DIAMOND PRODUCTS CATALOG

BOART LONGYEAR™

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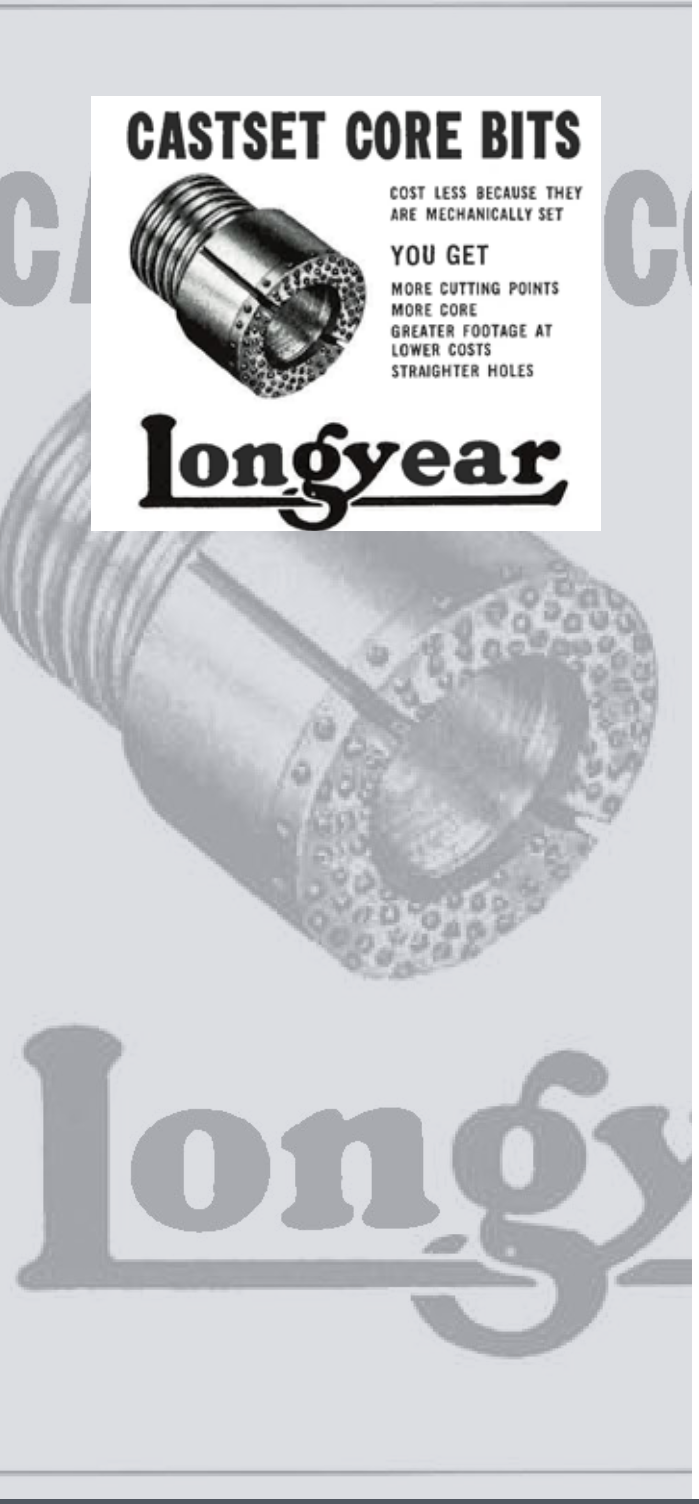
PRODUCT OVERVIEW



HISTORY

BOART PRODUCTS
Our diamond products were originally developed by Anglo American Corporation in the 1930s 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.

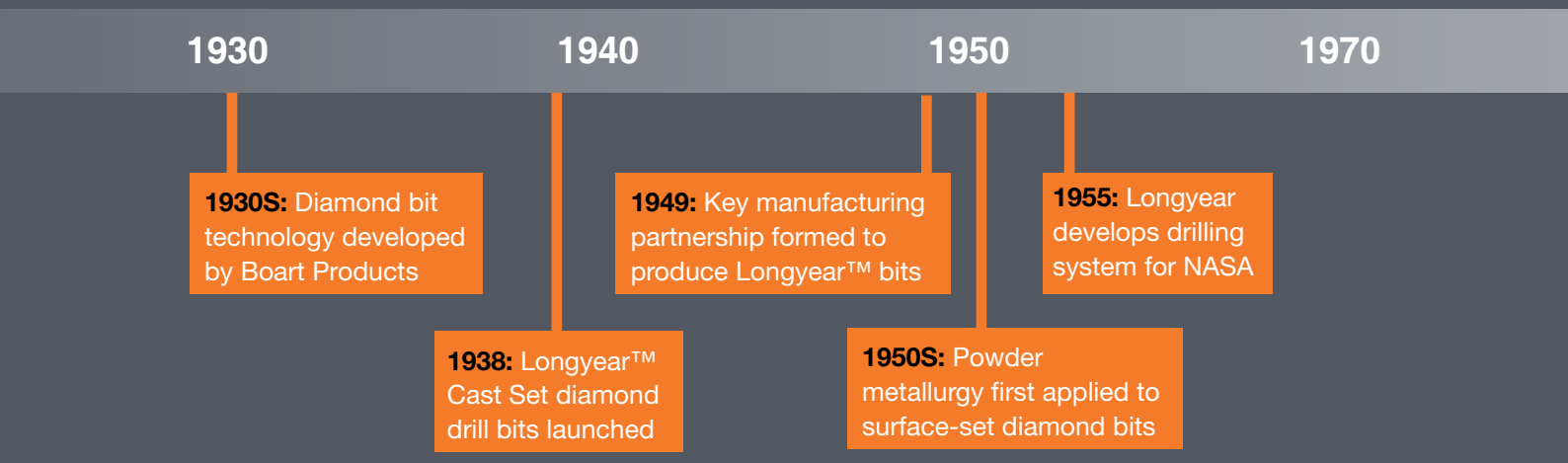
EARLY SUCCESS IN THE COPPER BELT
The first Boart bits off the line were put to use exploring for copper in Zambia and gold in the Orange Free State, South Africa. The early success of these bits paved the way for widespread adoption of the technology within the industry.

LONGYEAR
In 1938, the Longyear contract drilling department started using castset 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 1960s, the Longyear™ Q™ wireline took the industry by storm and opened the door for widespread adoption of Longyear drilling tools and consumables.

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.

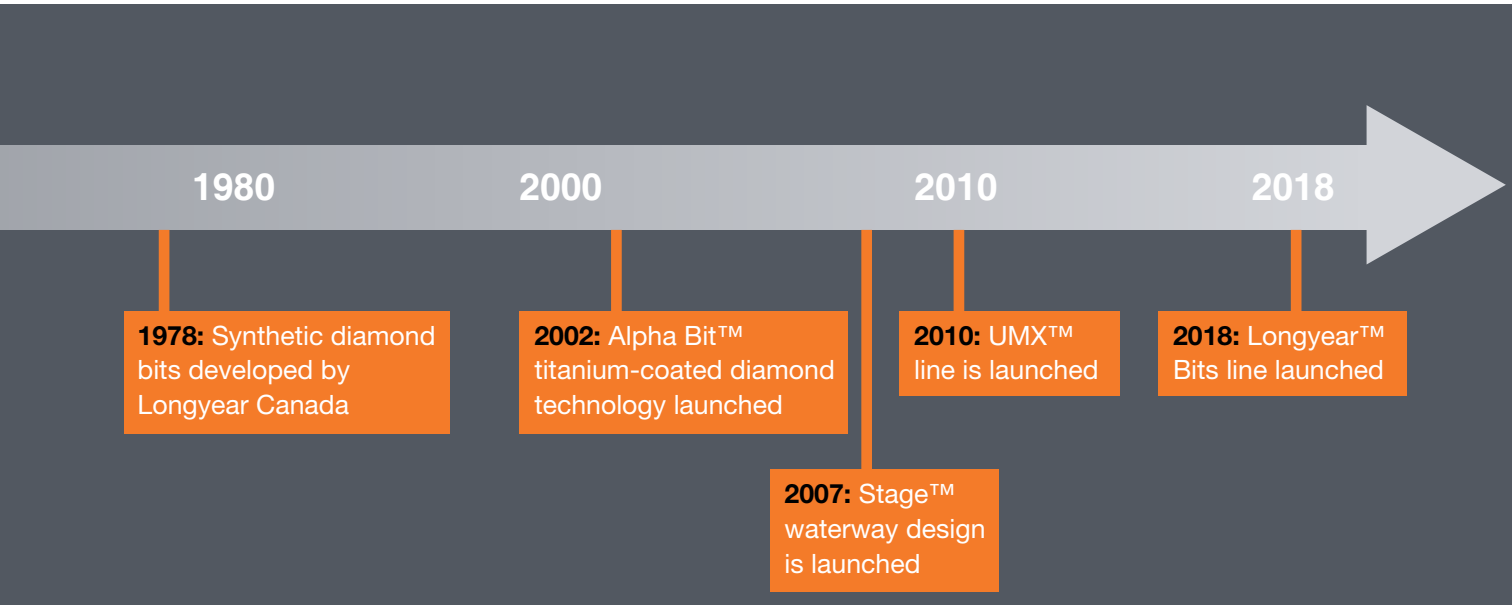
BIT HISTORICAL TIMELINE



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.



