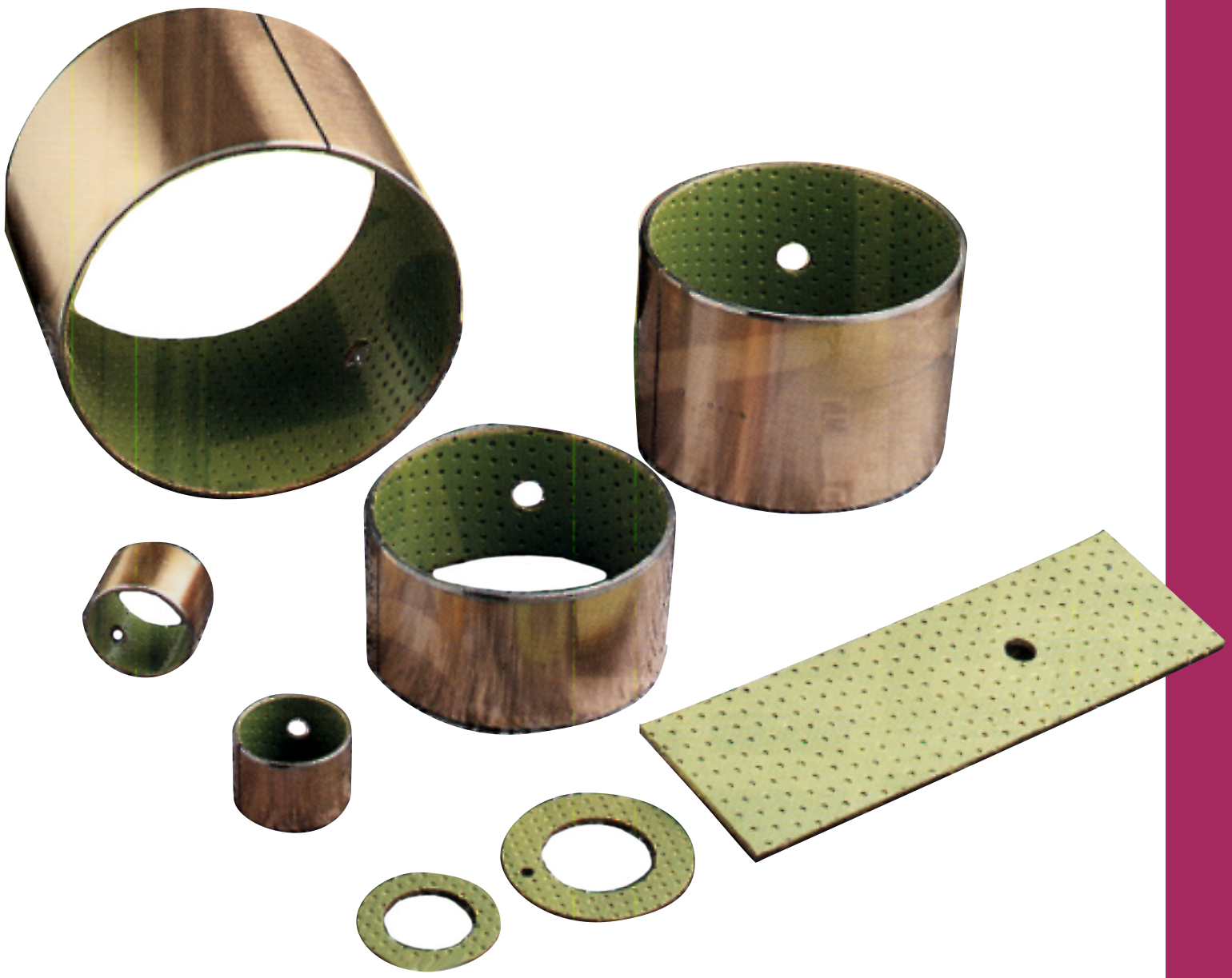
FRIMIX

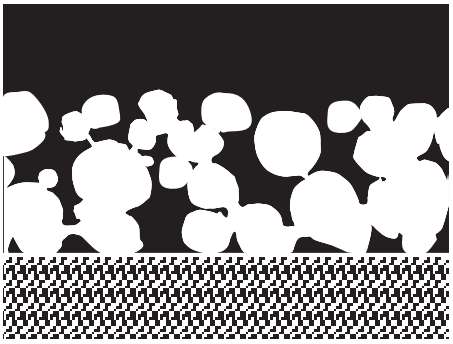
Multilayer bearing Acetal plastic



JOHNSON METALL AB

Construction

FRIMIX is made up of three layers. On a band of steel, a layer of bronze is sintered. On the bronze layer, the sliding surface of acetal plastic is attached. This sliding surface has indentations, the aim of which is to prevent lubricants from disappearing from the bearing. The aim of the bronze layer is to remove the friction heat from the bearing surface.



FRIMIX usage areas

FRIMIX is made from bands of varying thickness. The bands are used for making sliding bearings in the form of cylindrical bushings, washers, plates and special designs. FRIMIX bearings can be used in many applications, from civilian and industrial vehicles to tools and wherever there are moving joints that require minimum periodic lubrication. Lubrication ensures very low friction, minimal wear and protection against corrosive effects.

The use of FRIMIX continues to increase both due to the need to solve wear problems and to reduce costs by replacing roller bearings whenever possible. FRIMIX offers an answer to these issues by providing a compact bearing that is also easy to assemble.

