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Design of Rolling Contact Bearing Formulas

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List of 86 Design of Rolling Contact Bearing Formulas

Design of Rolling Contact Bearing

Angular Contact Bearing

1) Axial Load for Back to Back Bearings when F_a by F_r is greater than 1.14

$$fx \quad F_a = \frac{P_b - (0.57 \cdot F_r)}{0.93}$$

Open Calculator 

$$ex \quad 2969.355N = \frac{7350N - (0.57 \cdot 8050N)}{0.93}$$

2) Axial Load for Back to Back Bearings when F_a by F_r is less than or equal to 1.14

$$fx \quad F_a = \frac{P_{eq} - F_r}{0.55}$$

Open Calculator 

$$ex \quad 2909.091N = \frac{9650N - 8050N}{0.55}$$



3) Axial Load for Singly Mounted Bearings when F_a by F_r is greater than 1.14

$$fx \quad F_a = \frac{P_s - (0.35 \cdot F_r)}{0.57}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 2951.754N = \frac{4500N - (0.35 \cdot 8050N)}{0.57}$$

4) Equivalent Dynamic Load for Back to Back Bearings when F_a by F_r is greater than 1.14

$$fx \quad P_b = (0.57 \cdot F_r) + (0.93 \cdot F_a)$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 7378.5N = (0.57 \cdot 8050N) + (0.93 \cdot 3000N)$$

5) Equivalent Dynamic Load for Back to Back Bearings when F_a by F_r is less than or equal to 1.14

$$fx \quad P_b = F_r + (0.55 \cdot F_a)$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 9700N = 8050N + (0.55 \cdot 3000N)$$

6) Equivalent Dynamic Load for Singly Mounted Bearings when F_a by F_r is greater than 1.14

$$fx \quad P_s = (0.35 \cdot F_r) + (0.57 \cdot F_a)$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 4527.5N = (0.35 \cdot 8050N) + (0.57 \cdot 3000N)$$



7) Radial Load for Back to Back Bearings when F_a by F_r greater than 1.14

$$f_x \quad F_r = \frac{P_b - (0.93 \cdot F_a)}{0.57}$$

Open Calculator

$$ex \quad 8000N = \frac{7350N - (0.93 \cdot 3000N)}{0.57}$$

8) Radial Load for Back to Back Bearings when F_a by F_r less than or equal to 1.14

$$f_x \quad F_r = (P_{eq} - (0.55 \cdot F_a))$$

Open Calculator

$$ex \quad 8000N = (9650N - (0.55 \cdot 3000N))$$

9) Radial Load for Singly Mounted Bearings when F_a by F_r is greater than 1.14

$$f_x \quad F_r = \frac{P_s - (0.57 \cdot F_a)}{0.35}$$

Open Calculator

$$ex \quad 7971.429N = \frac{4500N - (0.57 \cdot 3000N)}{0.35}$$



Dynamic and Equivalent Load

10) Axial Thrust Load on Bearing given Equivalent Dynamic Load

$$fx \quad F_a = \frac{P_b - (X \cdot V \cdot F_r)}{Y}$$

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9_img.jpg\)](#)

$$ex \quad 1293.6N = \frac{7350N - (0.56 \cdot 1.2 \cdot 8050N)}{1.5}$$

11) Dynamic Load Capacity for Ball Bearing

$$fx \quad C = P_b \cdot \left(L_{10}^{\frac{1}{3}} \right)$$

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

$$ex \quad 38524.9N = 7350N \cdot \left((144)^{\frac{1}{3}} \right)$$

12) Dynamic Load Capacity for Bearing given Rated Bearing Life

$$fx \quad C = P_b \cdot \left(L_{10}^{\frac{1}{3}} \right)$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$ex \quad 38524.9N = 7350N \cdot \left((144)^{\frac{1}{3}} \right)$$

13) Dynamic Load Capacity for Roller Bearing

$$fx \quad C = P_b \cdot \left(L_{10}^{0.3} \right)$$

[Open Calculator !\[\]\(e50091943b385fe16d3277389202856f_img.jpg\)](#)

$$ex \quad 32643.45N = 7350N \cdot \left((144)^{0.3} \right)$$



14) Equivalent Dynamic Load for Bearing given Radial Factor

$$fx \quad P_b = (X \cdot F_r) + (Y \cdot F_a)$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 9008N = (0.56 \cdot 8050N) + (1.5 \cdot 3000N)$$

