

# SKF filament wound bushings

The maintenance-free heavy-duty bushing

- High load carrying capacity
- Corrosion resistant
- Maintenance-free



# Maintenance-free, durable, cost-effective

## Filament wound material provides top performance

SKF filament wound bushings are maintenance-free, corrosion resistant, high performance bushings. The backing consists of high strength glass fibres and the sliding surface is made from PTFE and polymer fibres. Both the backing and sliding surfaces are embedded in an epoxy resin matrix. These materials combine the mechanical properties of glass fibres and the outstanding tribological properties of PTFE and high-strength polymer fibres.

## SKF filament wound bushings reduce operating costs

SKF filament wound bushings are an excellent solution for bearing arrangements that operate under heavy load conditions with low sliding speeds and/or in corrosive environments. The special properties of these heavy-duty bushings provide users with a variety of ways to reduce operating costs:

- Compact cost-effective design.
- Extended service life.
- Reduced maintenance costs.
- Reduced energy costs.

A high load carrying capacity (→ **diagram 1**) enables a more compact and cost-effective design. Under identical loads, filament wound bushings operating in uncontaminated environments have a considerably longer service life than other bushings due to the high wear-resistance of the sliding surface.

The benefits for the user are less downtime, reduced need for maintenance and fewer spare parts required. In short: longer uptime and reduced operating costs. The excellent sliding properties of the bushing help reduce energy costs.

Maintenance-free bushing arrangements mean reduced design, manufacturing and lubrication costs, as lubrication fittings, holes, grooves and grease are not needed. Furthermore, the maintenance-free bushing has less impact on the environment since there is no need to dispose of used lubricant.

*SKF filament wound bushings are available in different diameters and widths*



## Additional benefits of filament wound bushings

SKF filament wound bushings remain operational long after most plain bearings or bushings have been replaced or undergone maintenance. The following features help filament wound bushings obtain a high level of operational reliability and long service life:

- Good impact resistance.
- Insensitivity to edge loading and misalignment.
- Good noise and vibration damping.
- Excellent resistance to corrosive media, including salt water and many chemicals (→ **table 1, page 4**).
- Good insulator, which prevents passage of electric current.

## Filament wound bushings in demanding applications

SKF filament wound bushings are an excellent solution for applications where there are heavy loads, strong vibrations and corrosive environments. Typical applications for filament wound bushings include:

- Construction machinery.
- Agriculture and forestry machines and equipment.
- Hoisting and conveying equipment.
- Structural steel engineering and hydraulic steelwork.
- Metalworking machinery.
- Packaging machines.
- Off-shore plants and equipment.

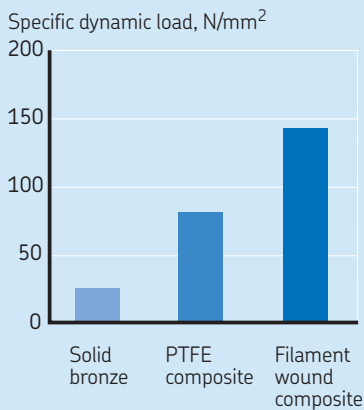
## Comprehensive product assortment

The SKF standard assortment ranges from a 20 to 200 mm bore diameter, each in three standard widths between 15 and 250 mm. Other dimensions are available on request.

