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BEARING INDUSTRIES

bushing

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content

engineering data

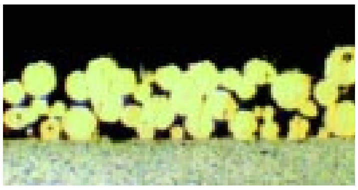
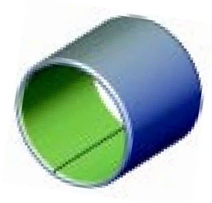
symbols and units in the catalogue

A	mm^2	Bush projected area
a_B		Bush dimension factor
a_C		Inner hole reaming factor
a_E		Heavy load factor
a_L		Adjusted life factor
a_M		Corresponding wear shaft material factor
a_T		Temperature factor
B	mm	Bush width
C	N	Dynamic load
C_i	mm	Internal chamfer axial length
C_o	mm	External chamfer axial length
D_{fl}	mm	Flange outer diameter
D_H	mm	Hausing diameter
D_i	mm	Cylindrical bush inner diameter, thrust pad inner diameter
D_{ia}	mm	Inner diameter after assembling
D_J	mm	Corresponding wear shaft diameter
D_O	mm	Cylindrical bush outer diameter, thrust pad outer diameter
F	N	Bearing load
f_i	N	Mounting force
f		Friction coefficient
L_H	h	Working life
N	min^{-1}	Rotating speed
N_{osz}		Oscillation frequency
p	N	Load rating
P_{lim}	N	Max static load
S_{fl}	mm	Flange edge thickness
S_T	mm	Thrust pad thickness
T	^0C	Temperature
V	m/s	Sliding speed
ϕ		Angular displacement

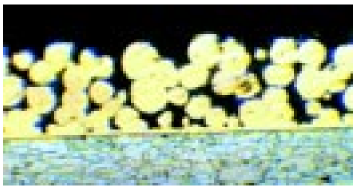
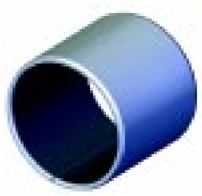
engineering data

bush basic structure

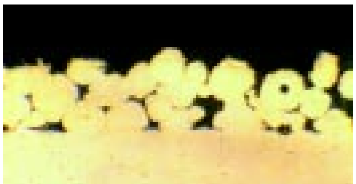
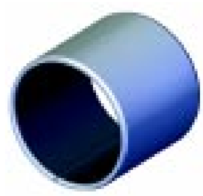
BK-1W

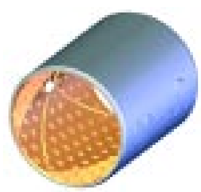
BK-1T

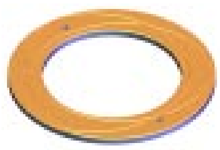




BK-1D


DF800





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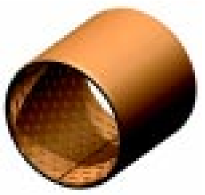
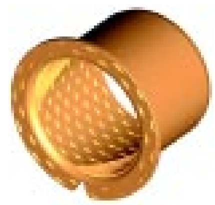
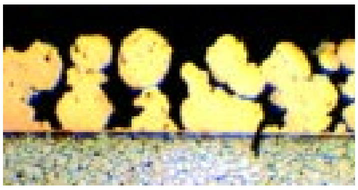
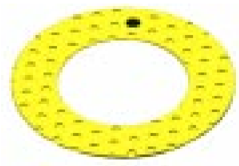




BK-2





Other

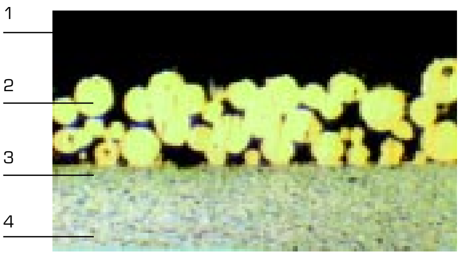
engineering data

triple layered series PTFE overlay

◇ BK-1W

· **Material structure**

1 PTFE and fabric mixture, 0.01-0.03mm
2 Spherical bronze powder, 0.2-0.3mm
3 Steel back, 0.7-2.3mm
4 Electroplated coating: tinned layer thickness, 0.005mm



· **Application characters**

1 PTFE and fabric mixture form a good transfer film when running, which can protect the mating shaft.
2 Because it has no lead, it is harmless .
3 Good loading capacity and anti-wear characteristics.
5 Bronze and steel plate have good heat-conductivity.
6 Products widely used for food machinery, medical machinery, tobacco machinery, drink machinery, office applications and other environmental friendly machinery.

◇ BK-1D

· **Material structure**

1 PTFE and other filling mixture, 0.01-0.03mm
2 Spherical bronze powder, 0.2-0.3mm
3 Steel back, 0.7-2.3mm
4 Electroplated coating: tinned layer thickness, 0.005mm

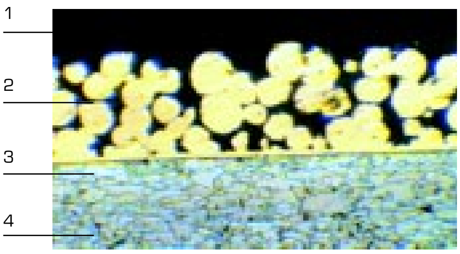
· **Application characters**

1 PTFE and oleophilic fabric mixture form a good transfer film when running, which can protect the mating shaft.
2 Good anti-wear feature, lower friction coefficient
3 Good run-in performance, no shaft seize phenomenon
4 Suitable for devices in rotating, oscillating and reciprocating motion
5 Lead free, suitable for food machinery, medical machinery and environment friendly equipment.
6 The products are especially suitable for applications in frequently reciprocating motions or in large side force, e.g. shock absorbers and various hydraulic oil tanks of automobiles and motorcycles.

◇ BK-1T

· **Material structure**

1 PTFE and other filling mixture, 0.01-0.03mm
2 Spherical bronze powder, 0.2-0.3mm
3 Steel back, 0.7-2.3mm
4 Electroplated coating: tinned layer thickness, 0.005mm



· **Application characters**

1 Low friction coefficient and stable performance with oil lubrication
2 Excellent anti-wear and impact resistance properties
3 Products widely used for various gear pumps, plunger pumps and paddle pumps, especially suitable for high and medium pressure gear pumps under fluid lubrication and boundary lubrication.

BEARING INDUSTRIES

BK-1 Series main chemical features list

Bushing series	Air	Vacuum	Water	Steam	Weak acid	Neutral acid	alkaline solution
BK-1W	●●●	●●●	●●●	●●●	●	○	●●●
BK-1D	●●●	●●●	●●●	●●●	●	○	●●●
BK-1T	●●●	●●●	●●●	●●●	●	○	●●●

●●● good ●● medium ● bad ○ no

BK-1 Series main physical features list

Bush series	Max load (N/mm²)			Max PV (N/mm2 x m/s)		Max sliding speed m /s	Working temperature ⁰C	Friction coefficient μ	Heat conductive factor	Coefficient of linear expansion 10-6/K
	Static load	Dynamic load	Oscil lation	Oil lubrication	Dry friction					
BK-1W	250	140	60	50	3.6	5.0	-195-270	0.04-0.2	13	15
BK-1D	250	140	60	60	3.8	3.0	-195-270	0.04-0.18	16	15
BK-1T	250	140	60	60	4.3	10.0	-195-260	0.03-0.18	13	15

bk-1 friction and wear character

Fig 1 is typical wear curve of BK-1 bush. During short running-in stage, bush weared quickly and PTFE overlay transfered to the mating surface and forms a physical lubricant film. Then the normal friction and wear stage will last for a long time. At the end of the life, bush will wear rapidly till fialed in very short time.

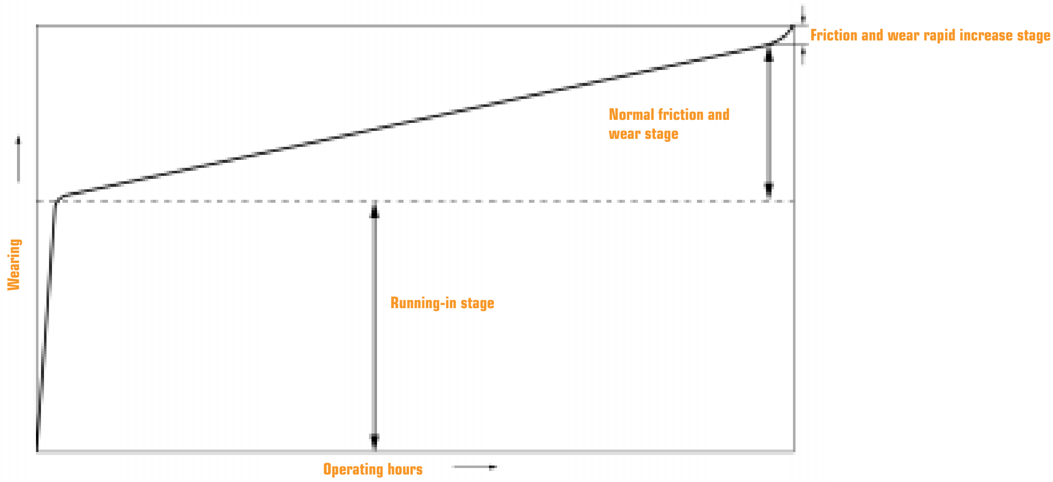


Fig.1 BK-1 Friction and wear

◇ Friction and wear stages of Bk-1 series bushes

Fig. 2

Running-in stage, self-lubrication layer of the BK-1 bearings will be worn to a thin layer. The worn-out PTFE material will be deposited onto the mating shaft and act as a self-lubricating media. At the end of Running-in stage, 10% of the bronze powder on the BK-1 bush self-lubrication layer would be exposed.

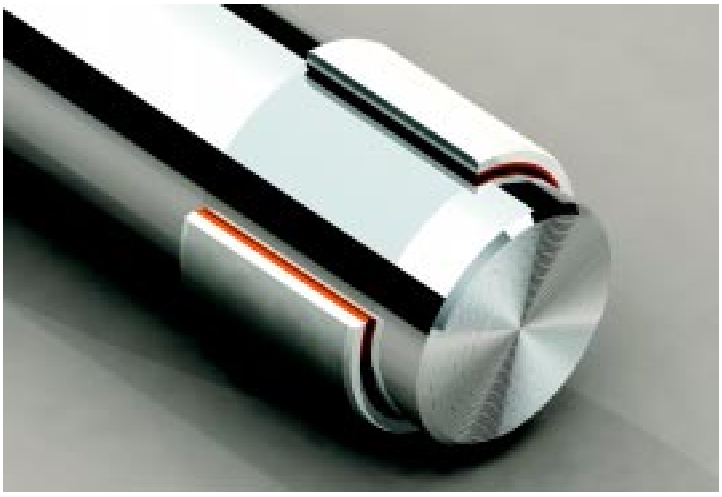


Fig. 3

Normal friction and wear stage, during which wear speed is greatly reduced, all in lubricating conditions. Eventually, bronze powder on the self-lubrication material will be more exposed.

Fig. 4

Friction and wear rapid increase stage, After a long time of normal operation, when the exposed bronze powder is over 70% of the self-lubrication material, wear increase obviously, friction coefficient and wear amount increase sharply, it comes to the end of the life limit of BK-1 bearings.

◇ Friction coefficient of BK-1 bushes depend on the following parameters

Load	p
Sliding speed	V
Surface roughness of the mating wear material	Ra
Bush temperature	T

Fig 5 is the parameter relation ship between these parameters, which can be used to evaluate the actual wear amount under dry lubrication after the running in stage. Accurate value may be ± 20% diffevent according to actual working conditions.

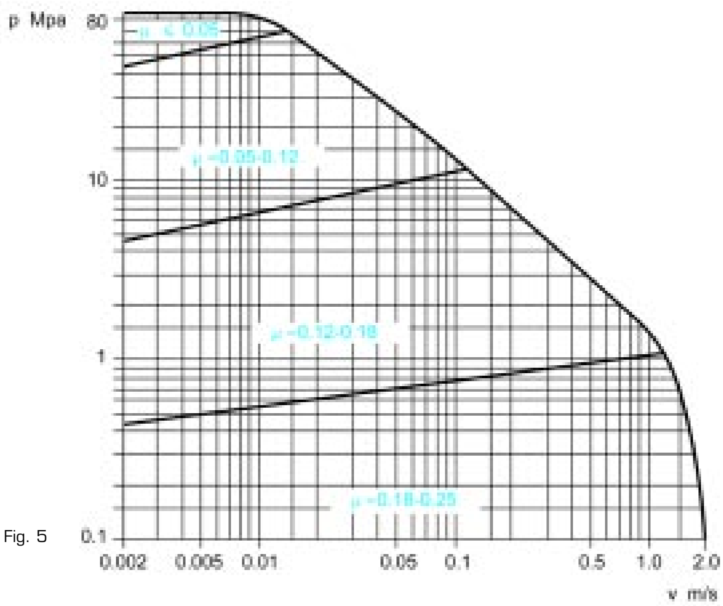


Fig. 5

When we choose a bush or calculate the working life of BK-1 bushes, the following parameters shall be taken into consideration. :

1) Load limit
2) PV value
3) Surface roughness of the corresponding wear material
4) Corresponding wear material
5) Working temperature
6) Lubrication, dust, houshing dimension and etc.

◇ Load rating p

Load rating of a bush is defined as the load on the projected area of the bush, N/mm²

1) For cylindrical bush

$$\bar{p} = \frac{F}{Di \cdot B}$$

2) Or thrust pad

$$\bar{p} = \frac{4F}{\pi \cdot (D_o^2 - D_i^2)}$$

3) For flanged bush

$$\bar{p} = \frac{F}{0.04 \cdot (D_{fl}^2 - D_i^2)}$$

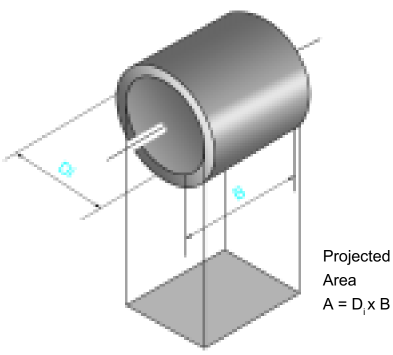


Fig.6 Projected Area

engineering data

◇ sliding speed V

· **Continuous rotation**

For cylindrical bush

$$V = \frac{D_i \cdot \pi \cdot N}{60 \cdot 10^3}$$

For thrust washer

$$V = \frac{\frac{D_o+D_i}{2} \cdot \pi \cdot N}{60 \cdot 10^3}$$

· **Oscillation motion**

For cylindrical bush

$$V = \frac{D_i \cdot \pi}{60 \cdot 10^3} \cdot \frac{4\,\Psi \cdot N_{osz}}{360}$$

For thrust washer

$$V = \frac{\frac{D_o+D_i}{2} \cdot \pi \cdot N}{60 \cdot 10^3} \cdot \frac{4\,\Psi \cdot N_{osz}}{360}$$

Bushing type	BK-1W	BK-1D	BK-1T
Speed limit (oil lubrication)	5.0m/s	3.0m/s	10m/s

◇ pV value

Working life of BK-1 series bush depends on its pV value. For thrust washer and flanged bush, the sliding friction speed usually takes the speed value at the mean diameter.

pV = p (N/mm²) x V (m/s)

Nush type	pV limit	
	Oil lubrication (N/mm² x m/s)	Dry friction (N/mm² x m/s)
BK-1W	50	3.6
BK-1D	60	3.8
BK-1T	60	4.3

◇ Application factors

Factors affecting BK-1 series bush application are listed below. We have to take them into consideration when choosing a bush and evaluating its working life.

· **Temperature**

Working life of BK-1 series bushes depend on the bush temperature. In dry friction condition

temperature factor

Working model	Seat hole type	Temperature factor a_T					
		25	60	100	150	200	280
Dry friction, continuous running	Normal radiation	1.0	0.8	0.6	0.4	0.2	0.1
Dry friction, continuous running	Separate houshing, bad radiation condition	0.5	0.4	0.3	0.2	0.1	-
Dry friction, continuous running	Non-metal houshing, extremely worse radiation	0.3	0.3	0.2	0.1	-	-
Dry friction, non-continuous running (continuous running < min and inactive For extended perieds)	Normal radiation	2.0	1.6	1.2	0.8	0.4	0.2
Dipping into water, continuous running		2.0	1.5	0.6	-	-	-
Dipping into water, dry friction, actenating/stopping		0.2	0.1	-	-	-	-
Continuous running under lubrication condition		3.0	2.5	2.0	1.5	-	-

- **Corresponding wear shaft**

When calculating working life of BK-1 series bush, The effect of mating wear shaft material may by expressed by mating material factor a_M and adjusted life factor a_L, see table:

Corresponding wear material	a_M	a_L
Steel and cast iron		
Carbon steel	1	200
Carbon manganese steel	1	200
Allay steel	1	200
Carbonized steel	1	200
Nitrided steel	1	200
Carbonitriding steel	2	200
Stainless steel (7-10%N_i, 17-20%C_r)	1	200
Cast iron	1	200
Electroplated steel (min plating layer thickness 0.013 mm)		
Cadmium plated	0.2	600
Hard cadmium plated	2.0	600
Lead plated	1.5	600
Nickel plated	0.2	600
Phosphating	0.2	300
Tin and nickel plated	3.0	600
Galvanized	0.2	600
Non-ferrous allaoy		
Aluminum allaoy	0.4	200
Bronze allaoy	0.1-0.4	200
Hard aluminum oxide	3.0	600

- **Bush dimension factor**

choose bush dimension factor a_B according to fig. 7

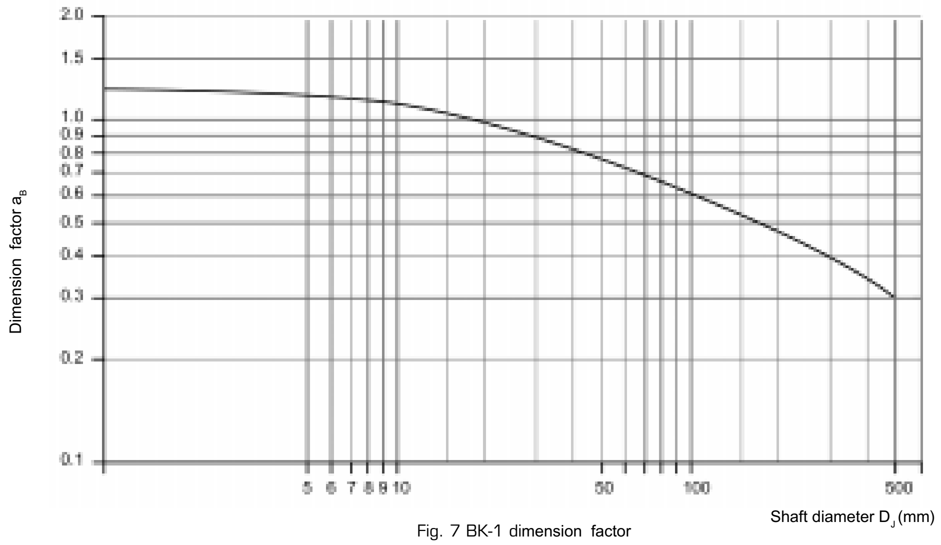


Fig. 7 BK-1 dimension factor

Bore reaming

BK-1 series bushes with reamed bore will lower the friction property. Factor a_c will be adopted in design and calculation to compensate this effect.

