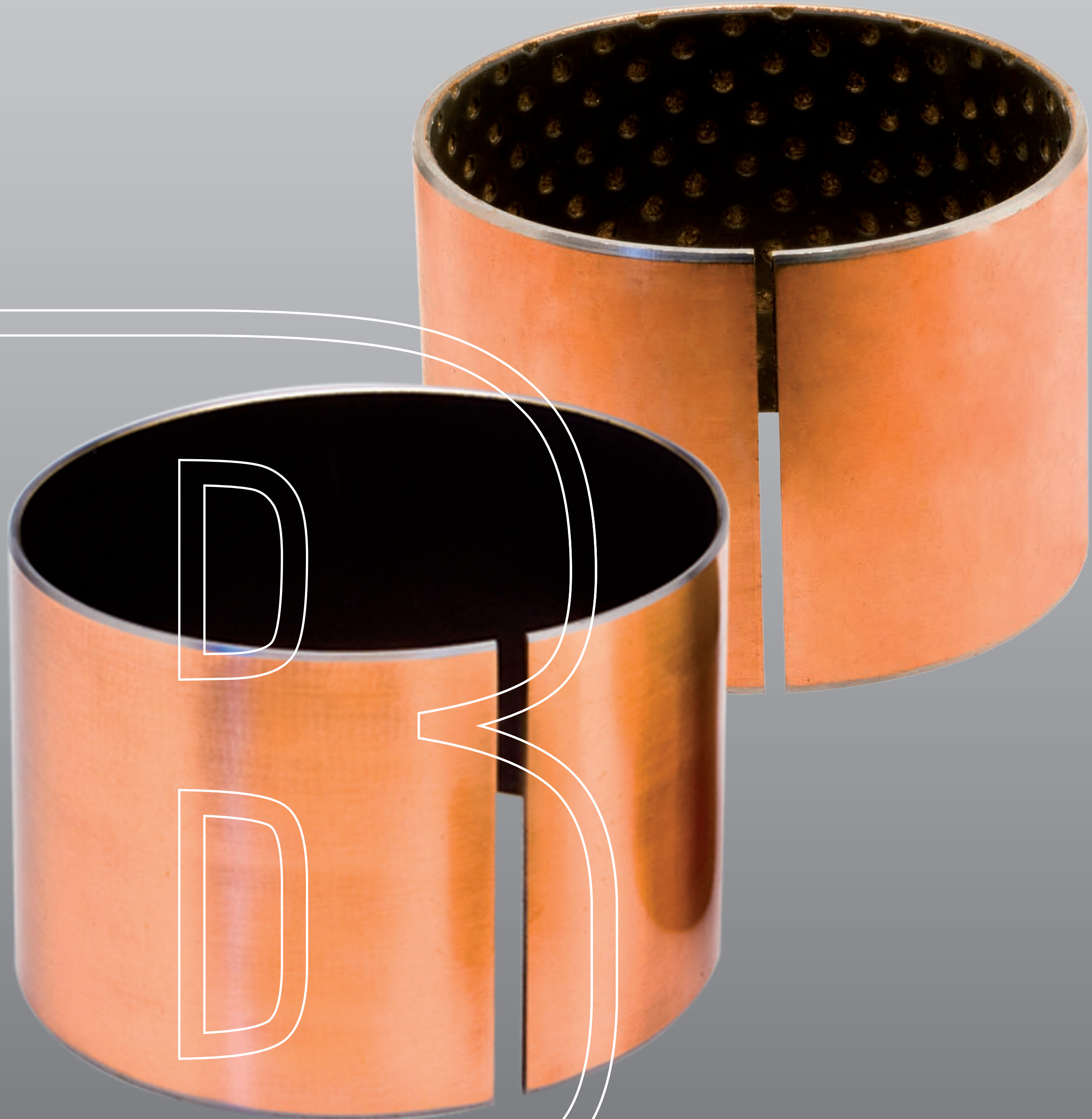
MBI

METAL BUSHINGS ITALIA



BUSHINGS

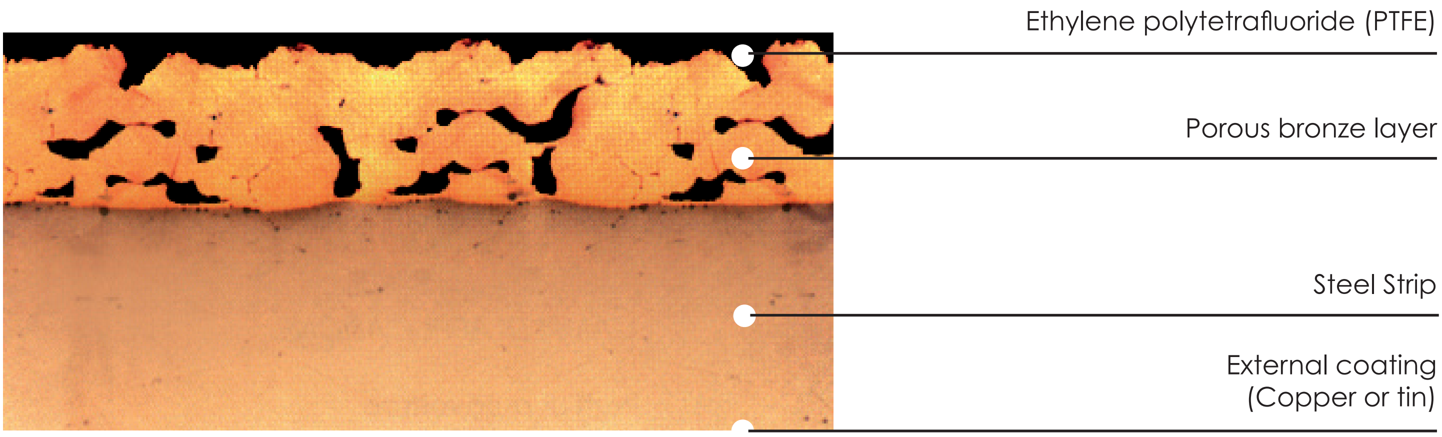
Self-Lubricating and relubricable bushings catalogue

MBI
METAL BUSHINGS ITALIA

PBF

PBF is the MBI material that forms the basis for the production of our self-lubricating bushings.
This product is made using advanced multi-step sintering techniques of bronze and a blend of additive-enhanced PTFE.
The performance of PBF has evolved over the years to meet customer requirements for both lubricant-free applications and applications with grease or oil.
The backing metal can be made of various materials, with the standard being low carbon steel.
Alternatives in stainless steel or bronze are also available.

BUSHING CROSS SECTION (MULTI-LAYER)



MBI MATERIALS

MBI Material	Backing Metal	Layer	Polymer
PBF	Low Carbon Steel	Sintered Bronze	PTFE + Additives
304-PBR	AISI 304	Sintered Bronze	
316-PBR	AISI 316	Sintered Bronze	
BZ-PBF	Bronze	Sintered Bronze	
PBK	Low Carbon Steel	Sintered Bronze	PEEK + Additives

FEATURES

