Material Removal Rate: Turning, Milling, Drilling

Material removal rate for turning (speed × feed × depth), milling (width × depth × table feed) and drilling (hole area × feed × rpm).

Method: MRR = v f a_p (turning); a_e a_p v_f (milling); (πD²/4) f N (drilling) (Kalpakjian, Manufacturing Engineering and Technology)

Input parameters

Unit system: SI

Parameter	Value	Unit
Process	Turning	
Cutting speed (turning)	180.00	m/min
Feed per revolution (turning, drilling) Turning and drilling: mm per revolution. Milling: enter the table feed per second here in mm.	0.25000	mm
Depth of cut	2.0000	mm
Width of cut (milling)	30.000	mm
Drill diameter	12.000	mm
Table feed (milling)	15.000	mm/min
Spindle speed (drilling)	800.00	rpm

Calculated results

Parameter	Value	Unit
Material removal rate	90.000	cm³/min

Formula and method

$$Q = v_c f a_p, \quad Q = a_e a_p v_f \ (v_f \text{ table feed}), \quad Q = \frac{\pi D^2}{4} f N$$

Variables

$\mathrm{process}$	Process	-
v_c	Cutting speed (turning)	m/s
f	Feed per revolution (turning, drilling)	m
a_p	Depth of cut	m
a_e	Width of cut (milling)	m
D	Drill diameter	m
v_f	Table feed (milling)	m/s
N	Spindle speed (drilling)	1/s
Q	Material removal rate	m³/s

Method and standards

Kinematics.

Assumptions and limits

- Steady cutting. The milling table feed is a speed (shown in mm/min), separate from the feed per revolution.

References

• MRR = v f a_p (turning); a_e a_p v_f (milling); (πD²/4) f N (drilling) (Kalpakjian, Manufacturing Engineering and Technology)

Report details

Report reference	FCC-WV6S-SX27 (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Material Removal Rate: Turning, Milling, Drilling
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/manufacturing/material-removal-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.