KYODO YUSHI TECHNICAL BULLETIN

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Service Life of Lubricating Grease in Ball Bearings (1)

Grease-lubricated rolling bearings may experience a sudden increase in friction torque after prolonged operation, making continued operation impossible. The operating time until this phenomenon occurs is referred to here as the “service life”. This paper aims to establish guidelines for developing long-service-life greases and reports the results of service life tests conducted on rolling bearings lubricated with the greases presented in Table 1 and Fig. 1.

Service life tests in accordance with DIN 51821 FE9 were carried out using the tester shown in Fig. 2 on 7206B angular contact ball bearings at an axial load of 1500 N, a rotational speed of 6000 min^{-1}, and a temperature of 120 °C or 150 °C. The space between the balls and the cage was filled with 4 g of grease. The time when the driving power of the tester exceeded approx. twice its steady value for more than six consecutive seconds was recorded as the service life. Four tests were conducted for each grease and the service life L_{50} as determined from the Weibull plot was taken as the representative value.

Figures 3 and 4 show the test results for the bearing without a cover at 120 °C and that with a cover at 150 °C, respectively. In both bearings, grease A showed the longest service life, followed by greases C and B. Contrary to expectations of a shorter service life at higher temperatures, all greases in the high-temperature tests (Fig. 4) demonstrated a service life equivalent to, or approximately three times longer than, that of the greases in the low-temperature tests (Fig. 3). This can be explained by the bearing cover, inside which grease was re-distributed by churning to supply oil to the raceway. Figure 5 shows the test results used to quantify the effect of the distance between the cover and the bearing, with curves tentatively fitted to the data. At any distance, A had the shortest service life, whilst B had the longest. C had a service life comparable to that of A at large distances, and to that of B when the distance was small. All greases had a shorter service life as the distance increased, which supports the explanation above.

Komoriya T, Ichimura R, Kochi T, Yoshihara M, Sakai M, Dong D, Kimura Y. Service Life of Lubricating Grease in Ball Bearings. (Part 1). Tribol Online. 2021;16(4): 236-245.

Table 1 Grease samples

Grease	A	B	C
Base oil Kinematic visc. (25 ˚C) mm^2/s	Paraffinic mineral oil 142		
Thickener	Aromatic diurea	Aliphatic diurea	Alicyclic-aliphatic diurea
Concentration, mass%	20.0	8.0	8.0
Penetration (60W)	300	296	297
Additive	Antioxidant		

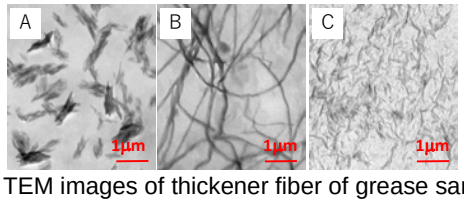


Fig.1 TEM images of thickener fiber of grease samples

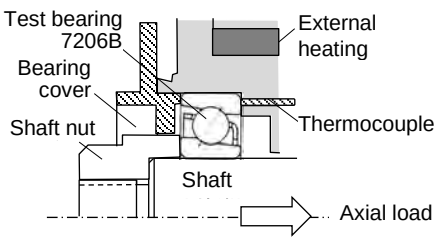


Fig.2 Schematic diagram of bearing test

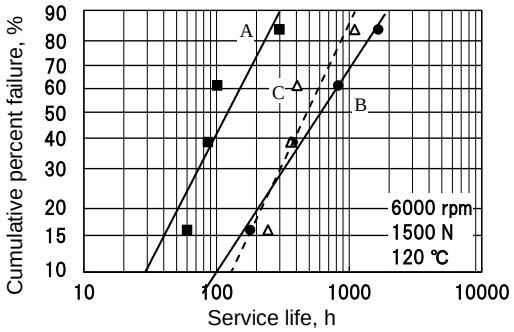


Fig.3 Weibull plot of service life
(w/o bearing cover, 120 ˚C)

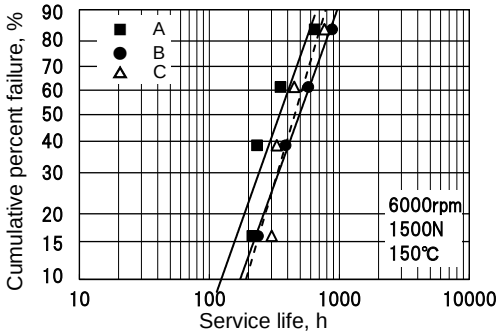


Fig.4 Weibull plot of service life
(w/ bearing cover, 150 ˚C)

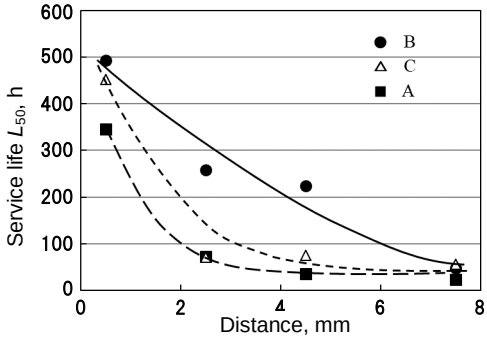


Fig.5 Change of L_{50} with the distance between the bottom of the cover and the front face of the bearing