1. The low coefficient of friction, free from stick-slip, allows the bearing to be used without any lubrication, increasing its longevity.
2. The steel strip quickly dissipates heat generated in the working area, keeping thermal expansions within extremely low limits. The external coating of copper or tin protects the sliding bearing from oxidation and corrosion, maintains light weight and compact size, and makes this product ideal for compact and versatile design.
3. Suitable for high loads, rotating, oscillating, and sliding movements, it also prevents noise and vibrations.
4. PTFE has the highest heat resistance, allowing the bushing to operate in a wide range of conditions and temperatures. The limited thickness improves thermal conductivity, preventing temperature rise at contact points.
5. Economical solution and easy to install.
6. The self-lubricating bearing is inert to most gases and chemical solvents, and it does not accumulate static electricity.

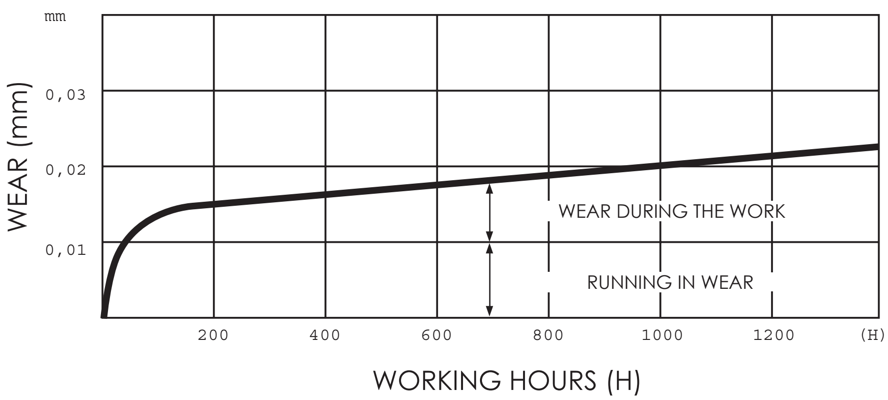
REFERENCE STANDARDS

The wrapped bushings are sized according to **ISO 3547** or **DIN 1494** standards. The strips used have the following properties:

