Tolerance Stack-Up Calculator

How-to guide: what the workbook does, how to use it and what every number means. mfgcalcs.com

Tolerance Stack-Up Calculator

Add up a one-dimensional tolerance stack and see the gap's worst-case and statistical (RSS) range against its specification, and which dimensions contribute most.

For: Design, mechanical, manufacturing and quality engineers checking fits, clearances and assembly gaps.

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Quick start

1. On Setup, name the gap you are studying, choose mm or in and type the gap's minimum and maximum.
2. On Stack-Up, add one row per dimension in the loop with its direction, nominal and plus and minus tolerances.
3. A Positive dimension opens the gap as it grows; a Negative one closes it. Read the Check column.
4. Open the Dashboard for the worst-case and RSS ranges against your limits and the biggest contributors.

What is in the workbook

Start Here	Read this first: what the workbook does and how to use it.
Setup	The gap you are studying, its unit and its specification.
Stack-Up	One row per dimension in the tolerance loop, in loop order.
Dashboard	Worst-case and statistical (RSS) gap against your limits, and which dimensions contribute most.
Method	How every number is calculated, with assumptions, limits and sources.
Verify	Self-check: the workbook's formulas recomputed on fixed inputs against an independent reference.
About MFG Calcs	Everything MFG Calcs offers, free: calculators, templates, tariff tools, data and the Calkee AI helper.

What each number means

Quantity	How it is calculated	Units
Direction and sign	Positive (+1) when a larger dimension makes the gap larger, Negative (-1) when it makes it smaller.	-
Mean	Nominal + (plus tolerance - minus tolerance) / 2.	length
Width and half tolerance	Plus + minus tolerance, and half of it.	length
Nominal gap and mean gap	Sum of sign x nominal, and sum of sign x mean.	length
Worst-case range	Mean gap -/+ the sum of the half tolerances.	length

Quantity	How it is calculated	Units
RSS range	Mean gap -/+ SQRT(sum of the squared half tolerances).	length
Worst-case and RSS share	Half tolerance / sum of half tolerances; squared half tolerance / sum of the squares.	%
Allowed width	Gap maximum - gap minimum.	length
Full width and margin	Sum of the tolerance widths (twice the worst-case half tolerance), and allowed width - full width.	length
Largest tolerance width	The widest tolerance zone in the loop (MAX of the widths).	length
Mean offset	Mean gap - (gap minimum + gap maximum) / 2: how far the stack sits from the middle of the specification.	length

Assumptions, limitations, sources and the self-check (the Verify sheet, which recomputes the workbook's formulas on fixed test inputs) are in the workbook. The last page shows the Dashboard with the example data for Halvard Gear Works, a fictional business.

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Engineering estimates for planning and improvement work. Verify the results against your own process, data and standards before you rely on them.

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Worst-case and statistical (RSS) gap against your limits, and which dimensions contribute most.

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Gap studied: Output shaft end play. Values in mm. The RSS range treats each tolerance as plus or minus three standard deviations of a centred normal process.

WORST-CASE MINIMUM (mm)	WORST-CASE MAXIMUM (mm)	RSS MINIMUM (mm)	RSS MAXIMUM (mm)
0.3100	**0.9300**	**0.4971**	**0.7429**
Limit 0.3000	Limit 0.8000	Limit 0.3000	Limit 0.8000
Within limits	**Out of limits**	**Within limits**	**Within limits**

Gap range against the specification



Share of the stack, by dimension

