Cold Work Percentage, True Strain and Work-Hardened Strength

Percent cold work and true strain from drawing or rolling reductions, flow stress after cold work by the Hollomon law, and the ideal drawing stress.

Method: Hollomon work hardening and ideal work

Input parameters

Unit system: SI

Parameter	Value	Unit
Initial diameter (or thickness)	5.0000	mm
Final diameter (or thickness)	4.0000	mm
Reduction type	Round bar or wire (area ∝ d²)	
Strength coefficient	320.00	MPa
Strain hardening exponent	0.54000	

Calculated results

Parameter	Value	Unit
Cold work	36.000	%
True strain	0.44629	
Flow stress after cold work	206.99	MPa
Ideal drawing (or rolling) stress	59.984	MPa

Notes for this case

• %CW = (A₀ − A)/A₀, ε = ln(A₀/A); flow stress K·εⁿ; ideal (frictionless) drawing stress = mean flow stress × ε. Real dies add friction and redundant work, typically 20–50 % more; a pass cannot exceed ε ≈ n + 1 limits in wire drawing (stress below flow stress).

Formula and method

$$\%CW = 1 - \frac{A}{A_0}, \quad \varepsilon = \ln\frac{A_0}{A}, \quad \sigma_f = K\varepsilon^n, \quad \sigma_d = \frac{K\varepsilon^{n+1}}{n+1}$$

Variables

d_0	Initial diameter (or thickness)	m
d_1	Final diameter (or thickness)	m
mode	Reduction type	-
K	Strength coefficient	Pa
n	Strain hardening exponent	-
$\%CW$	Cold work	-
ε	True strain	-
σ_f	Flow stress after cold work	Pa
σ_d	Ideal drawing (or rolling) stress	Pa

Method and standards

Work hardening.

Assumptions and limits

- Homogeneous deformation; Hollomon law.

References

Hollomon work hardening and ideal work

Report details

Report reference	FCC-V26Q-4P4B (the same inputs always give the same reference)
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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/materials/heat-treatment/cold-work-strength

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.