



Calculating spindle power consumption

Milling (Pc)

$$P_c = \frac{a_p \cdot a_e \cdot v_f \cdot K_c}{60 \times 10^6 \times \eta}$$

P_c (kW) : Absorbed power
a_e (mm) : Cutting width
K_c (MPa) : Specific cutting force

a_p (mm) : Cutting depth
v_f (mm/min) : Table feed per min
η : (Regime)

(Problem)

How much power is required to perform tool steel milling at a cutting speed of 80m/min.
 With 2mm depth of cut, 80mm width of cut, 280mm/min table travel and a Ø250 milling cutter with 12 inserts.
 Efficiency factor 80%.

(Answer) First, calculate the number of turns to obtain the feed per tooth

$$n = \frac{1000v_c}{\pi D_1} = \frac{1000 \times 80}{3.14 \times 250} = 101.91 \text{ t/min}$$

$$\text{Feed per tooth } f_z = \frac{v_f}{z \times n} = \frac{280}{12 \times 101.9} = 0.228 \text{ mm/tooth}$$

Replace the specific cutting power in the formula.

$$P_c = \frac{2 \times 80 \times 280 \times 1800}{60 \times 10^6 \times 0.8} = 1.68 \text{ kW}$$

K_c

Material	Tensile strength (MPa) and hardness	Specific cutting force K _c (MPa)				
		0.1mm/tooth	0.2mm/tooth	0.3mm/tooth	0.4mm/tooth	0.6mm/tooth
Soft Steel	520	2200	1950	1820	1700	1580
Carbon Steel	620	1980	1800	1730	1600	1570
Heat-treated steel	720	2520	2200	2040	1850	1740
Tool Steel	670	1980	1800	1730	1700	1600
Tool Steel	770	2030	1800	1750	1700	1580
Chrome manganese Steel	770	2300	2000	1880	1750	1660
Chrome manganese Steel	630	2750	2300	2060	1800	1780
Chrome molybdenum Steel	730	2540	2250	2140	2000	1800
Chrome molybdenum Steel	600	2180	2000	1860	1800	1670
Nickel chrome molybdenum steel	940	2000	1800	1680	1600	1500
Nickel chrome molybdenum steel	352HB	2100	1900	1760	1700	1530
Austenitic stainless steel	155HB	2030	1970	1900	1770	1710
Cast iron	520	2800	2500	2320	2200	2040
Hard cast iron	46HRC	3000	2700	2500	2400	2200
Ductile cast iron	360	2180	2000	1750	1600	1470
Grey cast iron	200HB	1750	1400	1240	1050	970
Copper	500	1150	950	800	700	630
Aluminium alloy (Al-Mg)	160	580	480	400	350	320
Aluminium alloy (Al-Si)	200	700	600	490	450	390
Aluminium alloy (Al-Zn-Mg-Cu)	570	880	840	840	810	720