15) Equivalent Dynamic Load for Back to Back Bearings

$$fx \quad P_b = (X \cdot V \cdot F_r) + (Y \cdot F_a)$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$ex \quad 9909.6N = (0.56 \cdot 1.2 \cdot 8050N) + (1.5 \cdot 3000N)$$

16) Equivalent Dynamic Load for Back to Back Bearings when subjected to Pure Radial Load

$$fx \quad P_b = 1 \cdot F_r$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$ex \quad 8050N = 1 \cdot 8050N$$

17) Equivalent Dynamic Load for Back to Back Bearings when subjected to Pure Thrust Load

$$fx \quad P_b = 1 \cdot F_a$$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

$$ex \quad 3000N = 1 \cdot 3000N$$



18) Equivalent Dynamic Load for Ball Bearing 

$$fx \quad P_b = \frac{C}{L_{10}^{\frac{1}{3}}}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 7030.453N = \frac{36850N}{(144)^{\frac{1}{3}}}$$

19) Equivalent Dynamic Load for Bearing given Rated Bearing Life 

$$fx \quad P_b = \frac{C}{L_{10}^{\frac{1}{p}}}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$ex \quad 7030.453N = \frac{36850N}{(144)^{\frac{1}{3}}}$$


20) Equivalent Dynamic Load for Roller Bearing 

$$fx \quad P_b = \frac{C}{L_{10}^{0.3}}$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$ex \quad 8297.146N = \frac{36850N}{(144)^{0.3}}$$



21) Race Rotation Factor for Bearing given Radial Factor 

$$fx \quad V = \frac{P_{eq} - (Y \cdot F_a)}{X \cdot F_r}$$

Open Calculator 

$$ex \quad 1.142413 = \frac{9650N - (1.5 \cdot 3000N)}{0.56 \cdot 8050N}$$

22) Radial Factor of Bearing given Equivalent Dynamic Load 

$$fx \quad X = \frac{P_{eq} - (Y \cdot F_a)}{V \cdot F_r}$$

Open Calculator 


$$ex \quad 0.533126 = \frac{9650N - (1.5 \cdot 3000N)}{1.2 \cdot 8050N}$$

23) Radial Load of Bearing given Radial Factor 

$$fx \quad F_r = \frac{P_b - (Y \cdot F_a)}{X \cdot V}$$

Open Calculator 

$$ex \quad 4241.071N = \frac{7350N - (1.5 \cdot 3000N)}{0.56 \cdot 1.2}$$

24) Thrust Factor on Bearing given Equivalent Dynamic Load 

$$fx \quad Y = \frac{P_{eq} - (X \cdot V \cdot F_r)}{F_a}$$

Open Calculator 

$$ex \quad 1.413467 = \frac{9650N - (0.56 \cdot 1.2 \cdot 8050N)}{3000N}$$



Rated Bearing Life

25) Rated Bearing Life in Hours

$$\text{fx } L_{10h} = L_{10} \cdot \frac{10^6}{60 \cdot N}$$

[Open Calculator !\[\]\(d66ff64371a51729ac8c1cdaa685ba6f_img.jpg\)](#)

$$\text{ex } 6857.143 = 144 \cdot \frac{10^6}{60 \cdot 350}$$

26) Rated Bearing Life in Million Revolutions for Ball Bearings

$$\text{fx } L_{10} = \left(\frac{C}{P_b} \right)^3$$

[Open Calculator !\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#)

$$\text{ex } 126.0232 = \left(\frac{36850N}{7350N} \right)^3$$

27) Rated Bearing Life in Million Revolutions for Roller Bearings

$$\text{fx } L_{10} = \left(\frac{C}{P_b} \right)^{\frac{10}{3}}$$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

$$\text{ex } 215.6919 = \left(\frac{36850N}{7350N} \right)^{\frac{10}{3}}$$



28) Rated Bearing Life in Million Revolutions given Bearing Speed

$$\text{fx } L_{10} = 60 \cdot N \cdot \frac{L_{10h}}{10^6}$$

[Open Calculator !\[\]\(0f848bbd71cef6b345273b16f905912a_img.jpg\)](#)

