Baker Hughes

Vanguard

Premium tricone drill bits

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Foundation for performance

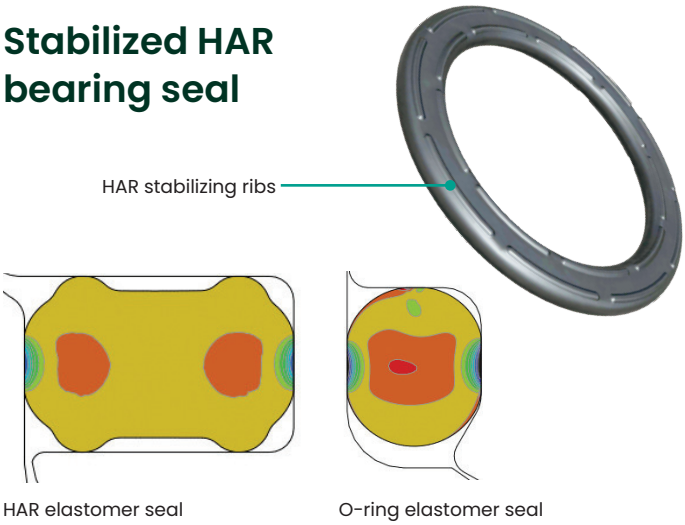
Vanguard™ tricone drill bit products mark the first use of stabilized high aspect ratio (HAR) sealed precision bearings. HAR elastomer seals are specially treated to reduce seal wear and increase protection against fluid infiltration. Also available are metal-sealed long-life bearings that provide added protection in high-speed and high-temperature applications. Engineers have the flexibility to choose the appropriate bearing seal option to suit any application need. Baker Hughes has been the leading drill bit provider for the global oil and gas exploration industry for over 100 years. These flagship tricone bits utilize next-generation technology with incredible versatility. Vanguard designs are predicated on balance between bearing, cutters, and body integrity. Drilling Application Review Team (DART) closely analyzes the application and selects the optimum combination of features to create the most efficient and durable bit for a specific formation. Essentially, the right bit for the right application.

The Vanguard advantage

Engineered cutters combine application-tuned carbide grades with aggressive tooth shapes for faster rate of penetration (ROP). Mathematical models improve cutter arrangements to reduce tracking and increase ROP. High-strength legs and enhanced outside-diameter (OD) protection prevent severe leg wear in directional applications. Elastomer parts rated for continuous service up to 550°F (288°C) temperatures are designed for hot-hole, high-temperature applications. These and more are the keys to maximum performance, whatever the application.

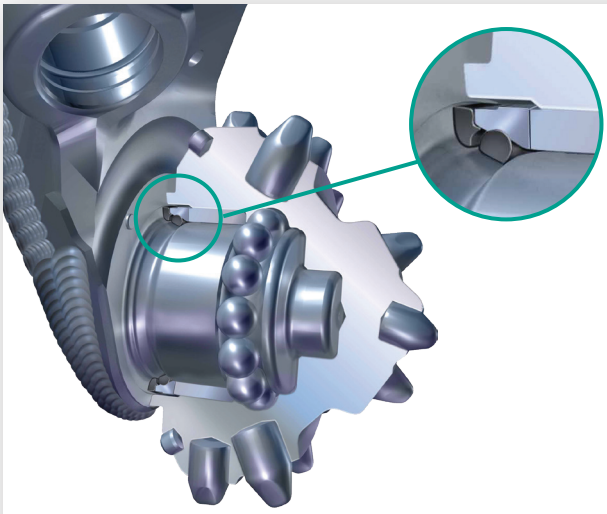
Vanguard bits transcend the expectations of the world's drillers. From the tough carbonate drilling of the Middle East, to delivering a quality hole in directional applications, or surviving long hours in a geothermal environment, Vanguard bits are setting new standards for performance and reliability.