Reaming depth	a_c
0.025mm	0.6
0.038mm	0.3
0.050mm	0.1

Load Type

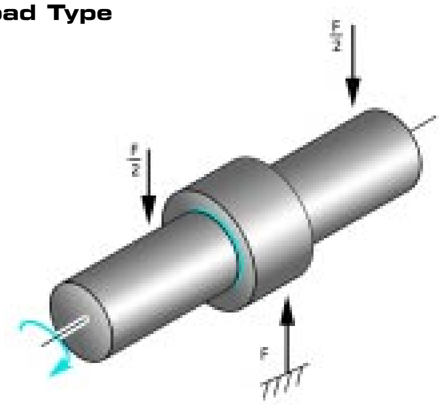


Fig. 8 constant load, still bush, running shaft

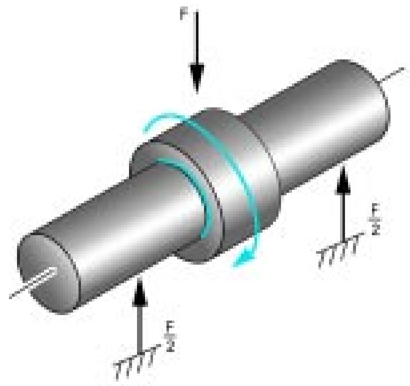


Fig. 9 rotating load, still shaft, rotating bush

Bush dimension calculation

- When choosing bush dimension, the diameter is calculated by

Calculating bush width B
still bush, running shaft

$$B = \frac{F \cdot N \cdot (L_H + a_L)}{1.25 \cdot 10^7 \cdot a_T \cdot a_M \cdot a_B} + \frac{F}{\overline{p}_{lim} \cdot D_i} \quad (\text{mm})$$

Running bush, still shaft

$$B = \frac{F \cdot N \cdot (L_H + a_L)}{2.5 \cdot 10^7 \cdot a_T \cdot a_M \cdot a_B} + \frac{F}{\overline{p}_{lim} \cdot D_i} \quad (\text{mm})$$

Thrust washer

$$D_o - D_i = \frac{F \cdot N \cdot (L_H + a_L)}{1.25 \cdot 10^7 \cdot a_T \cdot a_M \cdot a_B} + \sqrt{D_i^2 + \frac{1.3F}{\overline{p}_{lim}}} - D_i \quad (\text{mm})$$

Bearing life calculation

Bush dimension is limited by the mounting space. The following calculation will determine weather the bush design life meets requirements. If the calculated life is not as required, choose a larger bush.

For cylindrical bush

$$\bar{p} = \frac{F}{D_i \cdot B} \qquad [N/mm^2]$$

For flanged bush

$$\bar{p} = \frac{F}{0.04 \cdot (D^2_{fl} - D^2_i)} \qquad [N/mm^2]$$

For thrust pad

$$\bar{p} = \frac{4F}{\pi \cdot (D^2_o - D^2_i)} \qquad [N/mm^2]$$

· **Heavy load factor**

$$a_E = \frac{\bar{p}_{lim} - \bar{p}}{\bar{p}_{lim}} \qquad [N/mm^2]$$

If the calculated result a_E is a negative value, it indicates an overloaded bush. You have to increase bush diameter or length.

Adjusted PV value

For cylindrical bush

$$\bar{p}V = \frac{5.25 \cdot 10^{-5} F \cdot N}{a_E \cdot B \cdot a_T \cdot a_M \cdot a_B} \qquad [N/mm^2 \times m/s]$$

For thrust washer

$$\bar{p}V = \frac{3.34 \cdot 10^{-5} F \cdot N}{a_E \cdot (D_O - D_i) \cdot a_T \cdot a_M \cdot a_B} \qquad [N/mm^2 \times m/s]$$

For flanged bush

$$\bar{p}V = \frac{6.5 \cdot 10^{-5} F \cdot N}{a_E \cdot (D_{fl} - D_i) \cdot a_T \cdot a_M \cdot a_B} \qquad [N/mm^2 \times m/s]$$

For oscillation motion, calculate the mean rotating speed

$$N = \frac{4 \Psi \cdot N_{osz}}{360} \qquad [1mm^2 \times m/s]$$

Bush life calculation

For cylindrical bush, stable radial load

$$L_H = \frac{615}{\bar{p}V} - a_L \quad \text{(h)}$$

For flanged bush, axial load

$$L_H = \frac{410}{\bar{p}V} - a_L \quad \text{(h)}$$

For cylindrical bush, rotating load

$$L_H = \frac{1230}{\bar{p}V} - a_L \quad \text{(h)}$$

For thrust pad

$$L_H = \frac{410}{\bar{p}V} - a_L \quad \text{(h)}$$

For reamed bore bushes, factor a_C must be taken into consideration when evaluating bush life:

$$L_H = L_H \cdot a_C \quad \text{(h)}$$

Calculation examples

Known			
Load type	Constant load	Inner diameter	35 mm
	Continuous rotation	Width	20 mm
Shaft	Steel	Actual load	3000 N
		Rotation speed	40 rpm

Factor selection	
Limit load	140 N/mm²
Temperature factor a_T	1.0
Material factor a_M	1.0
Dimension factor a_B	0.87
Adjusted life factor a_L	200

Calculation	
Load rating p (N/mm²)	$\bar{p} = \frac{F}{D_i \cdot B} = \frac{3000}{35 \cdot 20} = 4.29$
Sliding speed V (m/s)	$V = \frac{Di \cdot \pi \cdot N}{60X10^3} = \frac{35 \cdot 3,14 \cdot 40}{60 \cdot 10^3} = 0.073$
PV value	$\bar{p}V = \bar{p} \cdot V = 4.29 \cdot 0.073 = 0.313$
Heavy load factor a_E	$a_E = \frac{\bar{p}_{lim} - \bar{p}}{\bar{p}_{lim}} = \frac{140 - 4.29}{140} = 0.097$
Adjusted pV value	$\bar{p}V = \frac{5.25 \cdot 10^5 F \cdot N}{a_E \cdot B \cdot a_T \cdot a_M \cdot a_g} = 0.37$
Bearing life L_H (h)	$L_H = \frac{615}{\bar{p}V} - a_L = \frac{615}{0.37} - 200 = 1462$

◇ Lubrication

BK-1 bushes have various lubrication methods. Lubricating media include water, lubrication oil (machinery oil, turbine oil, hydraulic oil, etc.), cooling liquid etc.

Generally, if the liquid does not erode PTFE or bronze, it is accepted that the bush can be used in this liquid. If it is doubtful weather BK-1 series bushes may be used in a kind of liquid, we suggest a simple test, put the bush into the liquid for 1-2 weeks, keep the liquid temperature range at 15-20^{0}C. It is determined that the bush is not suitable for the liquid when any one of the following happens.

· Great change on bush wall thickness
· Visible change on bush surface, which is different from discolouration or staining
· Change on bronze layer microstructure structure

◇ Grease lubrication

BK-1 bushes need no grease lubrication in normal conditions. Carefully adopt grease lubrication on following conditions.

· Bush sustains dynamic load
· If lubricants containing EP additives or having Pb or MoS2 , they will speed up the wear of BK-1 bushes.

◇ Bush mounting

For BK-1 cylindrical bush

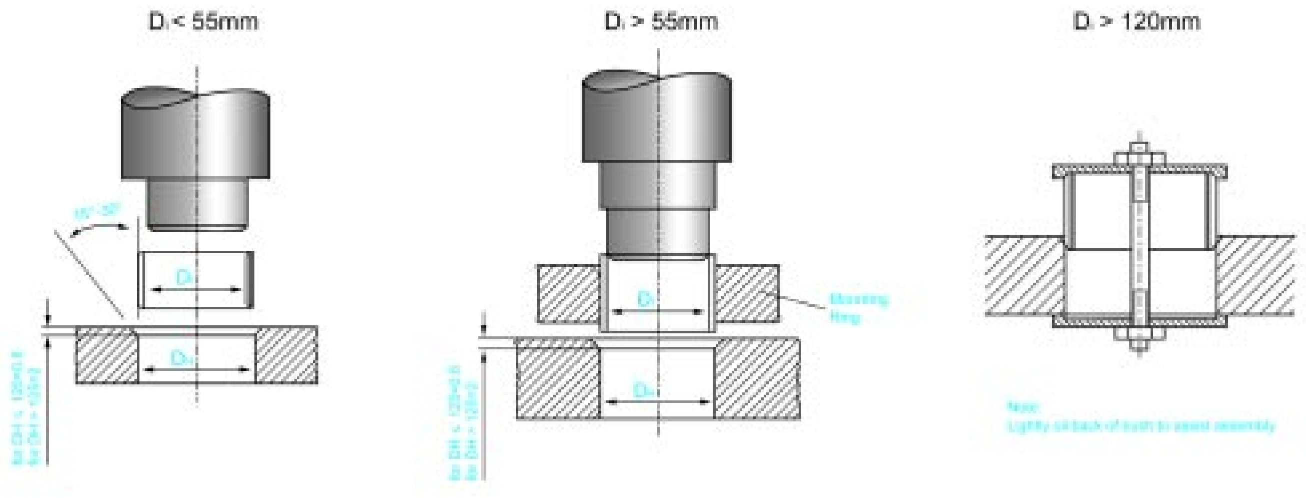


Fig.10 Mounting of cylindrical bushes

· **For flanged bush**

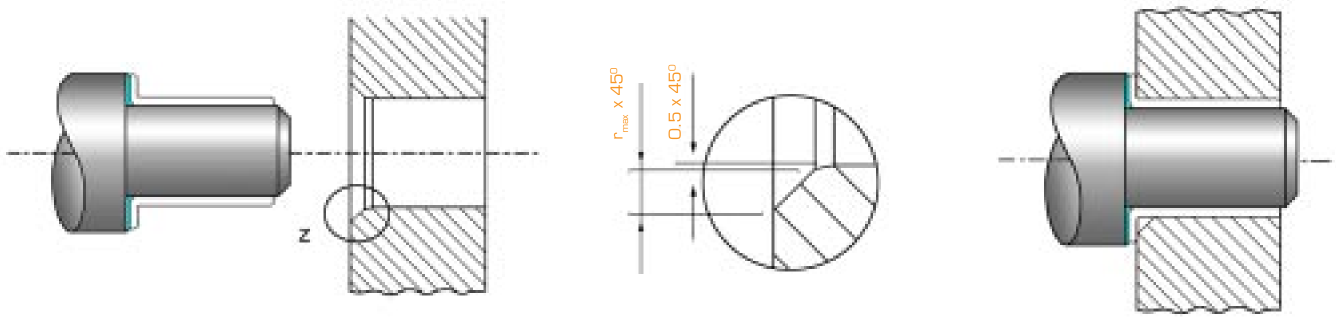


Fig.11 Mounting of flanged bushes

◇ Press in force when mounting bushes

Choose the relation between max press-in force and bush inner diameter as fig. 12

Press-in force

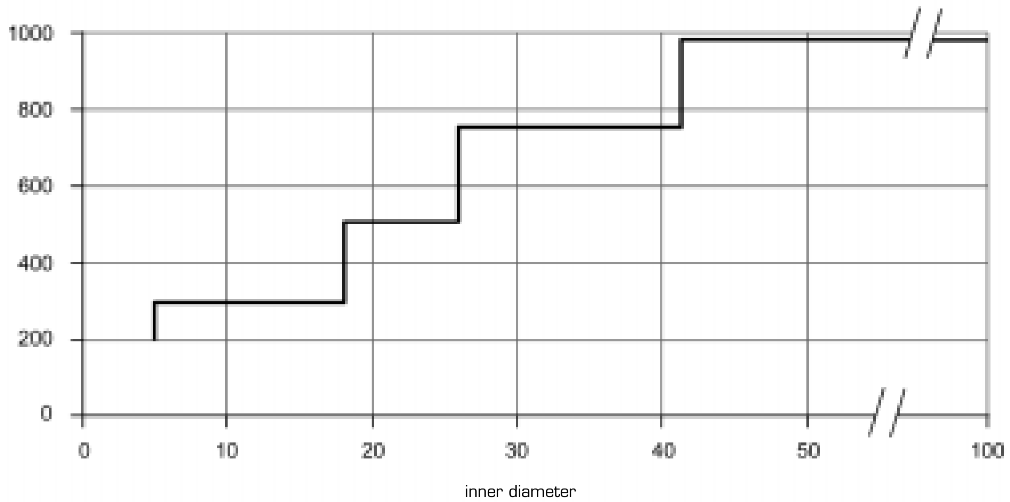


Fig.12 Relations between bush press in force and inner diameter

◇ Alignment error

For all bush mounting, correct alignment is the most important, especially for dry friction bushes. Misalignment of BK-1 bushes will affect the whole bush length or the whole diameter of the thrust washer.

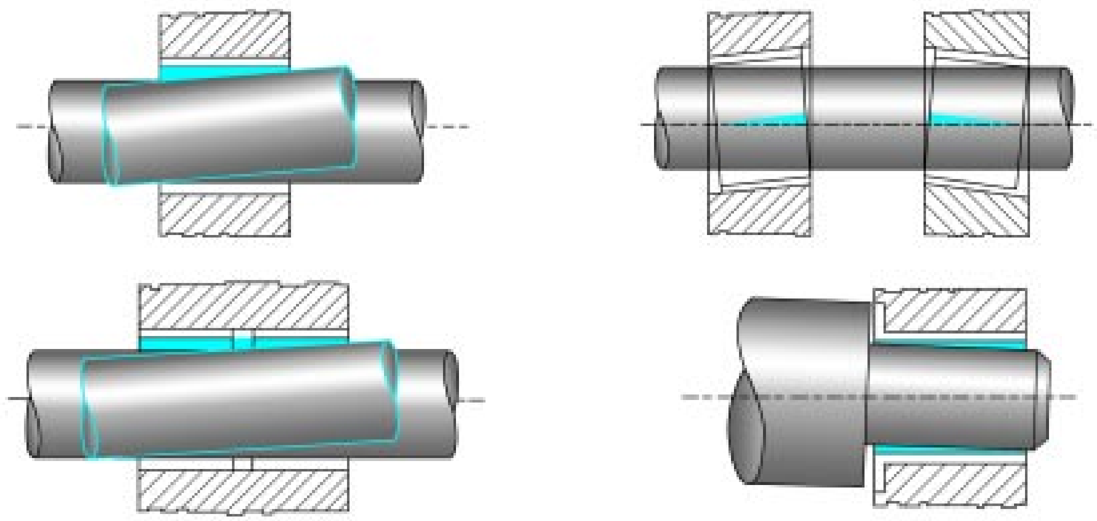


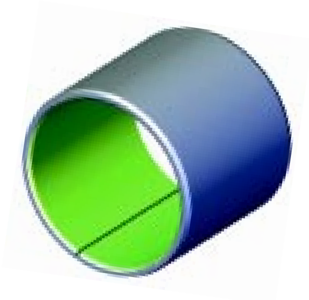
Fig. 13 Alignment error

BK – 1 series cylindrical bushes
metric sizes

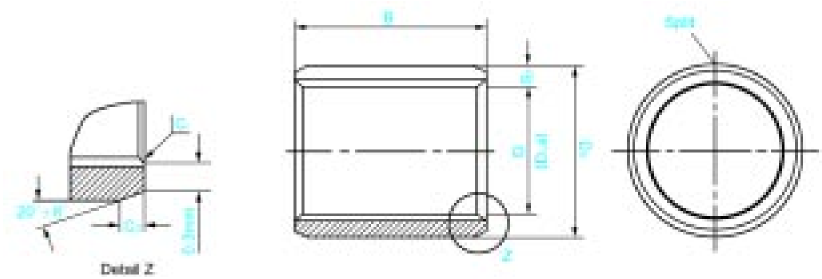
BK-1W, BK-1D, BK-1T

ID and OD chamfers

Wall thickness	C_o		C_i
S3	Machined	Rolled	
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 to -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 to -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 to -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 to -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 to -1.0