$$\text{ex } 168 = 60 \cdot 350 \cdot \frac{8000}{10^6}$$

29) Rated Bearing Life in Million Revolutions given Dynamic Load Capacity

$$\text{fx } L_{10} = \left(\frac{C}{P_b} \right)^p$$

[Open Calculator !\[\]\(3211b5d1d968fc1665909b34f9f16010_img.jpg\)](#)

$$\text{ex } 126.0232 = \left(\frac{36850\text{N}}{7350\text{N}} \right)^3$$

30) Rated Bearing Life in Million Revolutions given Median Life

$$\text{fx } L_{10} = \frac{L_{50}}{5}$$

[Open Calculator !\[\]\(9c2e8d1b5bd77cb5c9f83b7a9cff79fd_img.jpg\)](#)

$$\text{ex } 144 = \frac{720}{5}$$




31) Rated Bearing Life in Million Revolutions given Nominal Life 

$$fx \quad L_{10} = \left(\frac{1000}{\pi \cdot D} \right) \cdot L_{10s}$$

Open Calculator 

$$ex \quad 144.6863 = \left(\frac{1000}{\pi \cdot 880\text{mm}} \right) \cdot 0.4$$

Rolling Contact Bearing Configuration 32) Axial Thrust Load on Bearing given Race Rotation Factor 

$$fx \quad F_a = \frac{P_{eq} - (X \cdot V \cdot F_r)}{Y}$$

Open Calculator 

$$ex \quad 2826.933\text{N} = \frac{9650\text{N} - (0.56 \cdot 1.2 \cdot 8050\text{N})}{1.5}$$

33) Axial Thrust Load on Bearing given Thrust Factor 

$$fx \quad F_a = \frac{P_{eq} - (X \cdot F_r)}{Y}$$

Open Calculator 

$$ex \quad 3428\text{N} = \frac{9650\text{N} - (0.56 \cdot 8050\text{N})}{1.5}$$



34) Bore Diameter of Bearing

$$fx \quad d = 2 \cdot \frac{M_t}{\mu \cdot W}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 31.00775\text{mm} = 2 \cdot \frac{120\text{N} \cdot \text{mm}}{0.0043 \cdot 1800\text{N}}$$

35) Coefficient of Friction of Roller Contact Bearing

$$fx \quad \mu = 2 \cdot \frac{M_t}{d \cdot W}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 0.004444 = 2 \cdot \frac{120\text{N} \cdot \text{mm}}{30\text{mm} \cdot 1800\text{N}}$$

36) Friction Moment on Roller Contact Bearing

$$fx \quad M_t = \mu \cdot W \cdot \left(\frac{d}{2} \right)$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 116.1\text{N} \cdot \text{mm} = 0.0043 \cdot 1800\text{N} \cdot \left(\frac{30\text{mm}}{2} \right)$$

37) Load on Bearing given Moment on bearing

$$fx \quad W = \frac{M_t}{\mu \cdot \left(\frac{d}{2} \right)}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 1860.465\text{N} = \frac{120\text{N} \cdot \text{mm}}{0.0043 \cdot \left(\frac{30\text{mm}}{2} \right)}$$



38) Median Life of Roller Contact Bearing

$$fx \quad L_{50} = 5 \cdot L_{10}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 720 = 5 \cdot 144$$

39) Nominal Life of Roller Contact Bearing

$$fx \quad L_{10s} = \frac{L_{10}}{\frac{1000}{\pi \cdot D}}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$ex \quad 0.398103 = \frac{144}{\frac{1000}{\pi \cdot 880\text{mm}}}$$

40) Number of Bearings required given Reliability

$$fx \quad N_b = \frac{\log_{10}(R_s)}{\log_{10}(R)}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 3.369878 = \frac{\log_{10}(0.65)}{\log_{10}(0.88)}$$

41) Race Rotation Factor of Roller Contact Bearing

$$fx \quad V = \frac{P_{eq} - (Y \cdot F_a)}{X \cdot F_r}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$ex \quad 1.142413 = \frac{9650N - (1.5 \cdot 3000N)}{0.56 \cdot 8050N}$$



