Drillbits portfolio

2024

Transcend conventional drilling for seamless, end-to-end well construction solutions that catapult superefficiency

—Well Construction

Contents

SnapScan

Rapid dull grading and drilling record system

Features

- Available with iOS® and Android ®
- Cloud-based solution
- Powered by artificial intelligence and machine learning

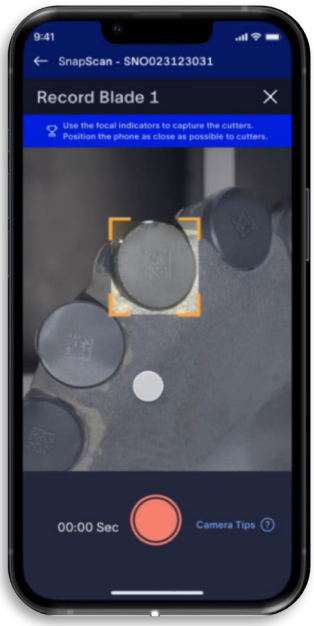
How it works

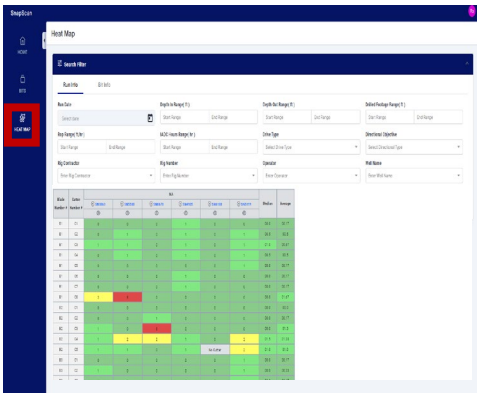
SnapScan™ application is trained on more than 20,000 images, which classify cutter primary characteristics into worn cutter, chipped cutter, broken cutter, spalled cutter, delaminated, bond failure, lost cutter, and others.

The photographic digital dull information is incorporated into workflows, enabling rapid improvement in cutting structure and cutter development life cycles with corresponding rapid improvements in drilling performance.

How it improves performance

SnapScan application delivers high-quality IADC dull grading through an AI mobile application and creates a personalized library of bit scans with a searchable database that is available for export. The application collects accurate cutter-by-cutter dull grade information and is connected to drilling metadata from a drilling records database, enabling drillers to make more accurate, more efficient business decisions. The application enhances bit selection when considering forensics data for objective PDC drillbit damage characterization and drives drilling performance.





Synapse

Performance insights and optimization service

Features

- Memory tortional vibration, three-axis acceleration, and rpm measurements at the bit
- Postrun data analysis for improved downhole understanding and drilling optimization
- Nonmagnetic assembly to prevent BHA interference
- Synthesized data delivery within 24 to 48 h
- Customizable burst mode

How it works

The Synapse™ performance insights and optimization service is a self-contained sensor module housed within the bit for true at-bit measurements. Its nonmagnetic assembly prevents interference within the BHA. And the memory-mode logging with optional preset sleep mode enables efficient acquisition of rotational speed, shock and vibration, and temperature data.

How it improves performance

Synapse performance insights and optimization service uses a memory-mode shock and vibration tool located inside PDC and roller cone bits. It provides postrun data to evaluate drilling system performance by measuring three-axis acceleration, torsional vibration, and rpm at the bit. This data is quickly processed and customized, per the customer's requirements to provide an improved understanding of downhole events and identify performance limiters. SLB experts can assess BHA drilling efficiency and deliver synthesized data within 24 to 48 h.

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Measurement	Range	Processing	Sampling Frequency
3-axial shock	-200 to 200 g_n	Rms, peak, and mean	800 Hz
3-axial vibration	-16 to 16 g_n	Rms, peak, and mean	800 Hz
Rpm	-666 to 666	Min., max., mean, and stick/slip	1,125 Hz
Torsional acceleration	-6,400,000°/s² to 6,400,000°/s²	Peak, mean	1,125 Hz
Temperature	–40 to 125 degC	Mean	1 Hz
Recording time	Up to 200 h		
Burst mode	10-min internal and 10-s duration		
3-axial shock			800 Hz
Torsional acceleration			1,125 Hz

AccuStrike

Short-makeup drill bit

Features

- Includes the shortest makeup length possible
- Facilitates efficient turning of steering energy into buildup rates
- Creates stiffness at the bit level to direct the BHA in the desired direction
- Enables lowers steering ratio where dogleg severity (DLS) achievement is possible
- Accommodates all drillbit technologies, including 3D-shaped cutters and Aegis™ 3D-printed armor