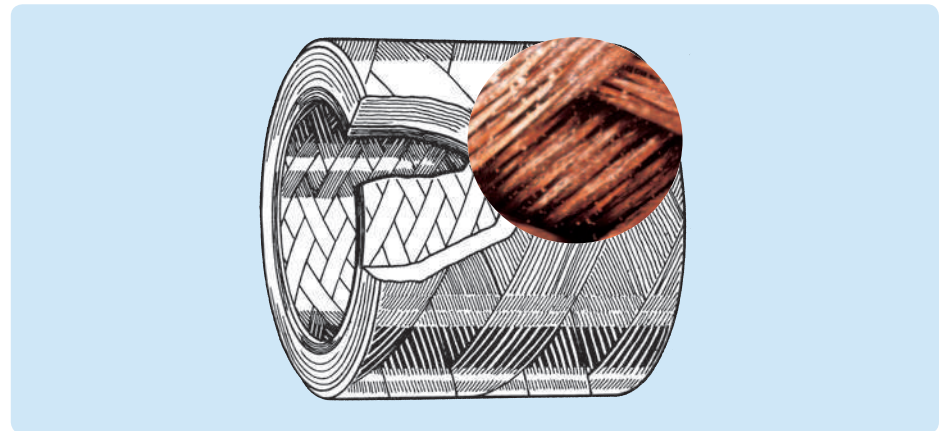
Diagram 1

### Load carrying capacity

Comparison of the permissible specific dynamic loads for different SKF sliding materials (sliding speed less than 0,01 m/s)



*Longitudinal section through the sliding layer. It shows the fibres wound in different directions*



*SKF filament wound bushings in a refuse truck*



*Excellent in harsh environmental conditions*



*Suitable even for use in salt water*



Table 1

## Chemical resistance of SKF filament wound bushings

## Substances at ambient temperature

Alcohols	Acids – 10 %	Gases	Others
Ethyl alcohol	Acetic acid	Acetylene	Petrol
Isobutyl alcohol	Boric acid	Butane	Diesel
Isopropyl alcohol	Citric acid	Carbon dioxide	Freon
	Hydrochloric acid	Ether	Formaldehyde
	Sulphuric acid	Hydrogen	
<b>Lyes – 10 %</b>	<b>Oils</b>	Natural gas	
Calcium hydroxide	Cotton seed oil	Nitrogen	
Magnesium hydroxide	Engine oil	Ozone	
Potassium hydroxide	Gear oil	Propane	
Sodium hydroxide	Hydraulic oil	Sulphur dioxide	
	Linseed oil		
	Mineral oil		

## Bushings data – general

## Dimensions

The dimensions of SKF filament wound bushings correspond to ISO 4379:1993. This provides full interchangeability with other bushings, e.g. bronze bushings, even in existing constructions.

## Tolerances

The tolerances (→ table 2) are adapted to the bushing material. The bore diameter of the bushings are manufactured to C10 tolerances. After fitting into a housing bore with H7 tolerance, the bore diameter tolerance will be within D11.

## Clearance

The operating clearance is determined by the shaft and bearing bore tolerances after fitting and corresponds to the values provided in table 3. Clearance increase, as a result of wear, is minimal during the service life of the bushing.

## Seals

Filament wound bushings have only a limited capacity to accommodate solid particles embedded into the filament wound material. Therefore, the sliding surface must be protected against the ingress of dirt. The use of SKF wiper seals (→ fig. 1) is recommended. Additional details about wiper seals are available on request.

Table 3

## Housing interference and operating clearance

Bushings		Operating clearance (Shaft h8)		Mean interference (Housing H7)
Bore diameter over	incl.	min	max	
mm		mm		mm
18	30	0,065	0,228	0,041
30	50	0,080	0,279	0,050
50	65	0,100	0,336	0,061
65	80	0,100	0,336	0,067
80	100	0,120	0,394	0,081
100	120	0,120	0,394	0,089
120	140	0,145	0,458	0,104
140	160	0,145	0,458	0,112
160	180	0,145	0,458	0,120
180	200	0,170	0,514	0,135

Table 4

## Material properties

Properties	Unit	Value
Permissible load		
– dynamic	N/mm <sup>2</sup>	140
– static	N/mm <sup>2</sup>	200
Permissible sliding velocity	m/s	0,5
Friction coefficient $\mu$	–	0,03 ... 0,08
Temperature range	°C	–50 ... +140
Thermal expansion (similar to steel)	K <sup>-1</sup>	$13 \times 10^{-6}$
Thermal conductivity	W/mK	0,4
Density	g/cm <sup>3</sup>	1,87

Table 2

Tolerances	
Component	Tolerance
<b>Bushing</b>	
Bore diameter	C10 (before mounting) D11 (after mounting)
Outer diameter	s8
Width	h13
<b>Housing</b>	H7
<b>Shaft</b>	h8

## Lubrication

Thanks to the sliding layer made from state-of-the-art fibres and resins, filament wound bushings are an excellent choice for dry running, lubricant-free applications.

