Precision
DRILLING

Z-Torque

Stick Slip Mitigation Software

HIGH
PERFORMANCE
HIGH VALUE

Alpha™

Z-Torque

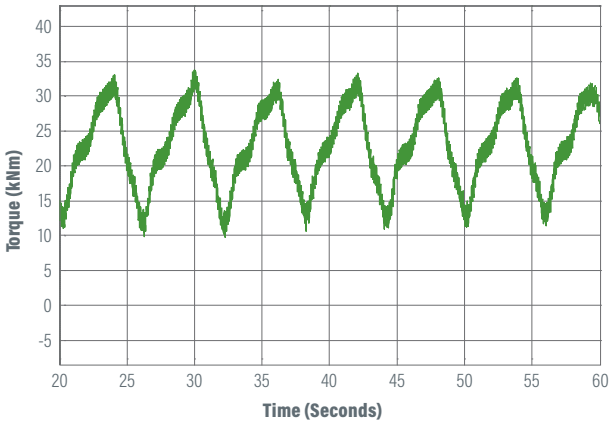
Reduce stick-slip with the latest Z-Torque technology interfaced into Alpha™

Stick-slip is when drilling stops and slips exhibiting a pattern caused by a discrepancy in imposed rotational speed and the actual speed of the bit below the surface resulting in axial and rotational vibrations which can cause:

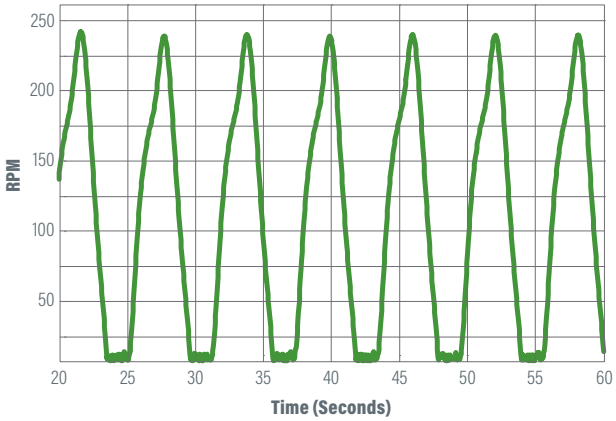
- Premature side cutter bit wear and tear or damage (*see Fig. 1*)
- Drill pipe fatigue
- Twist-offs
- Downhole equipment failure
- Reduced Rate of Penetration (ROP)

Fig. 1

Surface Torque



Downhole Revolutions Per Minute



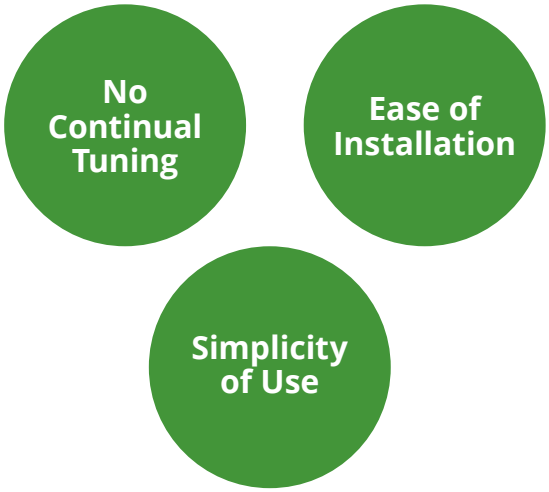
Z-Torque

BENEFITS

The **Z-Torque Alpha application** simulates a transformer matching the resistance of a power transmission line applied at multiple frequencies by controlling the top drive revolutions per minute to match the top drive impedance with the drill string. This reduces standing high-frequency electrical signals to help mitigate stick-slip vibrations.

Precision Drilling strives to achieve the highest quality drilling performance, and with Z-Torque we can mitigate multiple modes of stick-slips on our rigs.

Using the Alpha interface, drillers can adjust how intense Z-Torque performs, save settings for well plans, and more.



- **Diminishes the amount of downhole stick-slip (as seen on Fig. 2)**
- **Mitigates drilling dysfunction allowing for increased rates of penetration (ROP)**
- **Downhole vibrations are decreased minimizing the risk of unplanned trips**
- **Reduces drill pipe fatigue increasing drill pipe life**