Stabilized HAR bearing seal



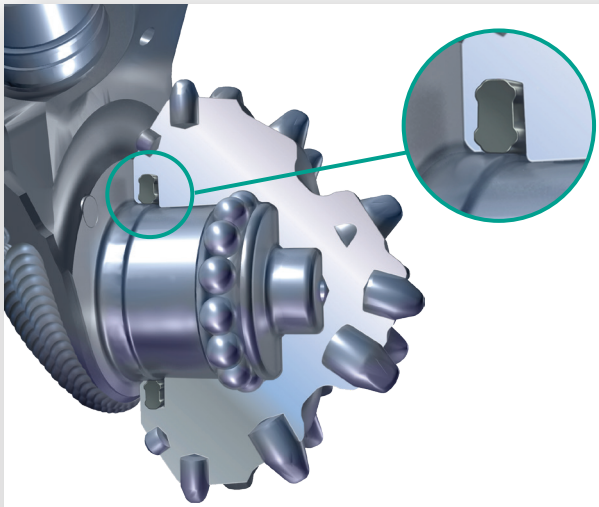
Thanks to their unique shape, HAR seals maintain greater sealing integrity than O-ring seals when subjected to identical drilling conditions. Their stabilizing ribs add to long seal life in all applications.

Vanguard premium features



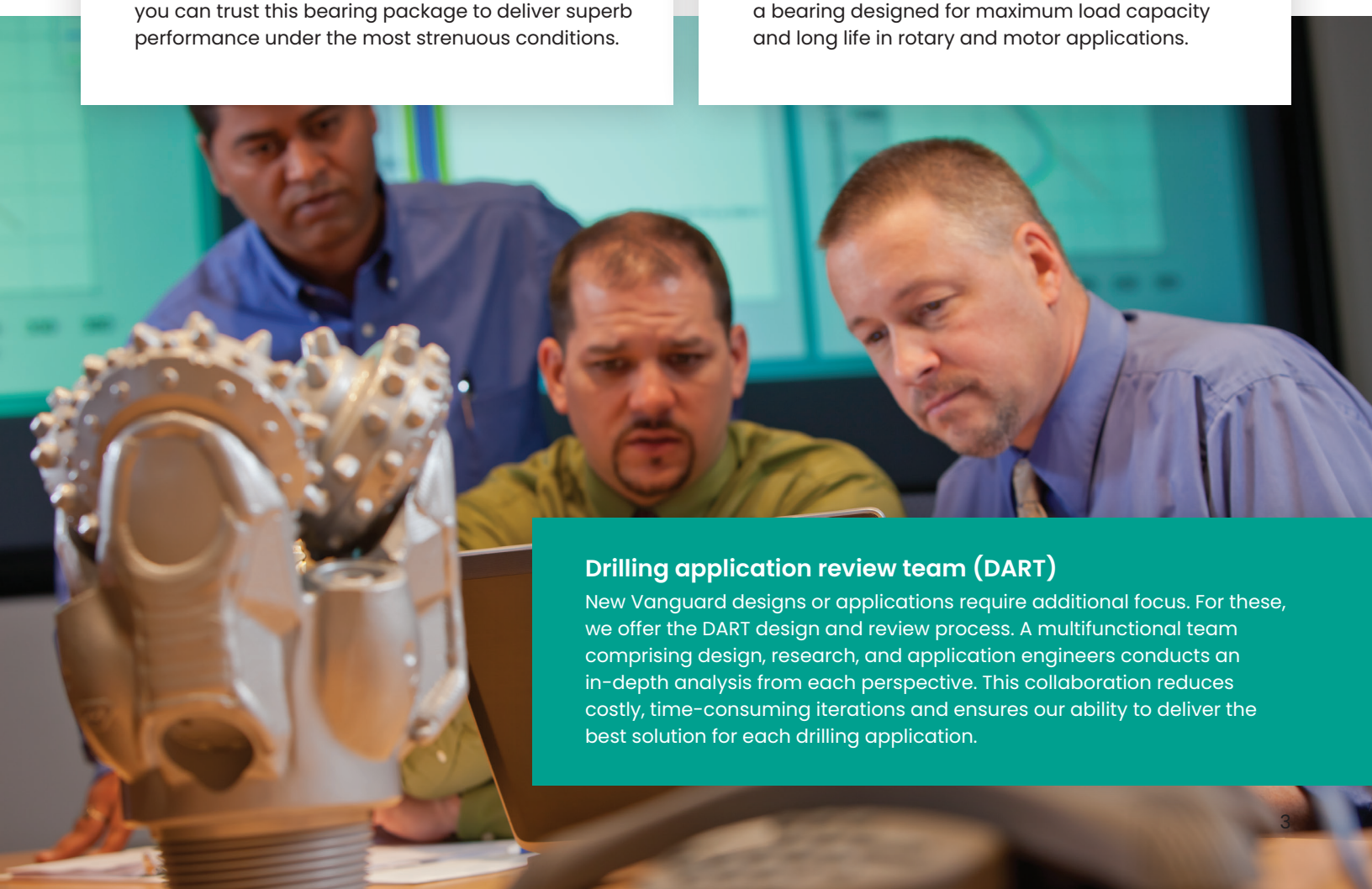
VM bearing package

Vanguard VM bits utilize the industry's most reliable bearing package for high-speed and high-temperature applications. Its unique metal-to-metal sealing system performs long hours under the most challenging conditions. With tighter tolerances, an advanced compensator/grease combination, and metal sealing surfaces, you can trust this bearing package to deliver superb performance under the most strenuous conditions.



VG bearing package