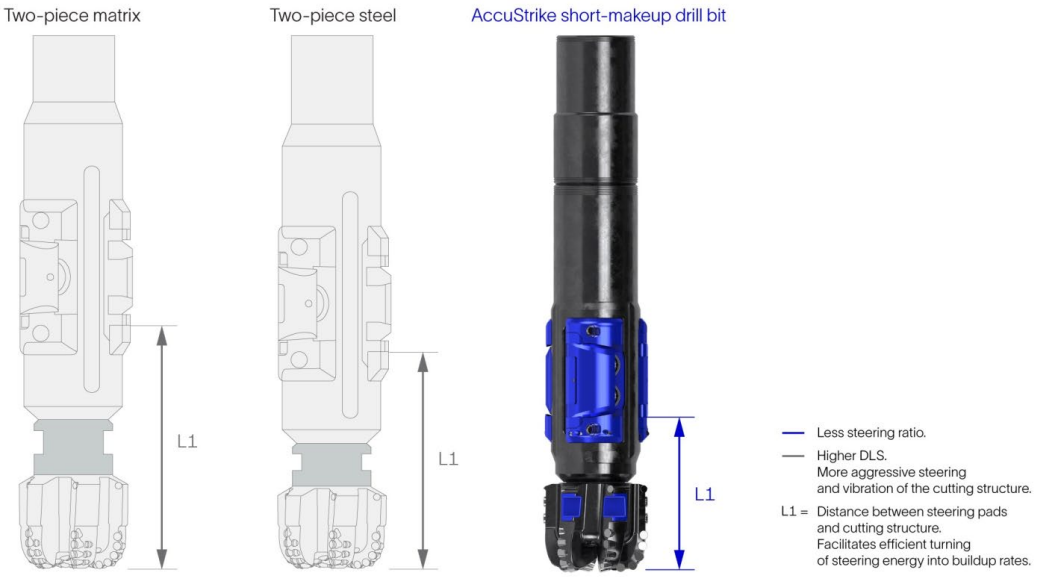
How it works

AccuStrike™ short-makeup drill bits reduce the distance between cutting structure and steering pads to efficiently direct the BHA in the desired direction and achieve high dogleg severity.

How it improves performance

AccuStrike bits help overcome challenges in curve sections of directional applications and achieve desired dogleg output to build planned well profiles. The drill bit delivers higher doglegs by reducing the distance between the cutting structure and steering pads on a rotary steerable system. AccuStrike short-makeup drill bits promote a more efficient drilling energy utilization delivering challenging directional objectives with accuracy and reliability.

In other sections of the well including vertical, build, tangent, and lateral, AccuStrike bits efficiently deliver the desired angle with less steering ratio.



Blade Family

PDC drill bits

Features

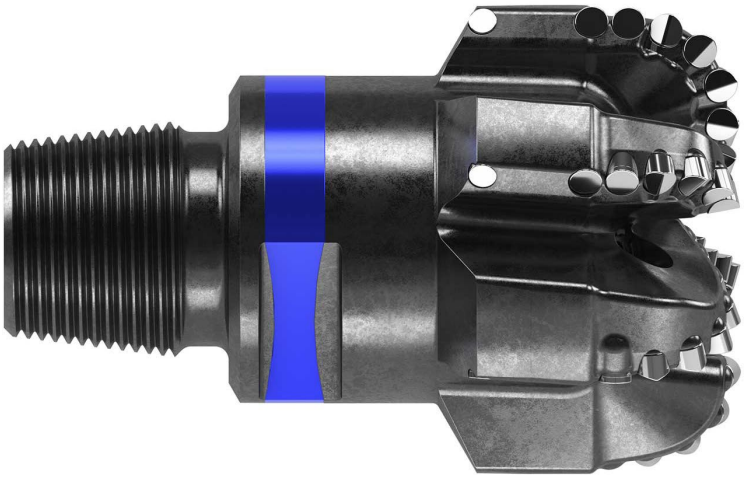
- Premium performance with superior durability
- Customized cutting structures
- Optimized hydraulics
- Application-specific enhancements
- Designed using IDEAS™ integrated dynamic design and analysis platform

How it works

The Blade family of PDC bits features continuous work and customer interaction to deliver better bit performance to customers' drilling challenges. By using sophisticated modeling tools and accounting for a multitude of dynamic variables in a virtual environment, the IDEAS platform moves bits through the design process much quicker while ensuring better reliability and performance than ever before.

How it improves performance

The customer-centric methodology for the Blade family PDC bits delivers application-specific solutions to drilling challenges. Whether it's two row of cutters on certain blades for bit durability and maximum ROP in abrasive formations or directional bits that produce less torque and stick/slip in transitional drilling, the Blade family of PDC bits is compatible with the extensive SLB cutting element portfolio. These cutting elements have extraordinary durability in all kinds of environments and enable runs that drill farther, faster, more responsively, with less bit runs.