## Material

The material properties can be found in **table 4**. SKF filament wound bushings can be machined, using normal methods, on all surfaces except for the sliding surface.

The bushing may be split longitudinally into two halves to facilitate mounting. To do this, the use of a diamond coated grinding wheel and cooling fluid is recommended. Care must be taken to avoid excessive temperatures, as they can destroy the bushing.

## Shaft recommendations

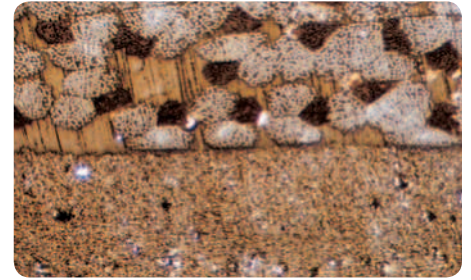
Hardened shafts are generally recommended for SKF filament wound bushings. For specific loads exceeding  $20 \text{ N/mm}^2$ , their hardness should be at least 50 HRC. Surface roughness is also important. Values of  $R_a = 0,2$  to  $0,4 \text{ }\mu\text{m}$  or  $R_z = 1$  to  $2 \text{ }\mu\text{m}$  are recommended with as smooth a surface profile as possible.

The best results have been obtained when surfaces were treated with nitride or plated with hard chromium and then polished.

## Bearing arrangement incorporating SKF filament wound bushings and wiper seals

## Mounting

Filament wound bushings are mounted in the same way as all plain bearings. Although no special tools are required, SKF recommends the use of mounting sleeves. For mounting larger numbers of these bushings, SKF recommends using a press and mounting tools adapted to the application. The use of a hydraulic press and a mounting dolly with a diameter that is 0,2 to 0,4 mm smaller than the bushing bore is one successful mounting method (→ **fig. 2**).



