1.4. Service Life

Model KR consists of an LM Guide, a Ball Screw and a support bearing. The rated life of each component can be obtained using the basic dynamic load rating indicated in Table 2 on page L-8 (Rated Load of Model KR).

LM Guide Unit

●Rated Life

$$L = \left(\frac{f_C \cdot C}{f_W \cdot P_C}\right)^3 \times 50$$

where

L : Rated life (km)
(The total travel distance that 90% of a group of identical LM Guide units independently operating under the same conditions can achieve without showing flaking)
C : Basic dynamic load rating (N)
P_C : Calculated applied load (N)
f_W : Load factor (see table 5 on page L-13)
f_C : Contact factor (see table 4 on page L-13)

●If a moment is applied to model KR-A/C or model KR-B/D using two nut blocks in close contact with each other, calculate the equivalent load by multiplying the applied moment by the equivalent factor indicated in table 6 on page L-13.

$$P_m = K \cdot M$$

where

P_m : Equivalent load (per nut block) (N)
K : Moment equivalent factor (see table 6 on page L-13)
M : Applied moment (N-mm)
(If planning to use three or more nut blocks, or use nut blocks with a wide span, contact THK .)

●If moment M_C is applied to model KR-B/D

$$P_m = \frac{K_C \cdot M_C}{2}$$

●If a radial load (P) and a moment are simultaneously applied to model KR

$$P_E = P_m + P$$

where

P_E : Total equivalent radial load (N)
Perform a rated life calculation using the above data.

●Service life time

When the rated life (L) has been obtained, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

$$L_h = \frac{L \times 10^6}{2 \cdot \ell_s \cdot n_1 \times 60}$$

where

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : Number of reciprocations per minute (min^{-1})

Ball Screw Unit/Support Bearing Unit

●Rated life

$$L = \left(\frac{Ca}{f_w \cdot Fa} \right)^3 \times 10^6$$

where

L : Rated life (rev.)
(The total number of revolutions that 90% of a group of identical Ball Screw units independently operating under the same conditions can achieve without showing flaking)
Ca : Basic dynamic load rating (N)
Fa : Axial load (N)
f_w : Load factor (see table 5 on page L-13)

When the rated life has been obtained from the equation above, if the stroke length and the number of reciprocations per minute are constant, the service life time is obtained using the following equation.

●Service life time

$$L_h = \frac{L \cdot \ell}{2 \cdot \ell_s \cdot n_1 \times 60}$$

where

L_h : Service life time (h)
ℓ_s : Stroke length (mm)
n_1 : Number of reciprocations per minute (min^{-1})
ℓ : Ball screw lead (mm)

■f_C : Contact factor

If two nut blocks are used in close contact with each other with model KR-B/D, multiply the basic load rating by the corresponding contact factor indicated in table 4.

■f_W : Load factor

Table 5 shows load factors.

■K : Moment equivalent factor (LM Guide unit)

When model KR travels under a moment, the distribution of load applied to the LM Guide is locally large (see page A-51). In such cases, calculate the load by multiplying the moment value by the corresponding moment equivalent factor indicated in table 6.

Symbols K_A, K_B and K_C indicate the moment equivalent loads in the M_A, M_B and M_C directions, respectively.

Table 4 Contact Factor (f_C)

Block type	Contact factor f_C
Type A/C	1
Type B/D	0.81

Table 5 Load Factor (f_W)

Vibrations/impact	Speed (V)	f_W
Faint	Very low V≦0.25m/s	1 to 1.2
Weak	Slow 0.25<V≦1m/s	1.2 to 1.5
Medium	Medium 1<V≦2m/s	1.5 to 2
Strong	High V>2m/s	2 to 3.5

Table 6 Moment Equivalent Factor (K)

Model No.	K_A	K_B	K_C
KR 15-A	3.2×10^{-1}	3.2×10^{-1}	9.09×10^{-2}
KR 15-B	5.96×10^{-2}	5.96×10^{-2}	9.09×10^{-2}
KR 20-A	2.4×10^{-1}	2.4×10^{-1}	7.69×10^{-2}
KR 20-B	4.26×10^{-2}	4.26×10^{-2}	7.69×10^{-2}
KR 26-A	1.73×10^{-1}	1.73×10^{-1}	5.88×10^{-2}
KR 26-B	3.06×10^{-2}	3.06×10^{-2}	5.88×10^{-2}
KR 30H-A	1.51×10^{-1}	1.51×10^{-1}	4.78×10^{-2}
KR 30H-B	2.76×10^{-2}	2.76×10^{-2}	4.78×10^{-2}
KR 30H-C	2.77×10^{-1}	2.77×10^{-1}	4.78×10^{-2}
KR 30H-D	3.99×10^{-2}	3.99×10^{-2}	4.78×10^{-2}
KR 33-A	1.51×10^{-1}	1.51×10^{-1}	4.93×10^{-2}
KR 33-B	2.57×10^{-2}	2.57×10^{-2}	4.93×10^{-2}
KR 33-C	2.77×10^{-1}	2.77×10^{-1}	4.93×10^{-2}
KR 33-D	3.55×10^{-2}	3.55×10^{-2}	4.93×10^{-2}
KR 45H-A	9.83×10^{-2}	9.83×10^{-2}	3.45×10^{-2}
KR 45H-B	1.87×10^{-2}	1.87×10^{-2}	3.45×10^{-2}
KR 45H-C	1.83×10^{-1}	1.83×10^{-1}	3.45×10^{-2}
KR 45H-D	2.81×10^{-2}	2.81×10^{-2}	3.45×10^{-2}
KR 46-A	1.01×10^{-1}	1.01×10^{-1}	3.38×10^{-2}
KR 46-B	1.78×10^{-2}	1.78×10^{-2}	3.38×10^{-2}
KR 46-C	1.85×10^{-1}	1.85×10^{-1}	3.38×10^{-2}
KR 46-D	2.5×10^{-2}	2.5×10^{-2}	3.38×10^{-2}
KR 55-A	8.63×10^{-2}	8.63×10^{-2}	2.83×10^{-2}
KR 55-B	1.53×10^{-2}	1.53×10^{-2}	2.83×10^{-2}
KR 65-A	7.55×10^{-2}	7.55×10^{-2}	2.14×10^{-2}
KR 65-B	1.35×10^{-2}	1.35×10^{-2}	2.14×10^{-2}

Note: For model KR-B/D, values for two nut blocks used in close contact with each other apply.