The Vanguard VG bearing is exceeding all industry standards. A newly improved High Aspect Ratio elastomer seal has been added to our field-tested precision bearing. This seal's unique geometry provides enhanced stabilization as it maintains optimum seal position within the bearing. The results–significantly lower heat and seal wear in a bearing designed for maximum load capacity and long life in rotary and motor applications.

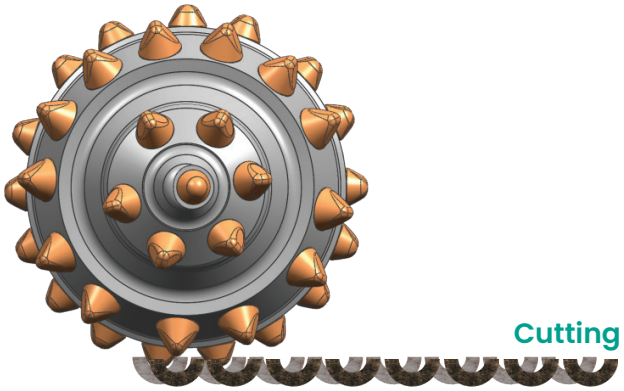


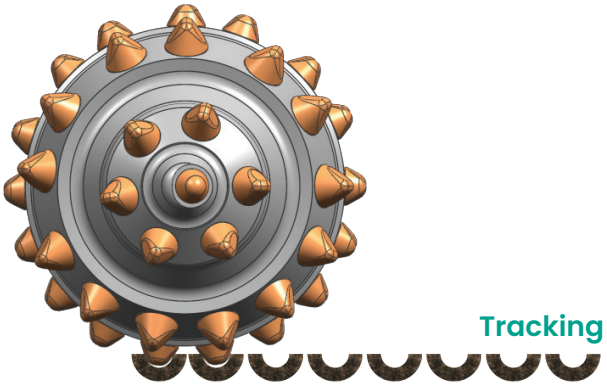
Drilling application review team (DART)

New Vanguard designs or applications require additional focus. For these, we offer the DART design and review process. A multifunctional team comprising design, research, and application engineers conducts an in-depth analysis from each perspective. This collaboration reduces costly, time-consuming iterations and ensures our ability to deliver the best solution for each drilling application.

