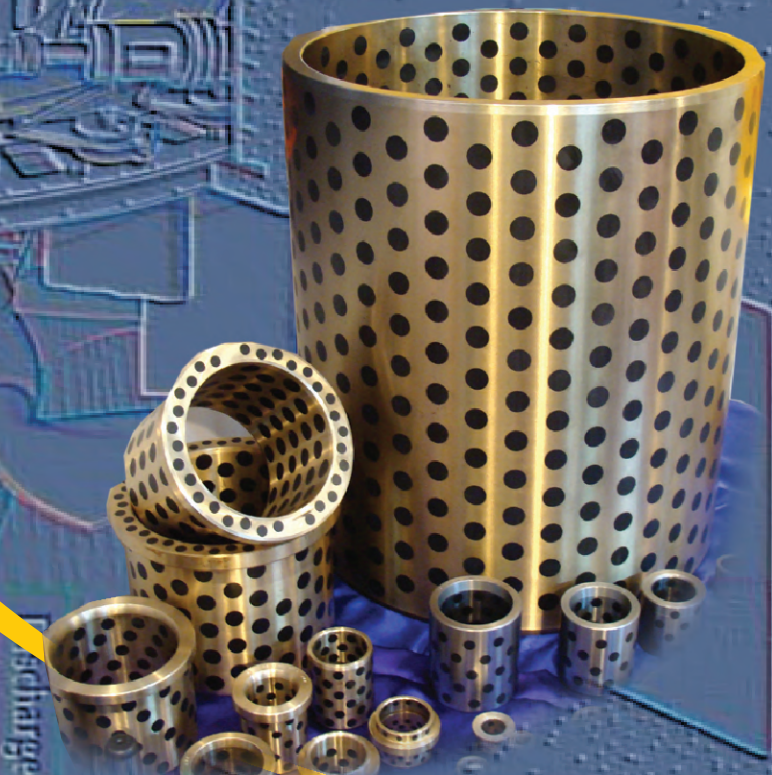
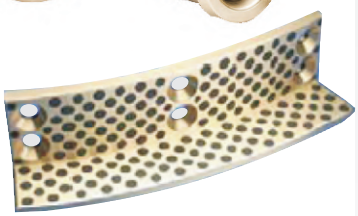
SELF LUBRICATING BEARINGS

MAINTENANCE FREE



COMPANY PROFILE



OUTLINE

Company Name	:	**AVI OILLESS DIE COMPONENTS INDIA PVT. LTD.**
Director	:	PRAMOD HENDRE PRASHANT HENDRE
Registered Office & Factory	:	Gat No. 697, 734, 735, At post Velu, Pune Satara Highway, Tal. Bhor, Dist. Pune, Pin.: 412 205, Maharashtra, (INDIA) Tel.: +91 8805985445 Web Site - www.avioilless.in E-mail: avioilless@yahoo.in / prashant@avioilless.in
Established	:	1993
Bank References	:	Bank of India, Warje, Pune 411058.

HISTORY

1993	Established under the name 'AVI ENTERPRISES' Warje Malwadi, Pune.
1998	Succeeds in developing own production technology for self lubricating slide plates, guide bushes.
2000	Established production system for press die components.
2002	Company started one more plant in name of AVI INDUSTRIES at Uttamnagar, Pune
2004	Company changed name to AVI OILLESS DIE COMPONENTS INDIA PVT. LTD. & merged Uttamnagar plant into it.
2006	AVI OILLESS DIE COMPONENTS INDIA PVT. LTD. obtained ISO 9001:2000 Certification.
	General product catalog of Standard Press Die components issued & distributed throughout in India.
2007	Developed self lubricating bearings for hydro power application. Started supply of self lubricating bearings for hydro power application.
2008	To increase production capacity, new plant established at Velu (Tal. Bhor, Dist. Pune), Plant goes into operation.
2012	Added centrifugal casting facility to produce self lubricating bearings upto 1200 mm Dia.

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Features of Self Lubricating Products

1. **No lubrication required**
Oil free performance is fully appreciated at locations where access for lubrication is difficult; where oil cannot be used due to conditions at high/low temperature, in underwater or solutions.
It is also suitable for locations where high load or impact load is applied, low speed operations, intermittent operations, oscillating operations, because oil lubrication is not effective in these areas.

2. **Smooth and spotless operation**
Oilless products are suitable for food machines or spinning machines that do not accept oil contamination. The non-use of oil allows for cleaner keep; and complete elimination of oil related problems such as oil slippage and odor.