Wall Thickness [mm]	Tolerance
1	0 / -0.02
1.5	0 / -0.03
2	0 / -0.03
2.5 up to Ø 60	0 / -0.03
2.5 up to Ø 65 ÷ 115	-0.01 / -0.05
2.5 up to Ø 120 ÷ 300	-0.035 / -0.085

INNER DIAMETER OF THE BUSHINGS AFTER INSTALLATION
- min. inner ø = min. housing ø - 2 x max. bushing thickness
- max. inner ø = max. housing ø - 2 x min. bushing thickness

SERVICE LIFE DIAGRAM



- **SLIDING**
V= (1 represents the sliding action in 1 minute)

- **OSCILLATION**
The oscillation angle can be converted into rpm using the following formula:

$$N = \frac{20°C}{360}$$

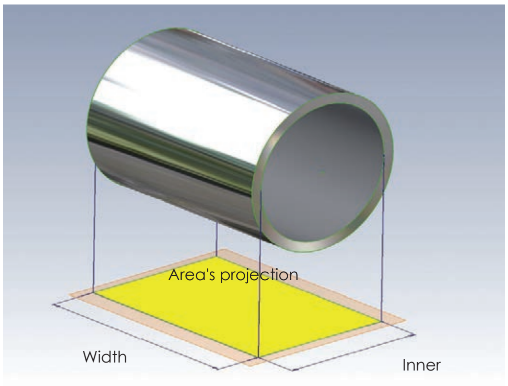
N= expressed in rpm
0°= oscillating angle (theta)
C=cycles/min

PV PRODUCT AND WEAR

In self-lubricating bushings, the pressure (P) * velocity (V) product, also known as the PV value, is a key parameter for determining the load capacity and lifespan of the bushing.
The PV value is often expressed in units such as N/mm² * m/s and indicates the severity of the working conditions for a bearing. A high PV value indicates that the bearing is subjected to high loads and speeds, which can lead to greater wear and a shorter lifespan.
The sliding bearing requires an initial running-in period, after which the bushing stabilizes dimensionally with linear wear.
The diagram indicates the variation of wear over time. The increased wear severity during the running-in phase is due to the transfer of part of the PTFE surface layer into the cavities of the mating surface (shaft).
This new layer formed on the shaft generates a lower coefficient of friction and less wear.
The following are the equations for calculating pressure, velocity, and PV in cylindrical bushings or thrust bearing:

Cylindrical Bushing	Washer
$V = \frac{\pi d N}{10^3}$	$V = \frac{\pi (d+D) N}{2X10^3}$
$P = \frac{W}{Ld}$	$P = \frac{4 W}{\pi (D^2-d^2)}$
$PV = \frac{\pi W N}{10^3 L}$	$PV = \frac{4W N}{10^3 (D^2-d^2)}$

V= Speed (m/s)
π= Pi (3,14)
N= rot. speed (rpm)
P= pressure (N/mm2)
W= Load (N)
L= Width (mm)
D= Outer diameter (mm)
d= Inner diameter (mm)



Area projection

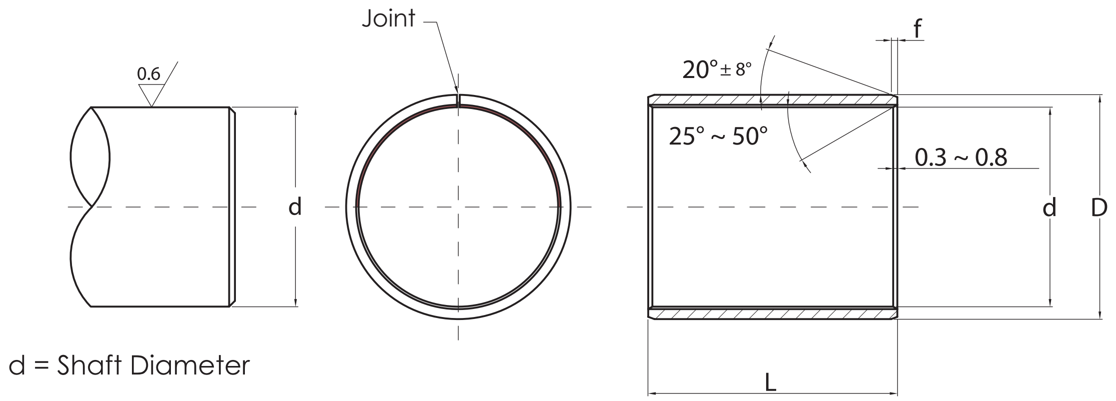
$$P = \frac{W \text{ (Load)}}{\text{Area Projection (mm}^2)}$$