42) Radial Factor of Roller Contact Bearing 

$$fx \quad X = \frac{P_{eq} - (Y \cdot F_a)}{F_r}$$

Open Calculator 


$$ex \quad 0.639752 = \frac{9650N - (1.5 \cdot 3000N)}{8050N}$$

43) Radial Factor of Roller Contact Bearing given Race Rotation Factor 

$$fx \quad X = \frac{P_{eq} - (Y \cdot F_a)}{V \cdot F_r}$$

Open Calculator 

$$ex \quad 0.533126 = \frac{9650N - (1.5 \cdot 3000N)}{1.2 \cdot 8050N}$$

44) Radial Load on Bearing 

$$fx \quad F_r = \frac{P_{eq} - (Y \cdot F_a)}{X}$$

Open Calculator 

$$ex \quad 9196.429N = \frac{9650N - (1.5 \cdot 3000N)}{0.56}$$

45) Radial Load on Bearing given Race Rotation Factor 

$$fx \quad F_r = \frac{P_{eq} - (Y \cdot F_a)}{X \cdot V}$$

Open Calculator 

$$ex \quad 7663.69N = \frac{9650N - (1.5 \cdot 3000N)}{0.56 \cdot 1.2}$$



46) Reliability of Bearing 

$$fx \quad R = e^{-\left(\frac{L}{a}\right)^b}$$

Open Calculator 

$$ex \quad 0.500037 = e^{-\left(\frac{5}{6.84}\right)^{1.17}}$$

47) Reliability of Bearing given Number of Bearings 

$$fx \quad R = R_s^{\frac{1}{N_b}}$$

Open Calculator 

$$ex \quad 0.897901 = (0.65)^{\frac{1}{4}}$$

48) Reliability of Complete Bearing System 

$$fx \quad R_s = R^N - \{b\}$$

Open Calculator 

$$ex \quad 0.599695 = (0.88)^4$$


49) Speed of Rotation of Bearing 

$$fx \quad N = L_{10} \cdot \frac{10^6}{60 \cdot L_{10h}}$$

Open Calculator 

$$ex \quad 300 = 144 \cdot \frac{10^6}{60 \cdot 8000}$$




50) Thrust factor of Bearing 

$$fx \quad Y = \frac{P_{eq} - (X \cdot F_r)}{F_a}$$

Open Calculator 

$$ex \quad 1.714 = \frac{9650N - (0.56 \cdot 8050N)}{3000N}$$

51) Thrust factor of Bearing given Race Rotation Factor 

$$fx \quad Y = \frac{P_{eq} - (X \cdot V \cdot F_r)}{F_a}$$

Open Calculator 

$$ex \quad 1.413467 = \frac{9650N - (0.56 \cdot 1.2 \cdot 8050N)}{3000N}$$

52) Train Wheel Diameter considering Bearing Life 


$$fx \quad D = \left(\frac{1000}{\pi \cdot L_{10}} \right) \cdot L_{10s}$$

Open Calculator 

$$ex \quad 884.1941mm = \left(\frac{1000}{\pi \cdot 144} \right) \cdot 0.4$$




Self Aligning Ball Bearings

53) Axial Thrust Load on Self Aligning Ball Bearing when F_a by F_r is greater than e 

$$fx \quad F_a = \frac{P_{eq_{sa}} - (0.65 \cdot F_r)}{Y_2}$$

Open Calculator 


$$ex \quad 3341.667N = \frac{12250N - (0.65 \cdot 8050N)}{2.1}$$

54) Axial Thrust Load on Self Aligning Ball Bearing when F_a by F_r is less than or equal to e 

$$fx \quad F_a = \frac{P_{eq_{sa}} - F_r}{Y_1}$$

Open Calculator 

$$ex \quad 3000N = \frac{12250N - 8050N}{1.4}$$

55) Equivalent Dynamic Load on Self Aligning Ball Bearing when F_a by F_r is greater than e 

$$fx \quad P_{eq_{sa}} = (0.65 \cdot F_r) + (Y_2 \cdot F_a)$$

Open Calculator 

$$ex \quad 11532.5N = (0.65 \cdot 8050N) + (2.1 \cdot 3000N)$$



56) Equivalent Dynamic Load on Self Aligning Ball Bearing when F_a by F_r is less than or equal to e

