Creep Rupture Life by the Monkman–Grant Relation

Creep rupture life from the minimum creep rate using the Monkman–Grant relation fitted to a reference test, with the rupture-life ratio between the two conditions.

Method: Monkman–Grant relation

Input parameters

Unit system: SI

Parameter	Value	Unit
Minimum creep rate in the reference test	1.0000e-06	1/h
Rupture time in the reference test	5,000.0	h
Monkman–Grant exponent	1.0000	
Minimum creep rate in service	1.0000e-07	1/h

Calculated results

Parameter	Value	Unit
Monkman–Grant constant	0.005000	
Predicted rupture life	50,000	h
Life ratio	10.000	

Notes for this case

- ε̇_min·t_r^m = C with m near 1 for many alloys, so a test that ruptures quickly predicts lives at lower creep rates. Use the same material, temperature range and failure mechanism; the constant is in SI time units (seconds) here.

Formula and method

$$\dot{\varepsilon}_{min} t_r^m = C_{MG}, \quad t_r = \left(\frac{C_{MG}}{\dot{\varepsilon}} \right)^{1/m}$$

Variables

$\dot{\varepsilon}_{ref}$	Minimum creep rate in the reference test	1/s
$t_{r,ref}$	Rupture time in the reference test	s
m	Monkman–Grant exponent	-
$\dot{\varepsilon}$	Minimum creep rate in service	1/s
C_{MG}	Monkman–Grant constant	-
t_r	Predicted rupture life	s
$t_r / t_{r,ref}$	Life ratio	-

Method and standards

Monkman–Grant.

Assumptions and limits

- Same material and mechanism.

References

Monkman–Grant relation

Report details

Report reference	FCC-PY12-8KXJ (the same inputs always give the same reference)
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Calculator	Creep Rupture Life by the Monkman–Grant Relation
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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/properties/monkman-grant-rupture-life

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.