Optimum Cutting Speed for Minimum Cost and Maximum Production

Tool life and cutting speed for minimum cost per part and for maximum production rate from Taylor's constants, machine rate, tool cost and change time.

Method: Machining economics (Gilbert): T_cost = (1/n − 1)(t_c + C_t/C_o); T_prod = (1/n − 1)t_c (Kalpakjian; Groover)

Input parameters

Unit system: SI

Parameter	Value	Unit
Taylor exponent	0.25000	
Taylor constant: cutting speed for a 1-minute tool life	400.00	m/min
Machine and labour cost per minute	15.000	
Tool cost per cutting edge	120.00	
Tool change time	2.0000	min

Calculated results

Parameter	Value	Unit
Tool life for minimum cost	30.000	min
Speed for minimum cost	170.91	m/min
Tool life for maximum production	6.0000	min
Speed for maximum production	255.58	m/min

Notes for this case

- Run between the two speeds (the 'high-efficiency range').

Formula and method

$$T_{cost} = \left(\frac{1}{n} - 1\right)\left(t_c + \frac{C_t}{C_o}\right), \quad T_{prod} = \left(\frac{1}{n} - 1\right) t_c, \quad V = \frac{C}{T^n}$$

Variables

n	Taylor exponent	-
C	Taylor constant: cutting speed for a 1-minute tool life	m/s
C_o	Machine and labour cost per minute	-
C_t	Tool cost per cutting edge	-
t_c	Tool change time	s
T_{cost}	Tool life for minimum cost	s
V_{cost}	Speed for minimum cost	m/s
T_{prod}	Tool life for maximum production	s
V_{prod}	Speed for maximum production	m/s

Method and standards

Gilbert.

Assumptions and limits

- Taylor law holds, V Tⁿ = C with T in minutes: C is the cutting speed for a 1-minute tool life (enter it in any speed unit; a constant fitted with T in seconds must be converted first, C_min = C_s × 60ⁿ).
- The tool change time must be above zero: with zero the maximum-production speed is unbounded.

References

- Machining economics (Gilbert): T_cost = (1/n − 1)(t_c + C_t/C_o)
- T_prod = (1/n − 1)t_c (Kalpakjian; Groover)

Report details

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Release checks	2 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/machining-economics-taylor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.