

Operating Parameters: Rotational Speed for Diamond Impregnated Core Bits

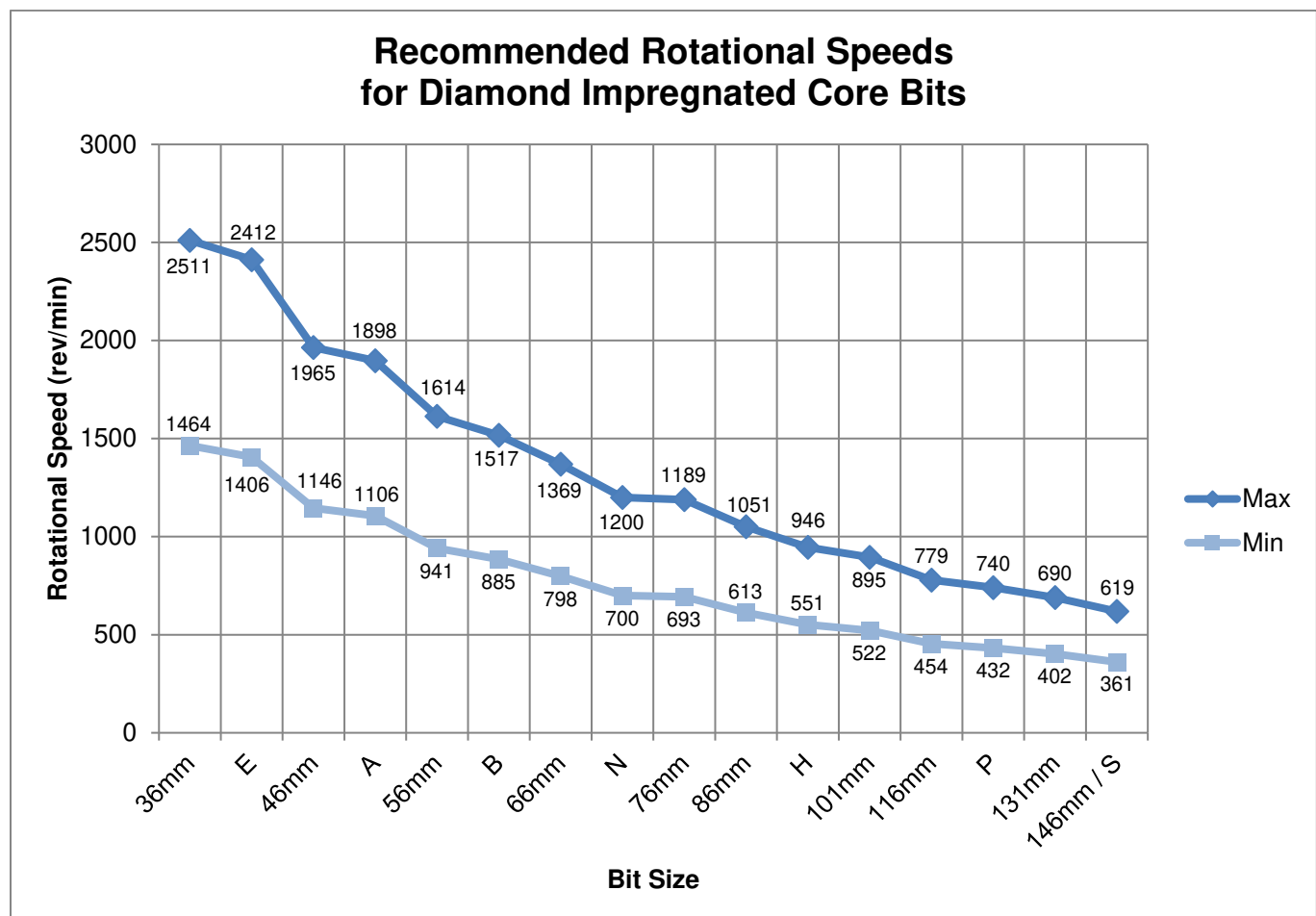
General guidelines for the determination of rotational speed

A peripheral speed of **2.7 to 4.7 metres/second** (9 to 15.5 feet/second) measured on the outside diameter of the bit crown will often provide an acceptable rate of penetration (ROP).

A higher peripheral speed will often yield a higher ROP. However, higher peripheral speeds often reduce the rate of wear on the bit's matrix layer – not allowing new layers of synthetic diamond to become exposed thus causing the original layers of diamond to become flat and polished. Conversely, a lower than recommended peripheral speed will cause the bit's matrix layer to abrade more readily, particularly under higher bit loads. This may result in the premature failure of the bit crown.

Other considerations related to rotational speed ...

- The formation conditions at a particular drill site may permit the use of higher rotational speeds and penetration rates than those recommended in this document.
- Rotational speeds approaching the recommended maximum may be applied in cases where softer or more abrasive rock types are predominant in the formation being drilled.