Area Projection
= dxL (see drawing)

V= Shaft speed (m/s)

TECHNICAL DATASHEET OF PBF MATERIAL

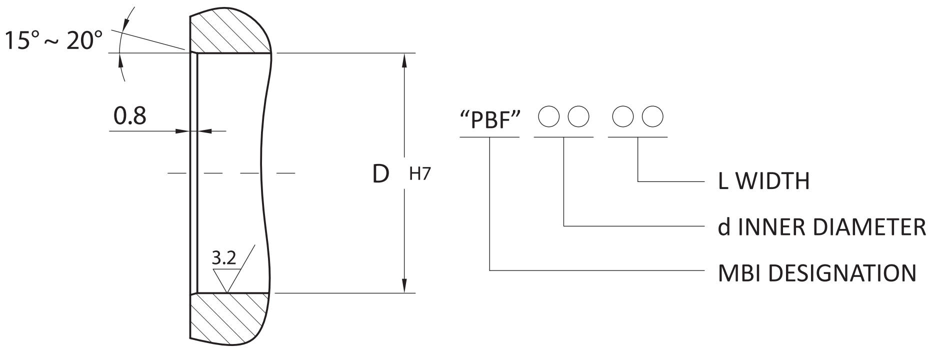
Continuous service (dynamic load)	**140 N/mm²**
Low-speed service (static load)	**250 N/mm²**
Oscillations	**60 N/mm²**
Max PV in dry conditions:	
Intermittent application	**3,6 N/mm²*m/s**
Continuous application	**1,8 N/mm²*m/s**
Max PV in oil lubrication	**50 N/mm²*m/s**
Operating temperature	**- 195 + 270 °C**
Coefficient of friction	**ɣ 0,04 – 0,20**



*diameters 3 and 4 are available with 0.75 thickness on request

Standard cylindrical bushings sizes (inch sizes on request)

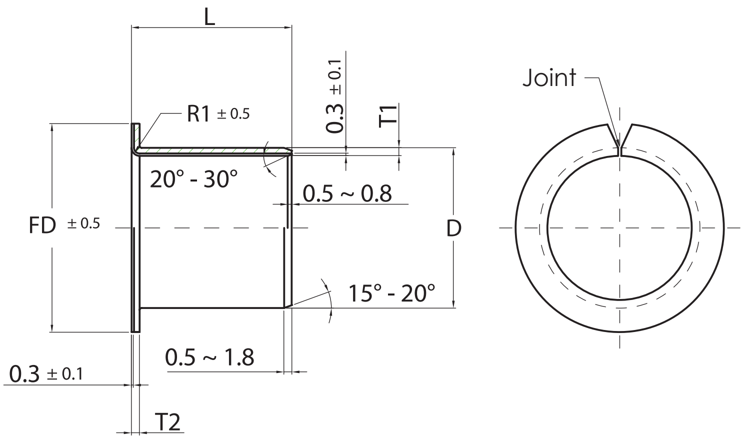
d	D	d Shaft (mm)	D Housing (mm)	Width L (mm) $^{0}_{-0.4}$																			f mm.
				4	5	6	8	10	12	15	20	25	30	40	50	60	70	80	90	95	100	115	
3*	5	3 $^{-0.025}_{-0.037}$	5 (H7) $^{+0.010}_{-0}$	0304	0305	0306																	
4*	6	4 $^{-0.025}_{-0.040}$	6 (H7) $^{+0.012}_{-0}$	0404		0406	0408																
5	7	5 "	7 (H7) $^{+0.015}_{-0}$	0504	0505	0506	0508																
6	8	6 "	8 (H7)			0606	0608	0610															
7	9	7 $^{-0.025}_{-0.040}$	9 (H7)					0710	0712														
8	10	8 "	10 (H7) "			0806	0808	0810	0812		0820												
9	11	9 "	11 (H7) "					0910															
10	12	10 "	12 (H7) $^{+0.018}_{-0}$			1006	1008	1010	1012	1015	1020												0,5
12	14	12 $^{-0.025}_{-0.043}$	14 (H7) "			1206	1208	1210	1212	1215	1220	1225											
13	15	13 "	15 (H7) "					1310			1320												
14	16	14 "	16 (H7) "					1410	1412	1415	1420	1425											
15	17	15 "	17 (H7) "					1510	1512	1515	1520	1525											
16	18	16 "	18 (H7) "					1610	1612	1615	1620	1625											
17	19	17 "	19 (H7) "					1710	1712	1715	1720												
18	20	18 "	20 (H7) $^{+0.021}_{-0}$					1810	1812	1815	1820	1825											
20	23	20 $^{-0.025}_{-0.046}$	23 (H7) "					2010	2012	2015	2020	2025	2030										
22	25	22 "	25 (H7) "					2210	2212	2215	2220	2225	2230										0,8
24	27	24 "	27 (H7) "							2415	2420	2425	2430										
25	28	25 "	28 (H7) "					2510	2512	2515	2520	2525	2530		2550								
28	32	28 "	32 (H7) $^{+0.025}_{-0}$							2815	2820	2825	2830	2840									
30	34	30 "	34 (H7) "						3012	3015	3020	3025	3030	3040									
32	36	32 $^{-0.025}_{-0.050}$	36 (H7) "								3220		3230	3240									1
35	39	35 "	39 (H7) "						3512	3515	3520	3525	3530	3540	3550								
38	42	38 "	42 (H7) "							3815	3820		3830	3840									
40	44	40 "	44 (H7) "						4012		4020	4025	4030	4040	4050								

