

## Rolling bearing

### 03 Deep Groove (Inner Geometry)


|            |                      |
|------------|----------------------|
| Changed on | 25.09.2024, 18:01:58 |
| Changed by | Kadkraft-Simufact    |

Non commercial version for demo and support purposes only ! (914)  
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## 1 Messages

 Calculation is consistent.

## 2 Overview

Rolling bearing calculation according to ISO/TS 16281:2008  
Deep groove ball bearing (single row)

## 3 Details for bearing internal geometry

|   |                         |         |
|---|-------------------------|---------|
| Number of rolling elements  | [Z]                     | 11      |
| Diameter of rolling element (mm)  | [D <sub>w</sub> ]       | 4.279   |
| Reference diameter (mm)   | [D <sub>pw</sub> ]      | 46.000  |
| Inner raceway diameter (mm)   | [d <sub>i</sub> ]       | 41.757  |
| Outer raceway diameter (mm)   | [d <sub>o</sub> ]       | 50.329  |
| Inner raceway curvature (mm)  | [r <sub>i</sub> ]       | 2.225   |
| Outer raceway curvature (mm)  | [r <sub>o</sub> ]       | 2.268   |
| Basic dynamic load rating (kN)  | [C <sub>r</sub> ]       | 4.813   |
| Basic static load rating (kN)   | [C <sub>0r</sub> ]      | 3.318   |
| Diametral backlash (μm)   | [Pd]                    | 13.000  |
| Axial clearance (μm)  | [Pa]                    | 0.000   |
| Fatigue load limit (kN)   | [C <sub>u</sub> ]       | 0.169   |
| Oil lubrication, on-line filtration, ISO4406 -/19/16, β <sub>40</sub> =75 |                         |         |
| Vickers hardness (-)  | [HV]                    | 660.000 |
| Failure probability coefficient   | [a <sub>1</sub> ]       | 0.638   |
| Limiting value for aISO coefficient                                       | [a <sub>ISO,max</sub> ] | 50.000  |

## 4 Results

|  |                                      |          |
|--|--------------------------------------|----------|
| Contamination factor   | [e <sub>c</sub> ]                    | 0.126    |
| Operating viscosity (mm <sup>2</sup> /s)   | [ν]                                  | 48.884   |
| Reference viscosity (mm <sup>2</sup> /s)   | [ν <sub>i</sub> ]                    | 17.131   |
| Viscosity ratio  | [κ]                                  | 2.854    |
| Minimum lubricant film thickness EHL (μm)  | [h <sub>min</sub> ]                  | 0.103    |
| Spin to roll speed ratio   | [ω <sub>s</sub> /ω <sub>roll</sub> ] | 0.000    |
|  |                                      |          |
| Bearing displacement (μm)  | [u <sub>x</sub> ]                    | 0.000    |
| Bearing displacement (μm)  | [u <sub>y</sub> ]                    | 23.287   |
| Bearing displacement (μm)  | [u <sub>z</sub> ]                    | -0.339   |
| Bearing misalignment (mrad)  | [r <sub>y</sub> ]                    | 0.000    |
| Bearing misalignment (mrad)  | [r <sub>z</sub> ]                    | 0.000    |
|  |                                      |          |
| Bearing reaction force (N)   | [F <sub>x</sub> ]                    | -0.000   |
| Bearing reaction force (N)   | [F <sub>y</sub> ]                    | -992.000 |
| Bearing reaction force (N)   | [F <sub>z</sub> ]                    | -0.000   |
|  |                                      |          |
| Bearing reaction torque (Nm)   | [M <sub>y</sub> ]                    | 0.000    |
| Bearing reaction torque (Nm)   | [M <sub>z</sub> ]                    | 0.000    |
|  |                                      |          |
| Equivalent load (kN)   | [P <sub>ref</sub> ]                  | 1.058    |
| Equivalent load (kN)   | [P <sub>0ref</sub> ]                 | 1.196    |
| Maximum pressure, inner ring (N/mm <sup>2</sup> )  | [p <sub>max_i</sub> ]                | 2798.703 |
| Maximum pressure, outer ring (N/mm <sup>2</sup> )  | [p <sub>max_o</sub> ]                | 2797.094 |
| Static safety factor (-)   | [S <sub>0w</sub> ]                   | 3.380    |
| Static safety factor (-)   | [S <sub>0ref</sub> ]                 | 2.775    |
| S <sub>0w</sub> = (p <sub>0</sub> /p <sub>max</sub> ) <sup>n</sup> , S <sub>0ref</sub> = C <sub>0r</sub> / P <sub>0ref</sub> |                                      |          |
| Maximum contact diameter, inside (mm)  | [d <sub>c_i</sub> ]                  | 41.757   |
| Minimum contact diameter, outside (mm)   | [d <sub>c_o</sub> ]                  | 50.329   |