AU Patent Nos. 2007333850; 2011201711; 2011201710; 2011201709; CA Patent Nos. 2,671,061; 2,826,570; US Patent Nos. 7,628,228; 7,874,384; 7,828,090; 8,051,929; CN Patent No. ZL200780051070.8; ZA Patent No. 2009/05801; ES, FI, SE, TR Patent No. 2122111; Patents Pending.

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 for more meters per bit.

LONGYEAR™ BITS

The Longyear™ Bits are similar to large diamond bits, but with the easy, smooth drilling characteristics drillers prefer. This means increased productivity throughout the entire operation, and ultimately more core.

To support higher penetration rates, the new Longyear formulas are combined with a new, more open, express geometry. Tapered intermediate waterways improve flushing and prevent accumulation of debris. Designed for fast cutting in competent ground, the new express geometry is available in our 16mm crown heights to maintain bit life at higher cutting speeds.

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.

The Stage waterway option is available in both 16mm and 25mm crown heights. Stage is also available in face discharge for very soft or broken ground conditions.

SPECIALTY BITS

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.

TUYERE BITS

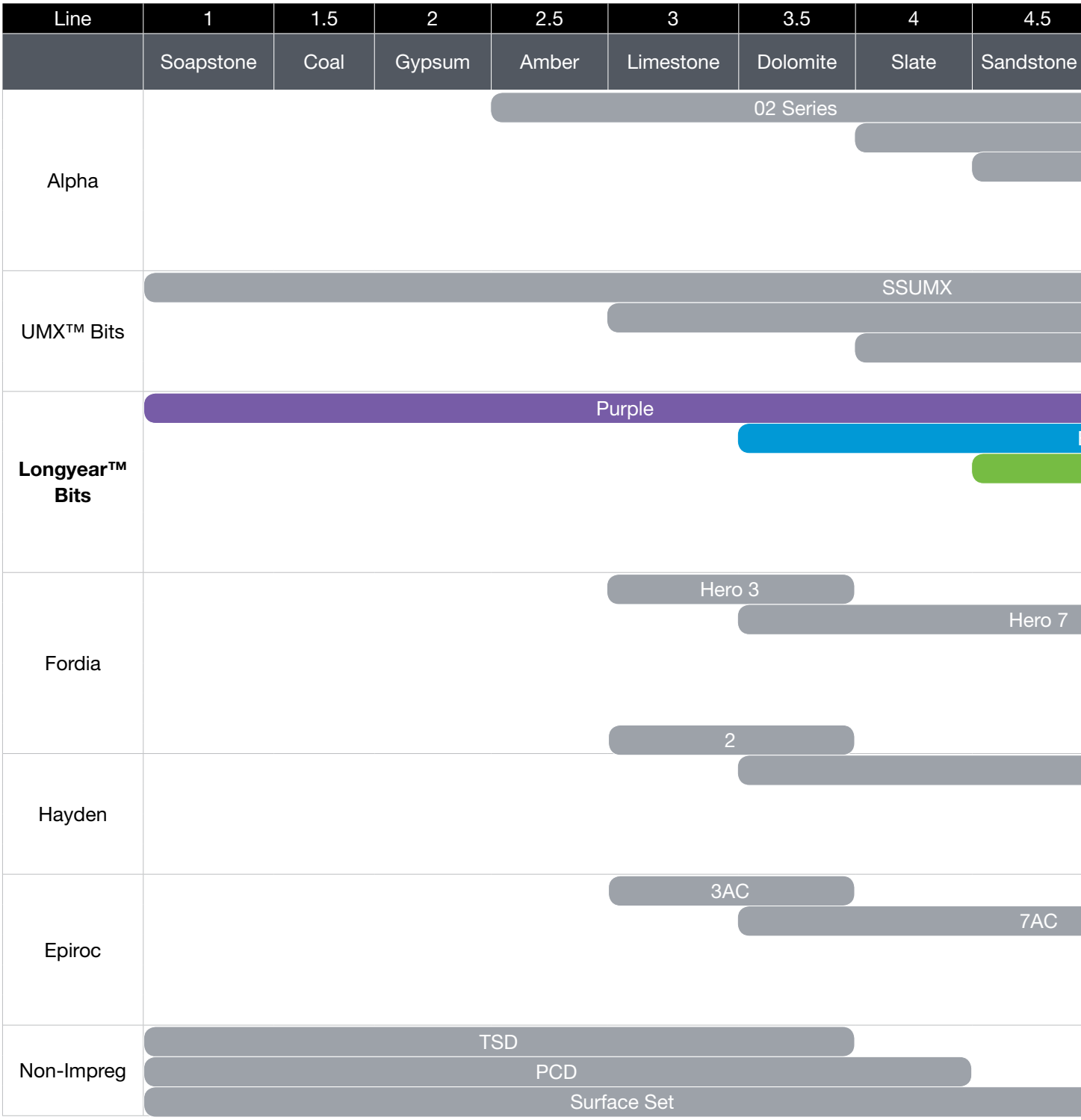
Tuyere bits are used for drilling holes through refractory bricks in smelters, named for the nozzles that inject air into smelting furnaces.

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.

BIT RANGE CHART: MOHS SCALE OF HARDNESS

SOFTER

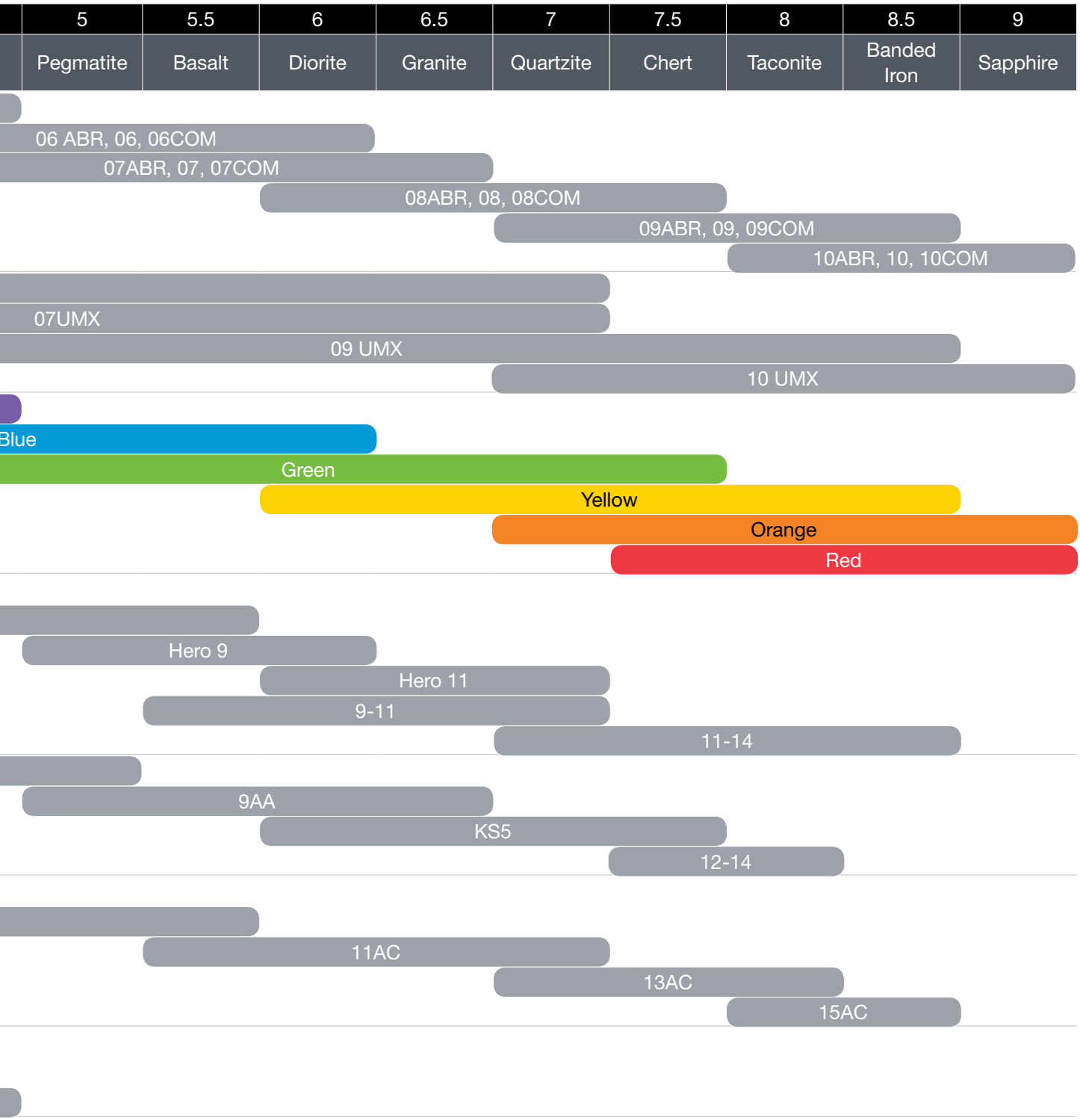


Conditions are often encountered where formations change repeatedly within a very short interval of drilling. Under such circumstances, select a bit that cuts the hardest of the expected formations, and adjust drill rates as abrasive rock is encountered to protect the bit from excessive wear rates.

