

# Performance without compromise

## PermaFORCE elite PDC drill bit

PermaFORCE™ elite PDC drill bits are designed to enhance rate of penetration (ROP) for faster drilling, while maintaining durability to complete the interval. These bits reduce well construction costs by improving drilling performance in applications where traditional PDC designs compromise performance for durability.

### MAKE FEWER TRIPS WITH FEWER COMPROMISES

PermaFORCE elite PDC drill bits deliver both enhanced stability and durability—improving drilling performance in complex intervals and challenging formation transitions.

- New PDC cutters demonstrate increased abrasion resistance and thermal stability with greater resistance to impact damage
- Uniquely shaped PDC technologies deliver greater durability and maintain a sharp cutting edge—expanding the operating envelope in challenging formations
- An improved stability window protects the cutting structure from premature damage in a wider variety of operating conditions

### IMPROVE DRILLING SPEED AND EFFICIENCY

PermaFORCE elite PDC drill bits are designed to drill faster through different formations and destroy challenging rock types more efficiently than traditional PDC bits. Cutting structures can be tailored to the applications to:

- Increase ROP potential and drilling efficiency
- Improve stability response during formation transitions for reduced vibrations
- Enhance hydraulic efficiency with expanded junk slot volumes and optimized nozzle placement



Lancer™ shaped cutters enhance efficiency in tough formations.



CryoCut™ shaped cutters improve cutting life in hard, abrasive formations.

### APPLICATIONS

- Complex drilling environments, complex directional profiles, and lithologies
- More powerful BHAs and rigs with increased energy demands
- Extended-length laterals
- Formations causing lower ROP or multiple bit runs

### BENEFITS

- Enhanced performance in complex intervals
- Expanded operating envelopes
- Improved stability with less vibrations and smoother torque responses
- Increased ROP and improved hydraulic efficiency
- Predictable, reliable performance

## ENHANCE RELIABILITY UNDER EXTREME CONDITIONS











PermaFORCE elite PDC drill bits perform reliably under extreme operating conditions and can be run confidently in the most challenging applications.

We design and engineer our PermaFORCE bits using proprietary 3D Tetrahedron™ bit drilling simulation software. This allows designers and application engineers to:

- Analyze, predict, and optimize PDC designs by creating digital twins of the bit and the drilling environment
- Deliver a solution with fewer design iterations

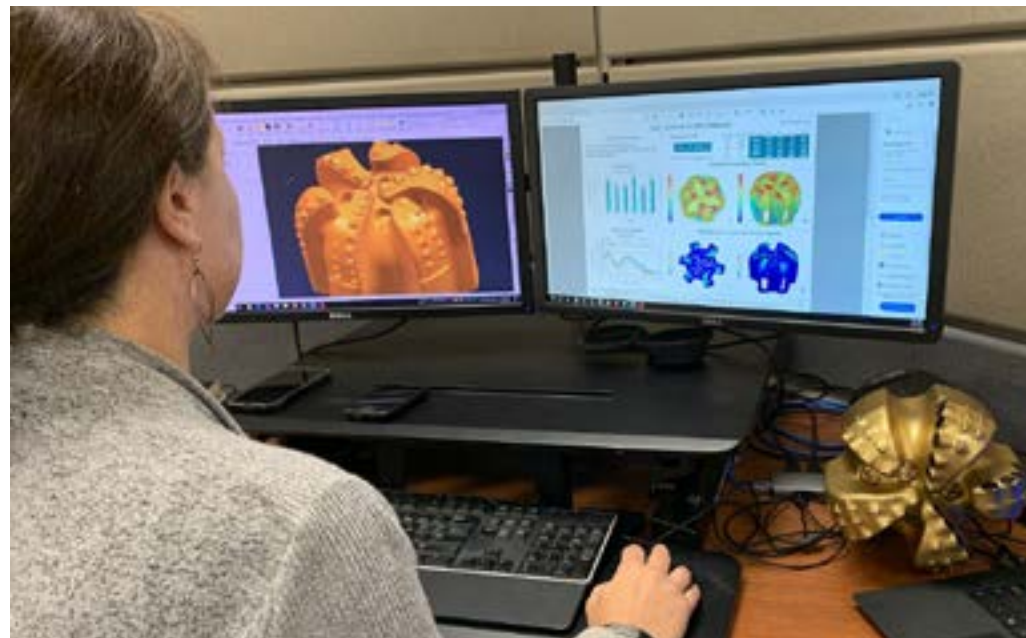
New matrix materials enhance the strength and wear resistance of the PermaFORCE drill bit body—improving performance under extreme conditions without compromising bit reliability.

Contact your local Baker Hughes representative to learn how PermaFORCE elite PDC drill bits can extend drilling efficiency and reliability in your most challenging formations.