$$f_x \text{ } P_{eq_{sa}} = F_r + (Y_1 \cdot F_a)$$

[Open Calculator !\[\]\(0f848bbd71cef6b345273b16f905912a_img.jpg\)](#)

$$ex \text{ } 12250N = 8050N + (1.4 \cdot 3000N)$$

57) Factor Y_1 of Self Aligning Ball Bearing when F_a by F_r is less than or equal to e

$$f_x \text{ } Y_1 = \frac{P_{eq_{sa}} - F_r}{F_a}$$

[Open Calculator !\[\]\(3211b5d1d968fc1665909b34f9f16010_img.jpg\)](#)

$$ex \text{ } 1.4 = \frac{12250N - 8050N}{3000N}$$

58) Factor Y_2 of Self Aligning Ball Bearing when F_a by F_r is greater than e

$$f_x \text{ } Y_2 = \frac{P_{eq_{sa}} - (0.65 \cdot F_r)}{F_a}$$

[Open Calculator !\[\]\(9c2e8d1b5bd77cb5c9f83b7a9cff79fd_img.jpg\)](#)

$$ex \text{ } 2.339167 = \frac{12250N - (0.65 \cdot 8050N)}{3000N}$$



59) Radial Load on Self Aligning Ball Bearing when F_a by F_r greater than e 

$$f_x F_r = \frac{P_{eq_{sa}} - (Y_2 \cdot F_a)}{0.65}$$

Open Calculator

$$ex \quad 9153.846N = \frac{12250N - (2.1 \cdot 3000N)}{0.65}$$

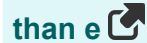
60) Radial Load on Self Aligning Ball Bearing when F_a by F_r is less than or equal to e 

$$f_x F_r = P_{eq_{sa}} - (Y_1 \cdot F_a)$$

Open Calculator

$$ex \quad 8050N = 12250N - (1.4 \cdot 3000N)$$

Spherical Roller Bearing

61) Axial Thrust Load on Spherical Roller Bearing when F_a by F_r is greater than e 

$$f_x F_a = \frac{P_{eq_{sp}} - (0.67 \cdot F_r)}{Y_2}$$

Open Calculator

$$ex \quad 3074.524N = \frac{11850N - (0.67 \cdot 8050N)}{2.1}$$



62) Axial Thrust Load on Spherical Roller Bearing when F_a by F_r is less than or equal to e

$$\text{fx } F_a = \frac{P_{eq_{sp}} - F_r}{Y_1}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 2714.286\text{N} = \frac{11850\text{N} - 8050\text{N}}{1.4}$$

63) Equivalent Dynamic Load on Spherical Roller Bearing when F_a by F_r is greater than e

$$\text{fx } P_{eq_{sp}} = (0.67 \cdot F_r) + (Y_2 \cdot F_a)$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 11693.5\text{N} = (0.67 \cdot 8050\text{N}) + (2.1 \cdot 3000\text{N})$$

64) Equivalent Dynamic Load on Spherical Roller Bearing when F_a by F_r is less than equal to e

$$\text{fx } P_{eq_{sp}} = F_r + (Y_1 \cdot F_a)$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 12250\text{N} = 8050\text{N} + (1.4 \cdot 3000\text{N})$$

65) Factor Y_1 of Spherical Roller Bearing when F_a by F_r is less than or equal to e

$$\text{fx } Y_1 = \frac{P_{eq_{sp}} - F_r}{F_a}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$\text{ex } 1.266667 = \frac{11850\text{N} - 8050\text{N}}{3000\text{N}}$$



66) Factor Y2 of Spherical Roller Bearing when Fa by Fr is greater than e



$$fx \quad Y_2 = \frac{Peq_{sp} - (0.67 \cdot F_r)}{F_a}$$

Open Calculator

$$ex \quad 2.152167 = \frac{11850N - (0.67 \cdot 8050N)}{3000N}$$

67) Radial Load on Spherical Roller Bearing when Fa by Fr greater than e



$$fx \quad F_r = \frac{Peq_{sp} - (Y_2 \cdot F_a)}{0.67}$$

Open Calculator

$$ex \quad 8283.582N = \frac{11850N - (2.1 \cdot 3000N)}{0.67}$$

68) Radial Load on Spherical Roller Bearing when Fa by Fr is less than

equal to e

$$fx \quad F_r = Peq_{sp} - (Y_1 \cdot F_a)$$

Open Calculator

$$ex \quad 7650N = 11850N - (1.4 \cdot 3000N)$$



Stribeck's Equation

69) Angle between adjacent Balls of Ball Bearing

$$fx \quad \beta = \frac{360}{z}$$

[Open Calculator !\[\]\(950a62bbddad88d64435fd35607dfc42_img.jpg\)](#)

