Longyear matches this special matrix with the highest-quality, unprocessed, natural drilling diamonds, specifically for use in its core bits. These diamonds have enough strength to handle the hardest ground conditions and result in the longest lasting bits.

The diamond grade and amount of diamond play a role in operating parameters as well. Typically, driller's use sufficient weight on bit to ensure the bit cuts freely at an acceptable penetration rate (usually 2 – 6 in/min, [5 – 15 cm/min]). In the absence of experience in the conditions to be drilled, an approximation of maximum weight on bit when using high-quality diamonds is given by the following formula:

Maximum Weight on Bit (lb) = Carat Weight x
Average Number of Stones/Carat x 7

Maximum Weight on Bit (kg) = Carat Weight x
Average Number of Stones/Carat x 3.2

Example: NQ BIT - 16 carats, 45/55 stones/carat

Maximum Suggested Weight on Bit =
 $16 \times 50 \times 7 = 5,600 \text{ lb}$
 $16 \times 50 \times 3.2 = 2,560 \text{ kg}$



STEP-TYPE (STP)

The step-type profile provides stabilized drilling capabilities and improves penetration in hard and competent formations. Available in 1-4 step profiles.



Crown Profiles

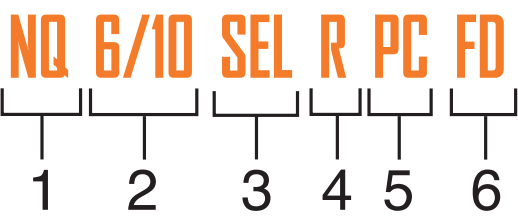
The profile of the bit face or crown is important because it affects drilling speed, hole deviation, and core recovery. There is a wide choice of profiles for surface set bits which cover all common drilling conditions. As a rule, multi-step bits, standardized by the DCDMA, drill fastest and provide excellent core recovery. For hard and/or broken conditions where round or semi-flat profiles would be preferred, SSUMX™ impregnated bits produce better performance.

Waterways

Waterways are usually shallow in surface set bits to provide even cooling and flushing throughout the face. When using Boart Longyear's Q™3 (triple-tube) core barrels to minimize core washing, such as in soft, friable formations, face discharge ports are recommended.

SURFACE SET BIT NAMING CONVENTION

Finding the right bit is easy. The naming convention directly corresponds to the description of the bit in the list of part numbers.desired.



1. Size

Bits are available in all standard sizes B, N, H, and P.

2. Diamond Size

Boart Longyear surface-set diamond bits are available in stone-per-carat configurations ranging for 6/10 to 25/35 SPC.

3. Diamond Grade

Diamond Grade maximizes your drill bit performance, life, and speed.

Special (SPL): High-quality, unprocessed natural diamonds
Select (SEL): Best quality, processed natural diamonds

4. Gauge

Boart Longyear bits are available in four standard gauge configurations.

Standard gauge (S)
Equal to reaming shell gauge (R)
Oversized Outer Diameter (OS Inches)

5. Crown Profile

Boart Longyear surface-set diamond bits are available in step crown profiles.

6. Waterway Option

Where applicable, waterway options are identified here.

Double angle (DA)
Face discharge (FD)

SURFACE SET BIT PART NUMBERS

BQ

PART #	DESCRIPTION
4012097	BIT BQ PLUG SEL RECOVERY TAP

HQ

PART #	DESCRIPTION
4011574	BIT HQ REC TAP 2.345 PLUG
4103760	BIT HQ 25/35 SEL 29CT S 6STP

NQ

PART #	DESCRIPTION
4011685	BIT NQ REC TAP 13.00CT SEL
4106130	BIT NQ 15/25 SEL 27CT S 5STP 15/25
ANQ475/1	BIT NQ 24.25CT SEL 4STP OS 3.032 25/35

HQ3

PART #	DESCRIPTION
4049791	BIT HQ3 6/10 SEL 52CT S 4STP
1HT483/1	BIT HQ3 25/35 SPL 33CT R 4STP
4106105	BIT HQ3 15/25 SEL 26CT S 7STP
4106065	BIT HQ3 15/25 SEL 35CT S 7STP FD

