

# Formulas and definitions for boring - METRIC

Penetration rate, mm/min

$$v_f = f_n \times n$$

Cutting speed, m/min

$$v_c = \frac{\pi \times D_c \times n}{1000}$$

Spindle speed, r/min

$$n = \frac{v_c \times 1000}{\pi \times D_c}$$

Feed per revolution, mm/r

$$f_n = z_c \times f_z$$

Metal removal rate, cm<sup>3</sup>/min

$$Q = \frac{v_c \times D_c \times f_n}{4}$$

Net power, kW

$$P_c = \frac{v_c \times a_p \times f_n \times k_c}{60 \times 10^3} \left( 1 - \frac{a_p}{D_c} \right)$$

Torque, Nm

$$M_c = \frac{P_c \times 30 \times 10^3}{\pi \times n}$$



| Symbol     | Designation/<br>definition                                | Unit                 |
|------------|-----------------------------------------------------------|----------------------|
| $D_c$      | Drill diameter                                            | mm                   |
| $f_n$      | Feed per revolution                                       | mm/r                 |
| $n$        | Spindle speed                                             | rpm                  |
| $v_c$      | Cutting speed                                             | m/min                |
| $v_f$      | Table speed                                               | mm/min               |
| $F_f$      | Feed force                                                | N                    |
| $k_c$      | Specific cutting force                                    | N/mm <sup>2</sup>    |
| $M_c$      | Torque                                                    | Nm                   |
| $P_c$      | Net power                                                 | kW                   |
| $Q$        | Metal removal rate                                        | cm <sup>3</sup> /min |
| $\kappa_r$ | Entering angle                                            | degree               |
| $z_c$      | Number of effective teeth<br>( $z_c = 1$ for step boring) | pcs                  |

Feed force, N

$$F_f \approx 0.5 \times k_c \times a_p \times f_n \times \sin \kappa_r$$