**Section through the composite material**  
Top layer: polymer (light) and PTFE fibres (dark)  
of the sliding layer

## Mounting SKF filament wound bushings with a dolly

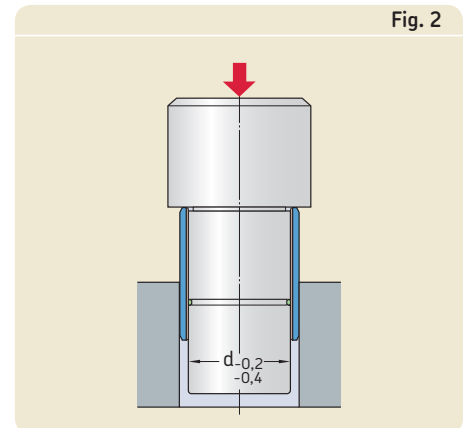


Fig. 2

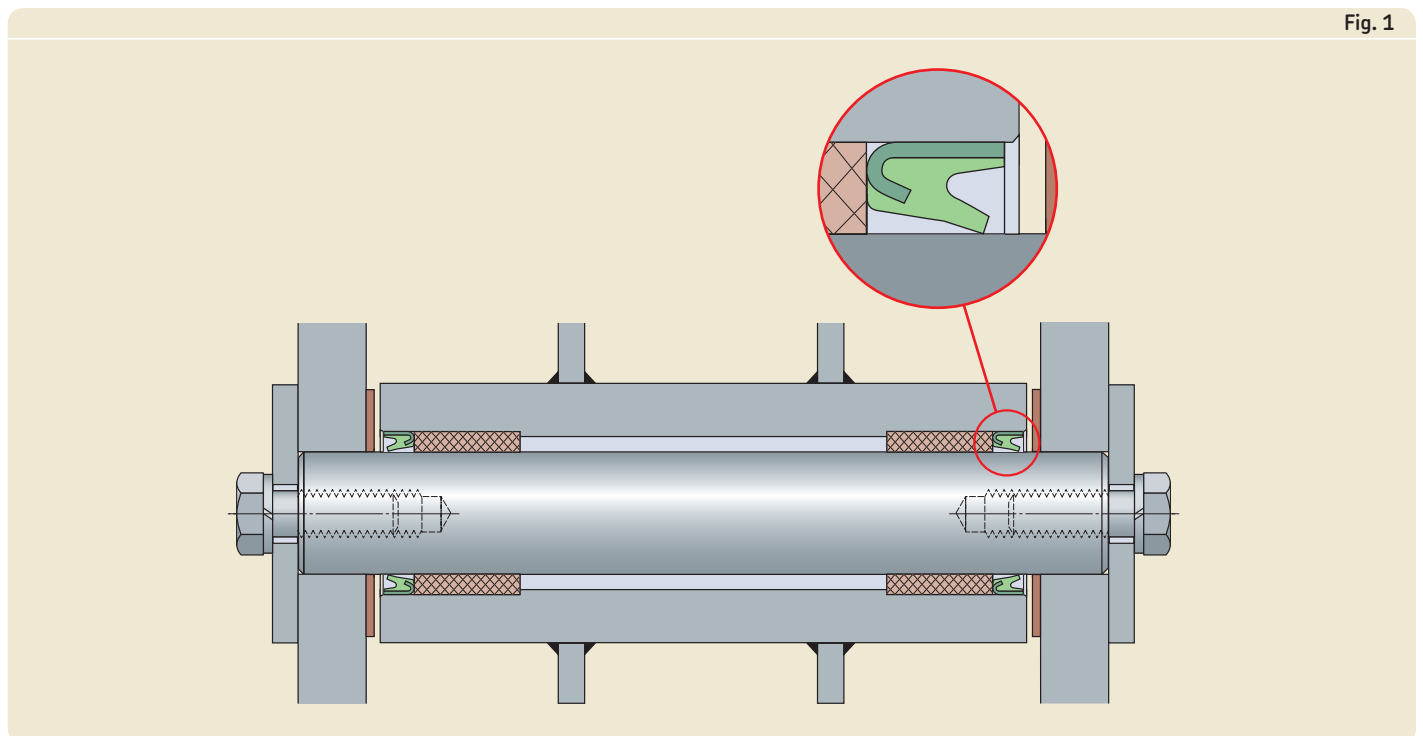


Fig. 1



## Calculation

The performance of SKF filament wound bushings depends on their position and application in question as well as on the combination of load, surface roughness and hardness, sliding speed, temperature and seal arrangement.

**Diagram 2** indicates acceptable combinations of specific bearing loads and sliding speeds for these bushings. The specific bearing load is calculated from the following equation:

$$p = \frac{F}{A}$$

where

$p$  = specific bearing load,  $\text{N}/\text{mm}^2$

$F$  = bearing load,  $\text{N}$

$A$  = load carrying cross section,  $\text{mm}^2$

(→ **fig. 3** and **product table** on **page 7**)

The sliding speed is calculated as follows:

$$v = 5,82 \times 10^{-7} d \beta f$$

where

$v$  = sliding speed,  $\text{m}/\text{s}$

$d$  = bushing bore diameter,  $\text{mm}$

$f$  = oscillation frequency or speed,  $\text{min}^{-1}$

$\beta$  = half the oscillation amplitude, degrees

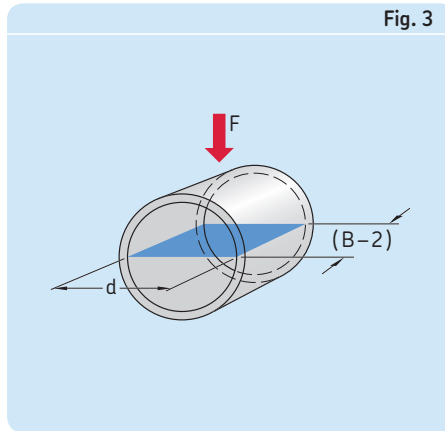
(→ **fig. 4**). One complete oscillation (from point 0 to point 4) equals  $4 \beta$ . For rotating movements  $\beta = 90^\circ$ .

If the values for the specific bearing load and the sliding speed are positioned below the curve in the  $p$  $v$  diagram, the bearing is suitable for the application. Under favourable conditions, operating ranges above the curve are also possible. In this case, contact the SKF application engineering service.