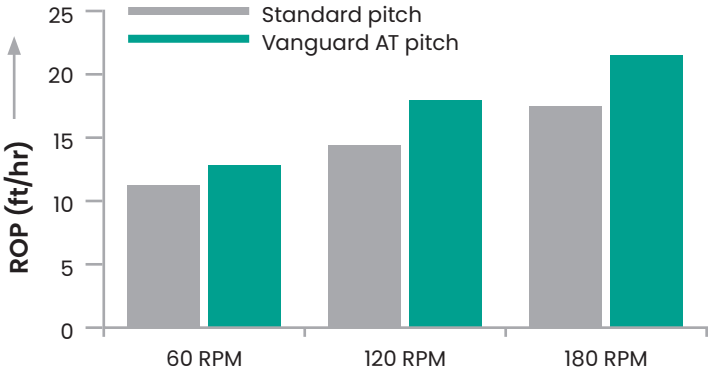
Computer-modeled cutter arrangements

Baker Hughes engineers use computer modeling to statistically improve resistance to tracking. Distance between inserts has been optimized to eliminate bit tracking, reduce cutter wear, and improve penetration rate. With these new mathematical tools, drillers receive more-efficient cutter arrangements designed specifically for their application.

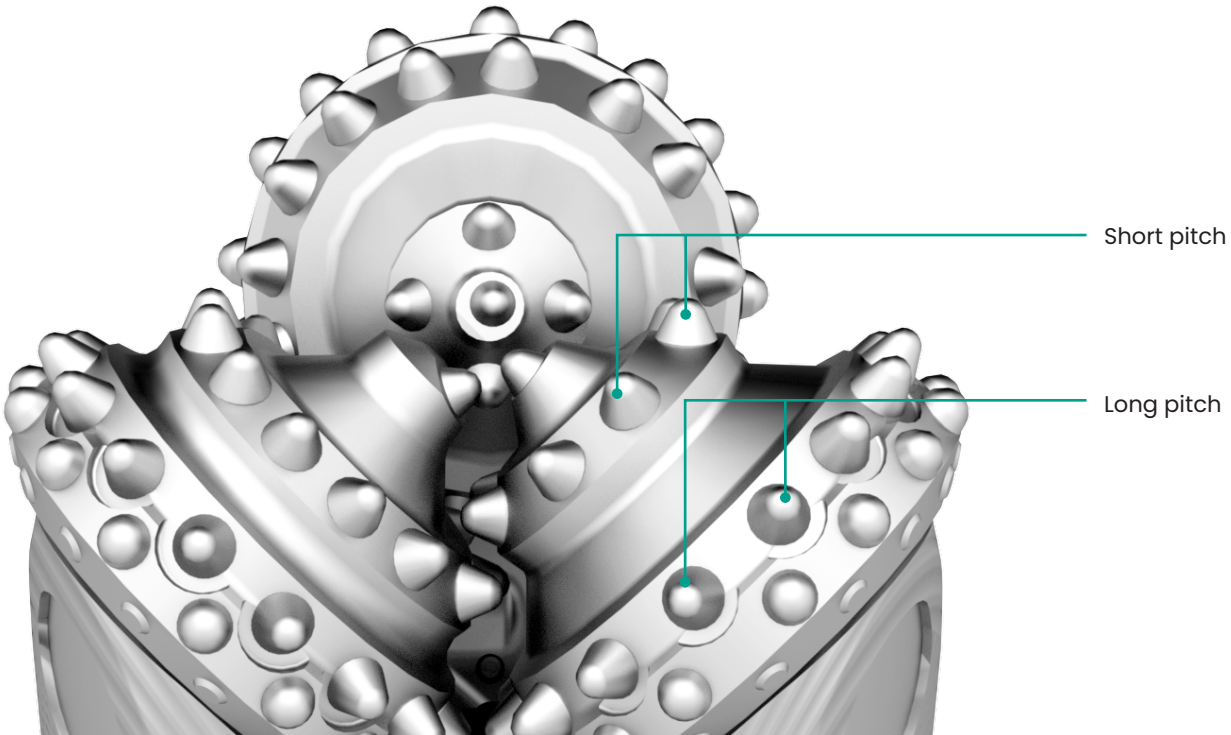




Laboratory testing



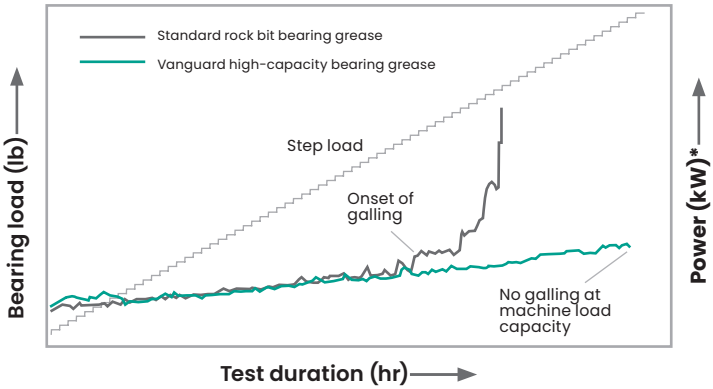
Two bits, differing only in cutter arrangements, were run in Carthage limestone at three different revolutions per minute (RPMs). At all speeds, the Vanguard bit, with computer-modeled cutter arrangements, consistently drilled at a higher ROP.



Superior bearing grease

All Vanguard bits utilize a high-viscosity bearing grease that increases the bearing's load-carrying capacity and ensures long bearing life.

Bearing grease lab testing



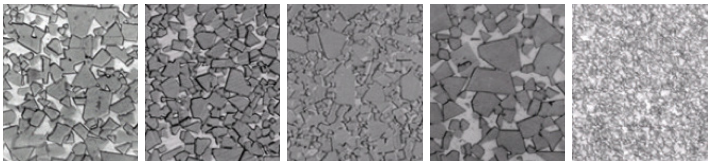
During a laboratory test, a bearing with standard lubrication initially seized after 23 hours and completely failed in 30 hours. A bearing with the new Vanguard grease ran to the test machine limits, running long hours without signs of high torque or the onset of bearing failure.

*Power-power required to rotate bearing. Relates to torque in bearing.

Advanced engineering in carbide grades and compacts