Nominal Diameter		Wall thickness S3		Length B	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_o	max.	min.	B < 70mm B = B ± 0.25mm B ⩾ 70mm B = B ± 0.5mm	max.	min.	max.	min.	max.	min.	max.	min
2	3.5	0.745	0.725	3 5	2.000	1.994	3.508	3.500	2.058	2.010	0.064	0.010
3	4.5	0.750	0.730	3 5 6	3.000	2.994	4.508	4.500	3.048	3.000	0.054	0.000
4	5.5	0.750	0.730	3 4 6 10	4.000	3.992	5.508	5.500	4.048	4.000	0.056	0.000
5	7	1.005	0.980	5 8 10	4.990	4.978	7.015	7.000	5.055	4.990	0.077	0.000
6	8	1.005	0.980	4 6 8 10	5.990	5.978	8.015	8.000	6.055	5.990	0.077	0.000
7	9	1.005	0.980	10	6.987	6.972	9.015	9.000	7.055	6.990	0.083	0.003
8	10	1.005	0.980	6 8 10 12	7.987	7.972	10.015	10.000	8.055	7.990	0.083	0.003
10	12	1.005	0.980	8 10 12 15 20	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
12	14	1.005	0.980	8 10 12 15 20 25	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006



Dimensions and Tolerances according to ISO 3547 standard

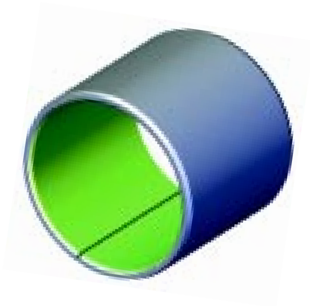
Nominal Diameter		Wall thickness S3		Length B	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_o	max.	min.	B < 70mm B = B ± 0.25mm B > 70mm B = B ± 0.5mm	max.	min.	max.	min.	max.	min.	max.	min
13	15	1.005	0.980	10 20	12.984	12.966	15.018	15.000	13.058	12.990	0.092	0.006
14	16	1.005	0.980	5 10 12 15 20 25	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
15	17	1.005	0.980	10 12 15 20 25	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006
16	18	1.005	0.980	10 12 15 20 25	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
17	19	1.005	0.980	20	16.984	16.966	19.021	19.000	17.061	16.990	0.095	0.006
18	20	1.005	0.980	10 15 20 25	17.984	17.966	20.021	20.000	18.061	17.990	0.095	0.006
20	23	1.505	1.475	10 15 20 25 30	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
22	25	1.505	1.475	15 20 25 30	21.980	21.959	25.021	25.000	22.071	21.990	0.112	0.010

BK – 1 series cylindrical bushes
metric sizes

BK-1W, BK-1D, BK-1T

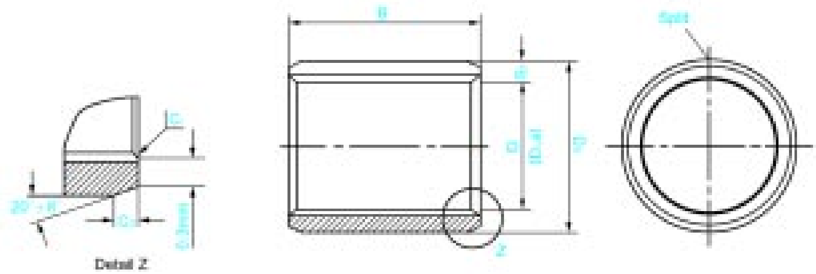
ID and OD chamfers

Wall thickness S3	C_o Machined	C_o Rolled	C_i
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 to -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 to -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 to -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 to -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 to -1.0



Nominal Diameter		Wall thickness S3		Length B	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_0	max.	min.	B < 70mm B = B ± 0.25mm B ≥ 70mm B = B ± 0.5mm	max.	min.	max.	min.	max.	min.	max.	min
24	27	1.505	1.475	15 20 25 30	23.980	23.959	27.021	27.000	24.071	23.990	0.112	0.010
25	28	1.505	1.475	15 20 25 30 50	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
28	32	2.005	1.970	15 20 25 30	27.980	27.959	32.025	32.000	28.085	27.990	0.126	0.010
30	34	2.005	1.970	10 15 20 25 30 40	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
32	36	2.005	1.970	20 30 40	31.975	31.950	36.025	36.000	32.085	31.990	0.135	0.015
35	39	2.005	1.970	20 30 35 40 50	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015
37	41	2.005	1.970	20	36.975	36.950	41.025	41.000	37.085	36.990	0.135	0.015

BEARING INDUSTRIES



Dimensions and Tolerances according to ISO 3547 standard

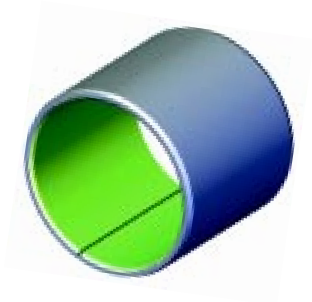
Nominal Diameter		Wall thickness S3		Length B	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_o	max.	min.	B < 70mm B = B ± 0.25mm B ⩾ 70mm B = B ± 0.5mm	max.	min.	max.	min.	max.	min.	max.	min
38	42	2.005	1.970	15 20 30 40	37.975	37.950	42.025	42.000	38.085	38.990	0.135	0.015
40	44	2.005	1.970	20 30 40 50	39.975	39.950	44.025	44.000	40.085	39.990	0.135	0.015
45	50	2.505	2.460	20 30 40 45 50	44.975	44.950	50.025	50.000	45.105	44.990	0.155	0.015
50	55	2.505	2.460	20 30 40 50 60	49.975	49.950	55.030	55.000	50.110	49.990	0.160	0.015
55	60	2.505	2.460	20 25 30 40 50 55 60	54.970	54.940	60.030	60.000	55.110	54.990	0.170	0.020
60	65	2.505	2.460	20 30 40 50 60 70	59.970	59.940	65.030	65.000	60.110	59.990	0.170	0.020
65	70	2.505	2.460	30 50 70	64.970	64.940	70.030	70.000	65.110	64.990	0.170	0.020
70	75	2.505	2.460	30 40 50 70	69.970	69.940	75.030	75.000	70.110	69.990	0.170	0.020

BK – 1 series cylindrical bushes
metric sizes

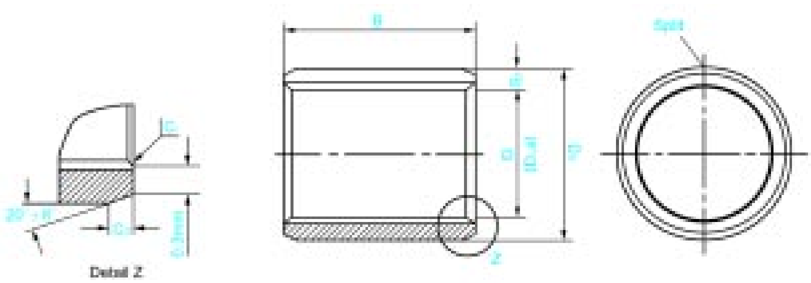
BK-1W, BK-1D, BK-1T

ID and OD chamfers

Wall thickness S3	C_o Machined	C_o Rolled	C_i
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 to -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 to -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 to -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 to -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 to -1.0



Nominal Diameter		Wall thickness S3		Length B	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_0	max.	min.	B < 70mm B = B ± 0.25mm B ⩾ 70mm B = B ± 0.5mm	max.	min.	max.	min.	max.	min.	max.	min
75	80	2.505	2.460	40 60 80	74.970	74.940	80.030	80.000	75.110	74.990	0.170	0.020
80	85	2.490	2.440	40 60 80 100	80.000	79.954	85.035	85.000	80.155	80.020	0.201	0.020
85	90	2.490	2.440	30 40 60 80 100	85.000	84.946	90.035	90.000	85.155	85.020	0.209	0.020
90	95	2.490	2.440	40 60 100	90.000	89.046	95.035	95.000	90.155	90.020	0.209	0.020
95	100	2.490	2.440	60 100	95.000	94.046	100.035	100.000	95.155	95.020	0.209	0.020
100	105	2.490	2.440	50 60 100 115	100.000	99.946	105.035	105.000	100.155	100.020	0.209	0.020
105	110	2.490	2.440	60 100 115	105.000	104.946	110.035	110.000	105.155	105.020	0.209	0.020
110	115	2.490	2.440	60 100 115	110.000	104.946	115.035	115.000	110.155	110.020	0.209	0.020
115	120	2.465	2.415	50 60 70 100	115.000	114.946	120.035	120.000	115.125	115.020	0.209	0.020



Dimensions and Tolerances according to ISO 3547 standard

Nominal Diameter		Wall thickness S3		Length B	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_O	max.	min.	B < 70mm B = B ± 0.25mm B ≥ 70mm B = B ± 0.5mm	max.	min.	max.	min.	max.	min.	max.	min
120	125	2.465	2.415	50 60 100	120.000	119.946	125.040	125.000	120.210	120.070	0.264	0.070
125	130	2.465	2.415	60 100	125.000	124.937	130.040	130.000	125.210	125.070	0.273	0.070
130	135	2.465	2.415	60 100	130.000	129.937	135.040	135.000	130.210	130.070	0.273	0.070
135	140	2.465	2.415	60 80 100	135.000	134.937	140.040	140.000	135.210	135.070	0.273	0.070
140	145	2.465	2.415	60 100	140.000	139.937	145.040	145.000	140.210	140.070	0.273	0.070
150	155	2.465	2.415	60 80 100	150.000	149.937	155.040	155.000	150.210	150.070	0.273	0.070
160	165	2.465	2.415	60 80 100	160.000	159.937	165.040	165.000	160.210	160.070	0.273	0.070
170	175	2.465	2.415	100	170.000	169.937	175.040	175.000	170.210	170.070	0.273	0.070
180	185	2.465	2.415	100	180.000	179.937	185.046	185.000	180.216	180.070	0.279	0.070
200	205	2.465	2.415	100	200.000	199.928	205.046	205.000	200.216	200.070	0.288	0.070
210	215	2.465	2.415	100	210.000	209.928	215.046	215.000	210.216	210.070	0.288	0.070
220	225	2.465	2.415	100	220.000	219.928	225.046	225.000	220.216	220.070	0.288	0.070
250	255	2.465	2.415	100	250.000	249.928	255.052	255.000	250.222	250.070	0.294	0.070
300	305	2.465	2.415	100	300.000	299.919	305.052	305.000	300.222	300.070	0.303	0.070

BK – 1 series flanged bushes
metric sizes

BK-1W, BK-1D, BK-1T

ID and OD chamfers

Wall thickness S3	C_o		C_i
	Machined	Rolled	
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 ~ -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 ~ -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 ~ -1.0

Nominal Diameter		Wall thickness S3		Flange thickness	Flange- Φ	Length	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_o	max.	min.	S_{f1}-0.2	D_{f1} ± 0.5	B ± 0.25	max.	min.	max.	min.	max.	min.	max.	min
3	4.5	0.750	0.730	0.75	7	4	3.000	2.994	4.508	4.500	3.048	3.000	0.054	0.000
4	5.5	0.750	0.730	0.75	9	4	4.000	3.992	5.508	5.500	4.048	4.000	0.056	0.000
5	7	1.005	0.98	1	10	5	4.990	4.978	7.015	7.000	5.055	4.990	0.077	0.000
6	8	1.005	0.98	1	12	4 7 8	5.990	5.978	8.015	8.000	6.055	5.990	0.077	0.000
8	10	1.005	0.98	1	15	5.5 7.5 9.5	7.987	7.972	10.015	10.000	8.055	7.990	0.083	0.003
10	12	1.005	0.98	1	18	7 9 12	9.987	9.972	12.018	12.000	10.058	9.990	0.086	0.003
12	14	1.005	0.98	1	20	7 9 12 17	11.984	11.966	14.018	14.000	12.058	11.990	0.092	0.006
14	16	1.005	0.98	1	22	12 17	13.984	13.966	16.018	16.000	14.058	13.990	0.092	0.006
15	17	1.005	0.98	1	23	9 12 17	14.984	14.966	17.018	17.000	15.058	14.990	0.092	0.006

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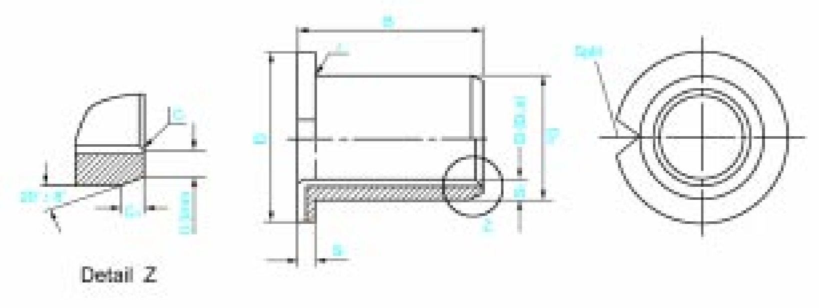
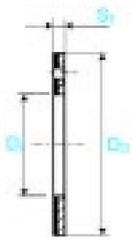


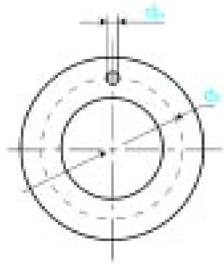
S3	1,0	1,5	2,0	2,5
r	1-0.5	1 ± 0.5	1,4 ± 0.5	2 ± 0.5

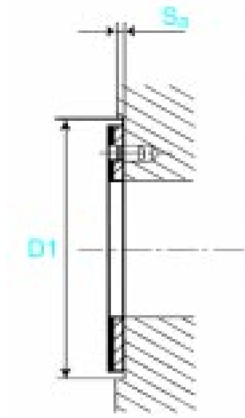
Nominal Diameter		Wall thickness S3		Flange thickness	Flange- Φ D_{f1} ± 0.5	Length B ± 0.25	Shaft - Φ D_J		Housing- Φ D_H		Ass. Inside- Φ $D_{i,a}$		Clearance C_D	
D_i	D_0	max.	min.	S_{f1}-0.2			max.	min.	max.	min.	max.	min.	max.	min
16	18	1.005	0.98	1	24	12 17	15.984	15.966	18.018	18.000	16.058	15.990	0.092	0.006
18	20	1.005	0.98	1	26	12 17 20	17.984	17.966	20.021	20.000	18.061	17.990	0.095	0.006
20	23	1.505	1.475	1.5	30	11.5 16.5 21.5	19.980	19.959	23.021	23.000	20.071	19.990	0.112	0.010
25	28	1.505	1.475	1.5	35	11.5 16.5 21.5	24.980	24.959	28.021	28.000	25.071	24.990	0.112	0.010
30	34	2.005	1.970	2	42	16 26	29.980	29.959	34.025	34.000	30.085	29.990	0.126	0.010
35	39	2.005	1.970	2	47	16 26	34.975	34.950	39.025	39.000	35.085	34.990	0.135	0.015
40	44	2.005	1.970	2	53	16 26 40	39.975	39.950	44.025	44.000	40.085	39.990	0.135	0.015
45	50	2.505	2.460	2.5	58	16 26	44.975	44.950	50.025	50.000	45.015	44.990	0.155	0.015

BK - 1 series washer
metric sizes

BK-1W, BK-1D, BK-1T





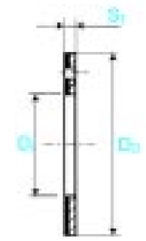


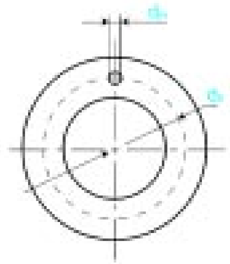
Part Number	shaft diameter	Inside - Φ D_i		Outside - Φ D_o		Wall thickness S_T		Locating hole - Φ d_H		Locating hole PCD - Φ d_p		Recess Depth S_a		Recess hole - Φ D_1	
		max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
BK-1 10 SF	8	10.25	10	20	19.75	1.5	1.45	1.9	1.6	15.12	14.88	1.2	0.8	20.12	20
BK-1 12 SF	10	12.25	12	24	23.75	1.5	1.45	1.9	1.6	18.12	17.88	1.2	0.8	24.12	24
BK-1 14 SF	12	14.25	14	26	25.75	1.5	1.45	2.4	2.1	20.12	19.88	1.2	0.8	26.12	26
BK-1 16 SF	14	16.25	16	30	29.75	1.5	1.45	2.4	2.1	23.12	22.88	1.2	0.8	30.12	30
BK-1 18 SF	16	18.25	18	32	31.75	1.5	1.45	2.4	2.1	25.12	24.88	1.2	0.8	32.12	32
BK-1 20 SF	18	20.25	20	36	35.75	1.5	1.45	3.4	3.1	28.12	27.88	1.2	0.8	36.12	36
BK-1 22 SF	20	22.25	22	38	37.75	1.5	1.45	3.4	3.1	30.12	29.88	1.2	0.8	38.12	38
BK-1 24 SF	22	24.25	24	42	41.75	1.5	1.45	3.4	3.1	33.12	32.88	1.2	0.8	42.12	42
BK-1 26 SF	24	26.25	26	44	43.75	1.5	1.45	3.4	3.1	35.12	34.88	1.2	0.8	44.12	44
BK-1 28 SF	25	28.25	28	48	47.75	1.5	1.45	4.4	4.1	38.12	37.88	1.2	0.8	48.12	48
BK-1 32 SF	30	32.25	32	54	53.75	1.5	1.45	4.4	4.1	43.12	42.88	1.2	0.8	54.12	54
BK-1 38 SF	35	38.25	38	62	61.75	1.5	1.45	4.4	4.1	50.12	49.88	1.2	0.8	62.12	62
BK-1 42 SF	40	42.25	42	66	65.75	1.5	1.45	4.4	4.1	54.12	53.88	1.2	0.8	66.12	66
BK-1 48 SF	45	48.25	48	74	73.75	1.5	1.45	4.4	4.1	61.12	60.88	1.7	1.3	74.12	74
BK-1 52 SF	50	52.25	52	78	77.75	2	1.95	4.4	4.1	65.12	64.88	1.7	1.3	78.12	78
BK-1 62 SF	60	62.25	62	90	89.75	2	1.95	4.4	4.1	76.12	75.88	1.7	1.3	90.12	90

