Steady-State Creep Rate (Norton Power Law)

Secondary creep rate of a metal at temperature and stress by Norton's power law with Arrhenius temperature dependence, with your constants and the time to a strain.

Method: Norton (1929) power law with Arrhenius term $\dot{\varepsilon} = A\,\sigma^n\,e^{(-Q/RT)}$

Input parameters

Unit system: SI

Parameter	Value	Unit
Constant A (1/s per MPa^n) Fitted with the rate in 1/s and stress in MPa; from creep data for the material. The default set is illustrative, not a particular steel.	0.10000	
Stress	80.000	MPa
Stress exponent	5.0000	
Activation energy	300.00	kJ/mol
Temperature	550.00	°C
Creep strain of interest	1.0000	%

Calculated results

Parameter	Value	Unit
Creep rate	1.0840e-07	1/h
Time to the strain (steady stage)	92,253	h

Notes for this case

- Steady (secondary) creep only; primary and tertiary creep and rupture need their own data (see Larson–Miller).

Formula and method

$$\dot{\varepsilon} = A\sigma^{n} \exp\left(-\frac{Q}{RT}\right)$$

Variables

A	Constant A (rate in 1/s with σ in MPa)	-
σ	Stress	Pa
n	Stress exponent	-
Q	Activation energy	J/mol
T	Temperature	K
ε_t	Creep strain of interest	-
$\dot{\varepsilon}$	Creep rate	1/s
t	Time to the strain (steady stage)	s

Method and standards

Norton–Arrhenius.

Assumptions and limits

- Secondary creep.
- A is a plain number fitted with the rate in 1/s and the stress in MPa; constants fitted in other units must be converted first.
- The default constants are illustrative only; they give a rate of the order of 1 % in 100 000 h at 80 MPa and 550 °C.

References

- Norton (1929) power law with Arrhenius term $\dot{\varepsilon} = A\,\sigma^n\,e^{(-Q/RT)}$

Report details

Report reference	FCC-VBX8-SGMQ (the same inputs always give the same reference)
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Method last reviewed	12 November 2026
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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/materials/properties/norton-creep-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.