Thermal-resistant diamond cutting element

Features

- Thicker diamond table
- Proprietary diamond table interface
- Improved thermal stability
- Increased durability

How it works

SLB developed the thermal-resistant diamond cutting element, a proprietary cutting technology with a thicker diamond table and engineered diamond table interface. The interface provides this cutting element with mechanical strength and durability. The cutting element also has a novel thermal stability against the tremendous heat that can approach 1,000 degC [1,832 degF] and shearing forces concentrated on the tip. This combination gives bits with thermal-resistant diamond cutting element better resistance to thermal degradation that causes cutter damage on other drill bits. These features improve drillbit rate of penetration (ROP) and its ability to drill to interval total depth (TD) in fewer or single bit runs.

How it improves performance

PDC bits with thermal-resistant diamond cutting elements save customers drilling time and reduce the need for costly bit trips. PDC bits with thermal-resistant diamond cutting elements effectively mitigate the effects of thermal degradation—cracking and chipping of the cutter surface—increasing durability, extending bit life, and improving overall bit performance.

Enduro 360

Rolling diamond cutting element

Features

- 360° revolution capability enables cutting element to stay sharper longer
- Number and placement of elements can be customized to maximize durability in bit cutting structure's high-wear areas
- No change in cutter size is required to integrate the element into any PDC bit cutting structure
- Element is available in 13-mm, 16-mm, and 19-mm sizes

How it works

The part of a fixed cutter's edge that engages the formation is subjected to mechanical and thermal effects that cause wear and chipping. Using a rolling cutting element increases durability by ensuring that the part of the element edge making contact with the formation is continually refreshed to stay sharper longer.

Precise positioning of Enduro 360™ rolling diamond cutting elements relative to contact with the formation, coupled with the bit's drilling force, drives efficient rotation of the Enduro 360 rolling diamond cutting element. Strategically positioned in the highest wear areas of a bit's cutting structure, the rolling cutting element's entire diamond edge is used to shear the formation.

How it improves performance

PDC bits with the Enduro 360 rolling diamond cutting element are proved to sustain run length increases of up to 57%, as compared with bits using fixed cutters. Ideal for abrasive environments and other drilling conditions that cause and accelerate PDC cutter wear, Enduro 360 element extends bit durability to deliver increased run footage and average ROP. In addition, the rotating action improves thermal dissipation, preventing concentrated heat buildup.

Stinger

Conical diamond element

Features

- Delivers high point loading onto the formation, fracturing hard-to-drill rock more efficiently
- Features a diamond layer that is twice as thick as that of a conventional PDC cutter, enhancing impact strength and improving overall bit durability

How it works

The Stinger™ conical diamond element's 3D geometry is optimized using finite-element analysis to model the precise point at which the element's tip contacts the formation. This ultrahigh concentration force, coupled with the element's thicker diamond table and state-of-the-art polycrystalline diamond blend, enables fracturing high-compressive-strength rock more efficiently for extended runs and faster ROP.

How it improves performance

PDC bits with the Stinger conical diamond element improve footage and ROP while maintaining greater toolface control and minimizing shock in challenging drilling applications that can cause impact damage to conventional bits. Bits with the Stinger element average a 55% increase in footage with a 30% increase in ROP compared with offset runs. Ideal for challenging drilling applications, including hard, interbedded, conglomerate, and chert and pyrite-inclusive formations, bits with Stinger elements significantly improve run footage and ROP, increase build rates with better toolface control, and enhance bit stability for BHA shock and vibration mitigation.

Axe

Ridged diamond element

Features

- Combined shearing and crushing actions to cut rock more effectively
- Thicker diamond table
- Ridge-shaped cutting geometry

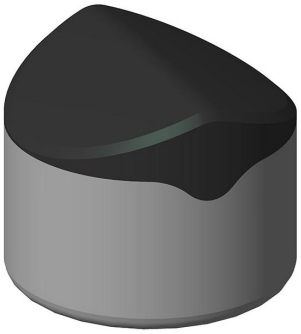
How it works

Axe™ ridged diamond elements feature a thicker diamond table on the cutter that increase cutting element durability and maintain desired ROP throughout the run. The ridge-shaped cutting element geometry reduces the cutting force requirement for less overall torque, less reactive torque fluctuation, and better toolface control.

How it improves performance

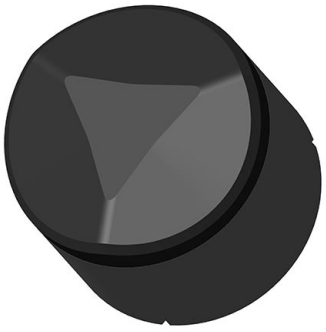
The crushing and shearing action of the Axe ridged diamond element achieves at least 22% deeper penetration to provide higher instantaneous ROP using the same weight on bit and rpm applied to conventional PDC cutters. The key is in the ridge-shaped geometry, which yields a diamond table that is 70% thicker than a conventional cutter while providing higher frontal impact resistance. This feature translates into improved durability and dull conditions for maintaining maximum ROP throughout the run.