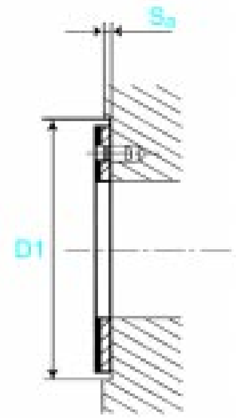
BK – 1E series washer
inch sizes

CCVI
BEARING INDUSTRIES

BK-1WE, BK-1DE, BK-1TE







Part Number	Inside - Φ D_i		Outside - Φ D_o		Wall thickness S_T		Locating hole - Φ d_H		Locating hole PCD - Φ d_p		Recess Depth S_a	
	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
BK-1E 06 SF	0.510	0.500	0.875	0.865	0.063	0.061	0.077	0.067	0.692	0.682	0.050	0.040
BK-1E 07 SF	0.572	0.562	1.000	0.990	0.063	0.061	0.077	0.067	0.786	0.776	0.050	0.040
BK-1E 08 SF	0.635	0.625	1.125	1.115	0.063	0.061	0.109	0.099	0.880	0.870	0.050	0.040
BK-1E 09 SF	0.697	0.687	1.187	1.177	0.063	0.061	0.109	0.099	0.942	0.932	0.050	0.040
BK-1E 10 SF	0.760	0.750	1.250	1.240	0.063	0.061	0.109	0.099	1.005	0.995	0.050	0.040
BK-1E 11 SF	0.822	0.812	1.375	1.365	0.063	0.061	0.109	0.099	1.090	1.089	0.050	0.040
BK-1E 12 SF	0.885	0.875	1.500	1.490	0.063	0.061	0.140	0.130	1.192	1.182	0.050	0.040
BK-1E 14 SF	1.010	1.000	1.750	1.740	0.063	0.061	0.140	0.130	1.380	1.370	0.050	0.040
BK-1E 16 SF	1.135	1.125	2.000	1.990	0.063	0.061	0.171	0.161	1.567	1.557	0.050	0.040
BK-1E 18 SF	1.260	1.250	2.125	2.115	0.063	0.061	0.171	0.161	1.692	1.682	0.050	0.040
BK-1E 20 SF	1.385	1.375	2.250	2.240	0.063	0.061	0.171	0.161	1.817	1.807	0.050	0.040
BK-1E 22 SF	1.510	1.500	2.500	2.490	0.063	0.061	0.202	0.192	2.005	1.995	0.050	0.040
BK-1E 24 SF	1.635	1.625	2.625	2.615	0.063	0.061	0.202	0.192	2.130	2.120	0.050	0.040
BK-1E 26 SF	1.760	1.750	2.750	2.740	0.063	0.061	0.202	0.192	2.255	2.245	0.050	0.040
BK-1E 28 SF	2.010	2.000	3.000	2.990	0.093	0.091	0.202	0.192	2.505	2.495	0.080	0.070
BK-1E 30 SF	2.135	2.125	3.125	3.115	0.093	0.091	0.202	0.192	2.630	2.620	0.080	0.070
BK-1E 32 SF	2.260	2.250	3.250	3.240	0.093	0.091	0.202	0.192	2.755	2.745	0.080	0.070

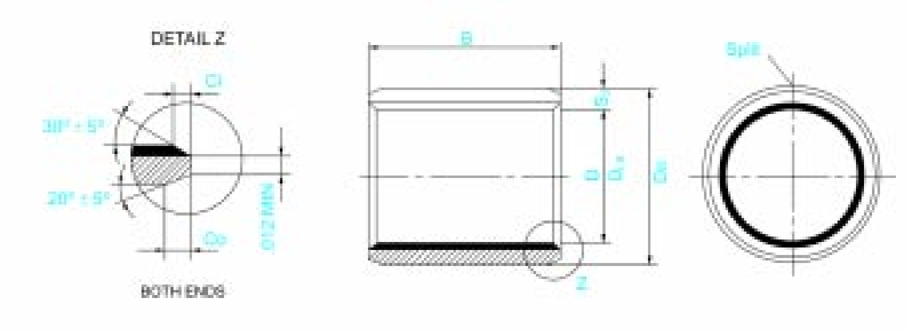
BK – 1E cylindrical bushes
inch sizes

BK-1WE, BK-1DE, BK-1TE

ID and OD chamfers

Di	Co	Ci
< 11/16	.014 ± 0.008	.020 ± 0.010
> 11/16	.030 ± 0.008	.020 ± 0.010

All dimensions in inch



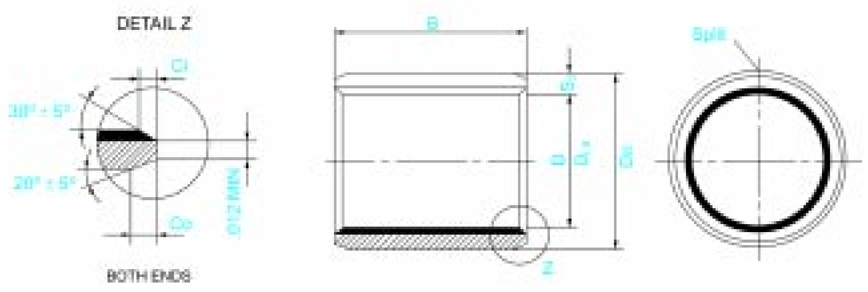
Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ $D_{i,a}$		Clearance C_D	
D_i	D_o	(0, -0.02)	max.	min.	max.	min.	max.	min.	max.	min.
1/8	3/16	1/8 3/16	0.1250	0.1243	0.1878	0.1873	0.1270	0.1253	0.0027	0.0003
5/32	7/32	5/32 1/4	0.1563	0.1556	0.2191	0.2186	0.1583	0.1566	0.0028	0.0003
3/16	1/4	3/16 1/4 3/8	0.1875	0.1868	0.2503	0.2497	0.1895	0.1877	0.0027	0.0002
1/4	5/16	1/4 3/8	0.2500	0.2492	0.3128	0.3122	0.2520	0.2502	0.0028	0.0002
5/16	3/8	3/8 1/2	0.3125	0.3117	0.3753	0.3747	0.3145	0.3127	0.0028	0.0002
3/8	15/32	3/8 1/2 3/4	0.3750	0.3741	0.4691	0.4684	0.3771	0.3752	0.0030	0.0002
7/16	17/32	1/2 3/4	0.4375	0.4365	0.5316	0.5309	0.4396	0.4377	0.0031	0.0002
1/2	19/32	3/8 1/2 5/8 7/8	0.5000	0.4990	0.5941	0.5934	0.5021	0.5002	0.0031	0.0002
9/16	21/32	1/2 3/4	0.5625	0.5615	0.6566	0.6559	0.5646	0.5627	0.0031	0.0002
5/8	23/32	1/2 5/8 3/4 7/8	0.6250	0.6240	0.7192	0.7184	0.6272	0.6252	0.0032	0.0002
11/16	25/32	7/8	0.6875	0.6865	0.7817	0.7809	0.6897	0.6877	0.0032	0.0002
3/4	7/8	1/2 3/4 1	0.7500	0.7488	0.8755	0.8747	0.7527	0.7502	0.0039	0.0002

CCVI BEARING INDUSTRIES

ID and OD chamfers

Di	Co	Ci
< 11/16	.014 ± 0.008	.020 ± 0.010
> 11/16	.030 ± 0.008	.020 ± 0.010

All dimensions in inch



Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ $D_{i,a}$		Clearance C_D	
D_i	D_0	(0, -0.02)	max.	min.	max.	min.	max.	min.	max.	min.
13/16	15/16	3/4 1	0.8125	0.8113	0.9380	0.9372	0.8152	0.8127	0.0039	0.0002
7/8	1	3/4 7/8 1	0.8750	0.8738	1.0005	0.9997	0.8777	0.8752	0.0039	0.0002
15/16	1 1/16	3/4 1	0.9375	0.9363	1.0630	1.0622	0.9402	0.9377	0.0039	0.0002
1	1 1/8	3/4 1 1 1/2	1.0000	0.9988	1.1255	1.1247	1.0027	1.0002	0.0039	0.0002
1 1/8	1 9/32	3/4 1	1.1250	1.1238	1.2818	1.2808	1.1278	1.1252	0.0040	0.0002
1 1/4	1 13/32	3/4 1 1 1/4 1 3/4	1.2500	1.2484	1.4068	1.4058	1.2528	1.2502	0.0044	0.0002
1 3/8	1 17/32	1 1 3/8 1 3/4	1.3750	1.3734	1.5318	1.5308	1.3778	1.3752	0.0044	0.0002
1 1/2	1 21/32	1 1 1/4 1 1/2 2	1.5000	1.4984	1.6568	1.6558	1.5028	1.5002	0.0044	0.0002
1 5/8	1 25/32	1 1 1/2	1.6250	1.6234	1.7818	1.7808	1.6278	1.6252	0.0044	0.0002
1 3/4	1 15/16	1 1 1/2 1 3/4 2	1.7500	1.7484	1.9381	1.9371	1.7535	1.7503	0.0051	0.0003
1 7/8	2 1/16	1 1 7/8 2 1/4	1.8750	1.8734	2.0633	2.0621	1.8787	1.8753	0.0053	0.0003

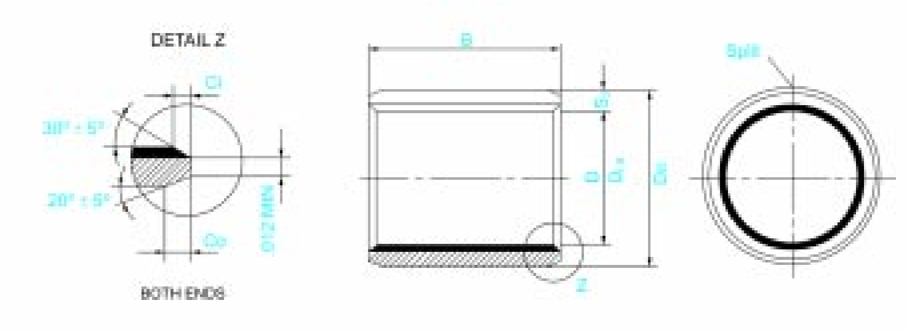
BK – 1E cylindrical bushes
inch sizes

BK-1WE, BK-1DE, BK-1TE

ID and OD chamfers

Di	Co	Ci
≤ 11/16	.014 ± 0.008	.020 ± 0.010
> 11/16	.030 ± 0.008	.020 ± 0.010

All dimensions in inch



Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ $D_{i,a}$		Clearance C_D	
D_i	D_o	(0, -0.02)	max.	min.	max.	min.	max.	min.	max.	min.
2	2 3/16	1 1 1/2 2 2 1/2	2.0000	1.9982	2.1883	2.1871	2.0037	2.0003	0.0055	0.0003
2 1/8	2 5/16	2 2 1/2	2.1250	2.1232	2.3130	2.3118	2.1300	2.1266	0.0068	0.0016
2 1/4	2 7/16	2 2 1/4 2 1/2 3	2.2500	2.2482	2.4377	2.4365	2.2547	2.2513	0.0065	0.0013
2 1/2	2 11/16	2 2 1/2 3 3 1/2	2.5000	2.4982	2.6881	2.6869	2.5051	2.5017	0.0069	0.0017
2 3/4	2 15/16	2 2 1/2 3 3 1/2	2.7500	2.7482	2.9370	2.9358	2.7540	2.7506	0.0058	0.0006
2 7/8	3 1/16	2 1/2 3	2.8750	2.8732	3.0623	3.0610	2.8793	2.8758	0.0061	0.0008
3	3 3/16	2 1/2 3 3 3/4	3.0000	2.9978	3.1872	3.1858	3.0042	3.0006	0.0064	0.0006
3 1/4	3 7/16	2 1/2 3	3.2500	3.2478	3.4372	3.4358	3.2542	3.2506	0.0064	0.0006
3 1/2	3 11/16	2 1/2 3 3 3/4	3.5000	3.4978	3.6872	3.6858	3.5042	3.5006	0.0064	0.0006
3 5/8	3 13/16	3 3 3/4	3.6250	3.6228	3.8122	3.8108	3.6292	3.6256	0.0064	0.0006
3 3/4	3 15/16	3 3 3/4	3.7500	3.7478	3.9372	3.9358	3.7542	3.7506	0.0064	0.0006
4	4 3/16	3 3 3/4 4 3/4	4.0000	3.9978	4.1872	4.1858	4.0042	4.0006	0.0064	0.0006

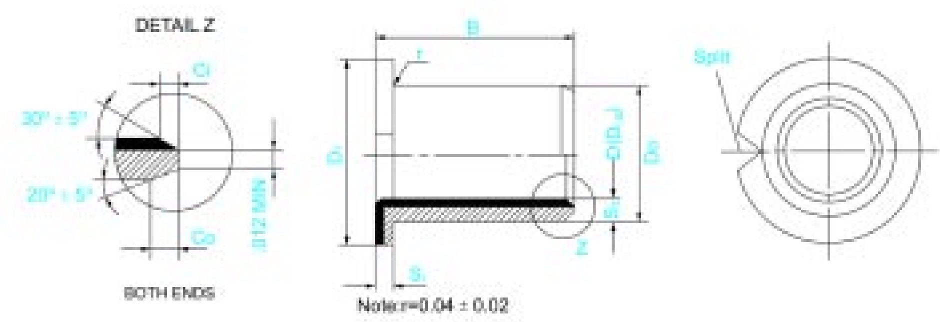
BK – 1E flanged bushes
inch sizes

BK-1WE, BK-1DE,BK-1TE

ID and OD chamfers

Di	Co	Ci
⩽ 11/16	.014 ± 0.008	.020 ± 0.010
> 11/16	.030 ± 0.008	.020 ± 0.010

All dimensions in inch



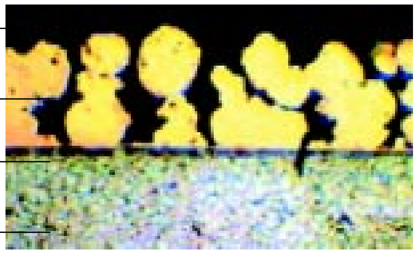
Nominal Diameter		Flange Wall S_{f1}		Flange - Φ D_{f1}	Lenght B	Shaft - Φ D_J		Housing - Φ DH		Ass. Inside - Φ $D_{i,a}$		Clearance C_D	
Di	Do	max.	min.	$D_i \leqslant \Phi\ D_{f1} = \Phi\ D_{f1} \pm 0.02$ $D_i < \Phi\ D_{f1} = \Phi\ D_{f1} \pm 0.03$	(0, -0.02)	max.	min.	max.	min.	max.	min.	max.	min.
3/8	15/32	0.052	0.044	11/16	1/4 3/8 1/2 3/4	0.3750	0.3741	0.4691	0.4684	0.3771	0.3752	0.0030	0.0002
1/2	19/32	0.052	0.044	13/16	1/4 3/8 1/2 3/4	0.5000	0.4990	0.5941	0.5934	0.5021	0.5002	0.0031	0.0002
5/8	23/32	0.052	0.044	15/16	3/8 1/2 5/8 3/4	0.6250	0.6240	0.7192	0.7184	0.6272	0.6252	0.0032	0.0002
3/4	7/8	0.068	0.060	1 1/8	3/8 1/2 3/4 1	0.7500	0.7488	0.8755	0.8747	0.7527	0.7502	0.0039	0.0002
7/8	1	0.068	0.060	1 1/4	1/2 3/4 1 1 1/4	0.8750	0.8738	1.0005	0.9997	0.8777	0.8752	0.0039	0.0002
1	1 1/8	0.068	0.060	1 3/8	1/2 3/4 1 1 1/4	1.0000	0.9988	1.1255	1.1247	1.0027	1.0002	0.0039	0.0002
1 1/4	1 13/32	0.083	0.075	1 3/4	1 1 1/4 1 1/2	1.2500	1.2484	1.4068	1.4058	1.2528	1.2502	0.0044	0.0002
1 1/2	1 21/32	0.083	0.075	2	1 1 1/2 2	1.5000	1.4984	1.6568	1.6558	1.5028	1.5002	0.0044	0.0002
1 3/4	1 15/16	0.098	0.090	2 3/8	1 1 1/2 2	1.7500	1.7484	1.9381	1.9371	1.7535	1.7503	0.0051	0.0003

engineering data

◇ triple layered series pom overlay

· **Material structure**

1 Mixture of polyformaldehyde and glass fiber: 0.3-0.5mm
2 Sintered bronze: 0.2-0.3mm
3 Steel back: 0.4-2.2mm
4 Tinned layer thickness: 0.005mm, copper-plated layer thickness: 0.008mm



· **Application charaters**

1 BK-2 are maintenance-free self-lubricating bearings;
2 BK-2 has higher pV value
3 BK-2 has low friction and low wear
4 Good anti-meshing feature
5 Working temperature range: -40ºC to +120ºC
6 Heavy load capacity
7 No water absorption, good dimension stability
8 Suitable for rotation, oscillation, reciprocating and sliding movement
9 BK-2 widely used for automobile chasis, forging machinery, metallic machinery, power station, rolling mills etc.
10 BK-2 suitable for non-lead applications as it is lead free.