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

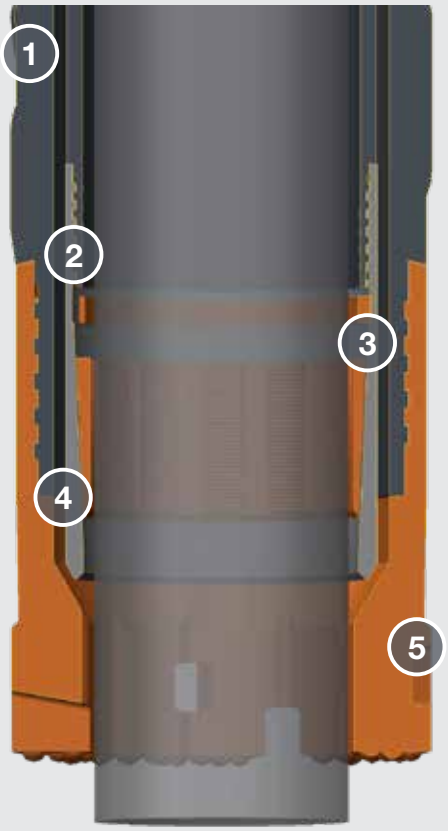
Fordia, Hayden, Epiroc and all other third-party trademarks are the property of their respective owners

HARDER



SYSTEM OVERVIEW

Q™ & Q™ TK SYSTEM



Q™-P 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

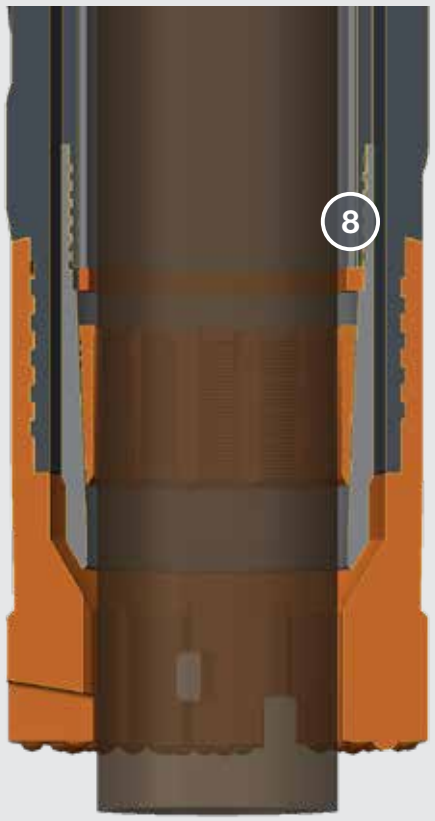
6. CORE LIFTER CASE

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 lifter 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



Q™ TT 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.

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, NQ-P	1.875	47.6	2.965	75.3	2.980	75.7	3.032	77.0	36.3	451
HQ, HQ-P	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

INSTALLATION

All recommended torque values below are for use with Boart Longyear™ full-grip outer tube wrenches. Pipe wrenches/Stilsons can crush, ovalize, or leave deep gripper marks that lead to fatigue failures due to the steel hardness of most diamond products. Steel-brush thread cleaning and generous application of anti-galling thread compound prior to make up is also recommended to prevent galling.

BIT, SHELL, COUPLING AND O/TUBE JOINT TORQUE VALUES:

AQ/BQ/BQTK: Minimum full-grip wrench torque =100 ft-lbs or 67 lbf using an 18" full-grip wrench

NQ/NQTK: Minimum full-grip wrench torque =125 ft-lbs or 83 lbf using an 18" full-grip wrench

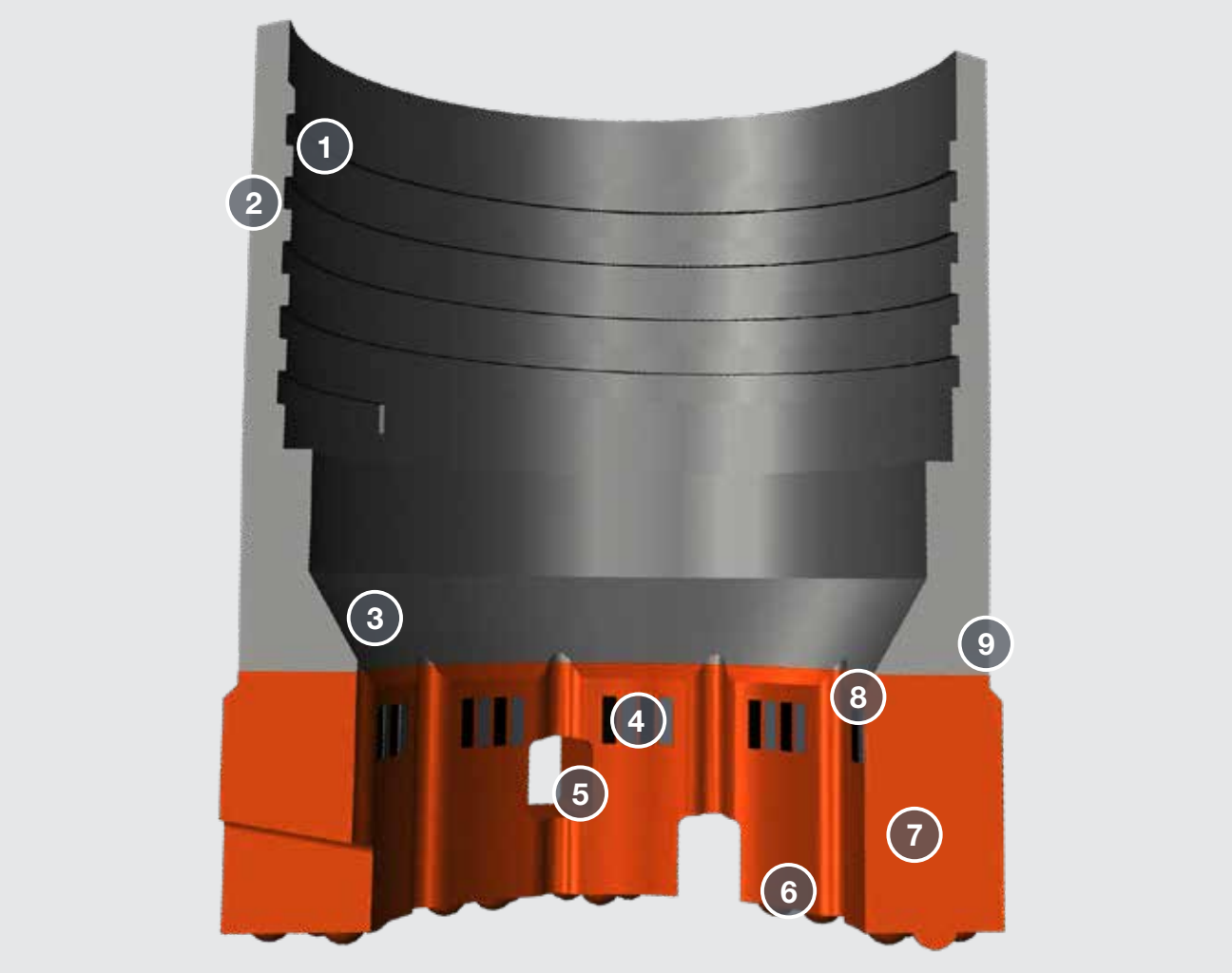
HQ: Minimum full-grip wrench torque =150 ft-lbs or 100 lbf using an 18" full-grip wrench

PQ: Minimum full-grip wrench torque =200 ft-lbs or 133 lbf using an 18" full-grip wrench

Q is a trademark of Boart Longyear.

IMPREGNATED DIAMOND BITS

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.

*Thermally Stable Diamond

6. BIT FACE
Patented 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.

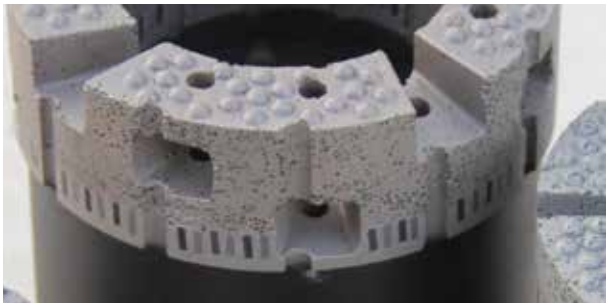
8. THROATLESS
Older designs had a small counterbore in the inner diameter (ID) at the start of the crown, referred to as a throat. This feature could accumulate material and accelerate ID gauge loss and has been eliminated in new designs.