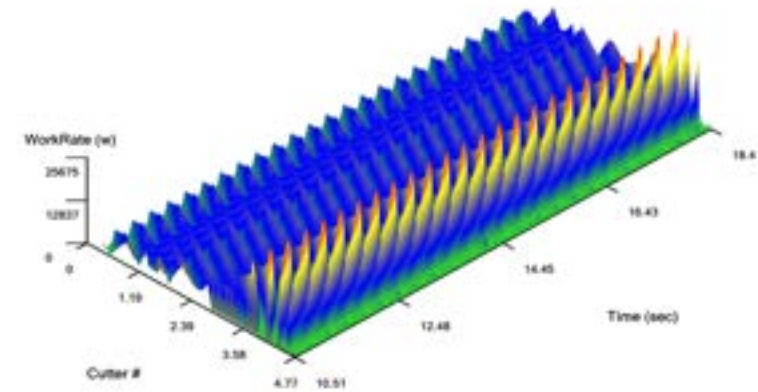
EXAMPLES OF CUTTER DAMAGE	CUTTER TECHNOLOGIES		FIELD RESULTS	
	Dynamus	PermaFORCE	Dynamus	PermaFORCE
<b>Breakage due to impact</b> 	IMPACT IMPACT	IMPACT		
<b>Mild abrasive wear with chipping and spalling</b>  	IMPACT GP*	IMPACT GP		
<b>Abrasive wear</b> 	ABRASION	ABRASION		

PermaFORCE cutters widen the operating envelope with greater abrasion and impact resistance compared to Dynamus bit cutters.

\*General purpose.



Baker Hughes field-based designers engineer solutions closer to customer operations.



This 3D cutter overload integrity risk plot highlights areas of highest cutter stress while drilling. Using this data, our bit design team adjusts cutter stresses to acceptable risk levels.

### Examples of optimized PermaFORCE PDC designs using the 3D Tetrahedron simulation software



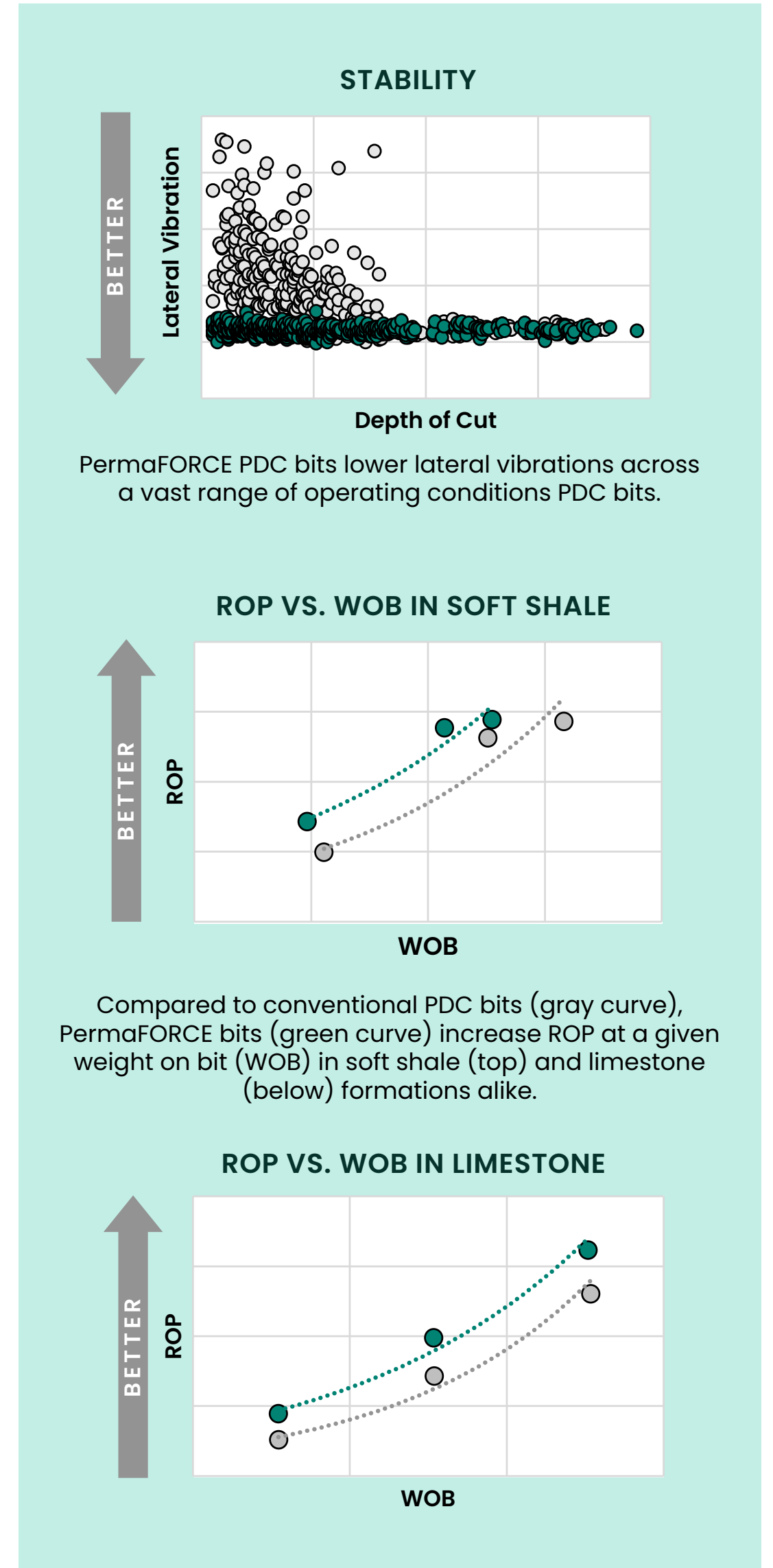
Design optimized for heavily interbedded formations



Design optimized for fast ROP in interbedded formations



Design optimized for hard, abrasive applications



# 3D TETRAHEDRON BIT DRILLING SIMULATION