Lubrication is always required and if grease is used, it is important to determine in advance if it is sufficient with only an initial lubrication or if periodic lubrication is necessary. More information on maintenance requirements later on.

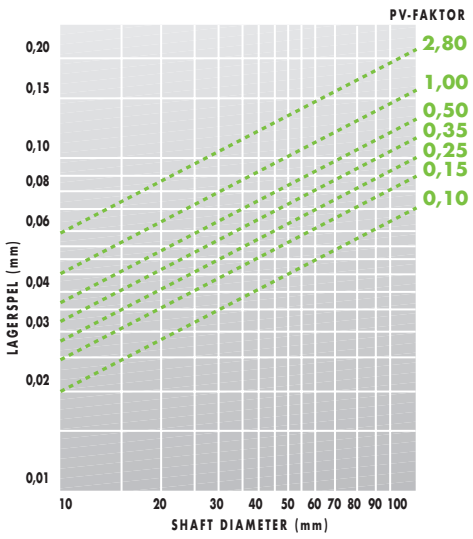
FRIMIX bearings

The FRIMIX products include bushings, washers and bands in metric dimensions.

Size factor

It is important that the clearance between shaft and bearing is correct. In general, the recommended bearing clearance depends on the PV factor and temperature. The chart shows the recommended bearing clearance as a function of shaft diameter for different values of the PV factor. The chart applies at a temperature of 20°C. For higher temperatures, the bearing clearance value is increased by 0.01 mm for every 20°C increase in temperature.

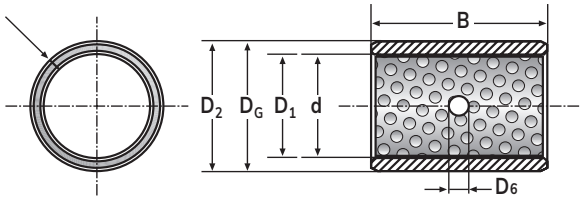
To obtain a smaller bearing clearance, FRIMIX with thicker sliding layer should be used. These bearings can be reamed to the desired inner diameter and bearing clearance.



Straight bearings

Please state when ordering:
FRIMIX, D_1 x B

D_1 Nominal inner diameter
D_2 Nominal outer diameter
d Shaft diameter
D_G Bearing housing diameter
S_2 Bearing wall thickness
D_6 Lubrication hole diameter
D_{1E} The inner diameter of the bearing after pressing in
B Bearing length