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.

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.

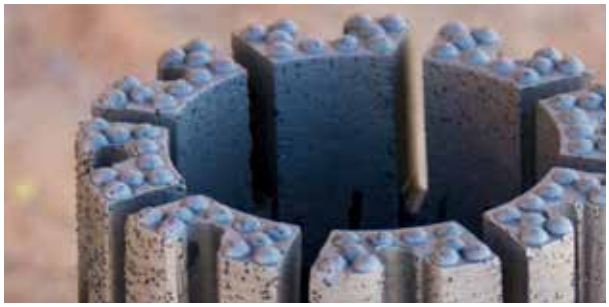
RAZORCUT™ FACE DESIGN
The patented design is ready to cut right out of the box and improves tracking and balance in the hole.

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.

EXPRESS GEOMETRY
To support higher penetration rates, we have combined the new Longyear™ formulas with a new, more open express geometry. Tapered intermediate waterways improving flushing and prevent accumulation of debris. Designed for fast cutting in competent ground, the new express geometry is available in our 16mm crown heights to maintain bit life at higher cutting speeds.



AU 2015203268; CA 2,784,465; AU Design Nos. 332257; 332260; 332261; CA Design Nos. 135751; CL Design 6479; CN Design No. ZL201030188519.X; EP Design No. 1216527-001; PE Design Nos. 2662; 2663; US Design Nos. D622,745; D647,114; ZA Design Nos. F2010/00750; CA Design No. 135753; CL Patent No. 52.578; PE Patent No. 9185; US Patent Nos. 9,903,165; 9,500,036; ZA Patent Nos. 2012/05225; 2013/07869; ES, FI, NO, SE, TR Patent No. 2513405.

AU 201082270; 2015202683; AU Design No. 332218; CA 2,762,861; CN201080035195.3; US 9,051,786; 9,637,980; CA Design No. 136438; CL Design 6561; CN Design No. ZL201030248719.X; EP Design 001225676-001; PE Design No. 2690; US Patent No. D630,656; ZA Design No. F2010/1030; ZA Patent No. 2012/01878; CL Patent No. 54.449; PE Patent No. 7799; ES, FR, TR Patent No. 2464809.

AU Patent Nos. 2007333850; 2011201711; 2011201710; 2011201709; CA Patent No. 2,671,061; CA Patent 2,826,590; CN Patent No. ZL200780051070.8; US Patent Nos. 7,628,228; 7,828,090; 7,874,384; 8,051,929; ZA Patent No. 2009/03801; ES, FI, SE, TR Patent No. 2122111.

Patents Pending

DIRECTIONAL DRILLING BITS

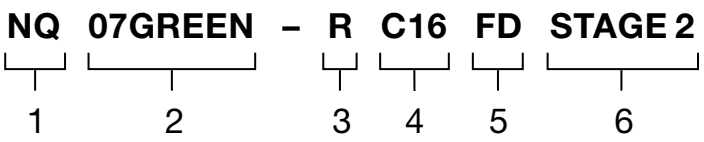
DOWNHOLE MOTOR BITS
Downhole motors (DHM) bits are threaded onto downhole motors and used in directional drilling applications. They have reinforced center ports and have an impregnated full face crown.

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

WEDGING CORE BIT
Boart Longyear™ wedging bits are diamond products that are made to follow wedges set in the bore hole with the intention of altering the hole direction. These special profiles are required to avoid drilling straight through the wedge. The tapered crown profile is available in a taper varying from 1/4" to 7/16" chamfer, a 7 steps (shown) or a radius Stage™ 2.

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 25 or 32 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 the following optional configurations:

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.

LONGYEAR™ BITS

How fast does it cut and how long does it last? That's what really matters to drillers. The Longyear™ Bits line was engineered to simplify the science of bit selection to make the fastest cutting bits that last longer for the maximum amount of quality core.

LONGYEAR™ MATRIX
After significant research, Boart Longyear has successfully created a chemical bond between diamond and matrix, which is stronger than the diamond itself. The increased diamond projection and improved face flushing create a bit with more versatility, higher penetration rates and longer life, similar to large diamond bits, but with the easy, smooth drilling characteristics drillers prefer. This means increased productivity throughout the entire operation, and ultimately more core.

LONGYEAR™ PURPLE BIT
Designed to cut soft formations and large grained medium formations with excellent life. Using large synthetic diamonds, it cuts at rates comparable to surface sets, while still having the benefits of an impregnated bit. This formula is also the best choice for drilling concrete with rebar, or drilling out stuck tools downhole.

LONGYEAR™ BLUE BIT
A general purpose bit for medium to medium-hard formations and a good choice for formations that have a mixture of soft, and medium-hard ground. This bit accommodates most drilling encountered and holds up.

LONGYEAR™ GREEN BIT
A general purpose bit biased towards penetration rate for medium-hard to hard formations and a good choice for formations that have a mixture of soft, medium-hard, and hard ground. This is the most versatile of the variable condition formulas and a good place to start when ground conditions are unknown.

LONGYEAR™ YELLOW BIT
The Longyear Yellow Bit is a free cutting formula for very hard and ultra-hard formations. As free cutting as an Alpha 09COM, it is much more durable; durable enough to be used to maximize penetration rates in somewhat softer conditions. This can also be used as alternative when drilling medium-hard formations with a low torque rig.

LONGYEAR™ ORANGE BIT
The Longyear Orange Bit is a free cutting formula for ultra-hard formations. As free cutting as an Alpha 10COM, it is much more durable; durable enough to be used to maximize penetration rates in somewhat softer conditions. This can also be used as alternative when drilling hard formations with a low torque rig.

LONGYEAR™ RED BIT
The Longyear Red Bit is the most free-cutting bit Boart Longyear has available. Designed to cut the hardest fine-grained ground, it quickly penetrates the very hardest rock formations. Durable enough to be used to maximize penetration rates in somewhat softer conditions. This bit can also be a good choice when drilling hard formations with a low torque rig.

Patents Pending

CASE STUDY: LONGYEAR™ BITS PUT 23% MORE CORE IN THE BOX

OVERVIEW

The Yilgarn Craton forms the bulk of Western Australia and is home to 30% of the world's gold deposits. Within this region, the Laverton district is one of the most important gold producing regions. Underground miners of these "nuggety" gold deposits are under significant pressure to reduce their all in sustaining costs (AISC) and improve their return. Combine each mine's sharp focus on costs with an extremely competitive diamond drilling market, and the result is the constant search for higher productivity in underground diamond drilling.

Using patented technology, the new Longyear™ bits have diamonds that are chemically bonded to the matrix creating a more versatile, faster penetrating, and a longer-lasting bit. The new Longyear bits retain the smooth drilling characteristics drillers prefer, resulting in more core in the box on every shift for every crew. Available in 16mm more open, express geometry for even higher cutting speeds as well as 16mm Stage™ and 25mm Stage 3 configurations.

Product:	Longyear™ Bits
Location:	Yilgarn Craton, Western Australia
Application:	Underground diamond drilling
Vital Stats:	23% Increase in Meters Drilled/Hour

23%
INCREASE IN METERS DRILLED/ HOUR

"The other night I witnessed a bit cutting 24 inches a minute—by far the fastest cutting bit Boart Longyear has made."

BOART LONGYEAR SITE SUPERVISOR, WESTERN TERRITORY

THE CHALLENGE

On the surface, the Laverton district is a flat, hot, dry environment with scattered acacia trees only interrupted by dry, salt lake beds, and gypsum sand dunes.

Underground, the formation is a mesothermal, meaning deep extending, gold deposit typical in Western Australia, composed of greenstone, a rock type common to gold deposits globally, basalts, magnetite shales and banded iron formations (BIF).

Within this host rock, the gold is typically contained within intrusive dykes of quartz porphyry near the shear and fracture networks which supported gold-bearing hydrothermal flow.

The greenstone, shale and even basalts are only of medium hardness and have the potential to be cut quite quickly, while the sections of BIF, quartz and fracture zones force slower penetration rates. The ideal bit would be versatile; free-cutting enough to easily handle the occasional BIF and quartz but tough enough to penetrate the greenstones quickly.

After optimizing drilling parameters, the incumbent product's (Hayden 9AA and KS5) average performance maxed out at 180 meters/ bit life and 22 centimeters/min of penetration rate over the three months of monitoring. While solid performance, a new solution was needed to continue improving productivity.

CASE STUDY: LONGYEAR™ BITS PUT 23% MORE CORE IN THE BOX

THE SOLUTION

The first step was to introduce the new Longyear Green Bit in a Stage 3 25mm configuration. The Longyear Green bit was selected to drill like the competitor's 9AA formula with Stage configuration to maximize life.