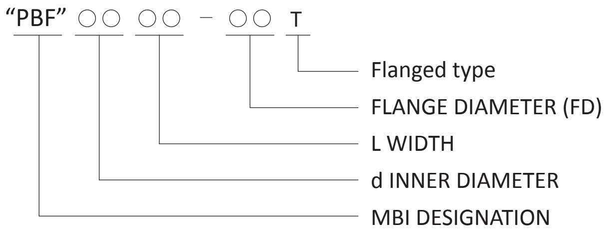


D = Housing Diameter

Sizes table (continues from page 4)

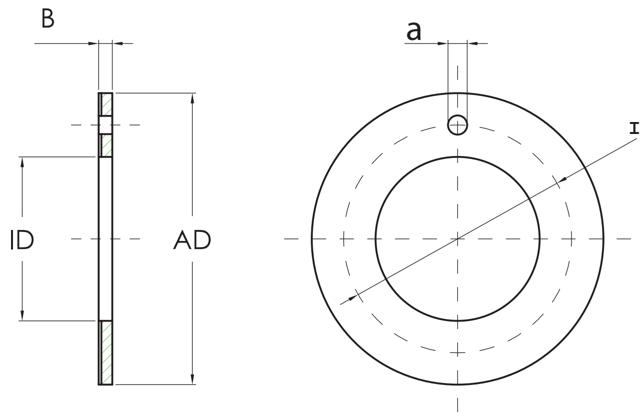
d	D	d Shaft (mm)	D Housing (mm)	Width L (mm) $^{0}_{-0.4}$																			f mm.
				4	5	6	8	10	12	15	20	25	30	40	50	60	70	80	90	95	100	115	
45	50	45 $^{-0.025}_{-0.037}$	50 (H7) $^{+0.025}_{+0}$								4520	4525	4530	4540	4550								1.2
50	55	50 "	55 (H7) $^{+0.030}_{-0}$								5020		5030	5040	5050	5060							
55	60	55 $^{-0.025}_{-0.055}$	60 (H7) "										5530	5540	5550	5560							
60	65	60 "	65 (H7) "										6030	6040	6050	6060	6070						
65	70	65 $^{+0.005}_{-0.035}$	70 (H7) "										6530	6540	6550	6560	6570						
70	75	70 "	75 (H7) "											7040	7050	7060	7070	7080					
75	80	75 "	80 (H7) "										7530	7540	7550	7560		7580					
80	85	80 "	85 (H7) $^{+0.035}_{-0}$											8040		8060		8080			80100		1,4
85	90	85 $^{+0.005}_{-0.030}$	90 (H7) "											8540		8560		8580			85100		
90	95	90 "	95 (H7) "											9040	9050	9060			9090		90100		
95	100	95 "	100 (H7) "												9550	9560					95100		
100	105	100 "	105 (H7) "												10050	10060						100115	
105	110	105 "	110 (H7) "													10560						105115	
110	115	110 "	115 (H7) "													11060						110115	
120	125	120 "	125 (H7) $^{+0.040}_{-0}$													12060					120100		1,6
125	130	125 $^{+0.005}_{-0.045}$	130 (H7) "																		125100	125115	
130	135	130 "	135 (H7) "													13060					130100		
140	145	140 "	145 (H7) "													14060					140100		
150	155	150 "	155 (H7) "												15050			15080			150100		
160	165	160 "	165 (H7) "																		160100		
180	185	180 "	185 (H7) $^{+0.046}_{-0}$																		180100		
200	205	200 $^{+0}_{-0.071}$	205 (H7) "																		200100		
220	225	220 "	225 (H7) "																		220100		
250	255	250 "	255 (H7) $^{+0.050}_{-0}$																		250100		
300	305	300 $^{+0}_{-0.081}$	305 (H7) "																		300100		





