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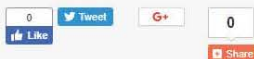


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PDC bit profile

The shape of a Polycrystalline Diamond Compact (PDC) bit body is called its profile.

Contents (hide)

- 1 Bit profile importance
- 2 Elements of PDC bit profile
 - 2.1 Profile categories
- 3 References
- 4 See also
- 5 Noteworthy papers in OnePetro
- 6 External links
- 7 Page champions
- 8 Category

Bit profile importance

Bit profile has a direct influence on the following bit qualities:

- Stability (tendency to vibrate or drill laterally away from bit centerline).
- Steerability.
- Cutter density.
- Durability.
- Rate of penetration (ROP).
- Cleaning efficiency.
- Prevention of thermal damage to cutters by cooling.

Elements of PDC bit profile

A profile governs:

- Hydraulic efficiency.
- Cutter and/or diamond loading.
- Wear characteristics across the bit face.

It is also the principal influence on bit productivity and stability. The geometry established by the profile contributes to hydraulic flow efficiency across the bit face. Hydraulic flows directly influence ROP through the cuttings removal they provide. If cuttings are removed as rapidly as they are produced, ROP will be relatively higher. If a bit is capable of generating cuttings faster than they can be removed penetration is restricted by the cuttings, and achievement of optimal ROP is impeded. Hydraulic flows also cool bit cutting elements and prevent thermal damage to them. Cutter life influences bit life and the economic efficiency of a bit investment. Fig. 1 describes the nomenclature of various PDC bit profiles. Starting at the centerline of the bit and moving outward to the gauge, profile is broken into five zones:

- Cone
- Nose
- Shoulder
- Taper
- Gauge

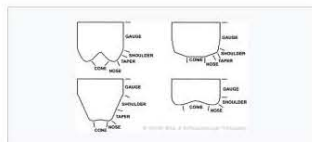


Fig. 1—Nomenclature of a PDC bit profile.

Profile categories

Profile shape is one of the most important characteristics of fixed-cutter bits, having direct influence on possibilities for cutter placement and densities and on hydraulic layouts. Profile also affects:

- Bit stability.
- The rotational speeds at which the bit can be run.
- Directional characteristics.
- Permissible weight on bit (WOB).
- Bit durability.

There are four general categories of PDC bit profiles. These range from long, parabolic curves to flat shapes with narrow-radius, compressed curves. The types are described (Fig. 2) as:

- Flat profiles.
- Short parabolic profiles.
- Medium parabolic profiles.
- Long parabolic profiles.



Fig. 2—PDC bit profile types.

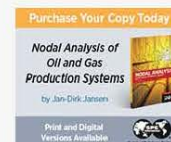
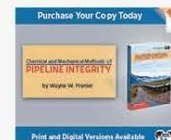
Parabolic profiles are considerably more aggressive than flatter profiles and produce higher ROPs at the expense of accelerated rates of abrasive wear. As bit profile becomes more parabolic, cutter wear on the inner radii around the nose increases. Parabolic profiles are susceptible to cutter breakage by impact, particularly if insufficient cutter density exists in the nose area.

When harder formations are drilled, flat profiles and high cutter loading are required. Flatter profiles uniformly place high loading on individual cutters and increase penetration. If abrasive wear is predominant, however, parabolic profiles enable the higher cutter densities that limit penetration, but increase resistance to abrasion.

PDC bits most frequently incorporate large shoulder radii and primarily use either short or medium parabolic profiles. Cone angles are sufficient to stabilize the bit from unwanted deviation without hindering steerability. Such designs give bits the versatility to drill efficiently either by conventional rotary drilling or with downhole motors.

Flat and long parabolic profiles are less commonly used designs. Flat profiles have a single radius on the shoulder and are less aggressive than parabolic profiles. Long parabolic profiles are made up of a series of curves beginning at the cone-to-nose intersection and continuing to the outside-diameter radius and gauge intersection.

References



See also

[Rotary drill bits](#)

[PDC bit configurations](#)

[PDC bit classification](#)

[PDC bit design](#)

[PEH:Introduction to Roller-Cone and Polycrystalline Diamond Drill Bits](#)

Noteworthy papers in OnePetro

S. Menand, H. Sellami and C. Simon 2004. PDC Bit Classification According to Steerability, SPE Drilling & Completion Volume 19, Number 1. 87837-PA. <http://dx.doi.org/10.2118/87837PA>.

S. Barton 2000. Development of Stable PDC Bits for Specific Use on Rotary Steerable Systems, IADC/SPE Asia Pacific Drilling Technology, 11-13 September. 62779-MS. <http://dx.doi.org/10.2118/62779-MS>.

External links

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Categories: [1.5 Drill bits](#) | [NR](#)



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