|  |                      |          |
|--|----------------------|----------|
| Inner ring speed (1/min)                       | [n <sub>1</sub> ]    | 1500.000 |
| Outer ring speed (1/min)                       | [n <sub>2</sub> ]    | 0.000    |
| Effective speed (1/min)                        | [n <sub>rel</sub> ]  | 1500.000 |
| Reference service life (-)                     | [L <sub>10r</sub> ]  | 94.240   |
| Reference service life (h)                     | [L <sub>nrh</sub> ]  | 1047.113 |
| Modified reference service life (-)            | [L <sub>10rm</sub> ] | 51.054   |
| Modified reference service life (h)            | [L <sub>nmrh</sub> ] | 567.268  |
| Rotational frequency cage (Hz)                 | [FTF]                | 11.337   |
| Rotational frequency of rolling element (Hz)   | [BSF]                | 133.202  |
| Over-rolling frequency of inner ring (Hz)      | [BPF]                | 150.292  |
| Over-rolling frequency of outer ring (Hz)      | [BPFO]               | 124.708  |
| Over-rolling frequency of rolling element (Hz) | [BPF]                | 266.404  |

**Bearing stiffness at point of operation**

dFr/dur = 95.007 N/μm, (dFr/dur)<sub>eff</sub> = (Fr/ur) = 42.595 N/μm  
 dMr/drr = 0.000 Nm/mrad ( 0.000 Nm/°, (dMr/drr)<sub>eff</sub> = (Mr/rr) = 0.000 Nm/mrad ( 0.000 Nm/°)

|    | u <sub>x</sub> | u <sub>y</sub> | u <sub>z</sub> | r <sub>y</sub> | r <sub>z</sub> |
|----|----------------|----------------|----------------|----------------|----------------|
| Fx | -4.965         | 0.000          | 0.000          | -0.121         | 100.468        |
| Fy | 0.000          | -95.036        | -1.258         | 0.000          | 0.000          |
| Fz | 0.000          | -1.254         | -43.145        | 0.000          | 0.000          |
| My | -0.000         | 0.000          | 0.000          | -0.568         | -0.016         |
| Mz | 0.099          | 0.000          | 0.000          | -0.016         | -2.061         |