3. **Solution to bearing friction problems**
Oilless products do not show problems due to lack of lubricant or failure of lubrication devices. An excellent lubrication effect of bearing is achieved even under excessive load or at low speed operations, thus eliminating "scoring" or "seizure" which have been frequently appearing on bearings. Eccentric wear or abnormal wear is not observed either. In addition, the bearing is excellent in wear resistance. It contributes to keeping constant dimensional quality of your machinery, eliminating failures and damages.

4. **Less maintenance and longer life**
Oilless products will greatly lessen your maintenance work on bearings. Time consuming daily maintenance or lubrication on bearing is no longer required. No abnormal wear occurs. If critical clearance is reached due to wear, simple maintenance is only required.

5. **Total cost reduction**
Oilless products can achieve the following cost reductions :
(1) Initial cost reduction
Design hours can be reduced due to deleted lubrication devices. Manufacturing hours can also be reduced due to deleted manufacturing hours and parts of lubrication devices. These advantages will lead to shortened lead time.
(2) Operation cost reduction
Lubrication is not required and wear problems can be eliminated during machine operation. Maintenance hours and replacement costs for lubrication devices are also reduced.

6. **Unlimited applications**
Oilless products have various standard sizes that allow unlimited applications in versatile fields. Wide selections are available in terms of load resistance, sliding speed resistance, heat resistance corrosion resistance and waterproofing. You can select an appropriate bearing from various standard sizes at the design stage.

Automobile Production

- Press Lines
- Assembly Lines
- Conveyor Lines
- Automobile Parts, etc.

Parts requiring heat resistance

- Steel Mills
- Drying Machines
- Blast Furnaces
- Kilns, Etc

Heavy duty machinery

- Steel Rolling Mills
- Injection Molding Machines
- Press Dies
- Transportation
- Machines, Etc.

Where oil contamination is objectionable

- Food processing machines
- Spinning machines
- Paper mills
- Printing machines, etc.

Others

- Hydropower Turbines, Gates
- Hydraulic machines
- Pneumatic machines
- Bearings sliding plates, etc.

Applications of Self Lubricating Bearings

In general oilless bearings are used for the followings areas

- Where it is inaccessible or difficult to lubricate bearings.
- Where hours for design, assembly and maintenance need to be saved.
- Where it is difficult to lubricate bearings due to high/low temperature.
- Where minimal space is required for bearings.
- Where corrosion resistance or waterproofing is required.
- Where there is dust in the operating environment.
- Where oil contamination is not desired.
- Where high load and low speed operation that does not accept lubrication is required.
- Where oscillation, reciprocating or frequent start and stop operations that makes lubrication insignificant are required.
- Where deterioration of lubrication oil occurs due to non-maintenance for a long time.

Type		Base material	Application range				Physical properties				
			maximum allowable load N / mm^2	maximum allowable sliding speed m / min	maximum allowable PV value N / mm^2 m / min	Limit temperature °C	Specific gravity	Hardness	Elongation %	Tensile strength N / mm^2	Coefficient of linear expansion 10^{-5}/°C
Solid Lubricant Bearing	Metal	Copper Alloy	100	15	200	300	8.0	HB 210 or more	12 or more	775 or more	1.9
		FG260	5	50	50	400	7.1 ~7.3	HB 100 ~ 200	———	150 ~250	1.0
		Case hardening Steel	30	10	60	400	7.8	HRC 55 or more	17 or more	700 or more	1.1

Comparison of bearings

		Oilless bearing	Slide bearing with lubrication	Roll bearing
Lubricating conditions		Acceptable without lubrication	Lubrication is required	Acceptable without lubrication on some cases
Bearing conditions	Load resistance	Good for extreme high load	Depend on lubrication and speed	Not good
	Speed resistance	Good for low/medium speed	Good for medium/high speed	Good for medium/high speed
	Oscillating characteristics	Good	Not good	Not good
	Intermittent operation	Good	Not good	Good
	Reciprocating operation	Good	Not good	Not good except for special bearing
	Impact resistance	Good	Good	Not good
	Fretting resistance	Good	Good	Not good
	Coefficient of friction	Relatively high	Depends on lubrication, load and speed	Very small
Environment conditions	Heat resistance	Good depending on the type	Depends on oil heat resistance	Not good
	Corrosion resistance	Good depending on the type	Good depending on the type	Not good
	Waterproof	Good	Not good except for special bearing	Waterproof is required
	Soundproof	Good	Good	Not good
	Effect by foreign matter	Minor	Minor	Large
Mating material	Material	Usually special steel	Usually special steel	Normal steel
	Surface finish	3-12 μmR max	3μmR max or less	6-12 μmR max
Shape of bearing	Max. size	Generally unlimited	Generally unlimited	Limited
	Limitation to shape	Generally unlimited	Generally unlimited	Limited
Fitting	Clearance	Relatively large	Relatively small	Extremely small
	Tolerance	Varies depending on the type	Relatively good	Good

a. Definition of solid lubricant.