The Axe ridged diamond element reduces the cutting force required by bits, translating to less overall torque, reduced reactive torque fluctuation, and better toolface control in curve applications. This advantage enables better build rates and higher overall ROPs, helping maximize production zone exposure and minimize drilling time.



Axe Ultra™
Ridged diamond element

Axe SR™
Scribe-ridged diamond element



Axe TR™
Triple-ridged diamond element

Hyper

Hyperbolic diamond element

Features

- Precision-molded diamond table with armored cutting edge
- Chip-breaking profile and hyperbolic shape

How it works

With hydrostatic pressures typically greater than 7,500 psi, plastic formations can be difficult to shear with a cutting element. The Hyper™ Hyperbolic diamond cutting element features an increased rake angle at the cutting edge, thus cutting up to 20% deeper into rock and increasing ROP.

Fixed cutters create long cuttings ribbons that lead to severe bit balling in soft and plastic formations. The hyperbolic shape and chip-breaking profile at the center of the Hyper element create small cuttings chips to mitigate balling and improve cuttings removal.

How it improves performance

A thick, precision-molded diamond table makes the Hyper element tougher and more durable, and the armored cutting edge withstands high-impact formation transitions. Because of the element's unique geometry, the bits with Hyper elements maintain steerability and directional tracking. Compared with conventional cutters, the Hyper elements require less vertical load and circumferential force to penetrate and shear rock, improving drilling efficiency and maintaining control. Bits with the hyperbolic diamond cutting element increase ROP by up to 21% on average in soft and plastic formations as compared with flat PDC cutters.

Strata

Concave diamond cutting element

Features

- Precision-molded diamond table with armored cutting edge
- Chip-breaking profile and hyperbolic shape

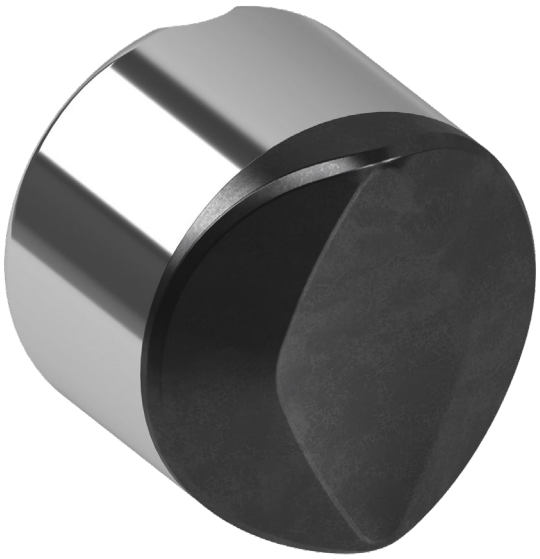
How it works

Strata™ concave diamond cutting element feature a distinctive concave shape that decreases the cutter back-rake angle to cut deeper into rock. It also forms into a tapered geometry with a thicker diamond table that significantly improves cutting efficiency and sustains a higher instantaneous ROP with the same input energy. For deep lateral wells where weight transfer to the bit is a challenge, the bits with Strata elements deliver better torque response at the bit for superior steerability and conformance to directional plans.

The thick diamond layer at the cutting tip and tapered profile toughen the cutting elements against chipping and breaking for increased durability.

How it improves performance

Bits with Strata elements increase ROP by up to 35% in medium strength formations as compared with flat PDC bits. The concave diamond element bit saves rig time and costs by delivering faster instantaneous ROP. It withstands impact damage in drilling through interbedded medium-strength formations with unconfined compressive strength (UCS) ranging up to 20,000 psi.



Aegis

3D-printed armor

Features

- Superior blade face and cutting element protection
- Shield against erosion caused by drilling fluid jetted from nozzles in the bit

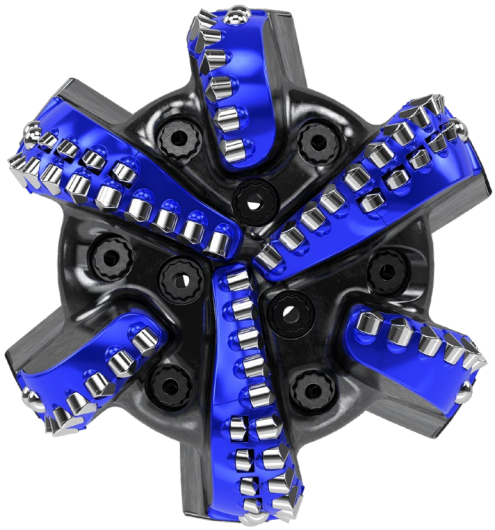
How it works

Aegis™ 3D-printed armor features individual strips applied to the blade face of steel-bodied bits that replace traditional hardfacing material.