F-u: N/μm, F-r: N/mrad, M-u: Nm/μm, M-r: Nm/mrad

| Rolling body | F  (kN) | F <sub>x</sub> (kN) | F <sub>y</sub> (kN) | F <sub>z</sub> (kN) | M <sub>y</sub> (Nm) | M <sub>z</sub> (Nm) | α (°) | p <sub>max</sub> (N/mm <sup>2</sup> ) | a <sub>i</sub> (mm) | b <sub>i</sub> (mm) | a <sub>o</sub> (mm) | b <sub>o</sub> (mm) |
|--------------|---------|---------------------|---------------------|---------------------|---------------------|---------------------|-------|---------------------------------------|---------------------|---------------------|---------------------|---------------------|
| 1            | 0.000   | 0.000               | 0.000               | 0.000               | 0.000               | 0.000               | 0.00  | 0.00                                  | 0.000               | 0.000               | 0.000               | 0.000               |
| 2            | 0.090   | 0.000               | -0.049              | -0.076              | 0.000               | 0.000               | 0.00  | 1655.01                               | 0.474               | 0.055               | 0.398               | 0.065               |
| 3            | 0.358   | 0.000               | -0.325              | -0.149              | 0.000               | 0.000               | 0.00  | 2619.58                               | 0.750               | 0.087               | 0.630               | 0.104               |
| 4            | 0.436   | 0.000               | -0.432              | 0.062               | 0.000               | 0.000               | 0.00  | 2798.70                               | 0.802               | 0.093               | 0.673               | 0.111               |
| 5            | 0.246   | 0.000               | -0.186              | 0.161               | 0.000               | 0.000               | 0.00  | 2311.39                               | 0.662               | 0.077               | 0.555               | 0.091               |
| 6            | 0.002   | 0.000               | -0.000              | 0.001               | 0.000               | 0.000               | 0.00  | 426.89                                | 0.122               | 0.014               | 0.103               | 0.017               |
| 7            | 0.000   | 0.000               | 0.000               | 0.000               | 0.000               | 0.000               | 0.00  | 0.00                                  | 0.000               | 0.000               | 0.000               | 0.000               |
| 8            | 0.000   | 0.000               | 0.000               | 0.000               | 0.000               | 0.000               | 0.00  | 0.00                                  | 0.000               | 0.000               | 0.000               | 0.000               |
| 9            | 0.000   | 0.000               | 0.000               | 0.000               | 0.000               | 0.000               | 0.00  | 0.00                                  | 0.000               | 0.000               | 0.000               | 0.000               |
| 10           | 0.000   | 0.000               | 0.000               | 0.000               | 0.000               | 0.000               | 0.00  | 0.00                                  | 0.000               | 0.000               | 0.000               | 0.000               |
| 11           | 0.000   | 0.000               | 0.000               | 0.000               | 0.000               | 0.000               | 0.00  | 0.00                                  | 0.000               | 0.000               | 0.000               | 0.000               |

Major elliptical axis 2·a, minor elliptical axis 2·b

a<sub>i</sub>, b<sub>i</sub>: Contact with inner raceway, a<sub>o</sub>, b<sub>o</sub>: Contact with outer raceway

