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Rolling bearings — Static load ratings

AMENDMENT 1

Roulements — Charges statiques de base

AMENDEMENT 1

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This document was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 8, *Load ratings and life*.

Rolling bearings — Static load ratings

AMENDMENT 1

Clause 4

Insert the following symbols:

$E(\kappa)$ complete elliptic integral of the second kind

$K(\kappa)$ complete elliptic integral of the first kind

$\Sigma\rho_e$ curvature sum at the outer ring contact

$\Sigma\rho_i$ curvature sum at the inner ring contact

$F(\rho)$ curvature difference of a point contact

γ auxiliary parameter, $\gamma = D_w \cos \alpha / D_{pw}$

κ ratio of semi major to semi minor axis of the contact ellipse

5.1.1

Replace the subclause with the following:

5.1.1 Basic static radial load rating for single bearings

The basic static radial load rating for radial ball bearings is given by Formula (1):

$$C_{0r} = f_0 \, i \, Z \, D_W{}^2 \cos\alpha \tag{1}$$

where, except for radial self-aligning ball bearings

$$f_0 = \min\left\{ f_{0,i}, f_{0,e} \right\}$$

in which

$$f_{0,i} = 2{,}399\ 05 \cdot \kappa_i \cdot \left[\frac{E(\kappa_i)}{2 + \frac{\gamma}{1-\gamma} - \frac{D_w}{2 \cdot r_i}} \right]^2 \tag{2}$$

$$f_{0,e} = 2{,}399\ 05 \cdot \kappa_e \cdot \left[\frac{E(\kappa_e)}{2 - \frac{\gamma}{1+\gamma} - \frac{D_w}{2 \cdot r_e}} \right]^2 \tag{3}$$

where

i is the inner ring;

e is the outer ring.

The calculation of the Hertzian parameters, κ and $E(\kappa)$, is described in Annex B.

For a radial self-aligning ball bearing, the factor, f_0, is given by Formula (4):

$$f_0 = 3{,}151\ 84 \cdot \left[\frac{\pi}{4} \cdot (1+\gamma)\right]^2 \tag{4}$$

The guide values given in Table 1 apply to bearings with a cross-sectional raceway groove radius not larger than 0,52D_w in radial and angular contact ball bearing inner rings, and 0,53D_w in radial and angular contact ball bearing outer rings and self-aligning ball bearing inner rings. The load-carrying ability of a bearing is not necessarily increased by the use of a smaller groove radius, but is reduced by the use of a groove radius larger than those indicated above. In the latter case, the value f_0 shall be calculated by the formulae given here.

Annex C gives a graphical representation of the value f_0 in dependency of the bearing internal geometry. The results of the formulae given here are preferred over Table 1 and Annex C.

5.2.1

Renumber Formula (2) and Formula (3) respectively into Formula (5) and Formula (6).

6.1

Replace the subclause with the following:

6.1 Basic static axial load rating

The basic static axial load rating for single-direction and double-direction thrust ball bearings is given by Formula (7):

$$C_{0a} = f_0\, Z\, D_w{}^2 \sin\alpha \tag{7}$$

where

$$f_0 = \min\left\{f_{0,i}, f_{0,e}\right\}$$

in which

$$f_{0,i} = 11{,}995\ 2 \cdot \kappa_i \cdot \left[\frac{E(\kappa_i)}{2 + \dfrac{\gamma}{1-\gamma} - \dfrac{D_w}{2 \cdot r_i}}\right]^2 \tag{8}$$

$$f_{0,e} = 11{,}995\ 2 \cdot \kappa_e \cdot \left[\frac{E(\kappa_e)}{2 - \dfrac{\gamma}{1+\gamma} - \dfrac{D_w}{2 \cdot r_e}}\right]^2 \tag{9}$$

where

i is the inner ring or shaft washer;

e is the outer ring or housing washer.

The guide values given in Table 1 apply to bearings with cross-sectional raceway groove radii not larger than 0,54D_w. The load-carrying ability of a bearing is not necessarily increased by the use of a smaller groove radius smaller than 0,54D_w, but is reduced by the use of a larger groove radius. In the latter case, the value f_0 shall be calculated by the formulae given here.

Annex C gives a graphical representation of the value f_0. The results of the formulae given here are preferred over Table 1 and Annex C.

6.2

Renumber Formula (5) and Formula (6) respectively into Formula (10) and Formula (11).

7.1.1

Renumber Formula (7) into Formula (12).