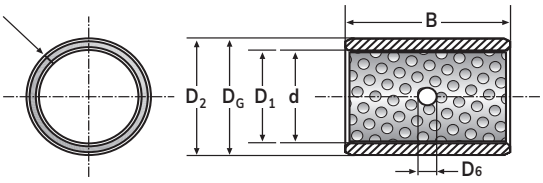


Dimension in mm							Length B ± 0.25 mm																		
D_1	D_2	d	D_G	S_2	D_6	D_{1E}	8	10	12	15	20	25	30	35	40	45	50	60	65	70	80	90	95	100	110	115	120
8	10	8.000	10.000			8.040	•	•	•																		
		7.978	10.015			8.107																					
10	12	10.000	12.000			10.040		•	•	•	•																
		9.978	12.018			10.110																					
12	14	12.000	14.000	0.954		12.040		•	•	•	•	•															
		11.973	14.018	0.980		12.110																					
14	16	14.000	16.000			14.040				•	•	•															
		13.973	16.018			14.110																					
15	17	15.000	17.000		4.0	15.040		•	•	•		•															
		14.973	17.018			15.110																					
16	18	16.000	18.000			16.040				•	•	•															
		15.973	18.018			16.110																					
18	20	18.000	20.000			18.040				•	•	•															
		17.973	20.021			18.113																					
20	23	20.000	23.000			20.052		•		•	•	•	•														
		19.967	23.021			20.137																					
22	25	22.000	25.000			22.052				•	•																
		21.967	25.021			22.137																					
24	27	24.000	27.000	1.442		24.052				•	•																
		23.967	27.021	1.474		24.137																					
25	28	25.000	28.000			25.052				•	•	•	•														
		24.967	28.021			25.137																					
28	31	28.000	31.000			28.052							•														
		27.967	31.025			28.141																					
28	32	28.000	32.000			28.064						•															
		27.967	32.025			28.161																					
30	34	30.000	34.000		6.0	30.064					•		•		•												
		29.967	34.025			30.161																					
32	36	32.000	36.000			32.064					•		•														
		31.961	36.025			32.161																					
35	39	35.000	39.000	1.932		35.064					•		•	•			•										
		34.961	39.025	1.968		35.161																					
36	40	36.000	40.000			36.064								•													
		35.961	40.025			36.161																					
40	44	40.000	44.000			40.064					•		•		•		•										
		39.961	44.025			40.161																					
45	50	45.000	50.000			45.080					•		•		•		•										
		44.961	50.025			45.197																					
50	55	50.000	55.000			50.080									•		•	•									
		49.961	55.030	2.414		50.202																					
55	60	55.000	60.000	2.460		55.080							•		•		•	•									
		54.954	60.030		8.0	55.202																					
60	65	60.000	65.000			60.080							•		•			•		•							
		59.954	65.030			60.202																					
65	70	65.000	70.000			65.100									•			•		•							
		64.954	70.030			65.262																					
70	75	70.000	75.000			70.100									•		•		•	•	•						
		69.954	75.030			70.262																					
75	80	75.000	80.000			75.100															•						
		74.954	80.030	2.384		75.262																					
80	85	80.000	85.000	2.450	9.5	80.100									•			•			•			•			
		79.954	85.035			80.267																					
85	90	85.000	90.000			85.100							•					•			•						
		84.946	90.035			85.267																					
90	95	90.000	95.000			90.100									•			•			•	•		•			
		89.946	95.035			90.267																					
95	100	95.000	100.000			95.100												•						•			
		94.946	100.035			95.267																					

Straight bearings

Please state when ordering:
FRIMIX, D_1 x B

D_1	Nominal inner diameter
D_2	Nominal outer diameter
d	Shaft diameter
D_G	Bearing housing diameter
S_2	Bearing wall thickness
D_6	Lubrication hole diameter
D_{1E}	The inner diameter of the bearing after pressing in
B	Bearing length