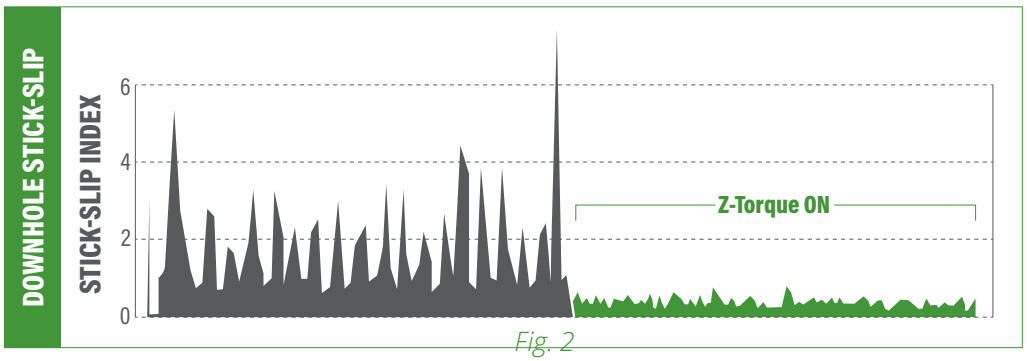
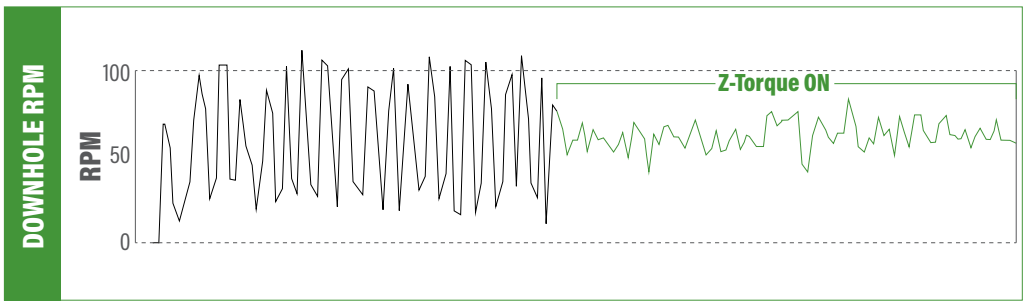


Fig. 2



Z-Torque

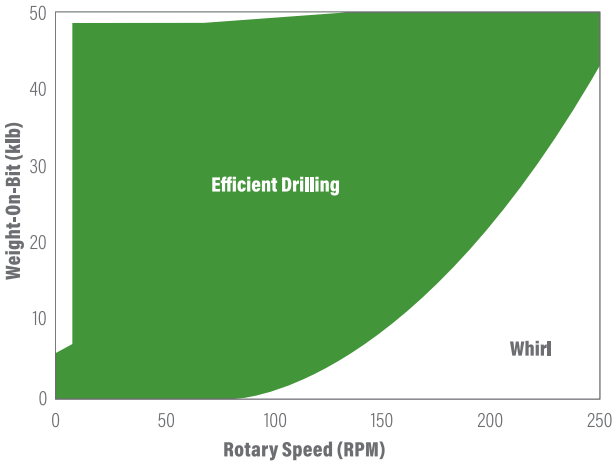
AN IMPROVED APPROACH[1] TO STICK-SLIP MITIGATION

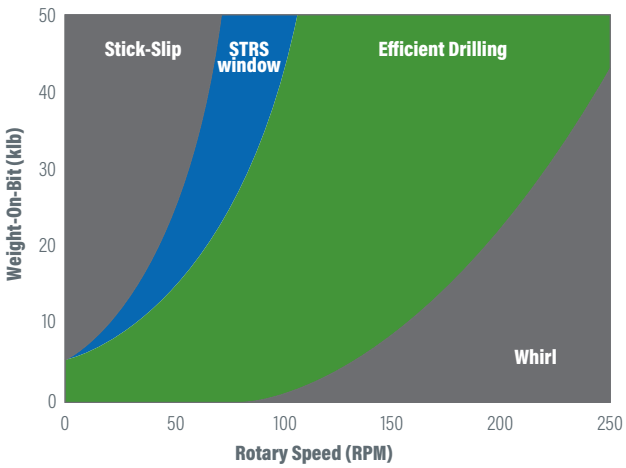
Conventional stick-slip mitigation systems like the SECOND ORDER INERTIA-STIFFNESS SYSTEM, uses a drill string model. It utilizes a modelled resonance frequency to dampen the torsional energy produced by stick-slips.

Z-Torque, on the other hand, uses wave guide impedance matching to address the problem eliminating the need for the drill string model. This allows the driller to focus solely on the top drive and drill pipe interaction.

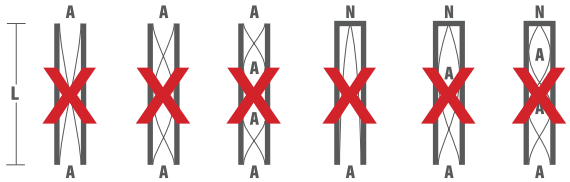
[1] *See Sicco Dwars (2015), MS SPE Conference Paper #173037, and, Sicco Dwars (2019) MS SPE Conference Paper #194108*

Z-Torque		CONVENTIONAL STRS
✓	Mitigates 1st stick-slip vibration frequency mode	✓
✓	Auto tuning	
✓	Targets multiple stick-slip vibration modes	
✓	Absorbs multiple stick-slip waves at the surface	
✓	Matches drive impedance to drill pipe impedance	
✓	Vibration frequency-independent	
✓	Expanded efficient drilling window	

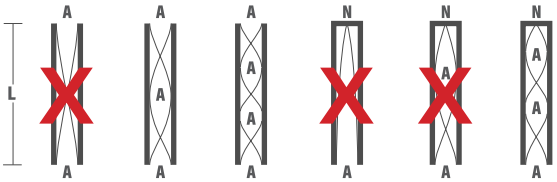




Z-TORQUE



CONVENTIONAL STICK-SLIP MITIGATION (STRS)



CALGARY
525 8th Avenue S.W., Suite 800
Calgary, Alberta T2P 1G1 Canada
403.716.4500

HOUSTON
10350 Richmond Ave., Suite 700
Houston, Texas 77042 USA
713.435.6100

www.PrecisionDrilling.com
info@PrecisionDrilling.com

Alpha™