NQ3

PART #	DESCRIPTION
4101745	BIT NQ3 25/35 SEL 24CT S 7STP
4102970	BIT NQ3 15/25 SEL 24CT S 6STP FD

PQ3

PART #	DESCRIPTION
4106460	BIT PQ3 6/10 SEL 50CT S 4STP
4106056	BIT PQ3 15/25 SEL 40CT S 4STP FD DA
4106060	BIT PQ3 15/25 SEL 37CT S 7STP FD

Q is a trademark of Boart Longyear.

CARBIDE BITS

Boart Longyear™ carbide bits are designed for drilling in soft to medium rock formations and overburden conditions.

Carbide Chip Devil’s Nightmare

The Devil’s Nightmare is aggressive – the special carbide that is used maximizes its capabilities. With efficient flushing characteristics, it offers high performance in a variety of applications ranging from soils to soft rock formations.



CARBIDE BIT NAMING CONVENTION

Finding the right bit is easy. The naming convention directly corresponds to the description of the bit in the list of part numbers desired.



1. Size

Bits are available in all standard drilling sizes B, N, H, and P.

2. Bit Type

Devil’s Nightmare (DN)

3. Gauge

Carbide bits are available in three standard OD gauge configurations.

Standard gauge (S)
Equal to reaming shell gauge (R)
Oversized Outer Diameter (OS Inches)

4. Waterway Option

Where applicable, waterway options are identified here.

Double angle (DA)
Face discharge (FD)

Q is a trademark of Boart Longyear.

CARBIDE BIT PART NUMBERS

NQ

Part #	DESCRIPTION
1NQEVP/1	BIT NQ DN R
ANQEVP/1	BIT NQ DN OS 3.032

NQTK*

Part #	DESCRIPTION
ANYEVP/1	BIT NQTK DN OS 3.032

*NQTK also known as NQ2

HQ

Part #	DESCRIPTION
1HQEVP/1	BIT HQ DN R

HQ3

Part #	DESCRIPTION
AHTEVP/6	BIT HQ3 DN OS 3.830

PQ

Part #	DESCRIPTION
1PQEVP/1	BIT PQ DN R

PQ3

Part #	DESCRIPTION
1PTEVP/2	BIT PQ3 DN R FD

Q is a trademark of Boart Longyear.



ACCESSORIES

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GUIDE PLUGS

Guide Plugs, also known as mud plugs, aid in transitioning bits across the wedge when directional drilling. Plugs can also be used to prevent filling inner tube with mud or debris during descent.

BQ

Part #	DESCRIPTION
4101948	PLUG BQ CARBON TAPERED

NQ/NQTK*/NQ3

Part #	DESCRIPTION
4101949	PLUG NQ CARBON TAPERED
4101845	PLUG NQTK CARBON TAPERED
4062225	PLUG NQ OS 3.032 CARBON TAPERED
4101952	PLUG NQ3 CARBON TAPERED

*NQTK also known as NQ2

HQ/HQ3

Part #	DESCRIPTION
4011438	PLUG HQ CARBON TAPERED
4101954	PLUG HQ3 CARBON TAPERED
4062229	PLUG HQ OS 3.895 CARBON TAPERED

Q is a trademark of Boart Longyear.



GAUGES

Steel Ring Gauges are used for verifying the size of new bits and/or shells. Gauges are available either in sets or individually. All gauges are stamped with measurement size for reference. Suitable for standard and reaming shell sizes, but not oversized shells.