◇ characters

· **Physical features**

Table 1 BK-2 bearings physical features

Bush series	Max loading (N/mm²)		Pressure intensity N/mm²	Working temperature ℃	Inner layer electric resistance factor Ω cm	Coefficient of linear expansion 10^{-6}/K
	Stat.	Dyn.				
BK-2	140	140	380	-40~+120	10^{15}	16

· **Chemical feature**

Table 2 BK-2 bearings chemical features

Bush series	5% hydrochlorn acid	5% nitric acid	5% sulfuric acid	5% acetic acid	10% ammonia water	5% sodium chloride	Acetone
BK-2	●	●	●	●	●●	●●	●●●

Bush series	Carbon tetrachloride	Paraffin wax	Gasoline	Kerosene	Diesel	Water	Sea water
BK-2	●●●	●●●	●●●	●●●	●●●	●●	●

●●● good ●● medium ● bad ○ no

◇ lubrication

· **lubrication selection**

BK-2 bushes must be lubricated. Lubricant selection depends on the pV value of the bush, sliding speed and lubrication stability in operational environment.

- **Grease lubrication**

Grease lubrication is a recommended method. Table 3 gives lubricating features of alternative greases. If working temperature above 50^{0}C, add an anti-hardening additive into the grease. Lubricating greases having EP additives, lead or MoS2 are not recommended for BK-2 bushes.

- **Oil lubrication**

If working temperature rises above 115^{0}C, hydrocarbon-based oil is not recommended for BK-2 bushes because the oil will desolve and produce a low concentration of unstable acids or free radical, which will decompose the acetal inner layer of the BK-2 bushes and decrease working performance. This is the reason why BK-2 cannot be used in circulating oil lubrication and oil bath lubrication systems.

- **Water**

BK-2 bushes may be used in water only under appropriate load and speed conditions.

- **Wil-water emulsion**

BK-2 is suitable for oil-water emulsion (95£∫5). It is recommended to pre-lubricated bushes with oil or grease before using the oil-water emulsion.

- **Gasoline**

When pV =0.21N/mm2xm/s, if gasoline is used as a lubricant, wear rate of BK-2 is 4-5 times higher than under grease lubrication.

Table 3 Lubricating Grease

Manufacturer	Brand	Base oil	Grade
Esso	Andok C	Mineral	●●
	Andok 260	Mineral	●●
	Cazar K	Mineral	●
Mobil	Mobilplex 47	Mineral	●●
	Mobiltemp 1	Mineral	●
Shell	Albida R2	Mineral	●●●
	Axinus S2	Mineral	●●
	Darina R2	Mineral	●●●
BP	Energrease LS2	Mineral	●●●
	Energrease LT2	Mineral	●●●

●●● good ●● medium ● bad

- **Design of BK-2 bushes**

When determining BK-2 bush size and calculating its working life, the following parameters should be taken into consideration.

1 Limit load, p
2 PV value
3 Mating surface roughness
4 Material of mating surface
5 Temperature
6 Other environmental factors: e.g. houshing size, lubricating condition etc.

engineering data

- **Load rating**

Load rating p is defined as the sustained force on unit projective area, N/mm^2

1) For cylindrical bush

$$\bar{p} = \frac{F}{D_i \cdot B}$$

2) For thrust washer

$$\bar{p} = \frac{4F}{\pi \cdot (D_o^2 - D_i^2)}$$

- **Limit load**

Table 4 is the limit load of BK-2 bushes under different working conditions

Table 4 BK-2 Bushing limit load

Load type	Working condition	Lubrication	Limit load
Constant load	Continuous low speed rotation or oscillation	Grease or oil	140
Constant load	Continuous rotation or oscillation	Grease or oil	70
Static load or dynamic load	Continuous rotation or oscillation	oil	45

- **Sliding speed**

Sliding speed is calculated as
For continuous rotation motion

For cylindrical bush

$$V = \frac{D_i \cdot \pi \cdot N}{60 \cdot 10^3}$$

For thrust washer

$$V = \frac{\frac{D_o + D_i}{2} \cdot \pi \cdot N}{60 \cdot 10^3}$$

For oscillation motion

For cylindrical bush

$$V = \frac{D_i \cdot \pi}{60 \cdot 10^3} \cdot \frac{4\,\Psi \cdot N_{osz}}{360}$$

For thrust washer

$$V = \frac{\frac{D_o + D_i}{2} \cdot \pi \cdot N}{60 \cdot 10^3} \cdot \frac{4\,\Psi \cdot N_{osz}}{360}$$

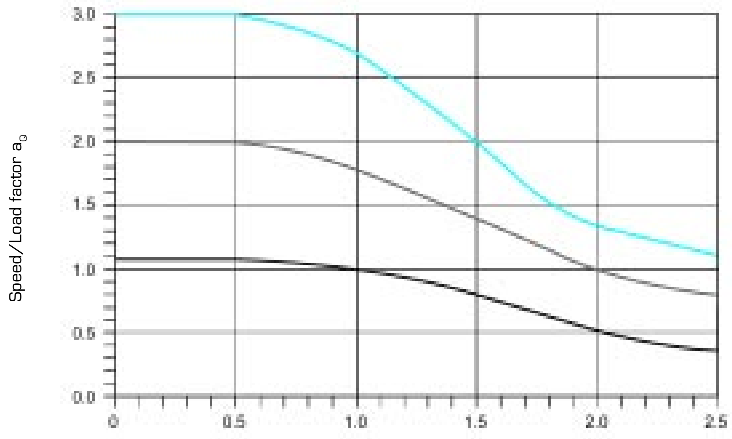
- **PV value**

Working life of BK-2 bushes depend on the pV value, its calculation formula is;

$pV = p\,V \quad N/mm^2 \times m/s$

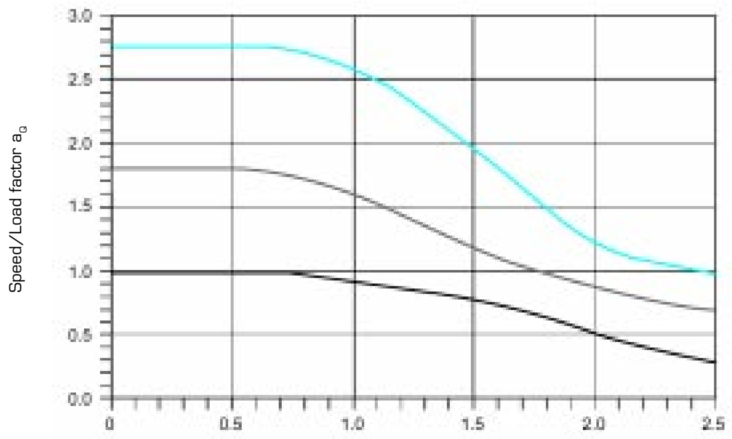
- **Load**

Besides pV value, load type and load direction also affect the operation of BK-2 bushes, which could be adjusted by factor a_Q.



Rotating load
Steaty load vertically downwards
Dynamic load or steady load not downwards

fig. 1 a_Q for non-machined BK-2 bushes



Rotating load
Steaty load vertically downwards
Dynamic load or steady load not downwards

fig. 2 a_Q for machined BK-2 busges

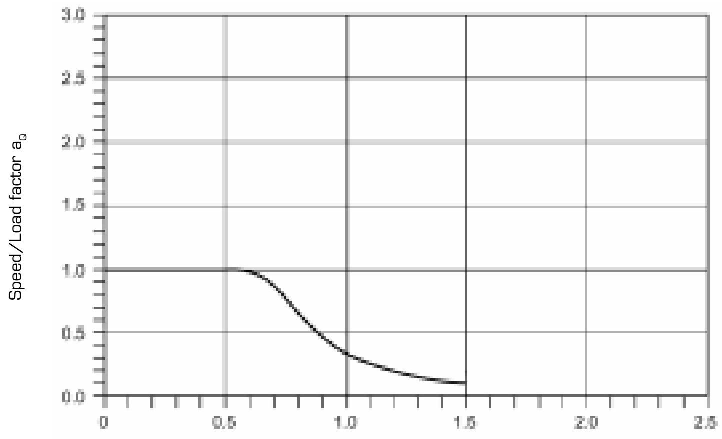


Fig. 3 a_Q for BK-2 thrust washers

engineering data

· **Temperature**

Another factor affecting bush life is the working temperature. If the bush temperature is above 40ºC, grease-lubricated BK-2 bush performance will decrease. For a given pV value, bush working temperature depend on environmental temperature. When calculating the bush life, factor a_T is introduced to take environmental temperature into consideration.

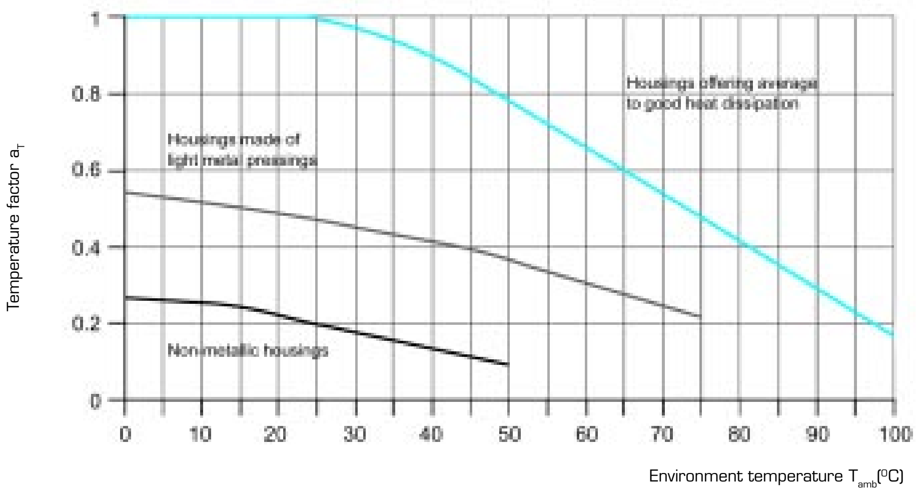


Fig. 4 BK-2 temperature factor a_T

· **Mating surface**

Wear of BK-2 bushes depend on the smoothness of the mating surfaces . Bush works normally when the mating surface roughness < Ra0.4. we take the effect of surface roughness to bush life into consideration by introducing the roughness factor a_S

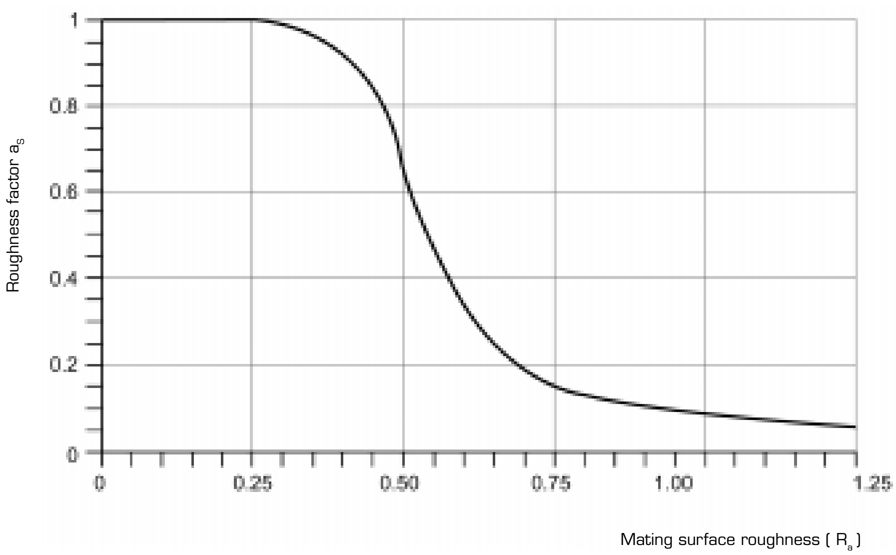


Fig. 5 BK-2 roughness factor

- **Bush size**

Production and conduction of bush friction heat closely related to bush size and environmental condition. For a given pV value, larger bush produces more heat than smaller one. Fig 6 gives bush size factor a_B

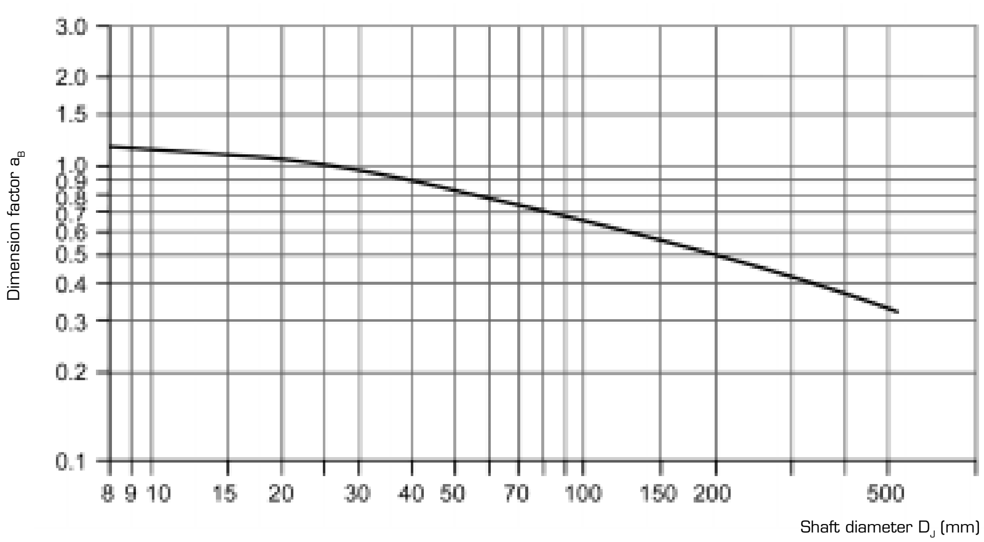


Fig. 6 BK-2 dimension factor a_B

- **Heavy load factor a_E:**

$$a_E = \frac{\bar{p}_{lim} - \bar{p}}{\bar{p}_{lim}}$$

If the calculated result a_E is an negative value or a_E > 10000, it indicates an overloaded bush. You have to increase bush diameter or length.

Effective pV value epV is calculated as

$$epV = \frac{a_E \cdot \bar{p}}{a_B}$$

If epV < 1.0,

$$L_H = \frac{3000}{e\bar{p}V} \cdot a_Q \cdot a_T \cdot a_S$$

If epV > 1.0,

$$L_H = \frac{3000}{(e\bar{p}V)^{2.4}} \cdot a_Q \cdot a_T \cdot a_S$$

Lubrication interval calculation

$$L_{RG} = \frac{L_H}{2}$$

Calculation example

Known			
Load type	Constant load	Inner diameter	40 mm
	Load direction: downward	Width	30 mm
Shaft	Steel	Actual load	15000 N
		Rotation speed	30 rpm
		Roughness Ra	0.3 μ m

Factor selection	
Limit load	70 N/mm²
Temperature factor a_T	1.0
Roughness factor a_S	0.98
Dimension factoR a_B	0.98
Speed/Load factor a_Q	1.8

Calculation	
Load rating p(N/mm²)	$\bar{p} = \frac{F}{D_i \cdot B} = \frac{15000}{40 \cdot 30} = 12.5$
Sliding speed V (m/s)	$V = \frac{Di \cdot \pi \cdot N}{60 \cdot 10^3} = \frac{40 \cdot \pi \cdot 30}{60000} = 0.063$
Heavy load factor a_E	$a_E = \frac{\bar{p}_{lim}}{\bar{p}_{lim}-\bar{p}} = \frac{70}{70-12.5} = 1.22$
Effective pV value	$e\bar{p}V = \frac{a_E \cdot \bar{p}_{lim}}{a_E} = \frac{1.22 \cdot 12.5 \cdot 0.063}{0.98} = 1.22$
Bush life L_H(h),	$L_H = \frac{3000}{e\bar{p}V} \cdot a_E \cdot a_T \cdot a_S = \frac{3000}{0.98} \cdot 1.8 \cdot 1.0 \cdot 0.98 = 5400$
Lubrication interval (h)	$L_{RG} = \frac{L_H}{2} = \frac{5400}{2} = 2700$

◇ Bush mounting

When mounting the bush, be careful and ensure no damage on BK-2 inner layer material.
When mounting the bush into the houshing, acarbonized and quenched step shaft should be adopted. To avoid damages during mounting, following points should be noted.

1 Use the recommended tolerance to suit the tolerance of the houshing
2 A 15-30⁰ guide chamfer on the houshing should be used
3 Guide chamfer shonld free of burrs
4 Use a light application of oil on the bush OD

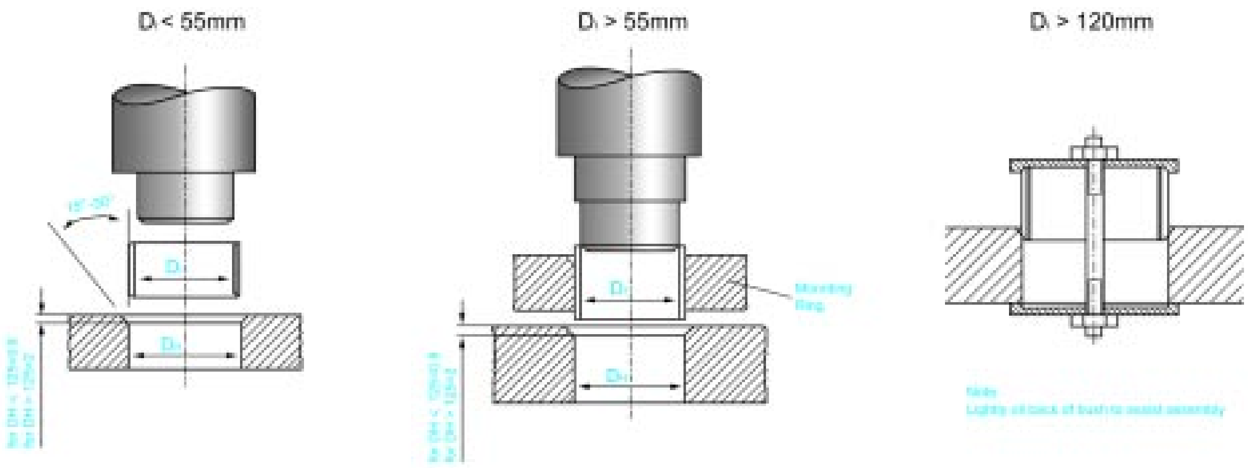


Fig. 7 BK-2 bush mounting

· **Press-in force when mounting bushes**

Press-in force for BK-2 bushes mounting is as fig 8.

