

AGE-1320

Section 1, CRN: 320/321/378

Section 2, CRN: 379/381/380

First Semester 1447 H (Fall 2025) – 2(1,1,2)

“Introduction to Manufacturing”

Saturday, November 1st, 2025 (10/05/1447H)

Drilling Exercise + **ANSWERS**

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Material-Removal Rate in Drilling

A hole is being drilled in a block of magnesium alloy with a 10 – *mm* drill bit at a feed of 0.2 *mm/rev* and with the spindle running at $N = 800 \text{ rpm}$. You are required to:

- Calculate the material-removal rate
- Compare the surface speed with the feed rate

Given:

- Workpiece material: magnesium alloy
- Process: drilling
- $D = 10 \text{ mm}$
- $f = 0.2 \text{ mm/rev}$
- $N = 800 \text{ rev/min}$

Solution:

a) **material-removal rate, $MRR = \left[\frac{(\pi)(D^2)}{4} \right] (f)(N)$**

$$MRR = \left[\frac{(\pi)(10 \text{ mm})^2}{4} \right] \left(0.2 \frac{\text{mm}}{\text{rev}} \right) \left(800 \frac{\text{rev}}{\text{min}} \right)$$

$$= 12566.37 \frac{\text{mm}^3}{\text{min}} * \left(\frac{1 \text{ min}}{60 \text{ s}} \right) = 209.44 \text{ mm}^3/\text{s}$$

► **$MRR = 209 \text{ mm}^3/\text{s}$**

b) Note, compare the surface speed (V) with the feed rate (or linear speed, v) in this problem:

$$\begin{aligned} V &= \pi DN = (2\pi \text{ rad/rev}) \left(\frac{10}{2} \text{ mm} \right) (800 \text{ rev/min}) \\ &= 25,132.74 \text{ mm/min} = \mathbf{25.1 \text{ m/min}} \end{aligned}$$

$$v = fN = (0.2 \text{ mm/rev})(800 \text{ rev/min}) = \mathbf{160 \text{ mm/min}}$$

i.e. V is much larger than v (157 times larger). Can you explain this?