Aegis 3D-printed armor extends the life of our steel-bodied bit designs because each strip is laser forged using electron beam melting. Constituent materials are heated to yield an alloy that provides an advanced armor cladding 400% more erosion resistant than traditional hardfacing and 40% stronger than matrix bit materials.

How it improves performance

Superior blade face and cutting element protection delivers not only more strength for aggressive bit designs—which improves overall bit performance on its own—but also better erosion resistance. This enables angling the bit nozzles toward the blades and cutting elements for more efficient cuttings evacuation enforced by drilling fluid flow. And that means faster ROP, more footage, and increased bit durability for longer runs.



NeoSteer CL

Curve and lateral at-bit steerable system

Features

- Application-specific SLB PDC bit design
- Nonmagnetic steering unit body
- Dual hydraulically activated pistons
- Inclination and azimuth closed loops to provide advanced automated tangent control
- Proprietary high-endurance-strength connector
- Near-bit measurements

How it works

The NeoSteer CL™ curve and lateral at-bit steerable system (ABSS) is specifically designed to enable drilling the curve and lateral in a faster single run where other methods require multiple trips. It achieves high build rates, increases on-bottom drilling speed and extends lateral lengths. Especially where vertical, curve, and lateral sections are the same hole size, the NeoSteer CL ABSS not only reduces NPT by eliminating the need to change out the BHA for every section, it also lowers CO_2 emissions.

How it improves performance

The NeoSteer CL ABSS includes comprehensive six-axis continuous inclination and azimuth measurements. The multiaxial component enables automatic hold inclination and azimuth (HIA) measurements for precise well positioning. This feature, along with self-steering capabilities, helps provide smooth tangents with minimized tortuosity. Near-bit extended-range gamma ray measurements provide additional well positioning data for improved real-time decision making.

- Gets to TD quicker by avoiding the postcurve trip
- Drills the curve and lateral sections with one BHA
- Provides increased reservoir exposure
- Attains a high build rate with effective geosteering
- Delivers a high-quality wellbore
- Streamlines completion with straight laterals

PDC bits

Nomenclature

PDC Bit Architecture	PDC Cutter Technology	Blade Count	Cutter Size	Features
B	X	6	16	S

Architecture	
N	NeoSteer™ at-bit steerable system
H	AccuStrike™ short-makeup drill bit
A	Aegis™ 3D-printed armor
B	Blade Family

Cutter Tech	
R	Enduro 360™ Rolling diamond cutting element
V	Strata™ Concave diamond cutting element
X	Axe™ Ridged diamond element
Y	Hyper™ Hyperbolic diamond cutting element
T	Thermal-resistant diamond cutting element
Z	Stinger™ Conical diamond element
F	FireStorm™ Wear-resistant high-impact PDC cutter technology

Blade Count
3
4
5
—
10
11
12

Cutter Size	
09	9 mm
11	11 mm
13	13 mm
16	16 mm
19	19 mm
22	22 mm

Features	
S	SHARC™ High-abrasion-resistance PDC drill bit
M	MDOC™ Depth-of-cut inserts
Z	Central Stinger
T	Integral sleeve
C	Nonstandard API connection
X	NeoSteer CLx™ Extreme curve and lateral at-bit steerable system

Xplorer

Premium roller cone drill bit

Features

- Tungsten carbide insert, milled tooth, and two cone drillbit options
- Dynamic twin-seal technology available
- Carbonate-optimized inserts available
- High-temperature seals available

How it works

Xplorer Gemini™ dynamic twin-seal technology features a primary seal that protects the bearings with a wear-resistant, dynamic face elastomer and a softer energizing material that exerts consistent pressure. A secondary seal protects the primary seal and guards against abrasive particles in the wellbore fluids that contact the bearing seal. A proprietary thermoplastic fabric is positioned on the seal's dynamic face to resist wearing, tearing, and heat damage.

The **Xplorer Shamal™** carbonate-optimized insert delivers maximum toughness for carbonate-based drilling operations around the world.

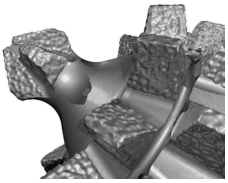
The **Xplorer Kaldera™** high-temperature seals feature specialized fabric compounds and a proprietary high-temperature grease formula to incrase seal life, lubricity, and load capacity for high-temperature applications.

TCT two-cone technology roller cone bits are designed with higher point loading, resulting in improved rock destruction.

How it improves performance

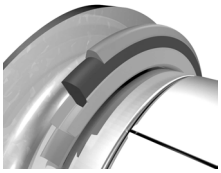
Xplorer premium roller cone drill bits deliver consistently superior performance in applications ranging from soft to ultrahard formations. These premium roller cone drill bits are armed with optimal cutting structures layouts bringing aggressiveness and robustness to enable higher rate of penetration at a lower cost per foot. Premium cutting structures, materials, and hydraulic options customize your application-specific bits for maximizing performance and durability in any environment.