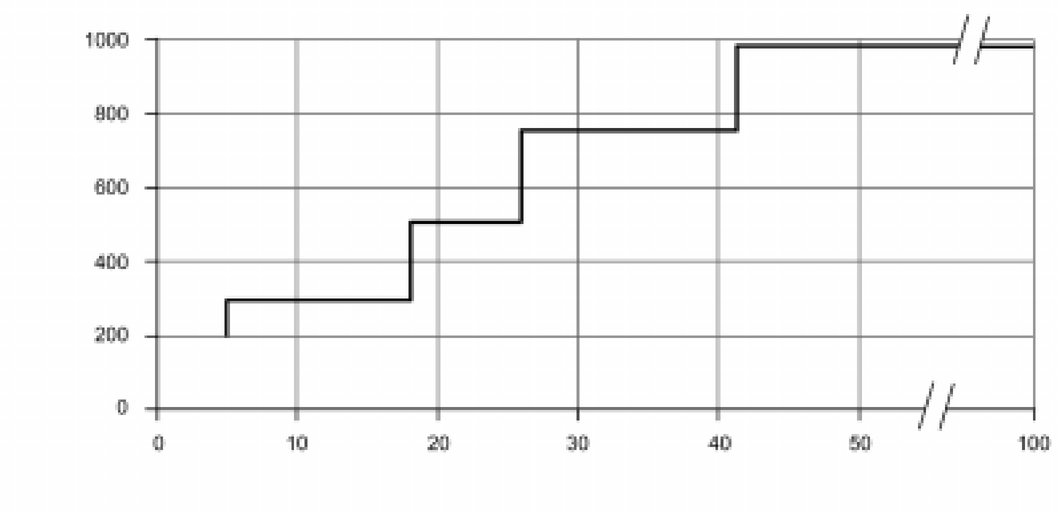


fig. 8 Relations between bush press in force and inner diameter

· **Alignment error**

For all bush mounting, correct alignment is very important. Misalignment will affect the whole bush length or the whole diameter of thrust washer.

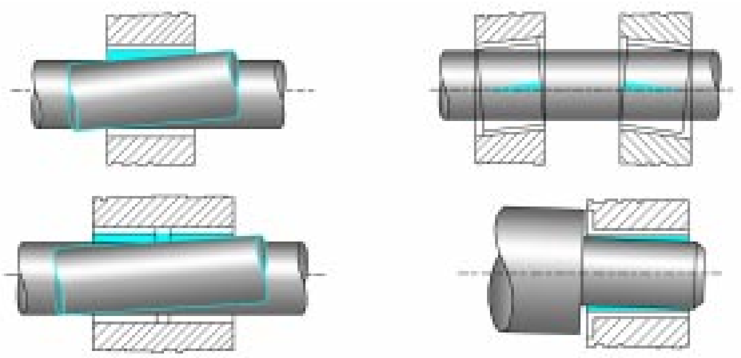


Fig. 9 Alignment error when mounting BK-2 bearings

· **Thrust washer mounting**

As the fig. 10 shown, locating the BK-2 thrust bush at the concave position. A gap must be left between inner diameter and shaft. Concave area diameter should 0.125mm larger than the bush outer diameter. If it has no concave structure when mounting, take the following methods.

1 Wood pin location
2 Screw location
3 Binding by adhesive agent

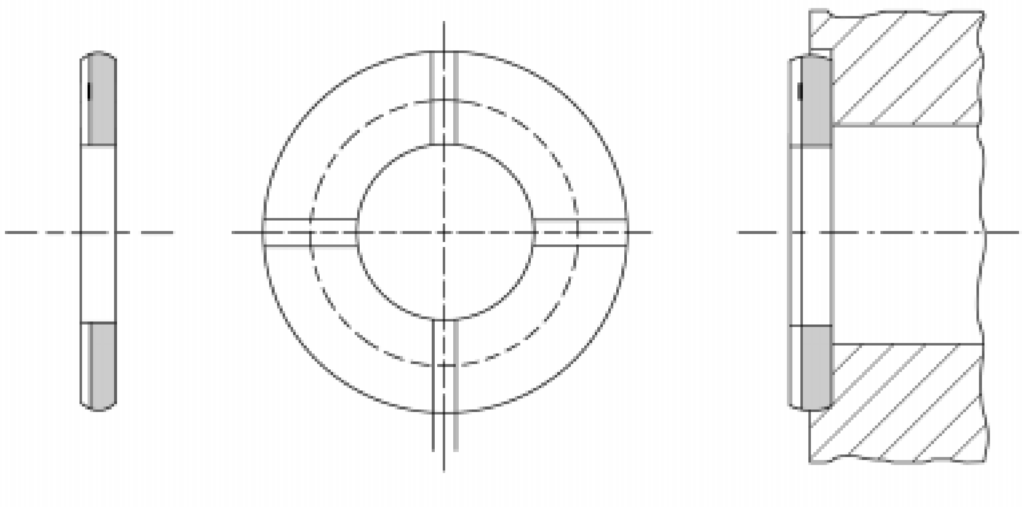
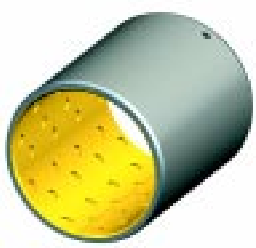


Fig. 10 Thrust washer mounting

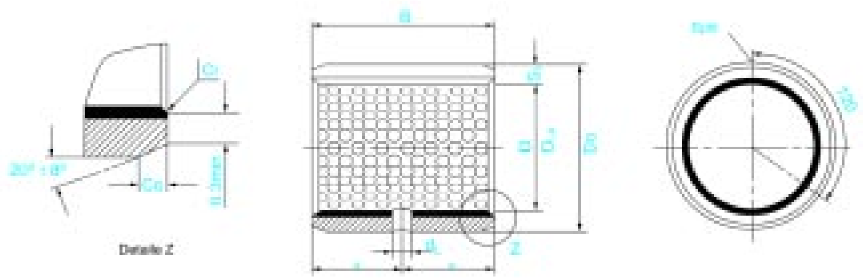
3K – 2 cylindrical bushes
metric sizes

ID and OD chamfers

Wall thickness	C_o		C_i
S3	Machined	Rolled	
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 ~ -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 ~ -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 ~ -1.0



Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_0	$B \leqslant 70$ B = B ± 0.25 $B > 70$ B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
8	10	8 10 12	8.000	7.978	10.015	10.000	8.105	8.040	0.127	0.040	none
10	12	10 12 15 20	10.000	9.978	12.018	12.000	10.108	10.040	0.130	0.040	3 4
12	14	10 12 15 20 25	12.000	11.973	14.018	14.000	12.108	12.040	0.135	0.040	3
14	16	20 25	14.000	13.973	16.018	16.000	14.108	14.040	0.135	0.040	4
15	17	10 12 15 25	15.000	14.973	17.018	17.000	15.108	15.040	0.135	0.040	3 4
16	18	15 20 25	16.000	15.973	18.018	18.000	16.108	16.040	0.135	0.040	4
18	20	15 20 25	18.000	17.973	20.021	20.000	18.111	18.040	0.138	0.040	4
20	23	10 15 20 25 30	20.000	19.967	23.021	23.000	20.131	20.050	0.164	0.050	4



Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_o	B < 70 B = B ± 0.25 B > 70 B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
22	25	15 20 25 30	22.000	21.967	25.021	25.000	22.131	22.050	0.164	0.050	6
24	27	15 20 25 30	24.000	23.967	27.021	27.000	24.131	24.050	0.164	0.050	6
25	28	15 20 25 30	25.000	24.967	28.021	28.000	25.131	25.050	0.164	0.050	6
28	31	30	28.000	27.967	31.025	31.000	28.135	28.050	0.168	0.050	6
28	32	20 25 30	28.000	27.967	32.025	32.000	28.155	28.060	0.188	0.060	6
30	34	20 30 40	30.000	29.967	34.025	34.000	34.155	30.060	0.188	0.060	6
32	36	20 30 35 40	32.000	31.961	36.025	36.000	32.155	32.060	0.194	0.060	6
35	39	20 30 35 50	35.000	34.961	39.025	39.000	35.155	35.060	0.194	0.060	6
36	40	35	36.000	35.961	40.025	40.000	36.155	36.060	0.194	0.060	6

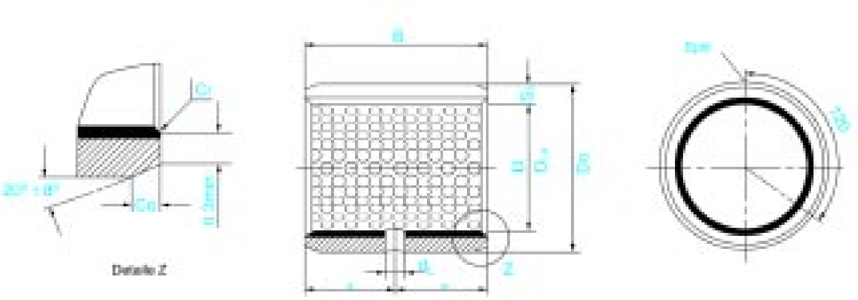
3K – 2 cylindrical bushes metric sizes

ID and OD chamfers

Wall thickness S3	C_o Machined	C_o Rolled	C_i
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 ~ -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 ~ -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 ~ -1.0

Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_o	B ≤ 70 B = B ± 0.25 B > 70 B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
37	41	20	37.000	36.961	41.025	41.000	37.155	37.060	0.194	0.060	6
40	44	20 30 40 50	40.000	39.961	44.025	44.000	40.155	40.060	0.194	0.060	8
45	50	20 30 40 45 50	45.000	44.961	50.025	50.000	40.195	40.080	0.234	0.080	8
50	55	40 50 60	50.000	49.961	55.030	55.000	50.200	50.080	0.239	0.080	8
55	60	20 25 30 40 50 60	55.000	54.954	60.030	60.000	55.200	55.080	0.246	0.080	8
60	65	30 40 60 70	60.000	59.954	65.030	65.000	60.200	60.080	0.246	0.080	8
65	70	40 50 60 70	65.000	64.954	70.030	70.000	65.262	65.100	0.308	0.100	8

BEARING INDUSTRIES



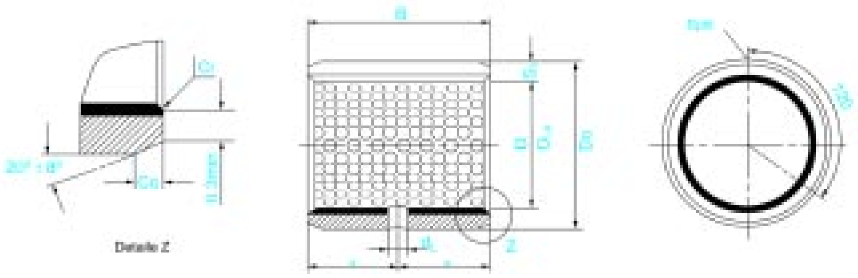
Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_O	B ≤ 70 B = B ± 0.25 B > 70 B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
70	75	40 50 65 70 80	70.000	69.954	75.030	75.000	70.262	70.100	0.308	0.100	8
75	80	40 60 80	75.000	74.954	80.030	80.000	75.262	75.100	0.308	0.100	9.5
80	85	60 80 100	80.000	79.954	85.035	85.000	80.267	80.100	0.313	0.100	9.5
85	90	30 40 60 80 100	85.000	84.946	90.035	90.000	85.267	85.100	0.321	0.100	9.5
90	95	40 60 80 90 100	90.000	89.946	95.035	95.000	90.267	90.100	0.321	0.100	9.5
95	100	60 100	95.000	94.946	100.035	100.000	95.267	95.100	0.321	0.100	9.5
100	105	50 60 80 95 115	100.000	99.946	105.035	105.000	100.267	100.100	0.321	0.100	9.5

3K – 2 cylindrical bushes
metric sizes

ID and OD chamfers

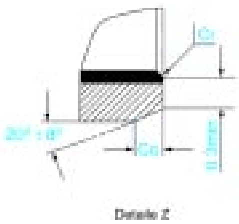
Wall thickness	C_o		C_i
S3	Machined	Rolled	
0.75	0.5 ± 0.3	0.5 ± 0.3	-0.1 ~ -0.4
1	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.5
1.5	0.6 ± 0.4	0.6 ± 0.4	-0.1 ~ -0.7
2	1.2 ± 0.4	1.0 ± 0.4	-0.1 ~ -0.7
2.5	1.8 ± 0.6	1.2 ± 0.4	-0.2 ~ -1.0

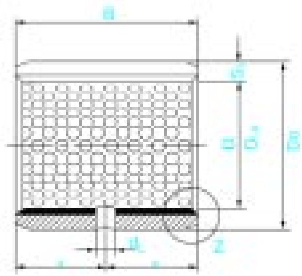
Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_O	B ≤ 70 B = B ± 0.25 B > 70 B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
105	110	60 110 115	105.000	104.946	110.035	110.000	105.267	105.100	0.321	0.100	9.5
110	115	60 110 115	110.000	109.946	115.035	115.000	110.267	105.110	0.321	0.100	9.5
115	120	50 70	115.000	114.946	120.035	120.000	115.267	115.100	0.321	0.100	9.5
120	125	60 100 110	120.000	119.946	125.040	125.000	120.272	120.100	0.326	0.100	9.5
125	130	60 100 110	125.000	124.937	130.040	130.000	125.272	125.100	0.335	0.100	9.5
130	135	50 60 80 100	130.000	129.937	135.040	135.000	130.280	130.130	0.343	0.130	9.5
135	140	60 80	135.000	134.937	140.040	140.000	135.280	135.130	0.343	0.130	9.5
140	145	50 60 80 100	140.000	139.937	145.040	145.000	140.280	140.130	0.343	0.130	9.5

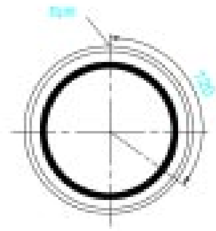


Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_0	B ≤ 70 B = B ± 0.25 B > 70 B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
150	155	50 60 80 100	150.000	149.937	155.040	155.000	150.280	150.130	0.343	0.130	9.5
160	165	50 60 80 100	160.000	159.937	165.040	165.000	160.280	160.130	0.343	0.130	11
170	175	50 60 80 100	170.000	169.937	175.040	175.000	170.280	170.130	0.343	0.130	11
180	185	50 60 80 100	180.000	179.937	185.046	185.000	180.286	180.130	0.349	0.130	11
190	195	50 60 80 100 120	190.000	189.928	195.046	195.000	190.286	190.130	0.358	0.130	11
200	205	50 60 80 100 120	200.000	199.928	205.046	205.000	200.286	200.130	0.358	0.130	11

3K - 2 cylindrical bushes
metric sizes



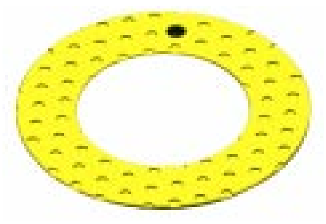


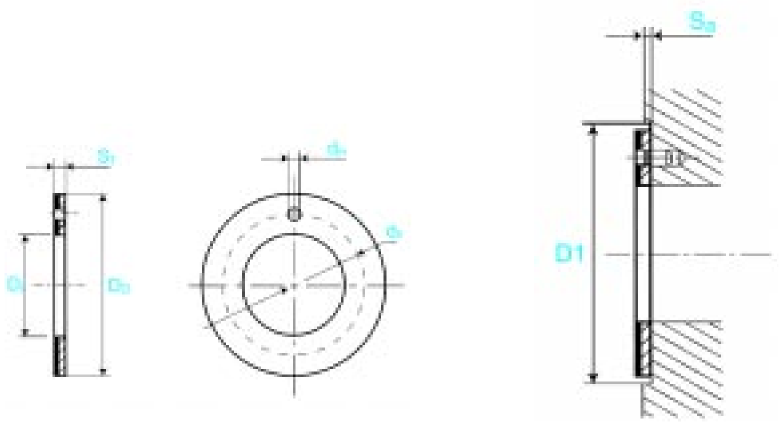


Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_0	B < 70 B = B ± 0.25 B > 70 B = B ± 0.50	max.	min.	max.	min.	max.	min.	max.	min.	min.
220	225	60 80 100 120	220.000	219.928	225.046	225.000	220.286	220.130	0.358	0.130	12
240	245	50 60 80 100 120	240.000	239.928	245.046	245.000	240.286	240.130	0.358	0.130	12
250	255	50 60 80 100 120	250.000	249.928	255.052	255.000	250.292	250.130	0.364	0.130	12
260	265	50 60 80 100 120	260.000	259.919	265.052	265.000	260.292	260.130	0.373	0.130	12
280	285	50 60 80 100 120	280.000	279.919	285.052	285.000	280.292	280.130	0.373	0.130	12
300	305	50 60 80 100 120	300.000	299.919	305.052	305.000	300.292	300.130	0.373	0.130	12