Comparing performance in the three-month period after adoption, penetration rate increased to 26 centimeters/minute and **bit life nearly doubled, increasing to 356 meters/bit.**

The ease of use and consistency across shifts was appreciated by the crews and helped produce the measurable gain. **These improvements combined to noticeably increase core in the box by 6%.**

The Boart Longyear™ drill crews correctly observed that such long life was not driving a significant increase in productivity as reduced tripping time has less impact than improved penetration, so the decision was made to trial even more free-cutting formulas.

The next bit trialed was the Longyear Yellow again in the Stage 3 25 mm configuration to line up against the competitor's KS5 and even 12-14. **The penetration rate jumped to an average of 35 centimeters per minute and life held at an impressive 300 meters per bit.**

Since the bits were still achieving much better life, Boart Longyear Drilling Services moved one more step up to the Longyear Red bit. Since the goal was to maximize penetration rate, the Longyear Red bits were produced in the 16 mm express configuration with a more open area for enhanced penetration. **The Longyear Red bits achieved an astonishing 60 centimeters per meter penetration rate and still lasted 120 meters.**

With the goal of maximizing productivity, the drill crews decided to use one Longyear Red at the top of the hole and finish it with a Longyear Yellow in 25 mm Stage 3. The results speak for themselves.

THE RESULT

After three months of measurement, this two-bit strategy averaged 283 meters/bit, still a 60% improvement over the competition and 34 centimeters per minute, a full doubling of penetration rate. The combined result put 23% more core in the box.

LONGYEAR™ BIT PART NUMBERS

AQTK

PART #	DESCRIPTION
4056358	BIT AQTK GREEN (P520) -R C12 EX 6@125/155 RZ
4056687	BIT AQTK GREEN (P520) -R C25 STG3
4056066	BIT AQTK YELLOW (P575) -R C12 EX 6@125/155 RZ
4056489	BIT AQTK ORANGE (P580) -R C25 STG3
4056064	BIT AQTK RED (P566) -R C12 EX 6@125/155 RZ
4056129	BIT AQTK RED (P566) -R C25 STG3

BQ

PART #	DESCRIPTION
4056402	BIT BQ PURPLE (P584) -R C12 GT
4056170	BIT BQ BLUE (P577) -R C12 GT
4056217	BIT BQ BLUE (P577) -R C16 EX 8@125/125
4056278	BIT BQ BLUE (P577) -R C16 TW 4@200<550
4056403	BIT BQ BLUE (P577) -R C25 STG3
4056171	BIT BQ GREEN (P520) -R C12 GT
4056212	BIT BQ GREEN (P520) -R C16 EX 8@125/125
4056273	BIT BQ GREEN (P520) -R C16 TW 4@200<550
4056405	BIT BQ GREEN (P520) -R C25 STG3
4056649	BIT BQ YELLOW (P575) -R C12 GT
4056650	BIT BQ YELLOW (P575) -R C16 EX 8@125/125
4056277	BIT BQ YELLOW (P575) -R C16 TW 4@200<550
4056310	BIT BQ YELLOW (P575) -R C25 STG3
4056515	BIT BQ ORANGE (P580) -R C16 EX 8@125/125
4056514	BIT BQ ORANGE (P580) -R C16 TW 4@200<550
4056518	BIT, BQ ORANGE (P580) -R C25 STG3

BQ (continued)

PART #	DESCRIPTION
4056214	BIT BQ RED (P566) -R C16 EX 8@125/125
4056275	BIT BQ RED (P566) -R C16 TW 4@200<550
4056407	BIT BQ RED (P566) -R C25 STG3
4056694	BIT BQ RED (P566) -R C12 GT

BQTK

PART #	DESCRIPTION
4056142	BIT BQTK BLUE (P577) -R C16 EX 8@125/125 RZ
4056034	BIT BQTK BLUE (P577) -R C25 STG3 RZ
4056141	BIT BQTK GREEN (P520) -R C16 EX 8@125/125 RZ
4055953	BIT BQTK GREEN (P520) -R C25 STG3 RZ
4056143	BIT BQTK YELLOW (P575) -R C16 EX 8@125/125 RZ
4056024	BIT BQTK YELLOW (P575) -R C25 STG3 RZ
4056272	BIT WD BQTK YELLOW (P575) S C12 7@188
4056292	BIT BQTK ORANGE (P568) -R C16 EX 8@125/125
4056312	BIT BQTK ORANGE (P580) -R C25 STG3
4056144	BIT BQTK RED (P566) -R C16 EX 8@125/125 RZ
4056022	BIT BQTK RED (P566) -R C25 STG3 RZ

Q is a trademark of Boart Longyear.

LONGYEAR™ BIT PART NUMBERS (continued)

NQ

PART #	DESCRIPTION
4056435	BIT NQ PURPLE (P584) -R C12 GT
4056639	BIT NQ PURPLE (P584) -R C16 EX 8@125/188
4056437	BIT NQ BLUE (P577) -R C12 GT
4056253	BIT NQ BLUE (P577) -R C12 FD GT
4056183	BIT NQ BLUE (P577) -R C16 EX 8@125/188
4056378	BIT NQ BLUE (P577) -R C16 TW 6@150<450
4056126	BIT NQ BLUE (P577) -R C25 STG3
4056645	BIT WD NQ BLUE (P577) C12 -R GT
4056440	BIT NQ GREEN (P520) -R C12 GT
4056248	BIT NQ GREEN (P520) -R C12 FD GT
4056181	BIT NQ GREEN (P520) -R C16 EX 8@125/188
4056360	BIT NQ GREEN (P520) -R C16 TW 6@150<450
4055897	BIT NQ GREEN (P520) -R C25 STG3
4056572	BIT NQ GREEN (P520) OS 3.032 C25 STG3 RZ
4056618	BIT NQ GREEN (P520) OS 3.032 C25 FD STG3 RZ
4056646	BIT WD NQ GREEN (P520) C12 -R GT
4056135	BIT NQ GREEN (P520) R C9 ID1STP 8@188
4056443	BIT NQ YELLOW (P575) -R C12 GT
4056179	BIT NQ YELLOW (P575) -R C16 EX 8@125/188
4056355	BIT NQ YELLOW (P575) -R C16 TW 6@150<450
4056029	BIT NQ YELLOW (P575) -R C25 STG3 RZ
4065007	BIT DHM BW R/P YELLOW (P575) NQ S C10 TP RT
4056379	BIT NQ ORANGE (P580) -R C16 EX 8@125/188
4056356	BIT NQ ORANGE (P580) -R C16 TW 6@150<450
4056627	BIT NQ RED (P566) -R C12 GT
4056250	BIT NQ RED (P566) -R C12 FD GT
4056178	BIT NQ RED (P566) -R C16 EX 8@125/188
4056357	BIT NQ RED (P566) -R C16 TW 6@150<450
4055991	BIT NQ RED (P566) -R C25 STG3 RZ
4056633	BIT NQ RED (P566) OS 3.032 C25 STG3 RZ

Q is a trademark of Boart Longyear.

NQ (continued)

PART #	DESCRIPTION
4065006	BIT DHM BW R/P RED (P566) NQ S C10 TP RT
4064919	BIT DHM BW R/P RED (P566) NQ R C16 BTFLY

NQTK

PART #	DESCRIPTION
4056453	BIT NQTK PURPLE (P584) -R C12 GT RZ
4056509	BIT NQTK BLUE (P577) -R C12 GT RZ
4056164	BIT NQTK BLUE (P577) -R C16 EX 8@125/188
4056384	BIT NQTK BLUE (P577) -R C16 TW 6@150<450 RZ
4056340	BIT NQTK BLUE (P577) OS 3.032 C16 EX 8@125/188
4056456	BIT NQTK GREEN (P520) -R C12 GT RZ
4056160	BIT NQTK GREEN (P520) -R C16 EX 8@125/188
4056279	BIT NQTK GREEN (P520) -R C16 EX 8@125/188 PINS
4056063	BIT NQTK GREEN (P520) -R C16 TW 6@150<450
4056338	BIT NQTK GREEN (P520) OS 3.032 C16 EX 8@125/188
4055912	BIT NQTK GREEN (P520) -R C25 STG3
4056207	BIT WD NQTK GREEN (P520) S 7STP
4056457	BIT NQTK YELLOW (P575) -R C12 GT RZ
4056163	BIT NQTK YELLOW (P575) -R C16 EX 8@125/188
4056062	BIT NQTK YELLOW (P575) -R C16 TW 6@150<450
4056006	BIT NQTK YELLOW (P575) -R C25 STG3
4056016	BIT NQTK YELLOW (P575) OS 3.032 C25 STG3
4056130	BIT NQTK ORANGE (P580) -R C16 TW 6@150<450 RZ
4056348	BIT NQTK P568 ORANGE -R C16 EX 8@125/188
4056147	BIT NQTK RED (P566) -R C16 EX 8@125/188
4056131	BIT NQTK RED (P566) -R C16 TW 6@150<450
4055977	BIT NQTK RED (P566) -R C25 STG3
4056015	BIT NQTK RED (P566) OS 3.032 C25 STG3

