

Machining Economics and Tool Life Cheat Sheet

Taylor equation, unit cost, optimum cutting speeds

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Taylor tool life	$V T^n = C$	V cutting speed, T tool life (min), C and n from tests
Tool life from speed	$T = (C / V)^{1/n}$	Solved form
Cost per piece	$C_p = C_m + C_s + C_l + C_t$	Machining, setup, handling, tooling per unit
Machining cost rate	$(L_m + B_m) \times \text{time}$	Labor rate plus burden rate; insert cost D_i in tooling
Time per part	$T_p = T_l + T_m + T_c/N_i + T_i/N_f$	Textbook form for inserts
Best speed for max rate	$T = (1/n - 1) T_c$	Textbook form; T_c = tool change time
Best speed for min cost	$T = (1/n - 1)(T_c + C_t/C_m)$	Textbook form; C_t cost per edge, C_m machine rate per min

Key takeaways

- Material cost is constant: it does not depend on cutting conditions.
- Quoted unit cost ranges in the post: \$35 to \$40 per hour for 3-axis, \$75 to \$120 per hour for multi-axis.
- Tool life is cutting time between sharpenings at an acceptable wear level, with break-in, steady and accelerated wear stages.
- Failure modes: fracture, temperature, gradual wear (abrasion, adhesion, diffusion, oxidation, plastic deformation).
- Between the two optimum speeds lies the high-efficiency machining range. Feed is maximized first, speed second.
- Illustration (mine): with $n = 0.13$, doubling speed cuts tool life to about 0.5% ($2^{-1/0.13} \approx 1/207$).
- The post's economics and optimum-speed equations and its worked answer are images, so formulas here are textbook forms.

Sample problem inputs in the post

Item	Value
Workpiece	300 mm long, 80 mm dia steel
Taylor constants	$n = 0.13$, $C = 100$ m/min (feed 0.4 mm/rev)
Rates and insert	Labor \$19/hr, burden \$15/hr, insert \$25
Times	Load 2.0 min, tool change 5.0 min, index 1.0 min