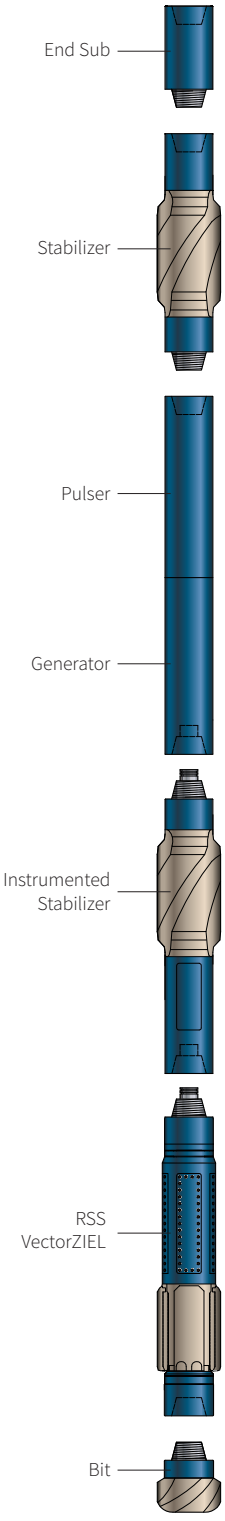
VectorZIEL Rotary Steerable System

The VectorZIEL™ rotary steerable system is an automatic steering tool for three-dimensional drilling. Offering higher ROP, improved cuttings removal, and precise trajectory control, the system helps you produce higher quality boreholes at reduced operational costs.

Based on a design that has been developed and refined over the past 20 years, the VectorZIEL tool offers reliable and precise directional control, even in the most demanding applications. The VectorZIEL tool is available for purchase or rental, and it's supported by NOV's global maintenance infrastructure, enabling directional drillers to offer high-tier directional drilling services around the world.

Key Features

- Integrated MWD system for real-time feedback while drilling
- Near-bit inclination, azimuth, and gamma measurements
- Closed loop trajectory control, which requires minimal intervention from surface
- Automated downlinking using surface downlink skid
- Can be combined with NOV's MWD and LWD tool portfolio for an integrated directional drilling and logging BHA



Technical Specifications

Operational Specifications	400	600	800
Hole size	6 to 6¾ in.	8½ to 9⅞ in.	12¼ to 13⅞ in.
Build-up rate	0 to 8.0°/100ft	0 to 8.0°/100ft	0 to 6.0°/100 ft
Max. operating torque	8,100 ft-lbf	11,000 ft-lbf	22,000 ft-lbf
Max. WOB	16,000 lbf	45,000 lbf	56,000 lbf
Max. RPM	250_{-1} min	250_{-1} min	250_{-1} min
Max. flow rate	290 GPM	530 GPM	1,060 GPM
Max. temperature	257/302°F (125/150°C)	257/302°F (125/150°C)	257/302°F (125/150°C)
Max. hydrostatic pressure	20,000 psi	20,000 psi	20,000 psi
Mud compatibility	Oil-based mud/water-based mud	Oil-based mud/water based mud	Oil-based mud/water based mud
Max. mud sand content (by volume)	1%	1%	1%
Rotary connections top connection (End Sub)	NC 38 box	NC 46 box	NC 56 box

Components of Bottomhole Assembly

Data receiving unit

Electro-hydraulic choke mechanism for downlink

Environmental Specifications

Vibration Test of PCB

Axes	**X, Y, and Z (orthogonal)**
Duration	**4 hours per axis (continuous)**
High-frequency test	
Level	**4.0-6.0g**
Frequency	**15 dB (1,000–10,000 Hz)**
	30 dB (10,000–100,000 Hz)
Low-frequency test	
Level	**20g RMS (random)**
Frequency	**10-500 Hz**

Temperature Test of PCB

Thermal soak	
Temperature	**125°C/150°C**
Duration	**120 hours (continuous)**
Thermal cycling	
Temperature profile	**120 minutes @ –20°C**
	120 minutes @ 125°C
Temperature ramp	**60 minutes (minimum)**
Number of cycles	**25**

Shock Test of RSS-Tool

Drop test	
Axes	**X, Y, and Z (orthogonal)**
Height of drop	**18in. (0.4572 m)**
Number	**10 drops per axis**
Air hammer test	
Axes	**X, Y, and Z (simultaneous)**
Frequency	**50–100 Hz**
Duration	**12 hours (continuous)**

Pressure Test of RSS-Tool

Pressure soak	
Temperature of water	**99°C (not boiling)**
Pressure	**600 bar / 1,400 bar**
Duration	**72 hours (continuous)**
Pressure cycling	
Temperature of water	**70°C**
Pressure profile	**1 bar for 5 minutes**
	14 bar for 30 minutes
	600 bar for 30 minutes
Number of cycles	**10**

Specifications of MWD System

Inclination	
Sensor	**X-, Y-, and Z-axis accelerometers**
Accuracy	**± 0.1°**
Raw data to surface	**G_x, G_y, G_z**
G_{tot} Quality check tolerance	**± 0.005 g**
Direction	
Sensor	**X-, Y-, & Z-Axis Magnetometers**
Accuracy	**± 1.0°**
Raw data to surface	**B_x, B_y, B_z**
B_{tot} Quality check tolerance	**± 0.3 µ T**
Dip angle quality check tolerance	**± 0.5°**
Logging	
Logging capability	**Gamma sensor**