### Designation system

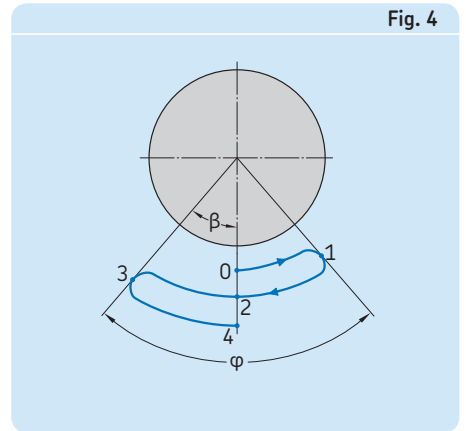
SKF filament wound bushings are identified by the prefix PWM (P = plain bearing, W = filament wound, M = metric). This is followed by the dimensions of the bore diameter, outside diameter and width in millimetres, uncoded, e.g. PWM 354130 with  $d = 35 \text{ mm}$ ,  $D = 41 \text{ mm}$  and  $B = 30 \text{ mm}$ .

Fig. 3



Load-carrying cross section  
 $A = d \times (B - 2)$

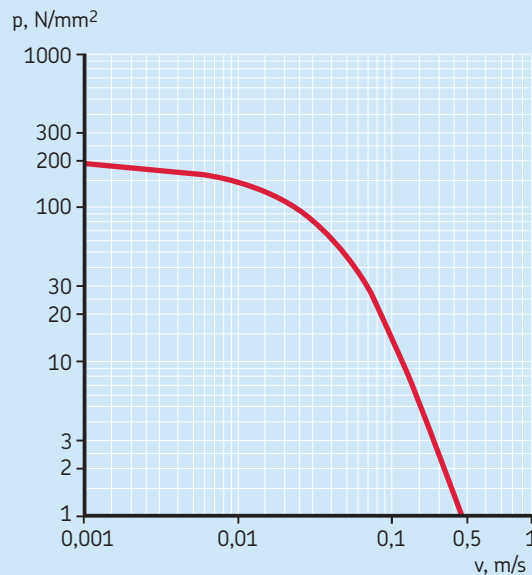
Fig. 4



$\varphi$  = angle of oscillation =  $2 \beta$   
One complete oscillation equals  $4 \beta$

