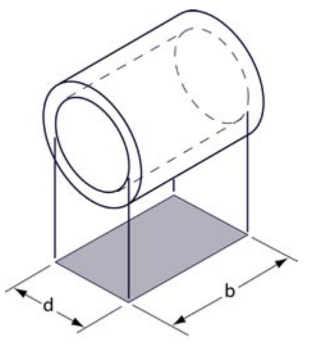
PV CALCULATIONS

The load factor PV has a considerable influence on determining the bearings useful operating life. PV is determined by multiplying the specific bearing load or pressure (P) by the sliding speed (V). Bearing materials are rated by a PV limit, with the PV limit representing the highest combination of load and speed under which the bearing material will operate. The PV unit of measure is $N/mm^2 \times m/s$.

To determine P in an application: The specific bearing load (P) is determined by dividing the bearing load by the pressure supporting area of the bearing. The units for P are N/mm^2. The pressure supporting area depends on the specific geometry of the bearing, the following are formula for the most common types of bearing geometry.

Sleeve Bushing



Specific Bearing Load (N/mm^2)

$$p = \frac{W_r}{d \times b}$$

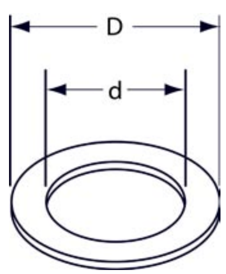
Sliding Speed (m/s) Rotation

$$v = \frac{\pi \times d \times N}{60 \times 10^3}$$

Sliding Speed (m/s) Oscillation

$$v = \frac{\pi \times d \times \partial \times N_{os}}{60 \times 10^3 \times 360}$$

Thrust Washer



Specific Bearing Load (N/mm^2)

$$p = \frac{4W_t}{\pi (D^2 - d^2)}$$

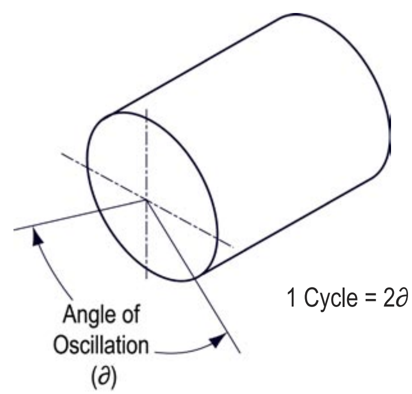
Sliding Speed (m/s) Rotation

$$v = \frac{\pi \times D \times N}{60 \times 10^3}$$

Sliding Speed (m/s) Oscillation

$$v = \frac{\pi \times D}{60 \times 10^3} \times \frac{2\partial \times N_{os}}{360}$$

p	specific bearing load	N/mm^2
W_r	load on bushing	N
d	inside diameter	mm
D	outside diameter	mm
W_t	load on thrust washer	N
N	speed of rotation	rpm
∂	angle of oscillation	degrees
N_{os}	frequency of oscillation	cycles /min
v	sliding speed	m/s



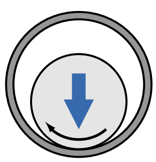
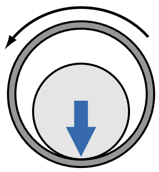
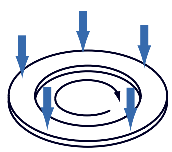
CALCULATION OF THE USEFUL LIFE

The operating life of a dry application TH sliding bushing is inversely proportional to the load factor (p x v) but, in order to achieve a close approximation of the figure, the following corrective factors must be introduced:

- K_a = constant relative to the type of application
- f_p = load correction factor
- f_c = application characteristics and temperature correction factor
- f_d= bearing size correction factor
- f_m = shaft material correction factor

$$L_h = \frac{K_a}{pv^{1.2}} \times f_p \times f_c \times f_d \times f_m$$

K_a = application type constant

UNIDIRECTIONAL LOAD	ROTATING LOAD	THRUST LOAD
		
400	800	250

f_p

p = N/mm²			
≤ 10	≤ 25	≤ 50	≥ 60
1	0.3	0.2	0.1

f_c = application characteristics

CHARACTERISTICS	HEAT DISSIPATION	TEMPERATURE °C					
		20	60	100	150	200	280
Continuous Dry Operation	Good	1.0	0.8	0.6	0.4	0.2	0.1
Continuous Dry Operation	Poor	0.5	0.4	0.3	0.2	0.1	-
Intermittent Operation Interval > 10 x Operating Time	Good	2.0	1.6	1.2	0.8	0.4	0.2
Constant Immersion in Water		2.0	1.6	0.8	-	-	-
Alternating Immersion in Water		0.4	0.2	0.1	-	-	-
Constant Immersion in Lubricant		3.0	2.4	1.8	1.2	0.8	-

f_m = shaft material correction factor

MATERIAL	f_m
Low Carbon Steel	1
Hardened Steel	1.5
Stainless Steel	2
Cast Iron (0.4 RQ)	1
Aluminum	0.4
Bronze	0.4
Plating	f_m
Zinc Cadmium	0.2
Nickel	0.2
Chrome	2
Anodized Aluminum	2

f_d	SHAFT DIAMETER (mm)				
	≤ 20	20 - 40	40 - 100	100 - 150	> 150
	1	0.9	0.7	0.5	0.4

APPLICATION

Having calculated the life of the bushing (L_h), the engineer has to decide whether to accept or reject the data obtained. If the estimated life is not acceptable, the sizes of the bushing are modified and a new check is made following the sequence previously adopted.

For a more detailed estimation of the operating life of DMR bushings and other products in the series, please complete the Application Data Sheet at the back of the catalogue and fax it to your local Daemar Technical Sales Representative.

For applications that come close to the design limits, it is always advisable to carry out prototype testing.

RUNNING-IN PERIOD

In order to complete the information and the calculations concerning the operating life of the bearings, consideration must be given to the operating method and the degree of wear on the bearings. The bearings have an initial running-in period during which the outer layer of the sliding surface is transferred onto the mating surface, compensating for the non-flatness of the contact and making the coefficient of friction stable.

After the running-in phase, the porous bronze layer is gradually exposed. The surface of the exposed bronze increases with the number of operating hours until it reaches 90% of the contact surface. At this point, the bearing is considered to have reached the end of its useful life.

If, after the running-in period, the bronze is exposed regularly over all the contact area, it confirms that the application was correct.