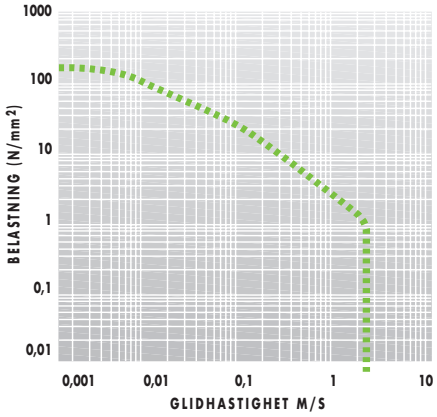


Dimension in mm							Length B ± 0.25 mm																		
D_1	D_2	d	D_G	S_2	D_6	D_{1E}	8	10	12	15	20	25	30	35	40	45	50	60	65	70	80	90	95	100	110	115	120
100	105	100.000	105.000			100.100											•	•			•		•			•	
		99.946	105.035			100.267																					
105	110	105.000	110.000			105.100												•								•	
		104.946	110.035			105.267																					
110	115	110.000	115.000	2.384		110.100																			•		
		109.946	115.035	2.450	9.5	110.267																					
		114.946	120.035			115.267																					
120	125	120.000	125.000			120.100												•						•	•		
		119.946	125.040			120.275																					
		124.937	130.040			125.275																					
130	135	130.000	135.000			130.130												•			•						
		129.937	135.040			130.280																					
135	140	135.000	140.000			135.130												•			•						
		134.937	140.040			135.280																					
140	145	140.000	145.000			140.130												•						•			
		139.937	145.040			140.280																					
150	155	150.000	155.000			150.130																		•			
		149.937	155.040			150.280																					
160	165	160.000	165.000			160.130															•			•			
		159.937	165.040			160.280																					
170	175	170.000	175.000			170.130															•						
		169.937	175.040			170.280																					
180	185	180.000	185.000			180.130																		•			
		179.937	185.046			180.286																					
190	195	190.000	195.000	2.380		190.130												•			•						
		189.928	195.046	2.435		190.286																					
200	205	200.000	205.000			200.130																		•			
		199.928	205.046			200.286																					
220	225	220.000	225.000			220.130												•						•			
		219.928	225.046			220.286																					
240	245	240.000	245.000			240.130															•						
		239.928	245.046			240.286											•										
250	255	250.000	255.000			250.130											•							•			
		249.928	255.052			250.292																					
		259.919	265.052			260.292																					
		279.919	285.052			280.292																					
300	305	300.000	305.000			300.130															•						
		299.919	305.052			300.292																					

Performance

The loadability of FRIMIX is expressed by the PV factor, where P is the load in N/mm^2 and V is the sliding speed of the sliding surface in m/s. The maximum permissible load under ideal conditions and static (V=0) is 140 N/mm^2. The projected area is considered to be a loadable surface, i.e. inner diameter x bearing length. In the dynamic state, the permissible load is reduced to 70 N/mm^2. The chart shows the maximum permissible PV values depending on the load, with grease lubrication and temperature 20°C. The maximum permissible PV value up to 1 N/mm^2 is thus 2.8. At higher temperatures, the permissible PV factor is reduced by 20% at 50°C, by 50% at 70°C and by 80% at 100°C.

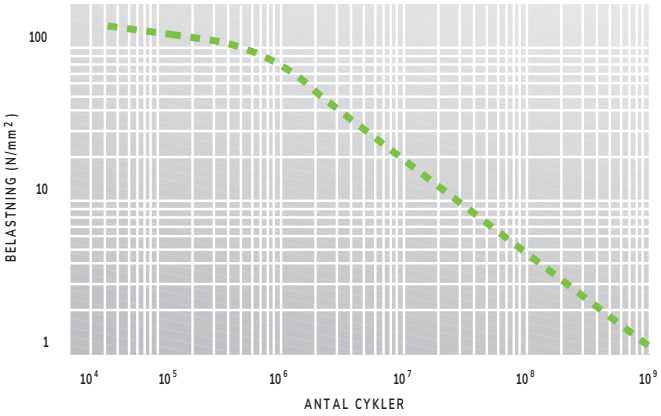
The function of the FRIMIX bearings is improved with oil lubrication where PV values up to 8 can be allowed.