$$ex \quad 1375.099^\circ = \frac{360}{15}$$

70) Diameter of Ball of Bearing from Stribeck's Equation

$$fx \quad d_b = \sqrt{\frac{5 \cdot C_o}{k \cdot z}}$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

$$ex \quad 4.20084\text{mm} = \sqrt{\frac{5 \cdot 45000\text{N}}{850\text{N}/\text{mm}^2 \cdot 15}}$$

71) Diameter of Ball of Bearing given Force required to produce Permanent Deformation in Ball

$$fx \quad d_b = \sqrt{\frac{F}{k}}$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$ex \quad 4.20084\text{mm} = \sqrt{\frac{15000\text{N}}{850\text{N}/\text{mm}^2}}$$



72) Force required to produce Permanent Deformation of Balls of Ball Bearing

$$fx \quad F = k \cdot d_b^2$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 14994N = 850N/mm^2 \cdot (4.2mm)^2$$

73) Force required to produce Permanent Deformation of Balls of Ball Bearing given Static Load

$$fx \quad F = 5 \cdot \frac{C_o}{z}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$ex \quad 15000N = 5 \cdot \frac{45000N}{15}$$

74) K Factor for Ball Bearing from Stribeck's Equation

$$fx \quad k = 5 \cdot \frac{C_o}{d_b^2 \cdot z}$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$ex \quad 850.3401N/mm^2 = 5 \cdot \frac{45000N}{(4.2mm)^2 \cdot 15}$$



75) K Factor for Ball Bearing given Force required to produce Permanent Deformation of Balls

$$fx \quad k = \frac{F}{d_b^2}$$

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$ex \quad 850.3401\text{N/mm}^2 = \frac{15000\text{N}}{(4.2\text{mm})^2}$$

76) Number of Balls of Ball Bearing from Stribeck's Equation

$$fx \quad z = 5 \cdot \frac{C_o}{k \cdot d_b^2}$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$ex \quad 15.006 = 5 \cdot \frac{45000\text{N}}{850\text{N/mm}^2 \cdot (4.2\text{mm})^2}$$

77) Number of Balls of Ball Bearing given Angle between Balls

$$fx \quad z = \frac{360}{\beta}$$

[Open Calculator !\[\]\(4688aadfd656ded00cd6bdfae55089a9_img.jpg\)](#)

$$ex \quad 859.4367 = \frac{360}{24^\circ}$$



78) Number of Balls of Ball Bearing given Static Load 

$$\text{fx } z = 5 \cdot \frac{C_o}{F}$$

Open Calculator 

$$\text{ex } 15 = 5 \cdot \frac{45000\text{N}}{15000\text{N}}$$

79) Static Load on Ball of Ball Bearing from Stribeck's Equation 

$$\text{fx } C_o = k \cdot d_b^2 \cdot \frac{z}{5}$$

Open Calculator 

$$\text{ex } 44982\text{N} = 850\text{N}/\text{mm}^2 \cdot (4.2\text{mm})^2 \cdot \frac{15}{5}$$

80) Static Load on Ball of Ball Bearing given Primary force 


$$\text{fx } C_o = F \cdot \frac{z}{5}$$

Open Calculator 

$$\text{ex } 45000\text{N} = 15000\text{N} \cdot \frac{15}{5}$$




Taper Roller Bearing

81) Axial Thrust Load on Taper Roller Bearing when F_a by F_r is greater than e 

$$fx \quad F_a = \frac{Pb_t - (0.4 \cdot F_r)}{Y}$$

Open Calculator 


$$ex \quad 3000N = \frac{7720N - (0.4 \cdot 8050N)}{1.5}$$

82) Equivalent Dynamic Load on Taper Roller Bearing when F_a by F_r is greater than e 