AQTK

Part #	DESCRIPTION
30003	AQTK/LTK48 BIT & SHELL
101510	GAUGE, AQTK NEW SHELL MAX, 1.895"
101511	GAUGE, AQTK NEW SHELL MIN, 1.885"
101512	GAUGE, AQTK NEW BIT MAX, 1.885"
101513	GAUGE, AQTK NEW BIT MIN, 1.875"

BQ

Part #	DESCRIPTION
30002	BQ/LTK60 BIT & SHELL WEAR
101501	GAUGE, BQ NEW SHELL MAX, 2.365"
101502	GAUGE, BQ NEW SHELL MIN, 2.355"
101503	GAUGE, RING BQ NEW BIT MAX, 2.355"
101504	GAUGE, RING BQ NEW BIT MIN, 2.345"

NQ

Part #	DESCRIPTION
30001	NQ BIT & SHELL WEAR
101416	NQ NEW SHELL MAX, 2.985"
101417	NQ NEW SHELL MIN, 2.975"
101418	GAUGE, RING NQ NEW BIT MAX, 2.975"
101419	GAUGE, RING NQ NEW BIT MIN 2.965"



HQ

Part #	DESCRIPTION
30000	HQ BIT & SHELL WEAR
101457	HQ NEW SHELL MAX, 3.790"
101458	HQ NEW SHELL MIN, 3.775"
101459	GAUGE, RING HQ NEW BIT MAX, 3.775"
101460	GAUGE, RING HQ NEW BIT MIN 3.761"

PQ

Part #	DESCRIPTION
102486	PQ BIT & SHELL WEAR
102487	PQ MAX NEW SHELL, 4.834"
102488	PQ MIN NEW SHELL, 4.820"
102489	GAUGE, RING PQ NEW BIT MAX, 4.815"
102490	GAUGE, RING PQ NEW BIT MIN 4.795"

Q is a trademark of Boart Longyear.

LIFTER CASES

Boart Longyear™ core lifter cases are made of a high-quality alloy steel that is specially heat treated to increase strength, toughness, and wear life. Available in Q™, QTK, Q-P, Q3, and QTT models. The specialized Q-P/QTT core lifter case works with Q-P/QTT bits to route fluid flow to the cutting face – further improving core recovery.



Q Lifter Case



Q3 Lifter Case



QP Lifter Case



QTT Lifter Case

AQTK

PART #	DESCRIPTION
5001021	AQTK CORE LIFTER CASE

BQ

PART #	DESCRIPTION
24830	BQ CORE LIFTER CASE
53199	BQTK CORE LIFTER CASE

NQ

PART #	DESCRIPTION
5008320	NQ-P CORE LIFTER CASE
24892	NQ CORE LIFTER CASE
29209	NQTK* CORE LIFTER CASE
26529	NQ3 CORE LIFTER CASE
65600	NQTT CORE LIFTER CASE

*NQTK also known as NQ2

HQ

PART #	DESCRIPTION
5007937	HQ-P CORE LIFTER CASE
25237	HQ CORE LIFTER CASE
26514	HQ3 CORE LIFTER CASE
65607	HQTT CORE LIFTER CASE

PQ

PART #	DESCRIPTION
52172	PQ CORE LIFTER CASE
26160	PQ3/PQTT CORE LIFTER CASE

Q is a trademark of Boart Longyear.

WARRANTY

Limited Warranty.

(a) Consumables. Boart Longyear warrants for a period of one (1) year after the date of shipment of the consumable products manufactured by it, or the performance of related services, under the Contract, that such consumable products are free from defects in materials and workmanship and such services are performed in a professional and workmanlike manner; provided, however, with respect to consumable products purchased through an authorized Boart Longyear distributor, the warranty period shall commence on the date of purchase by the end-user.

(b) Capital Equipment. Boart Longyear warrants that the capital equipment manufactured by it is free from defects in materials and workmanship for a period equal to the lesser of (i) one (1) year after the date of shipment, or (ii) the initial 1,000 operating hours. Boart Longyear warrants for a period of six (6) months after the performance of related services that such services are performed in a professional and workmanlike manner.

