Formulas from the “Lifetime calculation” article

Formula 1: Basic rating life in 10^6 revolutions

For ball bearings : $L_{10} = \left(\frac{C}{P}\right)^3$

For roller bearings : $L_{10} = \left(\frac{C}{P}\right)^{\frac{10}{3}}$

Basic rating life in operating hours : $L_{10h} = \frac{16\,666.\overline{6}}{n} \times \left(\frac{C}{P}\right)^p$

Formula 2: Equivalent dynamic load P

$P = X \times F_r + Y \times F_a$

F_r	Radial load
F_a	Axial load
X	Radial load factor can be found in the catalogue for each type of rolling bearing.
Y	Axial load factor can be found in the catalogue for each type of rolling bearing.

Formula 3: Modified calculation of rolling bearing service life L_{nm} and L_{nmh}

$L_{nm} = a_1 \times a_{ISO} \times L_{10}$

$L_{nmh} = a_1 \times a_{ISO} \times L_{10h}$

L_{nm}	Modified rating life in 10^6 revolutions
L_{nmh}	Modified rating life in hours
a_1	Life adjustment factor for reliability
a_{ISO}	Life modification factor for the operating conditions $a_{ISO} = f(e_c \times C_u \div P, \kappa)$ e_c = Contamination factor C_u = Fatigue load limit P = Equivalent dynamic load κ = Viscosity ratio
L_{10}	Basic rating life: Reference life in 10^6 revolutions

Formula 4: Viscosity ratio κ

$$\kappa = \frac{v}{v_1}$$

Formula 5: Reference viscosity v_1 and ist dependency on the speed n and the size D_{pw}

$$If\ n < 1\,000\ min^{-1}, v_1 = 45\,000\ n^{-0.83}\ {D_{pw}}^{-0.5}$$

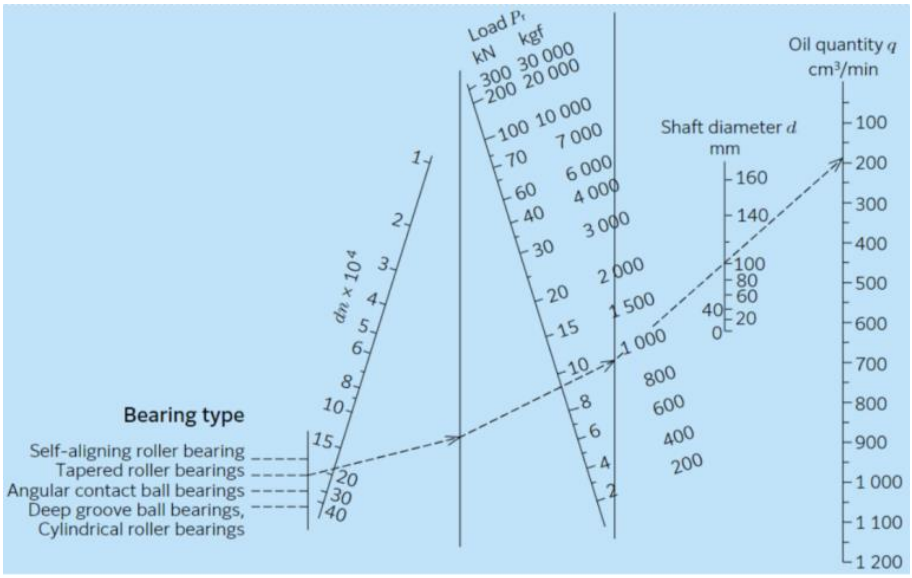
$$If\ n \geq 1\,000\ min^{-1}, v_1 = 4\,500\ n^{-0.5}\ {D_{pw}}^{-0.5}$$

Formula from the "Lubrication" article

Formula 6: Determination of required oil quantity

$$Q = K \times q$$

Q	Oil quantity per bearing (cm^3/min)
K	Permissible oil temperature rise factor
q	Lubricant quantity according to diagram (cm^3/min)



Formulas from the "Fit selection" article

Formula 7 und 8: Reduction of interference due to radial load Δ_{dF}

Formula 7	**Formula 8**
$F_r \leq 0.3\ C_{or}$	$F_r > 0.3\ C_{or}$
$\Delta_{dF} = 0.08 \left(d \times \frac{F_r}{B}\right)^{\frac{1}{2}}$ N	$\Delta_{dF} = 0.02 \left(\frac{F_r}{B}\right)$ N

$\Delta_{dF} =$ Required effective interference relative to radial load, μ m

$d =$ Bearing bore diameter, mm

$B =$ Inner ring width, mm

$F_r =$ Actual radial load, N

$C_{or} =$ Static load rating, N

Formula 9: Required effective interference for the temperature difference Δ_{dT}

$$\Delta_{dT} = 0.0015 \times d \times \Delta T$$

$\Delta_{dT} =$ Required effective interference for the temperature difference in μ m

$\Delta T =$ Difference between bearing inner ring temperature and the ambient temperature in °C

$d =$ Diameter of the bearing bore in mm

Formula 10: Change in interference due to different expansion coefficients

$$\Delta d_{TE} = (\alpha_1 - \alpha_2) \times d \times \Delta T$$

$\Delta d_{TE} =$ Change in interference due to different expansion coefficients, mm

$\alpha_1 =$ Coefficient of expansion of the rolling bearing, $\frac{1}{°C}$

$\alpha_2 =$ Expansion coefficient of the shaft or housing, $\frac{1}{°C}$

$d =$ Reference diameter of the relevant fit, mm

$\Delta T =$ Temperature difference between ambient and operation

Formulas from the "Bearing clearance, operating clearance and preload" article

Formula 11: Determination of radial and axial clearance

Radial clearance = δ

Axial clearance = $\delta_1 + \delta_2$

Formula 12: The operating clearance δ_{eff}

$\delta_{\text{eff}} = \delta_o - (\delta_f + \delta_t)$

δ_{eff} = Effective interference (due to fits), mm

δ_{o} = Bearing clearance, mm

δ_{f} = Decrease in bearing clearance due to interference caused by fits, mm

δ_{t} = Decrease in bearing clearance due to temperature differences between inner and outer rings, mm

Formula 13: The interference δ_f

$\delta_{\text{f}} = (0.70 \sim 0.90)\ \Delta_{deff}$

Δ_{deff} denotes the effective interference in mm.

Formula 14: Reduction of the operating clearance due to a temperature difference in the bearing δ_t

$\delta_{\text{t}} = \propto \times \Delta T \times D_o$

$\propto$ = Temperature coefficient of expansion of the bearing material, $12.5 \times \frac{10^6}{^\circ\text{C}}$

ΔT = Temperature difference (inner/outer ring) in °C

D_o = Outer ring raceway diameter, mm

Formula 15 and 16: The raceway diameter of the outer ring D_o

Formula 15

For ball bearings and spherical roller bearings:

$D_o = 0.20\ (d + 4.0D)$

Formula 16

For roller bearings (except spherical roller bearings):

$D_o = 0.25\ (d + 3.0D)$

Formula from the "Plastic deformation" article

Formula 17: Static safety factor S_0

$$S_0 = \frac{C_0}{P_0}$$

S_0 = static safety factor

C_0 = Static load rating

P_0 = Equivalent static load