Tungsten carbide insert drill bit

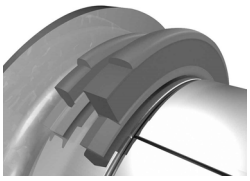


Milled tooth drill bit

TCT drill bit



Xplorer Kaldera high-temperature seals



Xplorer Gemini dynamic twin-seal

Roller cone bits

Nomenclature

Product Line	Bearing and Seal	IADC Code	Features
XR	G	417	S

Product Line	
XR	Xplorer
TCT	Two cone
MC	Monocone

Bearing and Seal	
none	Open or O-ring
G	Dual seal
F	Single premium seal
K	Geothermal

IADC Code
111
115
135
—
415
437
—

Features	
S	Xplorer Shamal™ Carbonate-optimized inserts
+	Premium hardfacing
A	Air applications
B, BD	Binary gage
OD, OD1	Diamond heel
D	Diamond gauge
DD	Full diamond cutting structure
R	Leg back protection with semi-round top (SRT) tungsten carbide inserts (TCI) on upper leg section and extending near full gauge
RD	Leg back protection with semi-round top (SRT) diamond enhanced inserts (DEI) on upper leg section and extending near full-gauge
PS	Leg back protection with SRT TCI on leg back region
PD	Leg back protection with DEI on leg back region

Specialty applications

Allegro XCD casing-while-drilling alloy bit

Features

- Unique bit body that can be drilled out by any standard PDC bit
- Large face waterways and junk slot areas
- Optional tungsten carbide coating

How it works

The Allegro XCD™ casing-while-drilling alloy bit is designed for drilling vertical or tangential wells to TD in one run. This PDC bit drills on standard casing that is rotated at the surface. The bit's sub is composed of durable oilfield-grade steel, while its body is made of a copper bronze alloy.
This unique alloy allows it to be drilled out by any standard PDC bit after the Allegro XCD bit has drilled to TD, and the casing has been cemented in place. The need for a dedicated drillout run is eliminated as the drillout PDC bit can continue drilling the next intervals.

How it improves performance

The SLB casing-while-drilling service improves well construction efficiency and coordination to better deliver your well. This approach not only provides a way to reduce the risks associated with wellbore instability, but it also greatly increases performance through time savings—both on the drilling and flat-time portions of the time-depth curve.

Casing while drilling minimizes annulus size as the casing rotates while cuttings are smeared into the borehole wall, sealing pores in the formation to reduce fluid losses and producing a stronger borehole for improved cementing.

Available Sizes

Application	Bit	Casing x Bit Size, in
Soft formations (<8,000-psi UCS)	XCD319	13⅜ × 17½
	XCD413	10¾ × 13½
	XCD416	9⅝ × 12¼
	XCD419	9⅝ × 12¼, 13⅜ × 17½, 18⅝ × 23, 20×23, 20×24
Medium formations (8,000- to 14,000-psi UCS)	XCD316	12¾ × 15½
	XCD416	9⅝ × 12¼
	XCD419	9⅝ × 12¼, 13⅜ × 17½
	XCD516	7 × 8½, 10¾ × 13½
	XCD519	16 × 18¼
	XCD616	13⅜ × 16, 13⅜ × 17½
Hard formations (>14,000-psi UCS)	XCD516	9⅝ × 11⅝, 9⅝ × 12¼
	XCD613	9⅝ × 12¼
	XCD716	9⅝ × 12

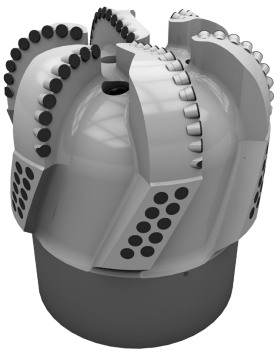
Nomenclature

Casing Size × Bit Size	Product Line	Blade Count	Cutter Size
9⅝ × 12¼	XCD	5	16

Product Line	
XCD	Allegro XCD casing-while-drilling alloy bit

Blade Count
3
4
5
6
7
7

Cutter Size
13 13 mm
16 16 mm
19 19 mm



Specialty applications

Concentric staged hole openers

Features

- Applications with high work rates
- Minimal stick-slip
- Maximum concentricity

How it works

The staged hole opener (SHO) is divided into four distinct sections.

Stage one: The pilot bit, either fixed cutter or roller cone, drills the initial hole diameter.

Stage two: The SHO pilot section consists of one or two rows of cutting structures to recondition the pilot hole and remove any swelling clays or moving halites. Gauge pads provide initial stabilization to reduce stick/slip, whirling, or off-center tendencies as the SHO begins the staged reaming process.

Stage three: The SHO pilot conditioning section includes a cutting structure designed to minimize work rates on each cutter position for maximum durability. By stress-relieving the formation with this intermediate stage, larger hole drilling can be done at a more aggressive ROP. The gauge pads and trimmers recentralizes the SHO.