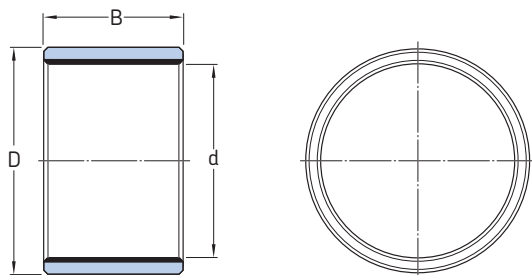
Diagram 2

$p$  $v$  diagram for filament wound bushings



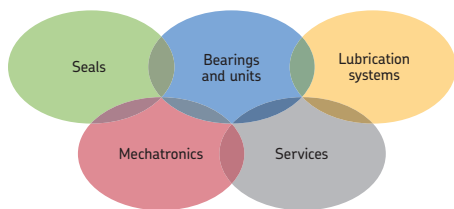
# Filament wound bushings, PWM series

d 20 – 200 mm



Dimensions					Mass	Designation	Dimensions					Mass	Designation
d	D	B	A <sup>1)</sup>				d	D	B	A <sup>1)</sup>			
mm			mm <sup>2</sup>		kg	–	mm			mm <sup>2</sup>		kg	–
20	24	15	260		0,0039	PWM 202415	90	105	60	5 220		0,26	PWM 9010560
	24	20	360		0,0052	PWM 202420		105	80	7 020		0,34	PWM 9010580
	24	30	560		0,0078	PWM 202430		105	120	10 620		0,52	PWM 90105120
25	30	20	450		0,0081	PWM 253020	95	110	60	5 510		0,27	PWM 9511060
	30	30	700		0,012	PWM 253030		110	100	9 310		0,45	PWM 95110100
	30	40	950		0,016	PWM 253040		110	120	11 210		0,54	PWM 95110120
30	36	20	540		0,012	PWM 303620	100	115	80	7 800		0,38	PWM 10011580
	36	30	840		0,017	PWM 303630		115	100	9 800		0,47	PWM 100115100
	36	40	1 140		0,023	PWM 303640		115	120	11 800		0,57	PWM 100115120
35	41	30	980		0,020	PWM 354130	105	120	80	8 190		0,40	PWM 10512080
	41	40	1 330		0,027	PWM 354140		120	100	10 290		0,50	PWM 105120100
	41	50	1 680		0,034	PWM 354150		120	120	12 390		0,59	PWM 105120120
40	48	30	1 120		0,031	PWM 404830	110	125	80	8 580		0,41	PWM 11012580
	48	40	1 520		0,041	PWM 404840		125	100	10 780		0,52	PWM 110125100
	48	60	2 320		0,062	PWM 404860		125	120	12 980		0,62	PWM 110125120
45	53	30	1 260		0,035	PWM 455330	120	135	100	11 760		0,56	PWM 120135100
	53	40	1 710		0,046	PWM 455340		135	120	14 160		0,67	PWM 120135120
	53	60	2 610		0,069	PWM 455360		135	150	17 760		0,84	PWM 120135150
50	58	40	1 900		0,051	PWM 505840	130	145	100	12 740		0,61	PWM 130145100
	58	50	2 400		0,063	PWM 505850		145	120	15 340		0,73	PWM 130145120
	58	60	2 900		0,076	PWM 505860		145	150	19 240		0,91	PWM 130145150
55	63	40	2 090		0,056	PWM 556340	140	155	100	13 720		0,65	PWM 140155100
	63	50	2 640		0,069	PWM 556350		155	150	20 720		0,97	PWM 140155150
	63	70	3 740		0,12	PWM 556370		155	180	24 920		1,15	PWM 140155180
60	70	40	2 280		0,076	PWM 607040	150	165	120	17 700		0,83	PWM 150165120
	70	60	3 480		0,11	PWM 607060		165	150	22 200		1,05	PWM 150165150
	70	80	4 680		0,15	PWM 607080		165	180	26 700		1,25	PWM 150165180
65	75	50	3 120		0,10	PWM 657550	160	180	120	18 880		1,20	PWM 160180120
	75	60	3 770		0,12	PWM 657560		180	150	23 680		1,50	PWM 160180150
	75	80	5 070		0,16	PWM 657580		180	180	28 480		1,80	PWM 160180180
70	80	50	3 360		0,11	PWM 708050	170	190	120	20 060		1,25	PWM 170190120
	80	70	4 760		0,15	PWM 708070		190	180	30 260		1,90	PWM 170190180
	80	90	6 160		0,20	PWM 708090		190	200	33 660		2,10	PWM 170190200
75	85	50	3 600		0,12	PWM 758550	180	200	150	26 640		1,70	PWM 180200150
	85	70	5 100		0,16	PWM 758570		200	180	32 040		2,00	PWM 180200180
	85	90	6 600		0,21	PWM 758590		200	250	44 640		2,80	PWM 180200250
80	90	60	4 640		0,15	PWM 809060	190	210	150	28 120		1,75	PWM 190210150
	90	80	6 240		0,20	PWM 809080		210	180	33 820		2,10	PWM 190210180
	90	100	7 840		0,25	PWM 8090100		210	250	47 120		2,95	PWM 190210250
85	95	60	4 930		0,16	PWM 859560	200	220	180	35 600		2,20	PWM 200220180
	95	80	6 630		0,21	PWM 859580		220	200	39 600		2,45	PWM 200220200
	95	100	8 330		0,26	PWM 8595100		220	250	49 600		3,10	PWM 200220250

<sup>1)</sup> Load carrying cross section.



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Drawing on five areas of competence and application-specific expertise amassed over 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide.

These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems.

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### Catalogues

CD-ROM: SKF Interactive Engineering Catalogue. Also on the internet: [www.iec.skf.com](http://www.iec.skf.com).

Other catalogues for SKF spherical plain bearings and rod ends, and seals are available. Contact your local SKF representative or your SKF distributor.

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