(c) General Terms. Boart Longyear further warrants that, to the extent applicable, as of the date of shipment or performance, all goods manufactured by it and services performed shall conform to the written specifications agreed between the parties. THIS IS BOART LONGYEAR'S ONLY WARRANTY. BOART LONGYEAR MAKES NO OTHER WARRANTY, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. As a condition to Boart Longyear's warranty obligations, Purchaser must: (i) contact Boart Longyear and request authorization to return any goods claimed to be defective promptly upon Purchaser's discovery of the alleged defect, (ii) upon receipt of an approved authorization code from Boart Longyear, return any goods claimed to be defective under the foregoing warranty, at Purchaser's expense, to the facility designated by Boart Longyear, and (iii) with respect to consumable products purchased through an authorized Boart Longyear distributor, the party making the warranty claim must also deliver to Boart Longyear reasonable evidence of the date of purchase. Boart Longyear shall perform its examination of the goods so returned by Purchaser and shall report the results of its examination to Purchaser within thirty (30) days following its receipt of such goods from

Purchaser, or, if longer time is required to complete such examination, within such time as would be required through the exercise of reasonable diligence. As a further condition to Boart Longyear's obligations hereunder for breach of warranty, Purchaser shall offer its reasonable cooperation and assist Boart Longyear in the course of Boart Longyear's review of any warranty claim. If requested by Purchaser, Boart Longyear will promptly repair or replace, at Boart Longyear's expense, goods that are confirmed to be non-conforming as a result of Boart Longyear's examination and according to Boart Longyear's warranty as set forth herein. All removal and installation of goods shall be at Purchaser's expense; provided, however, Boart Longyear will reimburse the Customer for an amount equal to the reasonable expenses incurred by the Customer and attributable to the removal and shipment of any defective goods. Boart Longyear reserves the right to reimburse Purchaser for an amount equal to the purchase price of any defective goods in lieu of providing repaired or replacement goods. Anything contained herein to the contrary notwithstanding, in no event shall Boart Longyear be liable for breach of warranty or otherwise in any manner whatsoever for: (i) normal wear and tear; (ii) corrosion, abrasion or erosion; (iii) any goods, components, parts, software or services which, following delivery or performance by Boart Longyear, has been subjected to accident, abuse, misapplication, modification, improper repair, alteration, improper installation or maintenance, neglect, or excessive operating conditions; (iv) defects resulting from Purchaser's specifications or designs or those of its contractors or subcontractors other than Boart Longyear; (v) defects associated with consumable parts or materials, the lifetime of which is shorter than the warranty period set forth in this Section; (vi) defects associated with Purchaser's specifications or designs or those of its contractors or subcontractors other than Boart Longyear; (vii) defects resulting from the manufacture, distribution, promotion or sale of Purchaser's own products; or (viii) accessories of any kind used by the Purchaser which are not manufactured by or approved by Boart Longyear.

WARRANTY (CONTINUED)

(d) Sourced Goods. If the defective parts or components are not manufactured by Boart Longyear, the guarantee of the manufacturer of those defective parts or components is accepted by the Purchaser and is the only guarantee given to the Purchaser in respect of the defective parts or components. Boart Longyear agrees to assign to the Purchaser on request made by the Purchaser the benefit of any warranty or entitlement to the defective parts or components that the manufacturer has granted to Boart Longyear under any contract or by implication or operation of law to the extent that the benefit of any warranty or entitlement is assignable.

(e) Limitation on Liability. Except as provided for herein, in no event will Boart Longyear be liable for any indirect, incidental, special, consequential, punitive or similar damages including, but not limited to, lost profits, loss of data or business interruption losses. In no event will the total, aggregate liability of Boart Longyear under the Contract exceed the value of the Contract under which liability is claimed. The liability limitations shall apply even if Boart Longyear has been notified of the possibility or likelihood of such damages occurring and regardless of the form of action, whether in contract, negligence, strict liability, tort, products liability or otherwise. The parties agree that these limits of liability shall survive and continue in full force and effect despite any termination or expiration of any Contract. Any action by Purchaser against Boart Longyear must be commenced within one year after the cause of action has accrued. No employee or agent of Boart Longyear is authorized to make any warranty other than that which is specifically set forth herein. The provisions in any specification, brochure or chart issued by Boart Longyear are descriptive only and are not warranties.

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