

Solⁿ

①

$$MRR = \frac{\text{Available power}}{\text{Sp. cutting energy}}$$

$$= \frac{3 \text{ kW} \times 0.7}{2.3 \text{ GJ/m}^3}$$

$$= \frac{3 \times 10^3 \times 0.7}{2.3 \times 10^9} \text{ m}^3/\text{s}$$

$$= 0.913 \times 10^{-6} \text{ m}^3/\text{s}$$

Volume of material to be removed by rough turning

$$= \frac{\pi}{4} \times 50 \times (100^2 - 76^2) \text{ mm}^3$$

$$= 165792 \text{ mm}^3$$

$$\text{So, machining time (a) for rough cut, } t_1 = \frac{0.913 \times 10^{-6} \times 10^9}{165792} \text{ sec.}$$

$$= 181.6 \text{ sec.}$$

$$\text{Machining time (b) for finish cut, } t_2 = \frac{L}{f} \cdot \frac{1}{N}$$

$$= \frac{L}{f} \cdot \frac{\pi D}{V}$$

$$= \frac{50}{0.1} \times \frac{\pi \times \left(\frac{70+76}{2}\right)}{1.5 \times 10^3}$$

$$= 76.4 \text{ sec.}$$

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(2)

$$MRR = f \cdot d \cdot V$$

$$= 0.25 \times 6 \times 9382.3$$

$$= 14073.45 \text{ mm}^3/\text{s}$$

$$= 14073.45 \times 10^{-9} \text{ m}^3/\text{s}$$

$$N = \frac{1}{0.5} \text{ rev./s}$$

$$V = \pi D N$$

$$= \pi \times \left(\frac{1500 + 1488}{2} \right) \times \frac{1}{0.5}$$

$$= 9382.3 \text{ mm/s}$$

Power consumption at the beginning of the operation = $14073.45 \times 10^{-9} \times 3.6 \times 10^9 \text{ W}$

$$= 50.7 \text{ kW}$$

$$\text{machining time} = \frac{\left(\frac{1500 - 600}{2} \right)}{0.25} \times 0.5$$

$$= 900 \text{ sec.}$$