Polymer Time–Temperature Shift (WLF Equation)

Shift factor between a reference temperature (often T_g) and another temperature for a polymer by the Williams–Landel–Ferry equation, and the equivalent time.

Method: Williams; Landel and Ferry (1955); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Temperature of interest	100.00	°C
Reference temperature (T_g for universal constants)	80.000	°C
WLF constant C_1	17.440	
WLF constant C_2	51.600	K
Time at the reference temperature	1,000.0	h

Calculated results

Parameter	Value	Unit
$\log_{10}$ of shift factor	-4.8715	
Shift factor	1.3443e-05	
Equivalent time at T	0.013443	h

Notes for this case

- WLF holds from about T_g to T_g + 100 K for amorphous polymers; below T_g use an Arrhenius shift.

Formula and method

$$\log_{10} a_T = \frac{-C_1 (T - T_r)}{C_2 + T - T_r}, \quad t_T = a_T t_r$$

Variables

T	Temperature of interest	K
T_r	Reference temperature (T_g for universal constants)	K
C_1	WLF constant C_1	-
C_2	WLF constant C_2	K
t_r	Time at the reference temperature	s
$\log_{10} a_T$	$\log_{10}$ of shift factor	-
a_T	Shift factor	-
t_T	Equivalent time at T	s

Method and standards

WLF equation.

Assumptions and limits

- Amorphous polymers above T_g.

References

- Williams
- Landel and Ferry (1955)
- J. Am. Chem. Soc. 77: 3701 (universal constants C_1 = 17.44, C_2 = 51.6 K at T_g)

Report details

Report reference	FCC-NJSD-PYXR (the same inputs always give the same reference)
Generated	17 November 2026, 19:44 UTC
Calculator	Polymer Time–Temperature Shift (WLF Equation)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/wlf-time-temperature-shift

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.