Calculation of rotational speed

The following formulae may be used to determine the required rotational speed (s) for any diamond impregnated diamond core bit or casing shoe:

Imperial system

$$s = \left(\frac{12}{\pi d} \right) p$$

Where:

d = The mean outside diameter of the bit crown measured in **inches**. Normally, this value is considered to be the mid-point of the outside set diameter tolerance.

p = The peripheral speed of the outside diameter of the bit crown measured in **feet per minute**. In order to establish the recommended rotational speed range, it is necessary to perform this calculation twice: Where one calculation is used to determine the minimum recommended rotational speed and the other calculation is used to determine the maximum recommended rotational speed. The value p is a function of the type of cutting media on the core bit or casing shoe. In the case of diamond impregnated products, the values of p are:

540 feet/minute (Minimum) and 930 feet/minute (Maximum).

Metric system

$$s = \left(\frac{1000}{\pi d} \right) p$$

Where:

d = The mean outside diameter of the bit crown measured in **millimetres**. Normally, this value is considered to be the mid-point of the outside set diameter tolerance.

p = The peripheral speed of the outside diameter of the bit crown measured in **metres per minute**. In order to establish the recommended rotational speed range, it is necessary to perform this calculation twice: Where one calculation is used to determine the minimum recommended rotational speed and the other calculation is used to determine the maximum recommended rotational speed. The value p is a function of the type of cutting media on the core bit or casing shoe. In the case of diamond impregnated products, the values of p are:

165 metres/minute (Minimum) and 284 metres/minute (Maximum).

Penetration rate index (PRI)

The concept of PRI should be considered when establishing the optimum rotational speed setting for an impregnated diamond core bit. The PRI provides the operator with an indication as to whether the bit is being overfed or underfed in relation to the rotational speed being used.

The PRI is calculated by simply dividing the rotational speed (s) by the observed penetration rate (r):

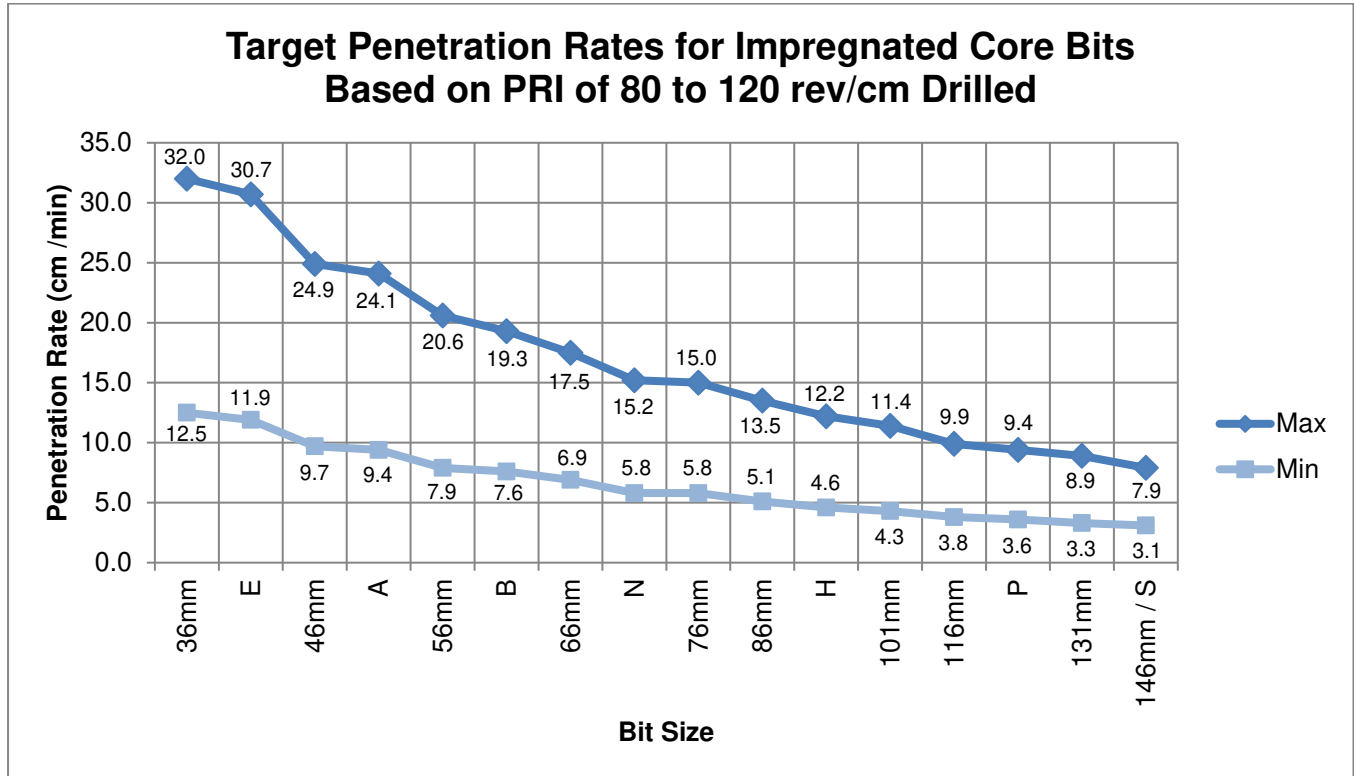
$$PRI = \frac{s}{r}$$

For optimum performance, the drill operator should try to maintain a PRI of either:

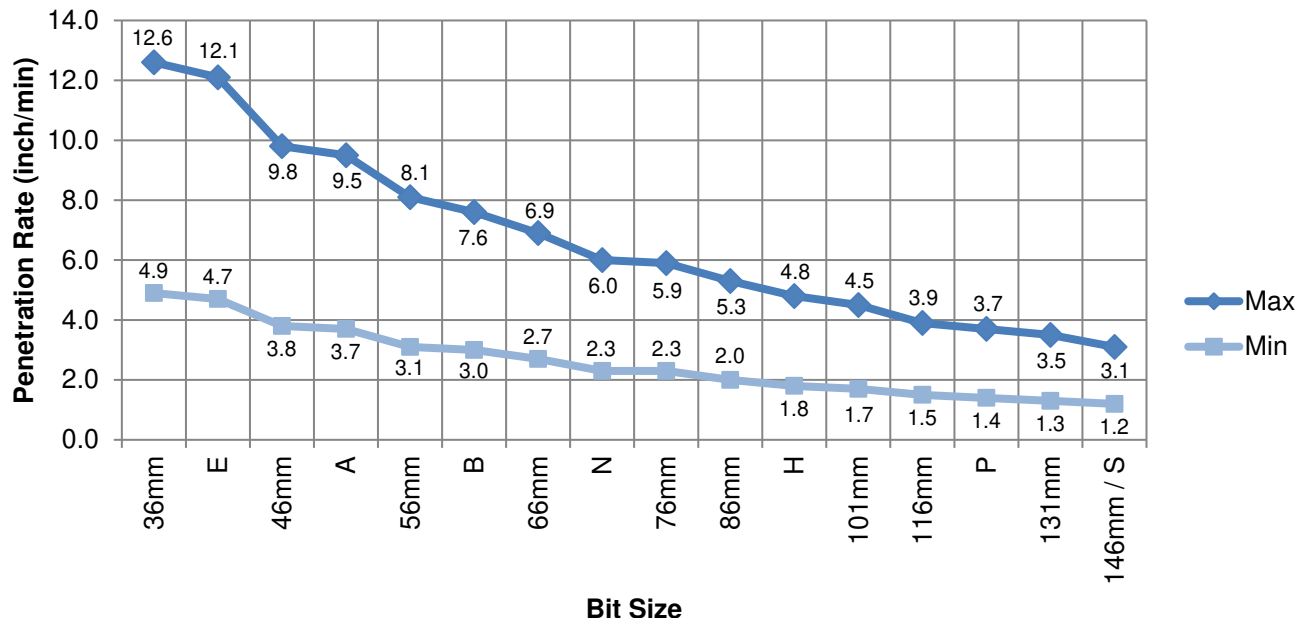
- 80 to 120 revolutions per cm drilled OR
- 200 to 300 revolutions per inch drilled.

The following graphs illustrate the range in which penetration rates should be maintained for optimum performance.

Note that when properly applied, VORTEX-type impregnated core bits will often achieve higher rates of penetration than those recommended in this document without creating an “overfeeding” condition.



Target Penetration Rates for Impregnated Core Bits Based on PRI of 200 to 300 rev/inch Drilled



Conversion factors

Length

1 mm = 0.039 inch
1 inch = 25.4 mm

Force

1 N = 0.225 lbf
1 kN = 225 lbf
1 lbf = 4.45 N

Mass

1 kg = 2.205 lb
1 lb = 0.454 kg

Pressure

1 MPa = 1 N/mm²
1 MPa = 145 lb/inch²
1 Bar = 100 kPa = 14.5 lb/inch²
1 lb/inch² = 0.0069 MPa
1 lb/inch² = 6.9 kPa

Volume

1 litre = 0.264 gal (US)
1 litre = 0.220 gal (Imperial)
1 gal (US) = 3.785 litres
1 gal (Imperial) = 4.546 litres

Technical Data Sheet TD104
Revision 5
Document Release Date: May 13, 2019

The technical application data in this document is intended as a basic guideline for the selection of the appropriate tools for your job. As drilling conditions and the capabilities of drilling equipment vary considerably from site to site, it is impossible to define absolute parameters for the application of our drilling tools. Some experimentation on the part of the end user may be required as parameters outside of those recommended in Dimatec's product literature may be applicable. Every effort has been made to ensure the accuracy of the data contained in this document. Dimatec Inc. cannot accept any liability due to errors or omissions in the data that we provide. Dimatec Inc. is constantly working to improve our products and therefore reserve the right to make changes to materials, specifications, prices and technical data without prior notice.