The DART team continuously designs, tests, and improves carbide grades to develop the best balance of fracture resistance and wear resistance for each application. Varying grain sizes and compositions of tungsten carbide crystals and cobalt yields different carbide grade material properties, and when matched with aggressive tooth shapes, extends bit life in application-specific runs.

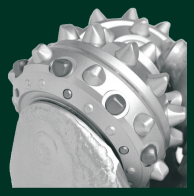
Application-specific variations of carbide grades



Shirttail and leg hardfacing

The patented STL and STLD shirttail packages are the industry's leading technology to strengthen legs and shirttails of tricone bits. STL and STLD technology is a field-proven answer for minimizing severe leg wear and also for ensuring superior bearing and seal protection in the most difficult applications.

Options

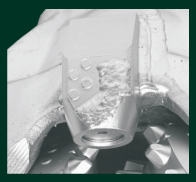


Vanguard diamond enhancement

For directional applications and highly abrasive formations, several Vanguard-exclusive diamond heel and gauge packages are available as an option.

Triple center jet

Three ports are positioned in the center of the bit. Center jets prevent bit balling and the associated reduction in penetration rate.



HighFlow extended nozzles

HighFlow extended nozzles can be added to maximize cuttings removal and improve penetration rates.

BOSS stabilization system

These unique integrated stabilizers provide near six-point contact with the borehole wall for unequaled stability and cutting structure protection.

OBM-resistant elastomer

Designed for oil-based mud, these elastomer materials dramatically reduce swelling and guard against drilling fluid infiltration.

