Weibull Reliability, Hazard Rate, Mean Life and B10 Life

Reliability, failure probability and hazard rate at a time for a two-parameter Weibull life distribution, with the mean life (MTTF) and B10 life.

Method: Two-parameter Weibull distribution (O'Connor, Practical Reliability Engineering, ch. 2)

Input parameters

Unit system: SI

Parameter	Value	Unit
Shape parameter	1.8000	
Scale (characteristic life)	20,000	h
Operating time	8,000.0	h
Failure fraction for the B life	10.000	%

Calculated results

Parameter	Value	Unit
Reliability	82.516	%
Failure probability	17.484	%
Hazard rate (per hour)	4.3240e-05	
Mean life	17,786	h
B life (time by which fraction p fails)	5,728.9	h

Notes for this case

- β < 1: early (infant) failures; β = 1: random (exponential); β > 1: wear-out. Bearings show β about 1.1–1.5, fatigue and wear 2–4.

Formula and method

$$R(t) = e^{-(t/\eta)^{\beta}}, \quad h(t) = \frac{\beta}{\eta}\left(\frac{t}{\eta}\right)^{\beta-1}, \quad MTTF = \eta\Gamma\left(1+\frac{1}{\beta}\right), \quad B_p = \eta[-\ln(1-p)]^{1/\beta}$$

Variables

β	Shape parameter	-
η	Scale (characteristic life)	s
t	Operating time	s
p	Failure fraction for the B life	-
$R(t)$	Reliability	-
$F(t)$	Failure probability	-
$h(t)$	Hazard rate (per hour)	-
$MTTF$	Mean life	s
B_p	B life (time by which fraction p fails)	s

Method and standards

Weibull distribution.

Assumptions and limits

- For β < 1 the hazard rate tends to infinity at t = 0; the page leaves it out there and gives it for any t above zero.
- Two-parameter Weibull.

References

- Two-parameter Weibull distribution (O'Connor, Practical Reliability Engineering, ch. 2)

Report details

Report reference	FCC-FMRG-P17C (the same inputs always give the same reference)
Generated	17 November 2026, 19:44 UTC
Calculator	Weibull Reliability, Hazard Rate, Mean Life and B10 Life
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/general/geometry/weibull-reliability-life

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.