Wear

A calculation of wear in sliding bearings is very uncertain as many factors in addition to PV values and temperature must be included. Such factors include surface finish of the mating materials, alignment, type of environment, lubricant purity, etc. The type of movement, axial, rotating, oscillating, rotating bearing or rotating shaft also has a major impact on wear. The chart shows the number of movements depending on the load. The bearing is considered worn out when the wear amounts to 0.15 mm. The service life of the bearing is estimated to be 30% shorter with rotating shaft compared to rotating bearings and washers are estimated to have a 50% shorter service life than that shown in the chart.

With loads 10-20 N/mm^{2,} the wear in FRIMIX bearings is very small. Also up to 120 N/mm^{2,} the wear is small as long as the lubricant is favourably distributed over the sliding surface, but the wear increases markedly as soon as the bearing runs dry. The bearing must be re-lubricated before it runs dry.



Friction

A characteristic feature of the acetal plastic (sliding surface) is that it forms bonds with the lubricant and a sliding surface with a long service life. The friction coefficient is affected by the same factors that affect service life. With grease lubrication you can expect a friction coefficient of 0.05–0.12. The lowest values are achieved with the highest load values.

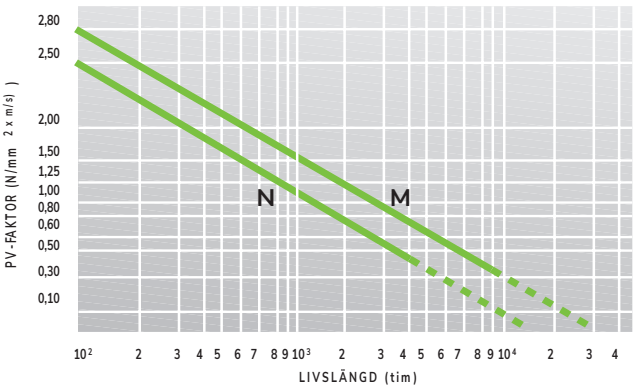
Oil lubrication further reduces friction and at high sliding speed, where hydrodynamic lubrication is achieved, a friction coefficient of 0.002 can be achieved.

In FRIMIX bearings, the static friction coefficient is very close to the dynamic one which is why so-called stick-slip problems rarely occur.

Maintenance

FRIMIX bearings can be used without any maintenance. Only one initial lubrication is required. However, you should re-lubricate at regular intervals where possible in order to increase the service life of the bearings. The chart shows life expectancy in hours depending on the PV factor under normal conditions (P≤30 N/mm^2; V≤ 1 m/s; T≤ 50°C; surface finish of mating material 0.4 µm).

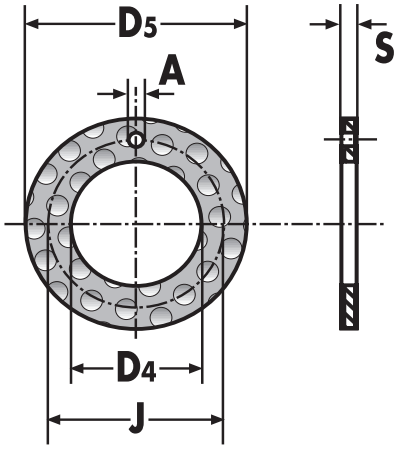
The lower curve (N) is used if the bearing is to be used maintenance-free and the upper curve (M) if periodic lubrication is possible.



Axial bearings

Please state when ordering:
FRIMIX, AXIAL D1

D_4 (+0.25)	D_5 (–0.25)	S	J (±0.12)	A
12	24	1.577 1.487	18	1.6 1.9
14	26		20	2.1 2.4
16	30		22	
18	32		25	
20	36		28	3.1 3.4
22	38		30	
24	42		33	
26	44		35	
28	48		38	4.1 4.4
32	54		43	
38	62		50	
42	66		54	
48	74	2.600 2.510	61	
52	78		65	



D_4 Nominal inner diameter
D_5 Nominal outer diameter
S Thickness
J Locking pin hole pitch diameter
A Locking pin hole diameter

JOHNSON METALL AB

We are the Nordic countries' leading manufacturer of cast and machined bronze products for industrial applications. We offer a comprehensive range of everything from standard stocked products to custom-manufactured components. Our vision is to always be your obvious choice as a supplier.

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