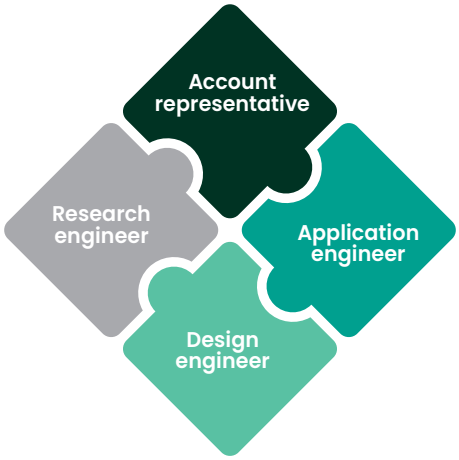
Premium performance

Technology

Bearings/seals
Lubrication
Cutting structures
Materials
Hydraulics
OD protection

+

Design process



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Solution

Nomenclature

Application

A – Arabia (Carbonate)
D – Directional
G – Geothermal
Blank – No specific sub line or steel tooth

Vanguard product line

V G D - 20

Seal type

G – Elastomer seal (HAR)
M – Metal-faced seal (SEMII)
X – Non-sealed (Geothermal)

Cutting structure

Options and nomenclature similar to existing lines

Case histories

HAR seal and improved carbide grades increase ROP and decrease drilling costs by 13%

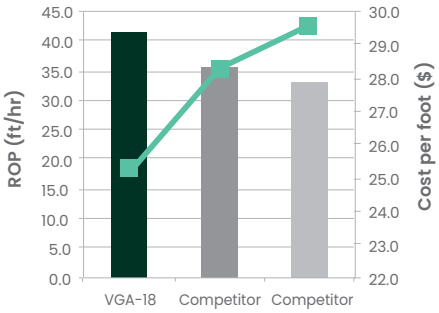
Bit: 6-in. VGA-18

Location: Raudhatain and Sabriya fields, Kuwait

Formation: Dolomite, nonabrasive carbonates

Challenge: Drill vertical interval at higher ROP while maintaining durability

Results: The 6-in. VGA-18 bit completed the interval at higher drilling speeds and saved 13% in drilling costs over 40 runs compared to competitor offsets. The operator was able to increase weight on bit (WOB) without sacrificing durability or seal integrity.



Vanguard slimhole design with enhanced elastomer seal provides best-in-class footage

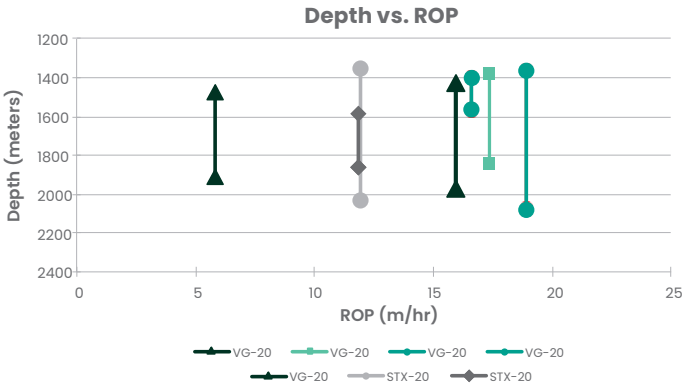
Bit: 6¼-in. VG-20

Location: Saskatchewan, Canada

Formation: Limestones, dolomite, and carbonates

Challenge: Increase footage and drilling hours in the Frobisher-Alida formation

Results: Application-specific slimhole configuration with enhanced elastomer seal drilled two intervals with a combined footage of 3,186 ft (971 m) and 108 hours.



Vanguard technology achieves 44% faster average ROP and 21% more footage compared to competitor offsets

Bit: $6\,{}^{1}/_{8}$-in. VG-44DX

Location: Alfalfa and Grant Counties, Oklahoma

Formation: Nonabrasive limestones and chert

Challenge: Increase footage and drilling speed in demanding Mississippi Chat lateral

Results: The $6\,{}^{1}/_{8}$-in. VG-44DX bit with improved carbide materials and novel cutting structure delivered the longest runs in the Mississippi Chat compared to competitor tungsten carbide inserts (TCI) runs. An average of 820 ft (250 m) was drilled at 29 ft/hr (9 m/hr) across 20 runs in the area.