Standard Flanged Bushing sizes

d	D	d Shaft (mm)	D Housing (mm)	Wall Thickness		Flange diam.	Total width L (mm) ± 0,25																	
				T1	T2		4	5,5	7	7,5	8	9	9,5	11,5	12	16	16,5	17	21,5	26	32,5	42,5	52,5	62,5
6	8	6 −0.025 −0.037	8 (H7) +0.015 −0	1.0 0 −0.03	1.0 0 −0.2	12	0603-12T		0606-12T		0608-12T													
8	10	8 "	10 "			15		0804-15T		0806-15T			0808-15T											
10	12	10 "	12 (H7) +0.018 −0			18			1006-18T			1008-18T			1010-18T			1015-18T						
12	14	12 −0.025 −0.043	14 "			20			1206-20T			1208-20T			1210-20T			1215-20T						
14	16	14 "	16 "			22						1408-22T			1410-22T			1415-22T						
15	17	15 "	17 "			23						1508-23T			1510-23T			1515-23T						
16	18	16 "	18 "			24						1608-24T			1610-24T			1615-24T						
18	20	18 "	20 (H7) +0.021 −0			26									1810-26T			1815-26T						
20	23	20 −0.025 −0.046	23 "	1.5 0 −0.03	1.5 0 −0.2	30								2010-30T			2015-30T		2020-30T					
22	25	22 "	25 "			33								2210-33T			2215-33T		2220-33T					
25	28	25 "	28 "			35								2510-35T			2515-35T		2520-35T					
30	34	30 "	34 "	2.0 0 −0.03	2.0 0 −0.2	42										3015-42T				3025-42T				
35	39	35 "	39 "			47										3515-47T				3525-47T				
40	44	40 "	44 "			53														4025-53T				
45	50	45 "	50 "	2.5 0 −0.03	2.5 0 −0.3	60															4530-60T			
50	55	50 "	55 (H7) +0.030 −0			65															5030-65T		5050-65T	
60	65	60 "	65 "			75																6040-75T		6060-75T



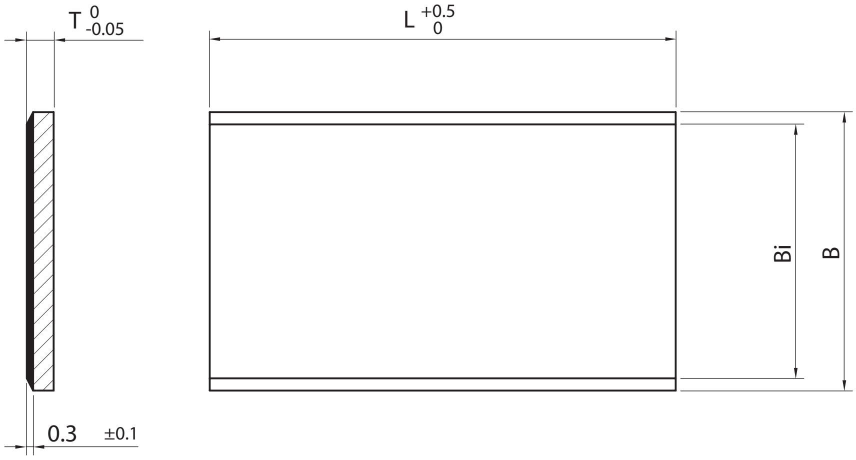
Recommended Housing:
From Di 12 up to Di 42 mm 1
From Di 48 up to Di 52 mm 1.5

