Impact Stress from a Falling Weight

Dynamic deflection, impact factor and stress when a weight falls a height onto a bar, beam or spring, from the static deflection by energy balance.

Method: Energy balance W(h + δ) = ½ k δ² (Timoshenko, Strength of Materials)

Input parameters

Unit system: SI

Parameter	Value	Unit
Falling weight	1.0000	kN
Height of fall	50.000	mm
Stiffness of the member at the impact point	2,000.0	N/mm
Stress under the weight applied statically	10.000	MPa

Calculated results

Parameter	Value	Unit
Static deflection W/k	0.50000	mm
Impact factor 1 + √(1 + 2h/δ_st)	15.177	
Dynamic deflection	7.5887	mm
Dynamic stress	151.77	MPa
Peak dynamic force	15.177	kN

Notes for this case

- Impact factor 15.2: the dynamic stress is 15.2 times the static one; check it against the yield strength or allowable.
- Energy balance with the member's mass neglected and no losses: an upper estimate. A load applied suddenly (h = 0) doubles the static values.

Formula and method

$$\delta_{st} = \frac{W}{k}, \quad n = 1 + \sqrt{1 + \frac{2h}{\delta_{st}}}, \quad \sigma_d = n\,\sigma_{st}$$

Variables

W	Falling weight	N
h	Height of fall	m
k	Stiffness of the member at the impact point	N/m
σ_{st}	Stress under the weight applied statically	Pa
δ_{st}	Static deflection W/k	m
n	Impact factor 1 + √(1 + 2h/δ_st)	-
δ_d	Dynamic deflection	m
σ_d	Dynamic stress	Pa
F_d	Peak dynamic force	N

Method and standards

Energy balance on a linear spring.

Assumptions and limits

- Elastic member, no mass.
- σ_st is your static stress under W (it is not computed from W); the dynamic stress is not compared with yield or an allowable, and a large impact factor is flagged.

References

• Energy balance $W(h + \delta) = \frac{1}{2} k \delta^2$ (Timoshenko, Strength of Materials)

Report details

Report reference	FCC-9TFS-8W4S (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Impact Stress from a Falling Weight
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/mechanical/statics-dynamics/impact-load-stress

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.