Minimum load

For a bearing to operate reliably, not only the correct fit but also compliance with a defined minimum load is essential. If the load is too low, the lubricant inside the bearing may not be sufficiently distributed, and vibrations or slip movements may not be adequately dampened. This can lead to premature wear or bearing failure, particularly in high speed or precision critical applications.

The required minimum load varies depending on the bearing type, operating conditions and lubrication regime. In most cases, it is expressed as a percentage of the bearing's basic static load rating (C_0). In certain cases – especially for pure axial bearings or applications with strongly varying speeds – more specific calculation methods are required.

The following overview summarises the typical minimum load criteria for different bearing types. These values serve as a technical guideline for bearing design and operational reliability.

Design	Bearing type	Formula
Ball bearings	Deep groove ball bearings (single/double row)	$P / C_{0r} > 0{,}01$
	Angular contact ball bearings (single/double row)	$P / C_{0r} > 0{,}01$
	Four-point contact bearings	$F_a \geq 1{,}2 \cdot Fr$
	Self-aligning ball bearings	$P / C_{0r} > 0{,}01$
	Thrust ball bearings	$F_{amin} = 1'000 \cdot A \cdot (n_{max} / 1'000)^2$
	Thrust angular contact ball bearings	$F_{rmax} \leq 0{,}47 \cdot F_a$
Roller bearings	Cylindrical roller bearings (all types)	$P / C_{0r} > 0{,}0166$ bzw. $P > C_{0r} / 60$
	Needle roller bearings / needle roller cages / drawn cup bearings	$P / C_{0r} > 0{,}0166$
	Tapered roller bearings (standard)	$P / C_{0r} > 0{,}0166$
	Barrel roller bearings	$P / C_{0r} > 0{,}0166$ bzw. $P > C_0 / 60$
	Spherical roller bearings	$P / C_{0r} > 0{,}01$; $F_a / F_r \leq 0.3$
	Thrust cylindrical roller bearings	$F_{amin} = 0{,}0005 \cdot C0a + k_a \cdot (C_{0a} \cdot n / 10^8)^2$ or $C_0 / 22'000$
	Thrust spherical roller bearings	$F_a \geq 1.25 \cdot C_0 / 1'000$ or $F_{amin} = 0{,}0005 * C_{0a} + k_a \cdot (C_{0a} * n / 10^8)^2$
	Thrust needle roller bearings	$F_{amin} \geq C_0 / 2'200$ or $F_{amin} = 0{,}0005 \cdot C_{0a} + 3 \cdot (C_{0a} * n / 10^8)^2$

Rule of thumb

- Minimum load for ball bearings ≅ 0,01 · C
- Minimum load for roller bearings ≅ 0,02 · C

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