LONGYEAR™ BIT PART NUMBERS

NQ-P

PART #	DESCRIPTION
4056666	BIT NQ-P BLUE (P577) S C12 FD 8@250
4056667	BIT NQ-P GREEN (P520) S C12 DD 8@250

NQ3

PART #	DESCRIPTION
4056641	BIT NQ3 PURPLE (P584) –R C12 FD GT
4056265	BIT NQ3 BLUE (P577) -R C12 TW 6@150<450
4056271	BIT NQ3 BLUE (P577) -R C12 FD TW 6@150<450
4056695	BIT NQ3 GREEN (P520) -R C12 FD GT
4056260	BIT NQ3 GREEN (P520) -R C12 TW 6@150<450
4056266	BIT NQ3 GREEN (P520) -R C12 FD TW 6@150<450
4056264	BIT NQ3 YELLOW (P575) -R C12 TW 6@150<450
4056270	BIT NQ3 YELLOW (P575) -R C12 FD TW 6@150<450
4056294	BIT WD NQ3 YELLOW (P575) S C12 6@188
4056588	BIT NQ3 ORANGE (P580) -R C12 FD TW 6@150<450
4056629	BIT NQ3 ORANGE (P580) -R C12 TW 6@150<450
4056262	BIT NQ3 RED (P566) -R C12 TW 6@150<450
4056268	BIT NQ3 RED (P566) -R C12 FD TW 6@150<450

NQTT

PART #	DESCRIPTION
4056575	BIT NQTT BLUE (P577) -R C16 FD TW 6@150<450
4056576	BIT NQTT GREEN (P520) -R C16 FD TW 6@150<450
4056578	BIT NQTT YELLOW (P575) -R C16 FD TW 6@150<450
4056579	BIT NQTT ORANGE (P580) -R C16 FD TW 6@150<450
4056581	BIT NQTT RED (P566) -R C16 FD TW 6@150<450

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LONGYEAR™ BIT PART NUMBERS (continued)

HQ

PART #	DESCRIPTION
4056409	BIT HQ PURPLE (P584) -R C12 GT
4056408	BIT HQ PURPLE (P584) -R C12 FD GT
4056410	BIT HQ BLUE (P577) -R C12 GT
4056244	BIT HQ BLUE (P577) -R C12 FD GT
4056153	BIT HQ BLUE (P577) -R C16 EX 10@125/155
4056386	BIT HQ BLUE (P577) -R C16 TW 8@125>464 RZ
4056647	BIT HQ BLUE (P577) OS 3.830 C16 EX 10@188/250
4056413	BIT HQ GREEN (P520) -R C12 GT
4056239	BIT HQ GREEN (P520) -R C12 FD GT
4056148	BIT HQ GREEN (P520) -R C16 EX 10@125/155
4056247	BIT HQ GREEN (P520) -R C16 TW 8@125>464 RZ
4056317	BIT HQ GREEN (P520) OS 3.830 C16 EX 10@125/188
4056679	BIT HQ GREEN (P520) OS 3.895 C16 DD TW 8@125<488 RZ
4056038	BIT HQ GREEN (P520) -R C25 STG3
4056417	BIT HQ YELLOW (P575) -R C12 GT
4056243	BIT HQ YELLOW (P575) -R C12 FD GT
4056152	BIT HQ YELLOW (P575) -R C16 EX 10@125/155
4056246	BIT HQ YELLOW (P575) -R C16 TW 8@125>464 RZ
4056052	BIT HQ YELLOW (P575) -R C25 STG3
4065013	BIT DHM NW R/P YELLOW (P575) HQ S C10 TP RT
4056324	BIT HQ ORANGE (P580) -R C16 TW 8@125>464 RZ
4056323	BIT HQ ORANGE (P580) -R C16 EX 10@125/155
4056414	BIT HQ RED (P566) -R C12 GT
4056150	BIT HQ RED (P566) -R C16 EX 10@125/155
4056325	BIT HQ RED (P566) -R C16 TW 8@125>464 RZ
4065012	BIT DHM NW R/P RED HQ S C10 TP RT
4065425	BIT DHM NW R/P RED (P566) HQ S C31 BTFLY RZ

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HQ-P

PART #	DESCRIPTION
4056548	BIT HQ-P BLUE (P577) S C12 DD 8@250
4056546	BIT HQ-P GREEN (P520) S C12 DD 8@250

HQ3

PART #	DESCRIPTION
4056419	BIT HQ3 PURPLE (P584) -R C12 GT
4056420	BIT HQ3 PURPLE (P584) -R C12 FD GT
4056424	BIT HQ3 BLUE (P577) -R C12 GT
4056423	BIT HQ3 BLUE (P577) -R C12 FD GT
4056232	BIT HQ3 BLUE (P577) -R C12 FD TW 8@125<488 RZ
4056220	BIT HQ3 BLUE (P577) -R C16 TW 8@125<488 RZ
4056070	BIT HQ3 BLUE (P577) -R C16 DD TW 8@125<488
4056343	BIT HQ3 BLUE (P577) OS 3.830 C16 TW 8@125<488
4056427	BIT HQ3 GREEN (P520) -R C12 GT
4056426	BIT HQ3 GREEN (P520) -R C12 FD GT
4056233	BIT HQ3 GREEN (P520) -R C12 FD TW 8@125<488 RZ
4056307	BIT HQ3 GREEN (P520) S C12 DD 8@313 PINS

LONGYEAR™ BIT PART NUMBERS (continued)

HQ3 (continued)

PART #	DESCRIPTION
4056177	BIT HQ3 GREEN (P520) OS 3.895 C12 GT
4056221	BIT HQ3 GREEN (P520) -R C16 TW 8@125<488 RZ
4056046	BIT HQ3 GREEN (P520) -R C16 DD TW 8@125<488
4056637	BIT HQ3 YELLOW (P575) -R C12 GT
4056071	BIT HQ3 YELLOW (P575) -R C16 DD TW 8@125<488
4056223	BIT HQ3 YELLOW (P575) -R C16 TW 8@125<488 RZ
4056555	BIT HQ3 YELLOW (P575) -R C16 FD TW 8@125<488 RZ
4056644	BIT HQ3 YELLOW (P575) OS 3.895 C12 TW 8@125<488 RZ
4056301	BIT WD HQ3 YELLOW (P575) -R C12 8@188
4056371	BIT HQ3 ORANGE (P580) -R C12 FD TW 8@125<488
4056366	BIT HQ3 ORANGE (P580) -R C16 TW 8@125<488
4056430	BIT HQ3 RED (P566) -R C12 FD GT
4056236	BIT HQ3 RED (P566) -R C12 FD TW 8@125<488 RZ
4056582	BIT HQ3 RED (P566) OS 3.895 C12 TW 8@125<488 RZ
4056224	BIT HQ3 RED (P566) -R C16 TW 8@125<488 RZ
4056109	BIT HQ3 RED (P566) -R C16 DD TW 8@125<488
4056111	BIT HQ3 RED (P566) -R C25 STG3

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HQTT

PART #	DESCRIPTION
4056672	BIT HQTT PURPLE (P584) OS 3.830 C12 FD 8@250 RZ
4056606	BIT HQTT BLUE (P577) -R C16 FD TW 8@125<488 RZ
4056601	BIT HQTT GREEN (P520) -R C16 FD TW 8@125<488 RZ
4056671	BIT HQTT GREEN (P520) OS 3.830 C12 FD 8@250
4056608	BIT HQTT YELLOW (P575) -R C16 FD TW 8@125<488 RZ
4056607	BIT HQTT ORANGE (P580) -R C16 FD TW 8@125<488 RZ
4056602	BIT HQTT RED (P566) -R C16 FD TW 8@125<488 RZ

LONGYEAR™ BIT PART NUMBERS (continued)

PQ

PART #	DESCRIPTION
4056654	BIT PQ PURPLE (P584) -R C12 GT
4056655	BIT PQ BLUE (P577) -R C12 GT
4056328	BIT PQ BLUE (P577) -R C12 FD TW 10@125<548 RZ
4056560	BIT PQ BLUE (P577) -R C16 TW 10@125<548 RZ
4056656	BIT PQ GREEN (P520) -R C12 GT
4056504	BIT PQ GREEN (P520) -R C16 EX 10@250/275
4056561	BIT PQ GREEN (P520) -R C16 TW 10@125<548 RZ
4056674	BIT PQ GREEN (P520) OS 4.950 C12 GT
4056657	BIT PQ YELLOW (P575) -R C12 GT
4056327	BIT PQ YELLOW (P575) -R C12 FD TW 10@125<548 RZ
4056505	BIT PQ YELLOW (P575) -R C16 EX 10@250/275
4056390	BIT PQ YELLOW (P575) -R C16 TW 10@125<548 RZ
4056389	BIT PQ ORANGE (P580) -R C16 TW 10@125<548 RZ
4056479	BIT PQ RED (P566) -R C12 GT
4056387	BIT PQ RED (P566) -R C16 TW 10@125<548 RZ
4065439	BIT DHM HW R/P RED (P566) PQ S C31 BTFLY RZ