BK - 2 series thrust washer
metric sizes

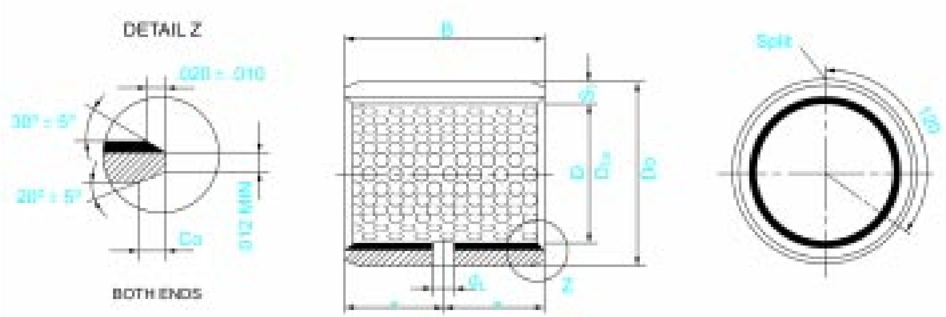
CCVI BEARING INDUSTRIES



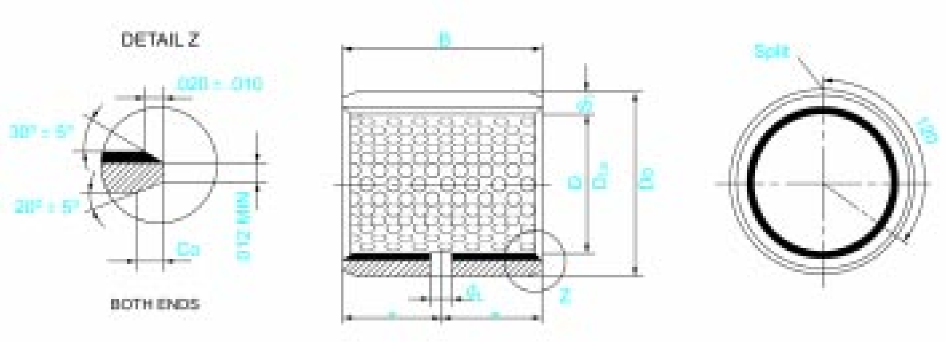


Part Number	shaft diameter	Inside - Φ D_i		Outside - Φ D_o		Wall thickness S_T		Locating hole - Φ d_H		Locating hole PCD - Φ d_p		Recess Depth S_a		Recess hole - Φ D_1	
		max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
BK-2 10 SF	8	10.25	10	20	19.75	1.5	1.45	1.9	1.6	15.12	14.88	1.2	0.8	20.12	20
BK-2 12 SF	10	12.25	12	24	23.75	1.5	1.45	1.9	1.6	18.12	17.88	1.2	0.8	24.12	24
BK-2 14 SF	12	14.25	14	26	25.75	1.5	1.45	2.4	2.1	20.12	19.88	1.2	0.8	26.12	26
BK-2 16 SF	14	16.25	16	30	29.75	1.5	1.45	2.4	2.1	23.12	22.88	1.2	0.8	30.12	30
BK-2 18 SF	16	18.25	18	32	31.75	1.5	1.45	2.4	2.1	25.12	24.88	1.2	0.8	32.12	32
BK-2 20 SF	18	20.25	20	36	35.75	1.5	1.45	3.4	3.1	28.12	27.88	1.2	0.8	36.12	36
BK-2 22 SF	20	22.25	22	38	37.75	1.5	1.45	3.4	3.1	30.12	29.88	1.2	0.8	38.12	38
BK-2 24 SF	22	24.25	24	42	41.75	1.5	1.45	3.4	3.1	33.12	32.88	1.2	0.8	42.12	42
BK-2 26 SF	24	26.25	26	44	43.75	1.5	1.45	3.4	3.1	35.12	34.88	1.2	0.8	44.12	44
BK-2 28 SF	25	28.25	28	48	47.75	1.5	1.45	4.4	4.1	38.12	37.88	1.2	0.8	48.12	48
BK-2 32 SF	30	32.25	32	54	53.75	1.5	1.45	4.4	4.1	43.12	42.88	1.2	0.8	54.12	54
BK-2 38 SF	35	38.25	38	62	61.75	1.5	1.45	4.4	4.1	50.12	49.88	1.2	0.8	62.12	62
BK-2 42 SF	40	42.25	42	66	65.75	1.5	1.45	4.4	4.1	54.12	53.88	1.2	0.8	66.12	66
BK-2 48 SF	45	48.25	48	74	73.75	1.5	1.45	4.4	4.1	61.12	60.88	1.7	1.3	74.12	74
BK-2 52 SF	50	52.25	52	78	77.75	2	1.95	4.4	4.1	65.12	64.88	1.7	1.3	78.12	78
BK-2 62 SF	60	62.25	62	90	89.75	2	1.95	4.4	4.1	76.12	75.88	1.7	1.3	90.12	90

3K – 2E cylindrical bushes
inch sizes



Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
D_i	D_o	(0, -0.02)	max.	min.	max.	min.	max.	min.	max.	min.	min.
1/2	5/8	3/8 1/2	0.5000	0.4990	0.6352	0.6345	0.5038	0.5007	0.0048	0.0007	5/32
5/8	12/16	5/8 3/4	0.6250	0.6240	0.7604	0.7596	0.6290	0.6258	0.0050	0.0008	5/32
3/4	7/8	3/4 1	0.7500	0.7488	0.8854	0.8846	0.7540	0.7508	0.0052	0.0008	
7/8	1	3/4 1	0.8750	0.8738	1.0105	1.0097	0.8791	0.8759	0.0053	0.0009	5/32
1	1 1/8	3/4 1	1.0000	0.9988	1.1356	1.1348	1.0042	1.0010	0.0054	0.0010	1/4
1 1/8	1 1/4	3/4 1	1.1250	1.1238	1.2606	1.2598	1.1292	1.1260	0.0054	0.0010	1/4
1 1/4	1 7/16	3/4 1	1.2500	1.2484	1.4170	1.4160	1.2550	1.2512	0.0066	0.0012	1/4
1 3/8	1 9/16	1 1 1/2	1.3750	1.3734	1.5420	1.5410	1.3800	1.3762	0.0066	0.0012	1/4



Nominal Diameter		Lenght B	Shaft - Φ D_J		Housing - Φ D_H		Ass. Inside - Φ Di,a		Clearance C_D		Oil hole - Φ d_L
Di	Do	(0, -0.02)	max.	min.	max.	min.	max.	min.	max.	min.	min.
1 1/2	1 11/16	1 1 1/2 2	1.5000	1.4984	1.6670	1.6660	1.5050	1.5012	0.0066	0.0012	5/16
1 5/8	1 13/16	1 1 1/2 2	1.6250	1.6234	1.7920	1.7910	1.6300	1.6262	0.0066	0.0012	5/16
1 3/4	1 15/16	1 1 1/2 2	1.7500	1.7484	1.9381	1.9371	1.7577	1.7515	0.0093	0.0015	5/16
1 7/8	2 1/16	1 1 1/2 2 2 1/4	1.8750	1.8734	2.0633	2.0621	1.8829	1.8765	0.0095	0.0015	5/16
2	2 3/16	1 1 1/2 2	2.0000	1.9982	2.1883	2.1871	2.0079	2.0015	0.0097	0.0015	5/16
2 1/2	2 11/16	1 1/2 2 2 1/2	2.5000	2.4982	2.6881	2.6869	2.5079	2.5015	0.0097	0.0015	5/16
3	3 3/16	1 1/2 2 2 1/2	3.0000	2.9978	3.1890	3.1876	3.0085	3.0019	0.0107	0.0019	3/8

engineering data

◇ DF series Bimetal bush

· **Application**

DF Bimetal bushes are widely used for oil lubrication applications. They need periodical lubrication at low speed applications, e.g. brake pedal, steering device, sliding parts of punching machines, construction equipment and bulldozers; medium-speed applications, e.g. connecting rod, sheering machinery etc.; high-speed applications, e.g. gear box, fuel pump, engine clutches etc..

· **DF alloy composition analysis**

Table 5 chemical composition of Bimetal bush

Element	DF800	DF720
Alloy type	CuPb10Sn10	CuPb24Sn4
Reference	USA: SAE 797	USA: SAE 799
Cu	balance	balance
Pb	9.0~11.0	21.0~27.0
Sn	9.0~11.0	3~4.5
Zn	0.5	0.5
P	0.1	0.1
Fe	0.7	0.7
Ni	0.5	0.5
Sb	0.2	0.2
Al	–	–
Si	–	–
Mn	–	–
Ti	–	–
Others	0.5	0.5

· **DF material physical characters**

Table 6 DF Bimetal bush physical characters

physical feature		DF800	DF720
Load limit N/mm^2		150	130
TensiL strength N/mm^2		185	150
Max speed (oil lubrication) m/s		5	10
Friction coefficient (oil lubrication)		0.06~0.14	0.06~0.16
Limit pV value, N/mm^{2}m/s	grease lubrication	2.8	2.8
	oil lubrication	10	100

· **Structure design**

DF Bimetal bushes are steel-backed with CuPb10Sn10 (Similar with SAE 797) 、CuPb24S$_n$4 (Similar with SAE 799)、sintered lager. The busges will adapt to different pressure, different working temperature and sliding speed by changing the internal alloy layer material. Various structures of oil grooves and oil holes satisfy different oil-filling methods and prevent bush failure.

- **Oil groove and oil indent**

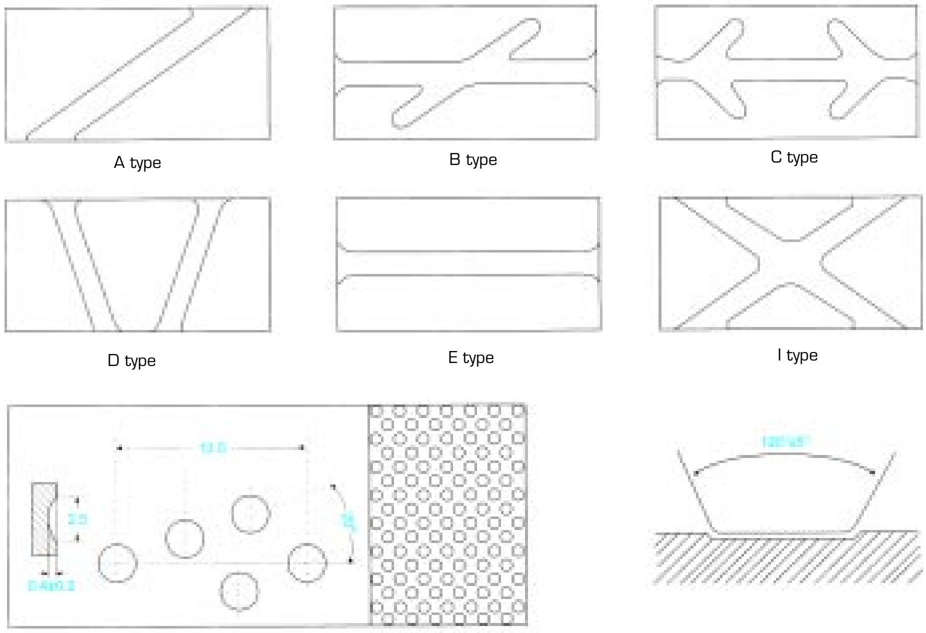


Fig 11 DF Bush oil grooves according to ISO 3547

- **Oil hole**

For complete lubrication of bushes, oil hole size will be designed as recommended values. If no special requirements, choose the size as table 7.

Table 7 oil hole diameter of Bimental bushes

Bearing O.D. (mm)	14~22	22~40	40~50	50~100	100~180
Oil hole diameter (mm)	3	4	5	6	7

Note: oil holes avoid the joints and loading areas for ease of lubrication.

- **Split**

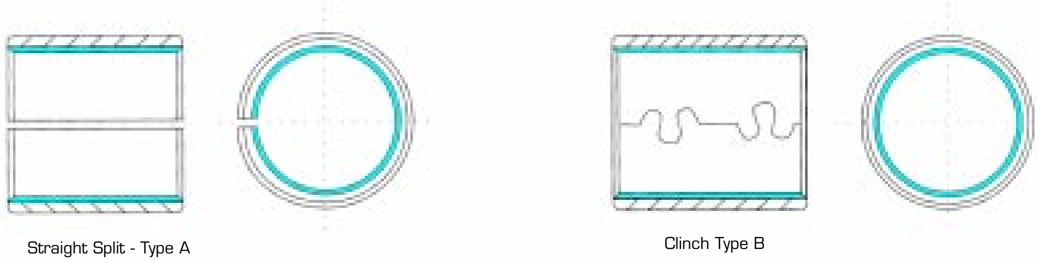


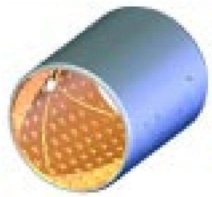
fig. 12 DF bush split type

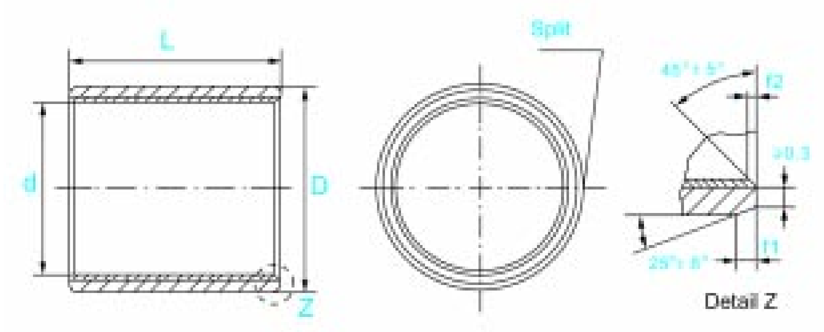
Choose clinch number according to table 8

Table 8 DF B1-metal bush hasp number

Bush length	Clinch
~ 45mm	1
45mm ~ 92mm	2
> 92mm	3

DF 800 cylindrical bushes
metric sizes





Types	Inside - Φ d	Outside - Φ D	Length
DF800 1010	10	12	10
DF800 1015	10	12	15
DF800 1020	10	12	20
DF800 1210	12	14	10
DF800 1215	12	14	15
DF800 1220	12	14	20
DF800 1410	14	16	10
DF800 1415	14	16	15
DF800 1420	14	16	20
DF800 1510	15	17	10
DF800 1515	15	17	15
DF800 1520	15	17	20
DF800 1610	16	18	10
DF800 1615	16	18	15
DF800 1620	16	18	20
DF800 1810	18	20	10
DF800 1815	18	20	15
DF800 1820	18	20	20
DF800 1825	18	20	25
DF800 2010	20	23	10
DF800 2015	20	23	15
DF800 2020	20	23	20
DF800 2025	20	23	25
DF800 2210	22	25	10
DF800 2215	22	25	15
DF800 2220	22	25	20
DF800 2225	22	25	25
DF800 2410	24	27	10
DF800 2415	24	27	15
DF800 2420	24	27	20
DF800 2425	24	27	25
DF800 2430	24	27	30
DF800 2515	25	28	15
DF800 2520	25	28	20
DF800 2525	25	28	25
DF800 2530	25	28	30
DF800 2615	26	30	15
DF800 2620	26	30	20
DF800 2625	26	30	25
DF800 2630	26	30	30
DF800 2815	28	32	15
DF800 2820	28	32	20
DF800 2825	28	32	25

Types	Inside - Φ d	Outside - Φ D	Length
DF800 2830	28	32	30
DF800 2840	28	32	40
DF800 3015	30	34	15
DF800 3020	30	34	20
DF800 3025	30	34	25
DF800 3030	30	34	30
DF800 3040	30	34	40
DF800 3215	32	36	15
DF800 3220	32	36	20
DF800 3225	32	36	25
DF800 3230	32	36	30
DF800 3240	32	36	40
DF800 3520	35	39	20
DF800 3525	35	39	25
DF800 3530	35	39	30
DF800 3540	35	39	40
DF800 3550	35	39	50
DF800 3820	38	42	20
DF800 3825	38	42	25
DF800 3830	38	42	30
DF800 3840	38	42	40
DF800 3850	38	42	50
DF800 4020	40	44	20
DF800 4025	40	44	25
DF800 4030	40	44	30
DF800 4040	40	44	40
DF800 4050	40	44	50
DF800 4520	45	50	20
DF800 4525	45	50	25
DF800 4530	45	50	30
DF800 4540	45	50	40
DF800 4550	45	50	50
DF800 5030	50	55	30
DF800 5040	50	55	40
DF800 5050	50	55	50
DF800 5060	50	55	60
DF800 5530	55	60	30
DF800 5540	55	60	40
DF800 5550	55	60	50
DF800 5560	55	60	60
DF800 6030	60	65	30
DF800 6040	60	65	40
DF800 6050	60	65	50
DF800 6060	60	65	60

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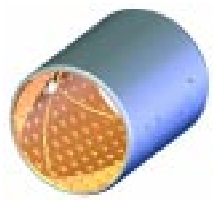
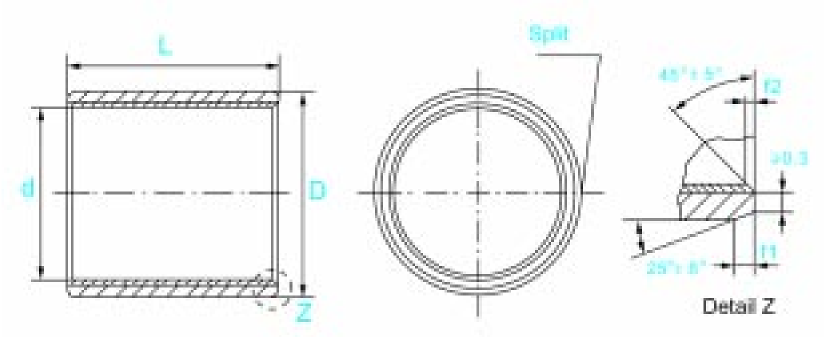
BEARING INDUSTRIES