Stage four: With the formation already stress relieved, the reaming section remains aggressive even in more competent formations. Gauge trimmers and spiraled gauge pads ensure good hole quality. Gauge pads in this section are kept short for directional responsiveness.

How it improves performance

The SHO cutting structures are engineered to ensure fast, smoothly drilled, high-quality, concentric hole opening under a wide range of application conditions. SHO tools are run successfully on rotary and rotary steerable assemblies in both straight and deviated holes.

Type	Size, in	Pilot, in
SHO719	26	22
SHOS516	24	20
SHO516	24	20
SHOS616	22	19½
SHO519	17½	12¼
SHOS616	17½	12¼
SHOS519	17	12¼
SHO716	16	12¼
SHO519	16	12¼
SHO519	14¾	12¼
SHO616	14½	10⅝
SHO519	14	11
SHO516	13½	8½
SHO519	12¼	8½
SHOS616	12¼	8½
SHO516	10⅝	8½
SHO616	9⅞	8½
SHOS516	8½	6⅛
SHOS516	7½	6⅛

Nomenclature

Product Line	Cutting Structure	Blade Count	Cutter Size
SHO	S	5	16

Product Line	Cutting Structure	Blade Count	Cutter Size
SHO Staged hole opener	S Backup cutters	5	16 16 mm
		6	19 19 mm
		7	

Specialty applications

Quad-D dual-diameter drift and drill reamer

Features

- Directional and BHA flexibility
- Drillout capability for eliminating trips
- Diameter control for full-gauge wellbore
- Compatibility in vertical and directional applications and variety of formations

How it works

Quad-D™ dual-diameter drift and drill reamer fulfills the two requirements of borehole enlargement—drift and drill—and provides hole opening below installed casing or liner sections. The drillout capability eliminates the need for a trip after drilling out the cement and casing shoe.

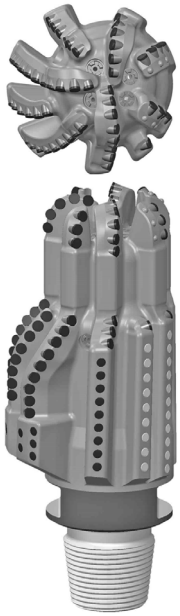
When a Quad-D reamer trips through casing, no part of the cutting structure comes in contact with the casing wall. This is achieved through the creation of a second gauge surface, the drift gauge. All cutters are strategically located inside the drift gauge surface, which is protected by tungsten carbide and diamond-enhanced inserts (DEIs). The placement of the reamer's drift axis is engineered to maximize drilling efficiency in both drillout and drill-ahead modes.

DEIs and carbide hardfacing provide maximum durability for maintaining pilot hole diameter and ensuring stability and hole integrity.

How it improves performance

Quad-D reamers are designed to provide durability, reduce torque response, maintain tangents, and reduce sliding time without compromising efficiency when drilling float equipment or formation.

The compact size of Quad-D reamers, along with spiral blades, a unique profile, and optimal gauge design, enables quick directional response, enhancing steerability.



Quad-D Reamer Specifications

Type	Size, in	Pilot, in
QDRS5216	20	16½
QDR5319	19	16½
QDRS5313	17½	14½
QDR5313	17	14½
QDR5316	16	14¾
QDR5313	14¾	12¼
QDR5213	14½	12¼
QDR5316	13¾	12¼
QDR5313	12¼	10⅝
QDR5313	10¾	9½
QDR5313	9⅞	8½
QDRS6313	7⅛	6⅝

Nomenclature

Product Line	Material	Pilot Blade Count	Reamer blades to full diameter	Cutter Size
QD	S	7	3	13

Product Line	Material	Blade Count	Cutter Size	Cutter Size
QD Quad-D Quad-D dual-diameter drift and drill reamer	M Matrix S Steel	3 4 5 6 7	3 4 5 6 7	13 13 mm 16 16 mm 19 19 mm

Specialty applications

Impax diamond-enhanced insert hammer bit

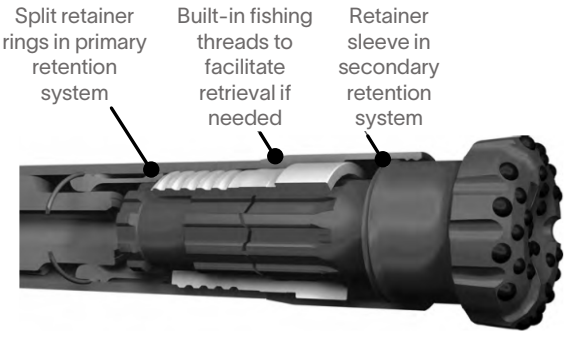
Features

- Hardened-steel guide sleeve
- Patented staggered adjacent-to-gauge (ATG) row cutting structure
- Dual retention system
- Available in 8-, 10-, and 12-in sizes

How it works

The Impax™ diamond-enhanced insert (DEI) hammer bit features a hardened-steel guide sleeve design that optimizes energy transfer between the hammer's piston and bit. The guide sleeve design also improves deephole drilling reliability by eliminating the plastic blow tube, which often causes conventional hammers to fail when they are subjected to shock, vibration, abrasive wear, high temperature, erosion, and misting.