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PQ3

PART #	DESCRIPTION
4056464	PQ3 PURPLE (P584) –R C12 FD GT
4056285	BIT PQ3 BLUE (P577) -R C12 FD TW 10@125<548 RZ
4056563	BIT PQ3 BLUE (P577) -R C16 DD 10@313 RZ
4056396	BIT PQ3 BLUE (P577) -R C16 TW 10@125<548
4056701	BIT PQ3 GREEN (P520) -R C12 FD GT
4056595	BIT PQ3 GREEN (P520) S C12 DD 10@313 PINS RZ
4056564	BIT PQ3 GREEN (P520) -R C16 DD 10@313 RZ
4056395	BIT PQ3 GREEN (P520) -R C16 TW 10@125<548
4056057	BIT PQ3 GREEN (P520) -R C16 FD TW 10@125<548
4056675	BIT PQ3 GREEN (P520) OS 4.950 C12 GT RZ
4056284	BIT PQ3 YELLOW (P575) -R C12 FD TW 10@125<548 RZ
4056566	BIT PQ3 YELLOW (P575) -R C16 DD 10@313 RZ
4056393	BIT PQ3 YELLOW (P575) -R C16 TW 10@125<548
4056683	BIT PQ3 YELLOW (P575) OS 4.950 C16 TW 10@150<575 RZ
4056589	BIT PQ3 ORANGE (P580) -R C12 FD TW 10@125<548 RZ
4056567	BIT PQ3 ORANGE (P580) -R C16 DD 10@313 RZ
4056394	BIT PQ3 ORANGE (P580) -R C16 TW 10@125<548
4056282	BIT PQ3 RED (P566) -R C12 FD TW 10@125<548 RZ
4056303	BIT PQ3 RED (P566) -R C16 DD 10@313 RZ PINS
4056586	BIT PQ3 RED (P566) -R C16 TW 10@125<548

LONGYEAR™ BIT PART NUMBERS

PQTT

PART #	DESCRIPTION
4056501	BIT PQTT BLUE (P577) -R C16 DD 10@313 RZ
4056512	BIT PQTT GREEN (P520) -R C16 DD 10@313 RZ
4055940	BIT PQTT GREEN (P520) S C12 FD TW 10@546 TW
4056331	BIT PQTT YELLOW (P575) S C12 FD
4056532	BIT PQTT YELLOW (P575) -R C16 DD 10@313 RZ
4056511	BIT PQTT ORANGE (P580) -R C16 DD 10@313 RZ
4056529	BIT PQTT ORANGE (P580) -R C16 FD TW 10@125<548
4056326	BIT PQTT RED (P566) -R C16 DD 10@313 RZ PINS
4056531	BIT PQTT RED (P566) -R C16 FD TW 10@125<548
4056068	BIT PQTT RED (P566) -R C16 FD TW 10@125<548 PINS

Q is a trademark of Boart Longyear.

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 ½ 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:

- Suspend the rods with the hydraulic system in the lowering position.
- 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.
- 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.

OPERATING PARAMETERS (continued)

- The pressure applied to the bit multiplied by the area of the hydraulic cylinders gives the force or weight on bit.
- 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 large diamonds, some 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.
- Large diamond 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 form 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 large diamond 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 large diamond bits obtain maximum life and penetration using plenty of water.

OPERATING PARAMETERS (continued)

WATER FLOW (continued)

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 rpm/240rpm X 20.2 GPM = 7.5 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.
- Large diamond 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.

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, NQ-P	950	3,000	13	8,500	37	10	35	13	50
HQ, HQ-P	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
Q is a trademark of Boart Longyear.

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)

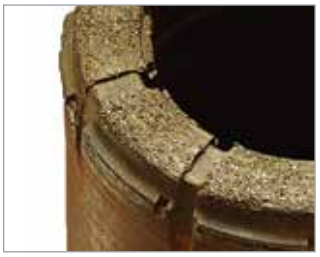
- **Cause:** Often caused by excessive penetration rate for the RPM used. This can also be caused by core grinding, overdrilling.
- **Solution:** Reduce penetration rate or increase RPM

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.

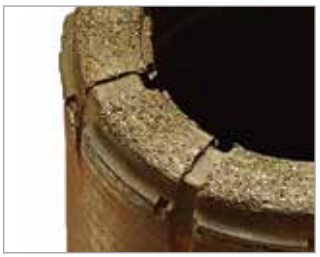
TROUBLESHOOTING (continued)



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

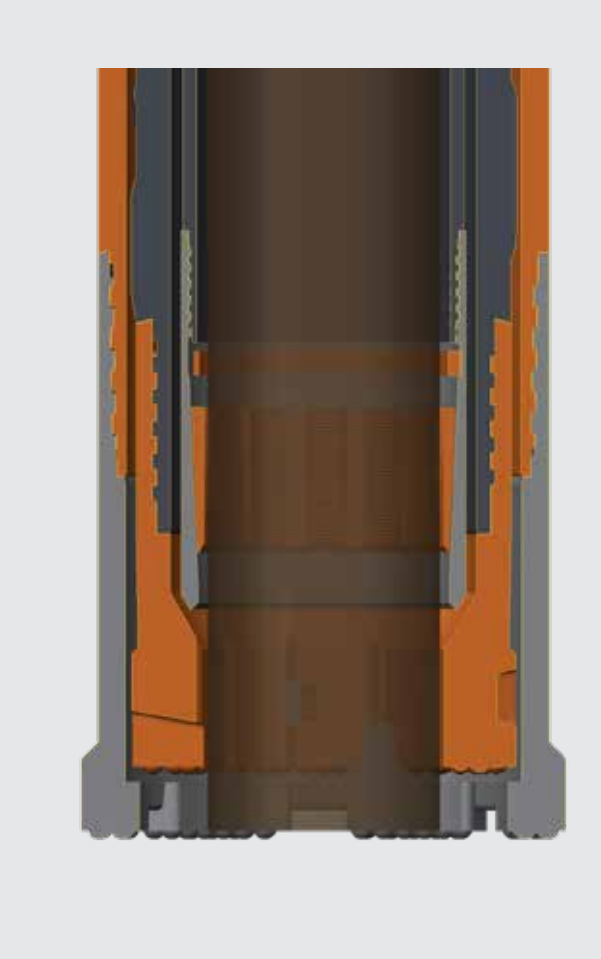
Cause: (A) Lack of fluid. (B) Too high of weight on bit being used

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


CHEETAH

CASING SHOES

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 6 mm 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

Boart Longyear™ casing shoes are designed for all exploration and geotechnical casing applications. The ability to drill faster with high penetration rates and outperform existing shoe technology in a wide range of ground formations make them ideal for anyone seeking a cost-effective alternative to their current shoe selection.

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.

CAS	NWT	PURPLE	S	C3	TTW RZ
1	2	3	4	5	6

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. Longyear formulas are designed cut faster and last longer while retaining an easy to use drilling behaviour. The CSUMX™ matrix has been designed to manage a wide variety of ground conditions including hard rock.

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 3 mm and 6 mm.

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

NQ/NRQ

PART #	DESCRIPTION
4055560	SHOE ROD NQ CSUMX R C3 TTW RZ
4056664	SHOE ROD NRQ PURPLE (P584) R C3 CS
4056665	SHOE ROD NXQ PURPLE (P584) R C3 CS
4055488	SHOE ROD NRQ CSUMX R C3 TTW RZ
4053260	SHOE ROD NRQ 09COM S C6 8@155

NW/NWT/HQ/HRQ/HXQ

PART #	DESCRIPTION
4056293	SHOE CAS NW PURPLE (P584) R C3 CS
4056623	SHOE CAS NW PURPLE (P584) OS 3.755 C6 TTW RZ
4055464	SHOE CAS NW CSUMX R C3 TTW RZ
4056621	SHOE CAS NWT PURPLE P584 R C3 TTW RZ
4056622	SHOE CAS NWT PURPLE (P584) OS 3.755 C6 TTW RZ
4055463	SHOE ROD HQ CSUMX R C3 TTW RZ
4055456	SHOE ROD HQ CSUMX OS 3.775 C6 TTW RZ
4053031	SHOE ROD HQ 09COM R 12@125
4056662	SHOE ROD HRQ PURPLE (P584) R C3 CS
4056663	SHOE ROD HXQ PURPLE (P584) R C3 CS
4055489	SHOE ROD HRQ CSUMX R C3 TTW RZ
4103835	SHOE ROD HRQHP 02 SPUD C4 0@000

Q, RQ, XQ, and UMX are trademarks of Boart Longyear.