$$fx \quad Pb_t = (0.4 \cdot F_r) + (Y \cdot F_a)$$

Open Calculator 

$$ex \quad 7720N = (0.4 \cdot 8050N) + (1.5 \cdot 3000N)$$

83) Radial Load on Taper Roller Bearing when F_a by F_r is greater than e 

$$fx \quad F_r = \frac{Pb_t - (Y \cdot F_a)}{0.4}$$

Open Calculator 

$$ex \quad 8050N = \frac{7720N - (1.5 \cdot 3000N)}{0.4}$$



Thrust Ball Bearing

84) Minimum Axial Load on Thrust Ball Bearing

Open Calculator 

$$fx \quad F_{\min} = A \cdot \left(\left(\frac{N}{1000} \right)^2 \right)$$

$$ex \quad 0.2499N = 2.04 \cdot \left(\left(\frac{350}{1000} \right)^2 \right)$$

85) Minimum Load Factor for Thrust Ball Bearing

Open Calculator 

$$fx \quad A = F_{\min} \cdot \left(\left(\frac{1000}{N} \right)^2 \right)$$

$$ex \quad 2.040816 = 0.25N \cdot \left(\left(\frac{1000}{350} \right)^2 \right)$$

86) Rotational Speed of Bearing given Maximum Axial Load and Maximum Load Factor

Open Calculator 

$$fx \quad N = 1000 \cdot \sqrt{\frac{F_{\min}}{A}}$$

$$ex \quad 350.07 = 1000 \cdot \sqrt{\frac{0.25N}{2.04}}$$



Variables Used






- **a** Constant a of Bearing
- **A** Minimum Load Factor
- **b** Constant b of Bearing
- **C** Dynamic Load Capacity of Bearing (*Newton*)
- **C_o** Static Load on Bearing (*Newton*)
- **d** Bore Diameter of Bearing (*Millimeter*)
- **D** Train Wheel Diameter (*Millimeter*)
- **d_b** Ball Diameter of a Bearing (*Millimeter*)
- **F** Force on Ball Bearing (*Newton*)
- **F_a** Axial or Thrust Load Acting on Bearing (*Newton*)
- **F_{min}** Minimum Axial Load Thrust Bearing (*Newton*)
- **F_r** Radial Load Acting on Bearing (*Newton*)
- **k** K Factor (*Newton per Square Millimeter*)
- **L** Corresponding Life of Bearing
- **L₁₀** Rated Bearing Life
- **L_{10h}** Rated Bearing Life in Hours
- **L_{10s}** Nominal Life in Millions of Kilometers
- **L₅₀** Median Life of Bearing
- **M_t** Friction Moment on Bearing (*Newton Millimeter*)
- **N** Speed of Bearing in RPM
- **N_b** Number of Bearings
- **p** Constant p of Bearing



- P_b Equivalent Dynamic Load on Back to Back Bearing (Newton)
- P_{eq} Equivalent Dynamic Load on Bearing (Newton)
- P_s Equivalent dynamic load on singly bearing (Newton)
- P_{bt} Equivalent Dynamic Load on Taper Bearing (Newton)
- $P_{eq_{sa}}$ Equivalent Dynamic Load on Self Aligning Bearing (Newton)
- $P_{eq_{sp}}$ Equivalent Dynamic Load on Spherical Bearing (Newton)
- R Reliability of Bearing
- R_s Reliability of Bearing System
- V Race-Rotation Factor
- W Load Acting on Bearing (Newton)
- X Radial Factor
- Y Thrust Factor for Bearing
- Y_1 Factor Y1 of Bearing
- Y_2 Factor Y2 of Bearing
- z Number of Balls in Bearing
- β Angle between Balls of Bearing in Degrees (Degree)
- μ Coefficient of Friction for Bearing



Constants, Functions, Measurements used

- **Constant: pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Constant: e**, 2.71828182845904523536028747135266249
Napier's constant
- **Function: log10**, $\log_{10}(\text{Number})$
The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.
- **Function: sqrt**, $\text{sqrt}(\text{Number})$
A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- **Measurement: Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Angle** in Degree ($^{\circ}$)
Angle Unit Conversion 
- **Measurement: Torque** in Newton Millimeter (N*mm)
Torque Unit Conversion 
- **Measurement: Stress** in Newton per Square Millimeter (N/mm²)
Stress Unit Conversion 



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