Impax bits also have an improved air delivery system that features a patented floating feed tube designed to reduce wear and downtime issues related to wear on the piston and air delivery components. Because high back pressure, circulation volume, and water produced from misting and influx are major causes of hammer failure, the Impax bit's lower chamber has been designed to handle 10% to 20% more water compared with conventional hammers.



How it improves performance

The ATG row on a bit assists in cutting a portion of the outer hole, helping to reduce the load on the primary gauge row inserts. The unique bottomhole fracture pattern uses energy more efficiently and subjects the cutting structure to less stress. This increases gauge integrity compared with a conventional hammer bit. The reduced exposure to competent formation significantly improves overall bit durability while enhancing ROP potential.

Impax bits have tough and durable DEIs that increase the footage drilled and lower the cost per foot. These bits eliminate the need for reaming, extending the life of the subsequent bit and providing a high-quality borehole for running casing. In addition, three exhaust ports improve bit-face cleaning for longer life and better ROP.

When possible, a secondary air course is used to provide additional flow channels that enhance cuttings removal by providing greater flow area across the bottom of the hole. The efficient use of circulating air improves hole cleaning capabilities and reduces the regrinding of cuttings to maximize ROP.

Nomenclature

Product Line	Gauge Insert Count	ATG Insert Count	Features
H	12	09	D+

Product Line	Gauge Insert Count	ATG Insert Count	Features
H Hammer	08	04	C Carbide insert
	10	06	D DEI
	12	08	F Flat profile
	14	09	G Diamond on gauge
	15	11	M Modified profile
	18	12	N Nonretainable
			PD DEI gauge protection
			R Retainable
			V Concave profile
			X Convex profile
			+ ATG feature

Specialty applications

Kinetic diamond-impregnated bits

Features

- Optimized mix of inserts, cutters, and diamond-impregnated matrix
- Center-flow fluid distribution and precisely placed ports
- Ideal for higher rotational velocities

How it works

To optimize durability and ROP, these bits are built with grit hot pressured inserts (GHIs), PDC cutters, thermally stable polycrystalline diamonds, and diamond-impregnated matrix materials.

Kinetic™ diamond-impregnated bits use optimized materials to increase durability and performance in tough formations. Critical to achieving this performance are the GHIs. These inserts comprise a proprietary combination of diamond crystals and tungsten carbide matrix powder tailored to the material properties of the drilling application. Kinetic diamond-impregnated bits GHIs use a granulation process that ensure a uniform diamond distribution unattainable with conventional inserts. This process makes Kinetic diamond-impregnated bits GHIs more durable and able to drill faster for a longer period of time.

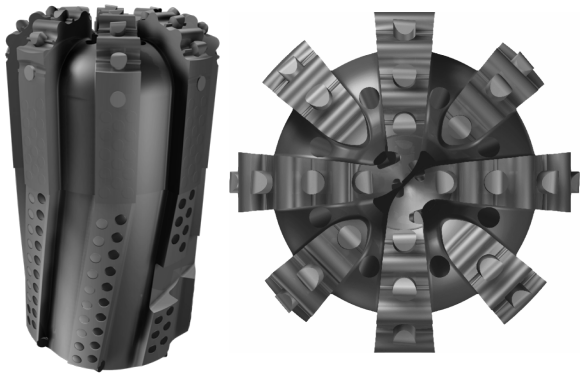
Kinetic bits use a combination of central flow fluid distribution and strategically placed ports to enhance bit cooling and cleaning. This feature is especially important when bits are used in softer formations.

Bit hydraulics enable effective drilling in a mix of lithologies at high ROPs and reduce the need to trip to change bit type.

How it improves performance

For tough, abrasive formations, Kinetic diamond-impregnated bits improve durability and ROP in the most rigorous drilling conditions. These bits can drill out float equipment and are also effective where softer formation is encountered or in overbalanced formations where drilling with conventional bits yields low ROP and footage.

The unique profile design of Kinetic bits is specific to the application and the drive system being used. The profile is tailored to optimize performance whether the Kinetic bit is run with a motor or on turbodrill.



Nomenclature

Product Line	Blade Count	Cutter Size
KH	7	13

Product Line	
K	Kinetic
H	Hybrid

Blade Count
5
6
7
—
12

Cutter Size	
13	13 mm
16	16 mm
19	19 mm