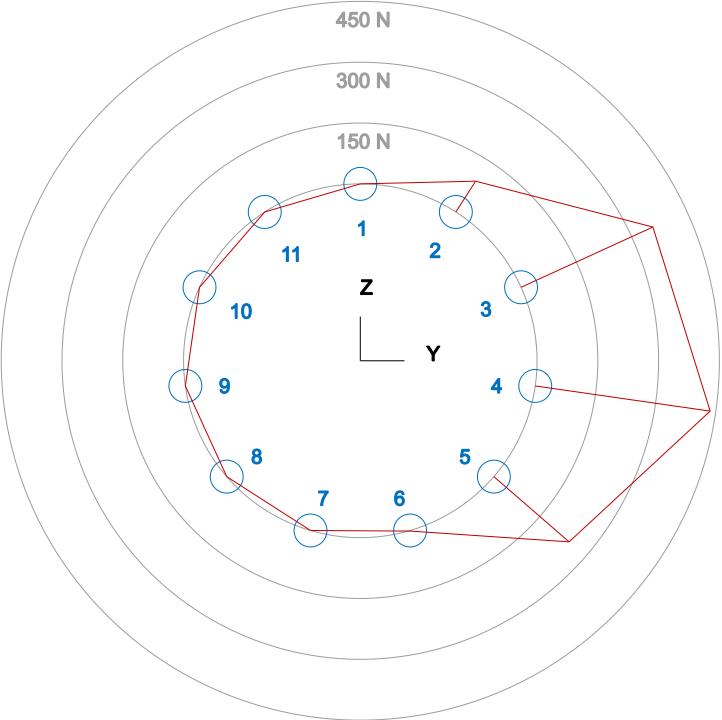


Figure: Load distribution

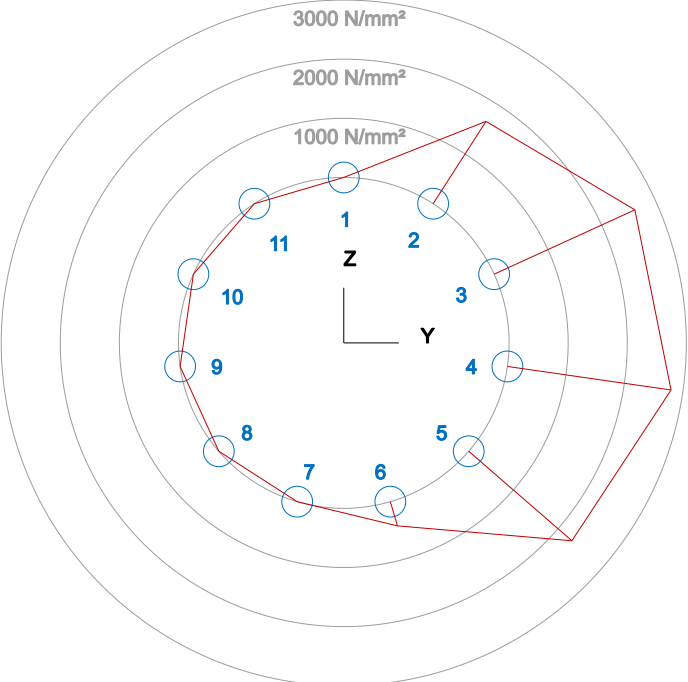


Figure: Pressure curve(Hertzian stress Contact on inner race)

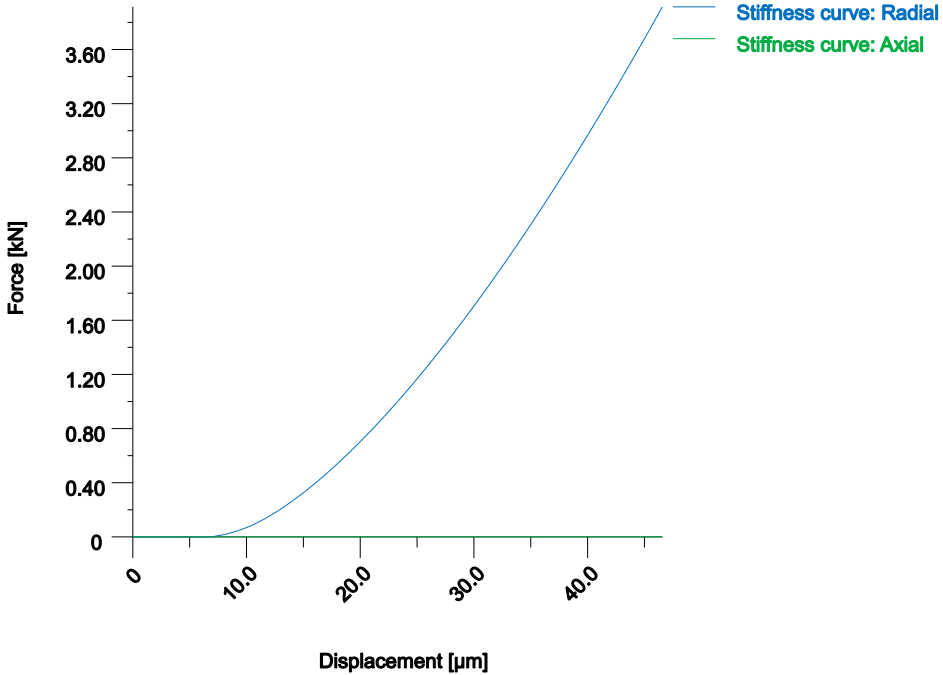


Figure: Stiffness curve

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