Types	Inside - Φ d	Outside - Φ D	Length
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DF800 6540	65	70	40
DF800 6550	65	70	50
DF800 6560	65	70	60
DF800 7030	70	75	30
DF800 7040	70	75	40
DF800 7050	70	75	50
DF800 7060	70	75	60
DF800 7080	70	75	80
DF800 7530	75	80	30
DF800 7540	75	80	40
DF800 7550	75	80	50
DF800 7560	75	80	60
DF800 8040	80	85	40
DF800 8050	80	85	50
DF800 8060	80	85	60
DF800 8080	80	85	80
DF800 8440	84	90	40
DF800 8450	84	90	50
DF800 8460	84	90	60
DF800 8480	84	90	80
DF800 8940	89	95	40
DF800 8950	89	95	50
DF800 8960	89	95	60
DF800 8980	89	95	80
DF800 9450	94	100	50
DF800 9460	94	100	60
DF800 9480	94	100	80
DF800 9490	94	100	90
DF800 9950	99	105	50
DF800 9960	99	105	60
DF800 9980	99	105	80
DF800 9990	99	105	90
DF800 10450	104	110	50
DF800 10460	104	110	60
DF800 10480	104	110	80
DF800 10950	109	115	50
DF800 10960	109	115	60
DF800 10980	109	115	80
DF800 11450	114	120	50
DF800 11460	114	120	60

Types	Inside - Φ d	Outside - Φ D	Length
DF800 11480	114	120	80
DF800 11950	119	125	50
DF800 11960	119	125	60
DF800 11980	119	125	80
DF800 12350	123	130	50
DF800 12360	123	130	60
DF800 12380	123	130	80
DF800 123100	123	130	100
DF800 12850	128	135	50
DF800 12860	128	135	60
DF800 12880	128	135	80
DF800 128100	128	135	100
DF800 13350	133	140	50
DF800 13360	133	140	60
DF800 13380	133	140	80
DF800 133100	133	140	100
DF800 13860	138	145	60
DF800 13880	138	145	80
DF800 138100	138	145	100
DF800 14360	143	150	60
DF800 14380	143	150	80
DF800 143100	143	150	100
DF800 14860	148	155	60
DF800 14880	148	155	80
DF800 14890	148	155	90
DF800 15360	153	160	60
DF800 15380	153	160	80
DF800 15390	153	160	90
DF800 15860	158	165	60
DF800 15880	158	165	80
DF800 158100	158	165	100
DF800 16360	163	170	60
DF800 16380	163	170	80
DF800 163100	163	170	100
DF800 16860	168	175	60
DF800 16880	168	175	80
DF800 168100	168	175	100
DF800 17360	173	180	60
DF800 17380	173	180	80
DF800 173100	173	180	100

engineering data

◇ BK 090 series

Chemical component

Cu%	Sn%	P%	Pb%	Zn%
91.68	8.3	0.02	/	/

Mechanical properties

Tensile strength N/mm^2	Yield point N/mm^2	Elongation %	Brinell hardness HB
91.68	8.3	0.02	110

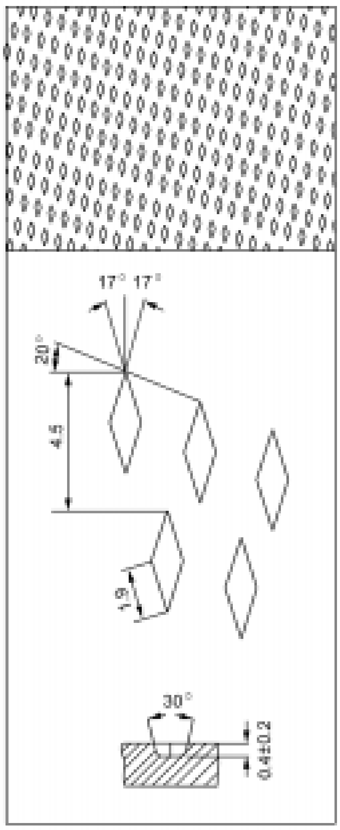
Physical properties

density g/m^3	Linear expansion cofficient 10-6/°C	Thermal conductivity W/m · K	Electrical conductivty m/ohm · mm^2	Modulus elasticity kN/mm^2
8.9	18.3	58	6.6	117

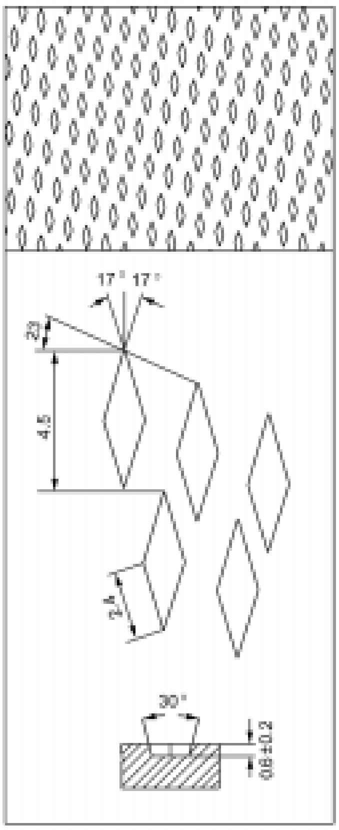
Load capacity

Low speed, oscillation ⩽ 0.01m/s	Rotating ⩽ 2m/s
100 - 120 N/mm^2	35 - 40 N/mm^2

Oil indents

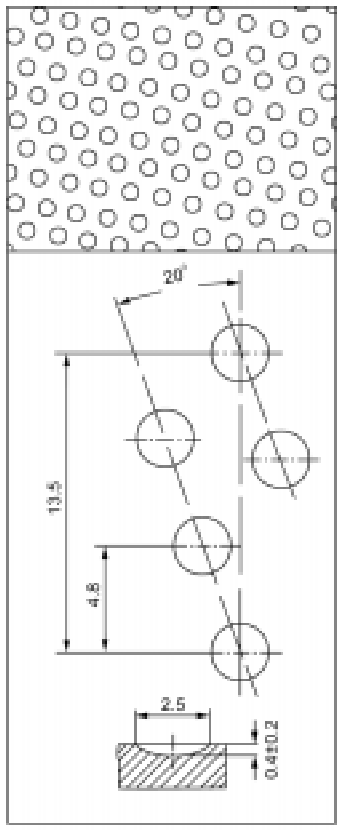


I · D < Φ 22mm



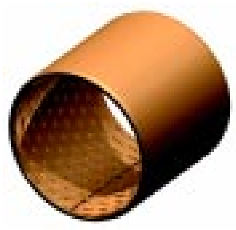
I · D > Φ 22mm

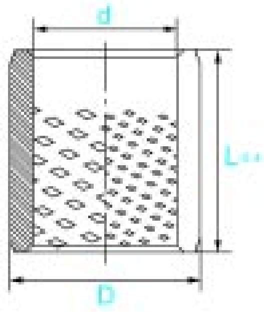
according to ISO 3547

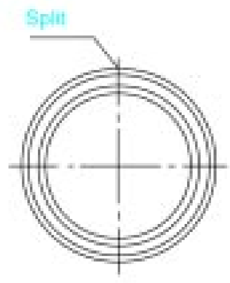


Spherical oil indent

bk 090 cylindrical bushes
metric sizes



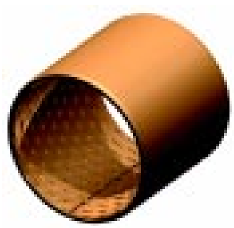


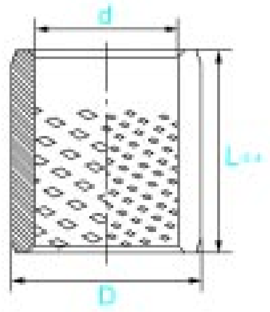


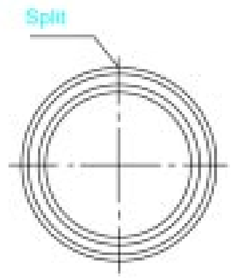
Types	Inside - Φ d	Outside - Φ D	Length
BK090 1010	10	12	10
BK090 1015	10	12	15
BK090 1210	12	14	10
BK090 1215	12	14	15
BK090 1220	12	14	20
BK090 1410	14	16	10
BK090 1415	14	16	15
BK090 1420	14	16	20
BK090 1425	14	16	25
BK090 1510	15	17	10
BK090 1515	15	17	15
BK090 1520	15	17	20
BK090 1525	15	17	25
BK090 1610	16	18	10
BK090 1615	16	18	15
BK090 1620	16	18	20
BK090 1625	16	18	25
BK090 1810	18	21	10
BK090 1815	18	21	15
BK090 1820	18	21	20
BK090 1825	18	21	25
BK090 2010	20	23	10
BK090 2015	20	23	15
BK090 2020	20	23	20
BK090 2025	20	23	25
BK090 2030	20	23	30
BK090 2215	22	25	15
BK090 2220	22	25	20
BK090 2225	22	25	25
BK090 2230	22	25	30
BK090 2240	22	25	40
BK090 2430	24	27	30
BK090 2515	25	28	15
BK090 2520	25	28	20
BK090 2525	25	28	25
BK090 2530	25	28	30
BK090 2815	28	31	15
BK090 2820	28	31	20
BK090 2825	28	31	25
BK090 2830	28	31	30
BK090 3015	30	34	15
BK090 3020	30	34	20
BK090 3025	30	35	25

Types	Inside - Φ d	Outside - Φ D	Length
BK090 3030	30	34	30
BK090 3040	30	34	40
BK090 3215	32	36	15
BK090 3220	32	36	20
BK090 3225	32	36	25
BK090 3230	32	36	30
BK090 3240	32	36	40
BK090 3515	35	39	15
BK090 3520	35	39	20
BK090 3525	35	39	25
BK090 3530	35	39	30
BK090 3535	35	39	35
BK090 3540	35	39	40
BK090 3550	35	39	50
BK090 4020	40	44	20
BK090 4025	40	44	25
BK090 4030	40	44	30
BK090 4040	40	44	40
BK090 4050	40	44	50
BK090 4060	40	44	60
BK090 4520	45	50	20
BK090 4525	45	50	25
BK090 4530	45	50	30
BK090 4540	45	50	40
BK090 4550	45	50	50
BK090 4560	45	50	60
BK090 5025	50	55	25
BK090 5030	50	55	30
BK090 5040	50	55	40
BK090 5050	50	55	50
BK090 5060	50	55	60
BK090 5520	55	60	20
BK090 5525	55	60	25
BK090 5530	55	60	30
BK090 5540	55	60	40
BK090 5550	55	60	50
BK090 5560	55	60	60
BK090 6025	60	65	25
BK090 6030	60	65	30
BK090 6035	60	65	35
BK090 6040	60	65	40
BK090 6050	60	65	50
BK090 6060	60	65	60
BK090 6080	60	65	80
BK090 6090	60	65	90
BK090 6530	65	70	30
BK090 6540	65	70	40

BK 090 cylindrical bushes
metric sizes



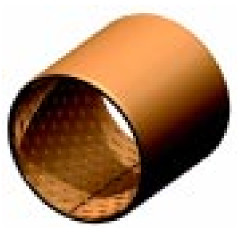


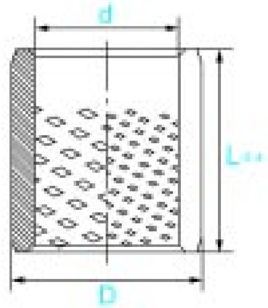


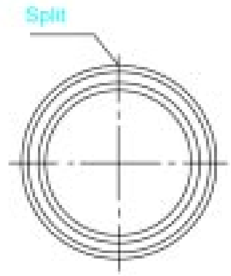
Types	Inside - Φ d	Outside - Φ D	Length
BK090 6550	65	70	50
BK090 6560	65	70	60
BK090 6580	65	70	80
BK090 7040	70	75	40
BK090 7050	70	75	50
BK090 7060	70	75	60
BK090 7070	70	75	70
BK090 7080	70	75	80
BK090 7090	70	75	90
BK090 7530	75	80	30
BK090 7540	75	80	40
BK090 7560	75	80	60
BK090 7580	75	80	80
BK090 8030	80	85	30
BK090 8040	80	85	40
BK090 8060	80	85	60
BK090 8080	80	85	80
BK090 8530	85	90	30
BK090 8540	85	90	40
BK090 8560	85	90	60
BK090 8580	85	90	80
BK090 9040	90	95	40
BK090 9060	90	95	60
BK090 9080	90	95	80
BK090 9090	90	95	90
BK090 10050	100	105	50
BK090 10060	100	105	60
BK090 10095	100	105	95
BK090 10560	105	110	60
BK090 105100	105	110	100
BK090 11060	110	115	60
BK090 110100	110	115	100
BK090 11560	115	120	60
BK090 115100	115	120	100
BK090 12060	120	125	60
BK090 120100	120	125	100
BK090 12560	125	130	60
BK090 125100	125	130	100
BK090 13060	130	135	60
BK090 130100	130	135	100
BK090 13560	135	140	60
BK090 135100	135	140	100

Types	Inside - Φ d	Outside - Φ D	Length
BK090 14060	140	145	60
BK090 140100	140	145	100
BK090 14560	145	150	60
BK090 145100	145	150	100
BK090 15060	150	155	60
BK090 150100	150	155	100
BK090 15560	155	160	60
BK090 155100	155	160	100
BK090 16060	160	165	60
BK090 160100	160	165	100
BK090 16560	165	170	60
BK090 165100	165	170	100
BK090 17060	170	175	60
BK090 170100	170	175	100
BK090 17560	175	180	60
BK090 175100	175	180	100
BK090 18060	180	185	60
BK090 180100	180	185	100
BK090 18560	185	190	60
BK090 185100	185	190	100
BK090 19060	190	195	60
BK090 190100	190	195	100
BK090 19560	195	200	60
BK090 195100	195	200	100
BK090 20060	200	205	60
BK090 200100	200	205	100
BK090 21560	215	220	60
BK090 215100	215	220	100
BK090 22560	225	230	60
BK090 225100	225	230	100
BK090 23560	235	240	60
BK090 235100	235	240	100
BK090 24560	245	250	60
BK090 245100	245	250	100
BK090 27560	275	280	60
BK090 275100	275	280	100
BK090 28560	285	290	60
BK090 285100	285	290	100
BK090 30060	300	305	60
BK090 300100	300	305	100

BK 090 cylindrical bushes
metric sizes







Types	Inside - Φ d	Outside - Φ D	Length
BK090 6550	65	70	50
BK090 6560	65	70	60
BK090 6580	65	70	80
BK090 7040	70	75	40
BK090 7050	70	75	50
BK090 7060	70	75	60
BK090 7070	70	75	70
BK090 7080	70	75	80
BK090 7090	70	75	90
BK090 7530	75	80	30
BK090 7540	75	80	40
BK090 7560	75	80	60
BK090 7580	75	80	80
BK090 8030	80	85	30
BK090 8040	80	85	40
BK090 8060	80	85	60
BK090 8080	80	85	80
BK090 8530	85	90	30
BK090 8540	85	90	40
BK090 8560	85	90	60
BK090 8580	85	90	80
BK090 9040	90	95	40
BK090 9060	90	95	60
BK090 9080	90	95	80
BK090 9090	90	95	90
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BK090 10060	100	105	60
BK090 10095	100	105	95
BK090 10560	105	110	60
BK090 105100	105	110	100
BK090 11060	110	115	60
BK090 110100	110	115	100
BK090 11560	115	120	60
BK090 115100	115	120	100
BK090 12060	120	125	60
BK090 120100	120	125	100
BK090 12560	125	130	60
BK090 125100	125	130	100
BK090 13060	130	135	60
BK090 130100	130	135	100
BK090 13560	135	145	60
BK090 135100	135	145	100

Types	Inside - Φ d	Outside - Φ D	Length
BK090 14060	140	145	60
BK090 140100	140	145	100
BK090 14560	145	150	60
BK090 145100	145	150	100
BK090 15060	150	155	60
BK090 150100	150	155	100
BK090 15560	155	160	60
BK090 155100	155	160	100
BK090 16060	160	165	60
BK090 160100	160	165	100
BK090 16560	165	170	60
BK090 165100	165	170	100
BK090 17060	170	175	60
BK090 170100	170	175	100
BK090 17560	175	180	60
BK090 175100	175	180	100
BK090 18060	180	185	60
BK090 180100	180	185	100
BK090 18560	185	190	60
BK090 185100	185	190	100
BK090 19060	190	195	60
BK090 190100	190	195	100
BK090 19560	195	200	60
BK090 195100	195	200	100
BK090 20060	200	205	60
BK090 200100	200	205	100
BK090 21560	215	220	60
BK090 215100	215	220	100
BK090 22560	225	230	60
BK090 225100	225	230	100
BK090 23560	235	240	60
BK090 235100	235	240	100
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BK090 245100	245	250	100
BK090 27560	275	280	60
BK090 275100	275	280	100
BK090 28560	285	290	60
BK090 285100	285	290	100
BK090 30060	300	305	60
BK090 300100	300	305	100

spherical plain bearings

rod ends

cam followers

mast bearings

bushing

ball bearings

needle bearings

inner rings

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