Standard thrust washers sizes

MBI Definition	Type	Dj + 0,25 mm	De - 0,25 mm	Sp - 0,05 mm	a +0,2 mm	I ± 0,12 mm
PBF	TW8M	10	20	1,5	1,5	15
PBF	TW10M	12	24	1,5	1,5	18
PBF	TW12M	14	26	1,5	2	20
PBF	TW14M	16	30	1,5	2	23
PBF	TW16M	18	32	1,5	2	25
PBF	TW18M	20	36	1,5	3	28
PBF	TW20M	22	38	1,5	3	30
PBF	TW22M	24	42	1,5	3	33
PBF	TW24M	26	44	1,5	3	35
PBF	TW25M	28	48	1,5	4	38
PBF	TW30M	32	54	1,5	4	43
PBF	TW35M	38	62	1,5	4	50
PBF	TW40M	42	66	1,5	4	54
PBF	TW45M	48	74	2	4	61
PBF	TW50M	52	78	2	4	65
PBF	TW60M	62	90	2	4	76

Example:

316-PBR - TW 16M
PBF - TW 16M



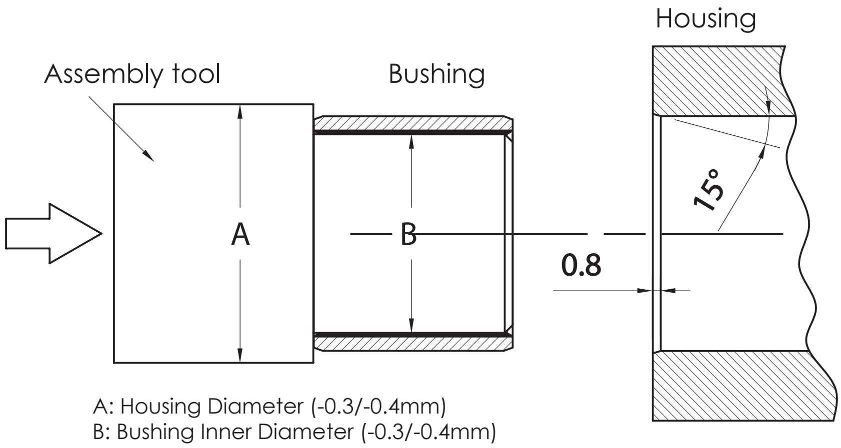
Strip sizes

Designation	Type	Sizes			
		T mm	B mm	Bi mm	L mm
PBF	125 10	1,0	125	120	500
PBF	125 15	1,5	125	120	500
PBF	125 20	2,00	125	120	500
PBF	125 25	2,5	125	120	500
PBF	125 30	3,00	125	120	500
PBF	170 10	1,0	170	165	1000
PBF	170 15	1,5	170	165	1000
PBF	170 20	2,0	170	165	1000
PBF	170 25	2,5	170	165	1000

Example:

PBF - 125 10
304-PBR - 125 10

INSTALLATION INSTRUCTIONS



A: Housing Diameter (-0.3/-0.4mm)
B: Bushing Inner Diameter (-0.3/-0.4mm)

PRESS-FITTING FORCE

The sliding bearings can be either press-fitted into the housing. For easy and correct press-fitting of the bushing, it is recommended to use a guide mandrel (see picture) and to clean and deburr the mounting housing beforehand.
Note: During this phase, pay attention to the tolerances as indicated in the dimensional table.

$$F = t \times 0{,}8 \times L \times \delta \text{ max.}$$

t = Wall thickness (mm)
L = total width (mm)
δ max. = max. δ circumferential force (Kg/mm²) = 10

$$= 10^4 \times 1{,}9 \times \frac{\text{max. bushings ø - min. housing ø}}{\text{max. bushings ø}}$$

CONSTRUCTION STANDARDS

1) Recommended Tolerances for Shaft and Housing

The sliding bearing is suitable for being housed according to the following parameters:
- Housing tolerance: H7
- Shaft tolerance: Consult the dimensional table
In cases where other assembly principles need to be followed, the clearance between the shaft and housing should be adapted equivalently to the value **H7** (housing) and **f6** (shaft).

2) To determine the operational clearance, three factors must be considered:

- Housing size
- Bushing wall thickness
- Shaft size

For rigid housing:
- Minimum clearance = (min. housing diameter tolerance - max. bushing wall thickness x 2) - max. shaft tolerance value.
- Maximum clearance = (max. housing diameter tolerance - min. bushing wall thickness x 2) - min. shaft tolerance value.

