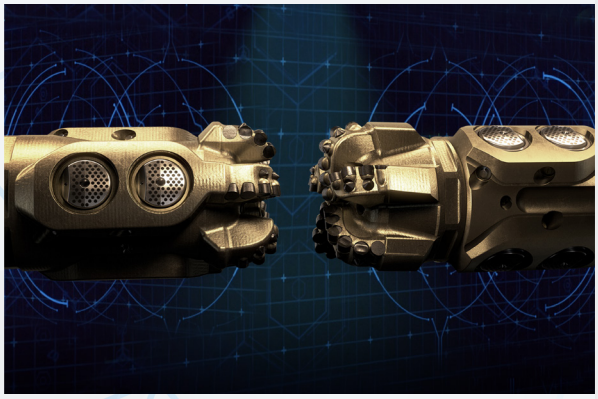
NeoSteer CL

Curve and lateral at-bit steerable system



APPLICATIONS

- Pad and batch drilling operations
- Horizontal wells with long lateral sections
- Wells requiring high build rates and high dogleg severity (DLS)
- Unconventional wells

BENEFITS

- Enables single-run drilling of vertical, curve, and lateral sections with a single BHA
- Achieves high build rates while meeting lateral length requirements
- Improves control and reaction time
- Lowers overall well tortuosity by leveraging closed-loop automation

FEATURES

- Application-specific Smith Bits PDC cutting structure
- Dual hydraulically activated pistons
- Hold inclination azimuth (HIA) closed loops to provide advanced automated tangent control
- Proprietary high endurance strength connector
- Near-bit measurements including
  - Inclination
  - Azimuthal
  - Gamma ray
  - Azimuthal gamma ray
  - HD surveying

The NeoSteer CL* curve and lateral at-bit steerable system (ABSS) is specifically designed to enable drilling the curve and lateral in a single run. It enables achieving high build rates and extended lateral lengths without compromising ROP. Especially where vertical, curve, and lateral sections are the same hole size, the NeoSteer CL ABSS reduces NPT by eliminating the need to change out the BHA for every section.

The NeoSteer CL ABSS uses piston technology to push against the borehole wall for propulsion; the pistons are placed next to the cutting structure for greater curvature leverage. The NeoSteer CL ABSS uses this leverage to achieve higher build rates with no additional application of hydraulic force. This provides the ability to meet both the build requirements in the curve section and the directional control requirements in the lateral section.

The NeoSteer CL ABSS steering unit incorporates metal-to-metal hydraulic seals which reduce erosion and increase hydraulic design capability for improved performance. In addition, the ABSS can be adapted with XPC* extreme-profile single shoulder connections to increase reliability during high-DLS drilling. These connectors also enable compatibility with Smith Bits PDC application-specific cutting structures. The NeoSteer CL ABSS and customizable bits work in concert to provide single-run drilling with greater drilling efficiency.

MULTIAXIS MEASUREMENTS AND AUTOMATIC TRAJECTORY CONTROL FOR ACCURATE WELL PLACEMENT IN SHALE AND UNCONVENTIONAL WELLS

The NeoSteer CL ABSS includes comprehensive six-axis continuous inclination and azimuth measurements. The multiaxial component enables automatic 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.

AZIMUTHAL IMAGE GAMMA RAY FOR IMPROVED STEERING IN THE CURVE AND LATERAL SECTIONS

The NeoSteer CL ABSS can be configured with an onboard azimuthal image gamma ray cartridge to improve in-zone percentage and enable steering within the reservoir sweet spot. With an azimuthal gamma ray cartridge just 6 ft behind the cutting structure, operators can identify signs of changing lithology earlier to enact instant steering corrections.

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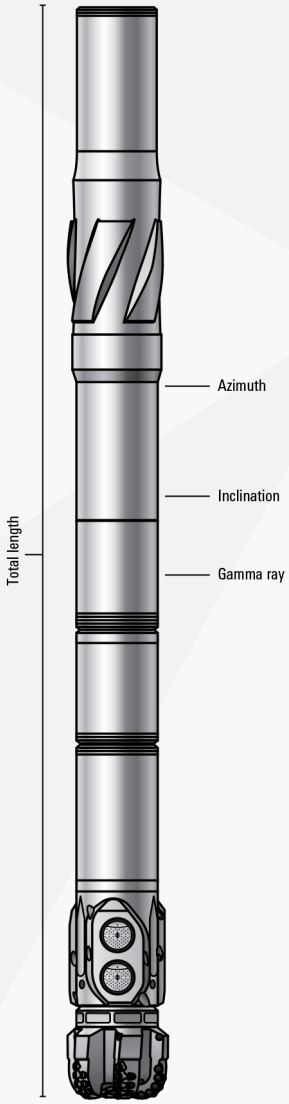
SPECIFICATIONS		NEOSTEER CL AB55
Nominal OD (API)		6 3/4 in
Hole size		8 1/2 in
Overall length		13.92 ft
Weight of assembly in air		1,464 lbm
Max. collar dogleg	Sliding Rotating	16°/100 ft 15°/100 ft
Max. operating torque †		16,000 ft.lbf
Max. operating load		1,100,000 lbf
Max. weight on bit		As per cutting structure specifications
Max. lost circulation material		50 lbm/bbl medium nut plug
Flow range ‡		210 - 970 galUS/min
Max. cumulative shock count		200,000 > 50 gn
Max. peak shock		250 gn
Max. rotational speed		350 rpm
Max. temperature §		302 degF
Max. hydrostatic pressure		20,000 psi
Recommended pressure drop across bit		300 - 1,200 psi
Mud sand content		1% by volume
ROTARY CONNECTIONS		
Collar upper connection		4½ IF box
Bit box		Bit cutting structure is incorporated into the tool
SPECIFICATIONS		**NEOSTEER CL AB55**
Bit face to gamma ray ††		6.23 ft
Bit face to accelerometers ††		7.16 ft
Bit face to magnetometers ††		9.25 ft
Inclination accuracy		0.11 (at 1 sigma level)
Azimuth accuracy		1.8 at 90° inclination (at 1 sigma level)
Gamma ray accuracy, azimuth 4-quadrant		±5% (30 - s averaging window)
Shock detector threshold, radial		50 gn ±5 gn (±500 gn max peak)



Engineered BHA and bit design is required to deliver optimal system performance.
Reference point for the pistons is the welded connection between the bit and tool body.
† Depending on weight on bit (WOB).
‡ Depending on mud weight values.
§ Optional 350 degF [175 degC] available.
†† Measurements will vary slightly depending upon the cutting structure used.