HW/HWT*

PART #	DESCRIPTION
4055465	SHOE CAS HW CSUMX R C3 TTW RZ
4056659	SHOE CAS HW PURPLE (P584) R C3 CS
4055469	BIT CAS HW CSUMX OS 4.765 C6 TTW RZ
4056661	BIT CAS HWT PURPLE (P584) OS 4.765 C6 CS
4051320	BIT CAS HWT 02 R C5 8@125
4051001	SHOE CAS HW 02 R C3 8@125
4054954	BIT CAS HWT 02 NS 4.810 X 3.792 C5 18@125
4056197	SHOE CAS HWT PURPLE (P584) R C3 CS
4056198	SHOE CAS HWT PURPLE (P584) OS 4.765 C6 CS
4056642	BIT CAS HWT YELLOW (P575) 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

PW/PWT

PART #	DESCRIPTION
4056624	SHOE CAS PW PURPLE (P584) R C3 TTW RZ
4056625	SHOE CAS PW PURPLE (P584) OS 5.790 C6 TTW RZ
4056660	BIT CAS PWT BLUE (P577) OS 5.790 C6 CS
4052929	BIT CAS PWT 06 S C6 12@125
4056658	SHOE CAS PWT PURPLE (P584) R C3 CS
4056626	SHOE CAS PWT PURPLE (P584) OS 5_790 C6 CS
4055485	SHOE CAS PWT CSUMX R C3 TTW RZ
4055460	SHOE CAS PWT CSUMX OS 5.790 C6 TTW RZ
4052355	SHOE CAS PWT 02 R C3 12@125

REAMING SHELLS

REAMING SHELLS

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.

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.

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.

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

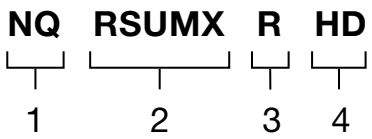
ABRASIVE DIAMOND IMPREGNATED PAD
Using rows of synthetic diamond and TSD pins, abrasive pads generate less torque in the hole than the equivalent RSUMX shell, while still producing long life.

DUAL PAD
Available in dual pad 10” configurations for straighter holes when deviation is a concern.

US Patent Nos. AU 2011379964; CA 2,784,916; CL 54.546; CN ZL201180074402.0; PE 7805; US 9,446,503; ZA 2014/03786.

REAMING SHELLS (continued)

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 A, B, N, H, and P.

2. REAMER TYPE
Reaming shells are available in the RSUMX and ABRbrasice pad styles.

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
4064363	SHELL AQTK ABR R DP

BQ

PART #	DESCRIPTION
4064589	SHELL AC BQ ABR R
4064555	SHELL BQ ABR R
4062922	SHELL BQ RSUMX R+
4063823	SHELL ROD BQ ABR R
4062858	SHELL BQ NO PADS

BQTK

PART #	DESCRIPTION
4064905	SHELL AC BQTK ABR R
4064170	SHELL BQTK ABR R DP
4064174	SHELL ROD BRQTK ABR R

Q, RQ, and UMX are trademarks of Boart Longyear.

NQ/NRQ

PART #	DESCRIPTION
4064590	SHELL AC NQ ABR R
4065050	SHELL AC NQ ABR OS 3.032
4065001	SHELL AC NQU ABR R DP
24901	SHELL NQ NO PADS
4064554	SHELL NQ ABR R
4064364	SHELL NQ ABR R DP
4065051	SHELL NQ ABR OS 3.032
4062562	SHELL NQ RSUMX R+
4063081	SHELL NQ RSUMX R+ HD
4062938	SHELL NQ RSUMX OS 3.032 HD
4064881	SHELL ROD NQ ABR R
4064272	SHELL ROD NRQ ABR R
4065668	SHELL ROD NXQ ABR R

HQ/HRQ

PART #	DESCRIPTION
4064591	SHELL AC HQ ABR R
25248	SHELL HQ NO PADS
4064556	SHELL HQ ABR R
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
4064882	SHELL ROD HQ ABR R
4064708	SHELL ROD HRQ ABR R
4065671	SHELL ROD HXQ ABR R

PQ/PHD

PART #	DESCRIPTION
4106245	SHELL PQ/HWT IMP A/C RMR NEXT
4064557	SHELL PQ ABR R
4062272	SHELL PQ RSUMX R+
4063923	SHELL PQ RSUMX R+ HD
4062925	SHELL PQ RSUMX OS 4.950
4063420	SHELL ROD PHD/HWT RSUMX R

SPECIALTY BITS

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.

HQ	PCD8	R	FD	NND	TP
1	2	3	4	5	6

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 8 mm (PCD8) or 13 mm (PCD13) PCD cutters or TSD 6 mm (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

PART #	DESCRIPTION
4065380	BIT NW PCD13 96MM R/P
4064605	BIT NQTK PCD8 R FD
4056632	BIT PQ PCD8 OS 4.950 12@200<400
1PTBVC/2	BIT PQTT TSD R FD
4062215	BIT PQTT PCD13 S FD 12 8MM PCDS NO ID WW'S

Q is a trademark of Boart Longyear.

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, drillers 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 x 50 x 7 = 5,600 lb
16 x 50 x 3.2 = 2 560 kg

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.

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.

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 BITS (continued)

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.

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. TOTAL CARAT WEIGHT
Boart Longyear discloses the total carat weight used, and more diamond weight generally means more life.

5. 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)

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

7. WATERWAY OPTION
Where applicable, waterway options are identified here.

Double angle (DA)
Face discharge (FD)

SURFACE SETS

PART #	DESCRIPTION
4011685	BIT NQ REC TAP 13.00CT SEL
4101745	BIT NQ3 25/35 SEL 24CT S 7STP
4101964	BIT PLUG N R/P 25/35 SEL 48CT NQ S BN
4011574	BIT HQ REC TAP 2.345 PLUG
4103760	BIT HQ 25/35 SEL 29CT S 6STP
4106105	BIT HQ3 15/25 SEL 26CT S 7STP
4101965	BIT PLUG N R/P 45/55 SEL 53CT HQ S BN
4106060	BIT PQ3 15/25 SEL 37CT S 7STP FD

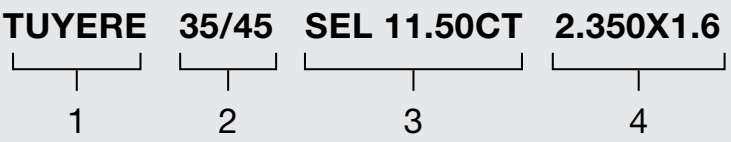
Q is a trademark of Boart Longyear.

TUYERE BITS

In many smelters, the blast furnace incorporates tuyeres (a nozzle through which air is blown into the furnace) to increase the efficiency of the blast furnace. These tuyeres are made of copper and are water cooled since the temperature directly in front of the them may be 3600°F to 4200°F.

When refractory bricks are replaced or smelters rebuilt, passages for these tuyeres need to be drilled through the brick. The following bits are designed for this application.

TUYERE 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. TYPE
All tuyere bits will have tuyere in the name.

2. SIZE
Bits are available in sizes to match the application.

3. DIAMOND SIZE, DIAMOND GRADE, AND TOTAL CARAT WEIGHT, OR FORMULA
Boart Longyear surface-set diamond bits are available in stone-per-carat configurations ranging for 6/10 to 25/35 SPC. Diamond Grade drives drill bit performance, life, and speed. Select (SEL): Best quality, processed natural diamonds. Standard (STD): Lower cost, partially processed drilling diamonds

4. OD AND ID SIZE
Boart Longyear bits are available in different OD and ID sizes.

TUYERE

PART #	DESCRIPTION
4062918	BIT TUYERE 7UMX 2.500 x 1.900 C9 6@125 BACK REAM RZ
4062630	BIT TUYERE 7UMX 3.000 x 2.369 8@155 BACK REAM
4018168	BIT TUYERE 35/45 SEL 11.50CT 2.350 X 1.6
4065479	BIT TUYERE 14/16 STD 14CT 2.500 X 1.640
4011608	BIT TUYERE 14/16 STD 11.50CT 2.500 x 1.895
4064647	BIT TUYERE 45/55 SEL 8.30 CT 2.938 x 2.537
4064646	BIT TUYERE 14/16 SEL 15.6CT 5.563 x 5.033

UMX is a trademark of Boart Longyear.

ACCESSORIES

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.

NQ/NQTK*/NQ3

PART #	DESCRIPTION
4101949	PLUG NQ CARBON TAPERED
4101845	PLUG NQTK 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

Q is a trademark of Boart Longyear.

SCRATCH TEST KITS

Scratch Test Kits, also known as hardness testers, are used both to help identify minerals and select bits for drilling applications.
The picks are made of metals and alloys of hardness values equal to 2 through 9 on Mohs' hardness scale. Because they are made of metal, they are easily ground to sharp points which will not break off and which can be easily sharpened, unlike traditional mineral picks.

SCRATCH KIT

PART #	DESCRIPTION
4065217	KIT, SCRATCH TEST

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.

BQ

PART #	DESCRIPTION
30002	BQ/LTK60 BIT & SHELL WEAR

NQ

PART #	DESCRIPTION
30001	NQ BIT & SHELL WEAR

HQ

PART #	DESCRIPTION
30000	HQ BIT & SHELL WEAR

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 lifer 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

WARRANTY (continued)

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.

(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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