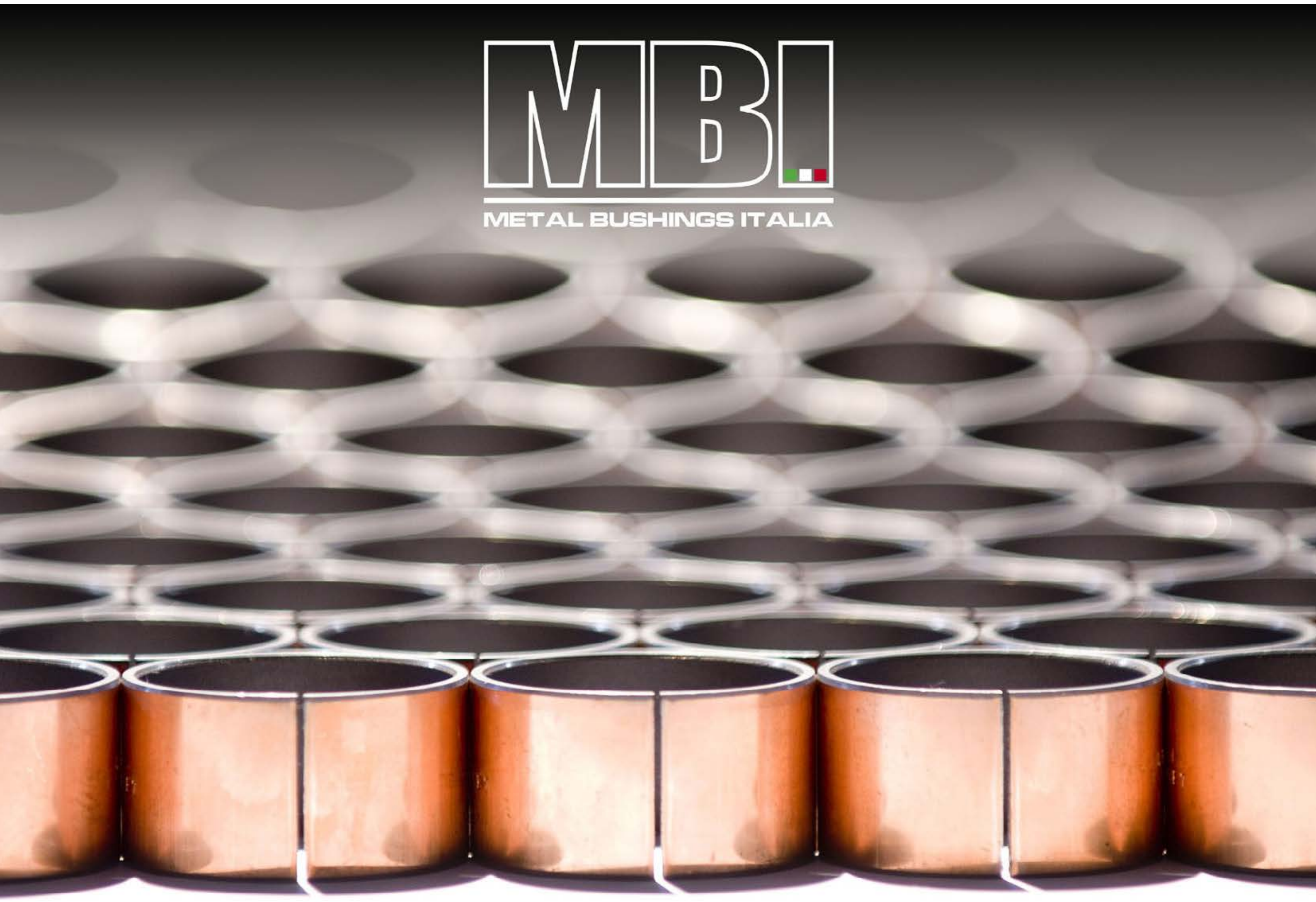
In the presence of lubrication, a clearance of 0.03 mm or more on the shaft is recommended.
For operations at temperatures greater than or equal to 180°C, the thermal expansion of the bearing wall support metal should be considered.

3) Shaft Execution

a) For normal applications, the following materials can be used:
- Carbon steel (C35)
- Nickel-chromium alloy steel (35NiCr9)
- Nickel-chromium-molybdenum steel (30NiCrMo8)
- Chromium-plated steels

Soft or non-ferrous metals are less suitable because they limit the bushing's lifespan, maintaining it at acceptable but not optimal levels. These metals can be used with coatings or heat treatments to increase surface hardness and consequently wear resistance.

b) Permissible Roughness:
The surface roughness of the shaft is crucial for the bearing's lifespan. High surface roughness can irreparably damage the self-lubricating overlay and compromise its performance prematurely. For optimal bearing performance, a high level of surface finish on the shaft is recommended.
The recommended roughness varies from **0.6 to 0.8** μm.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