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Advanced PDC design extends durability and speed

Extensive field testing verified the design, with the Diamond Edge series producing longer runs and showing exceptional post-run conditions.

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Varel International has introduced its patent-pending polycrystalline diamond compact (PDC) bit series, Diamond Edge, for hard rock and transitional drilling applications.

Challenged with applications that called for increased blade and cutter counts as well as high penetration rates, bit designers looked for ways to exploit the speed of a *single* set bit with the durability of a *plural* set design.

To develop a solution, Varel designers studied the cutting structure wear predictions using SPOT, Varel's proprietary virtual drilling simulator. They examined the tendencies of the cutting structure and how the penetration rate of the cutting structure was affected when encountering formation transitions while drilling. To control the detrimental effects of bit vibration during transitions, an asymmetrical blade cutting structure was used. Precisely defined plural blades added durability and stability to the design without reducing rate of penetration (ROP). This produced a bit that operates with the speed of a lighter set bit and also has the ability to react to changing formations and perform as a heavier set design.

In one tight gas application in Desoto Parish, Louisiana operators required a bit to drill the Hosston/Travis Peak and Cotton Valley formations with interbedded shales, sandstones, and limestones.

Varel recommended the 9⅞-in. DE713PUX, a seven-blade Diamond Edge PDC bit. The bit drilled the interval at 20.3 ft/hr (6.2 m/hr), moving through 1,602 ft (488 m) and drilling down to 9,772 ft (2,978.5 m) including more than 270 ft (82.3 m) of the Cotton Valley formation. The post-run analysis indicated only slight wear to the lower part of the bit shoulder with the main cutting structure remaining completely intact.

Combined local offsets drilled an average of just 577 ft (176 m) at 15.9 ft/hr (4.8 m/hr) with the best competitive offset performing slightly above average, drilling 844 ft (257.3 m). The post-run analysis of this competitive bit indicated there was no diamond remaining on the inner two-thirds of the bit radius; a failed cutting structure that drilled substantially less footage than the Diamond Edge bit.

Estimates of interval costs per foot showed a potential savings of up to US $124.30/ft ($407.83/m) when using the Diamond Edge series, equaling a potential savings of more than $199,000 per interval drilled.*

The post-run analysis of the 9⅞-in. DE713PUX Diamond Edge bit confirmed the durability of the cutting structure in the Haynesville shale. (Image courtesy of Varel)

Permian Basin

The lithology of New Mexico's Permian basin is composed of extremely hard, heterogeneous formations. Drillers often still use a PDC to drill out, a roller cone in the hardest zones, and another PDC bit to complete the section.

In Eddy County, New Mexico, Varel recommended a 7 ⅞-in. DE616X bit to the drill the section. Not only did the six-bladed Diamond Edge design drill more than 3,000 ft (914 m) at 98.9 ft/hr (30 m/hr), but the driller also declared a field record for ROP performance. In addition, the first run with the bit drilled through the traditional roller cone zone, thereby replacing the roller cone bit and trip. Offsets in the area averaged 77 ft/hr (23 m/hr) and a distance of 2,755 ft (840 m). E&P

**Cost is based on competitive rig hourly rates and universal bit pricing, regardless of vendor.*