In the NOTE, replace “Equation (7)” by “Formula (12)”.

7.2.1

Renumber Formula (8), Formula (9) and Formula (10) respectively into Formula (13), Formula (14) and Formula (15).

8.1.1

Renumber Formula (11) into Formula (16).

In the NOTE, replace “Equation (11)” by “Formula (16)”.

8.2.1

Renumber Formula (12) and Formula (13) respectively into Formula (17) and Formula (18).

8.2.2

Replace “Equation (12)” by “Formula (17)”.

9.1

Renumber Formula (14) and Formula (15) respectively into Formula (19) and Formula (20).

Replace “Equation (14)” and “Equation (15)” respectively by “Formula (19)” and “Formula (20)”.

In all the document

Replace the term “Equation” by “Formula”.

A.5.1

Replace “according to Equation (1)” with “according to Formula (1)”.

A.5.2

Add the following text at the end of the subclause:

For a single-row angular contact ball bearing having the same internal dimensions as above but radial bearing conformities, Formula (A.1) gives

C_{0ar} = 18 731/0,26 = 72 042

C_{0ar} = 72 000 N

A.5.3

Add the following text at the end of the subclause:

For a single-row angular contact ball bearing having the same internal dimensions as above and radial bearing conformities, Formula (A.2) gives

C_{0aa} = 1,43 × 76 049 = 108 750

C_{0aa} = 109 000 N

Annex B and Annex C

Add the following annexes after Annex A:

Annex B
(informative)

Calculation of the Hertzian parameters for point contact

The ratio of semi-major to semi-minor axis of the contact ellipse, κ, is independent of the modulus of elasticity and Poisson's ratio of the contacting bodies. It can be derived iteratively from Formula (B.1):

$$1-\frac{2}{\kappa^2-1}\cdot\left[\frac{K(\kappa)}{E(\kappa)}-1\right]-F(\rho)=0 \qquad \text{(B.1)}$$

The complete elliptic integral of the first kind, $K(\kappa)$, is as shown in Formula (B.2):

$$K(\kappa)=\int_0^{\frac{\pi}{2}}\left[1-\left(1-\frac{1}{\kappa^2}\right)\cdot(\sin\phi)^2\right]^{-\frac{1}{2}}\mathrm{d}\phi \qquad \text{(B.2)}$$

The complete elliptic integral of the second kind, $E(\kappa)$, is as shown in Formula (B.3):

$$E(\kappa)=\int_0^{\frac{\pi}{2}}\left[1-\left(1-\frac{1}{\kappa^2}\right)\cdot(\sin\phi)^2\right]^{\frac{1}{2}}\mathrm{d}\phi \qquad \text{(B.3)}$$

The curvature sum of the inner ring (shaft washer) raceway contacts is as shown in Formula (B.4):

$$\sum\rho_{\mathrm{i}}=\frac{2}{D_{\mathrm{w}}}\cdot\left[2+\frac{\gamma}{1-\gamma}-\frac{D_{\mathrm{w}}}{2\cdot r_{\mathrm{i}}}\right] \qquad \text{(B.4)}$$

The curvature sum of the outer ring (housing washer) raceway contacts is as shown in Formula (B.5):

$$\sum\rho_{\mathrm{e}}=\frac{2}{D_{\mathrm{w}}}\cdot\left[2-\frac{\gamma}{1+\gamma}-\frac{D_{\mathrm{w}}}{2\cdot r_{\mathrm{e}}}\right] \qquad \text{(B.5)}$$

The relative curvature difference of the inner ring (shaft washer) raceway contacts is as shown in Formula (B.6):

$$F_{\mathrm{i}}(\rho)=\frac{\dfrac{\gamma}{1-\gamma}+\dfrac{D_{\mathrm{w}}}{2\cdot r_{\mathrm{i}}}}{2+\dfrac{\gamma}{1-\gamma}-\dfrac{D_{\mathrm{w}}}{2\cdot r_{\mathrm{i}}}} \qquad \text{(B.6)}$$

and the relative curvature difference of the outer ring (housing washer) raceway contacts is as shown in Formula (B.7):

$$F_{\mathrm{e}}(\rho)=\frac{\dfrac{-\gamma}{1+\gamma}+\dfrac{D_{\mathrm{w}}}{2\cdot r_{\mathrm{e}}}}{2-\dfrac{\gamma}{1+\gamma}-\dfrac{D_{\mathrm{w}}}{2\cdot r_{\mathrm{e}}}} \qquad \text{(B.7)}$$