A solid lubricant is a material used as powder or thin film to provide protection from damage during relative movement and to reduce friction and wear. Other terms commonly used for solid lubrication include dry lubrication, and solid-film lubrication. Although these terms imply that solid lubrication takes place under dry conditions, fluids are frequenctly the inorganic compounds graphite and molybdenum disulfide (MoS_2) and the polymer material poly tetra fluoroethylene. (PTFE)

b. Characteristics.

The properties important in determining the suitability of a material for use as a solid lubricant are discussed below.

- **Crystal structure** : Solid lubricants such as graphite and MoS_2 possess a lamellar crystal structure with an inherently low shear strength. Although the lamellar structure is very favorable for materials such as lubricants, nonlamellar materials also provide satisfactory lubrication.
- **Thermal stability :** . Thermal stability is very important since one of the most significant uses for solid lubrications is in high temperature applications not tolerated by other lubricants.
  Good thermal stability ensures that the solid lubricant will not undergo undesirable phase or structural changes at high or low temperature extremes.
- **Oxidation stability :** The lubricant should not undergo undesirable oxidative changes when used within the applicable temperature.
- **Volatility :** The lubricant should have a low vapor pressure for the expected application at extreme temperatures and in low-pressure conditions.
- **Chemical reactivity :** The lubricant should form a strong, adherent film in the base material.
- **Mobility :** The life of solid films can only be maintained if the film remains intact. Mobility of adsorbates on the surfaces promotes self-heading and prolongs the endurance of films.
- **Melting Point :** If the melting point is exceeded, the atomic bonds that maintain the molecular structure are destroyed, rendering the lubricant ineffective.
- **Hardness :** Some materials with suitable characteristics, have failed appears to be the practical limit for solid lubricants. A hardness @ 70 ~ 80 shore - D scale appears to be the pratical limit for solid lubricant.
- **Electrical conductivity :** Certain applications, such as sliding electric contacts, require high electrical conductivity while other applications, such as insulators making rubbing contact, require low conductivity.

c. Application.

Generally, solid lubricants are used in applications not tolerated by mire conventional lubricants. The most common conditions requiring use of solid lubricants are discussed below.

- Extreme temperature and pressure conditions. These defines as high- temperature applications up to 1926^0 C (3500^0 F), where other lubricants are prone to degradation or decomposition; extremely low temperature, down to -212^{0}C (-350^{0}F), where lubricants may volatilize.
- As additives. Graphite, MoS_2 and zinc oxide are frequently added to fluids and greases. Surface conversion coatings are often used to supplement other lubricants.
- Intermittent loading conditions. When equipment is stored or is idle for prolonged periods, Solids provide permanent, non corrosive lubrication.
- Inaccessible locations. Where access for servicing is especially difficult, solid lubricants offer a distinct advantage, provided the lubricant is satisfactory of the intended loads and speeds.
- High dust and lint areas. Solids are also useful in areas where fluids may tend to pick up dust and lint with liquid lubricants; these contaminants more readily form a grinding paste, causing damage to equipment.
- Contamination. Because of their solid consistency, solids may be used in application where the lubricant must not migrate to other locations and cause contamination of other equipment, parts, or products.
- Environmental. Solid lubricants are effective in applications where the lubricated equipment is immersed in water that may be polluted by other lubricants, such as oils and greases.

d. Advantages of solid lubricants.

- More effective than fluid lubricants at high loads and speeds.
- High resistance to deterioration in storage.
- Highly stable in extreme, temperature, pressure, radiation and reactive environments.
- Permit equipment to be lighter and simpler because lubrication distribution systems and seals are not required.

Types Of Solid Lubricants

Graphite :

Graphite has interesting frictional properties. In its structure the carbon atoms are arranged in a series of parallel planes or sheets which are relatively part apart. (3.40 A^0), while the carbon atoms in the individual planes are in a regular hexagonal array, the distance between each carbon atom & it's neighbour being 1.42A^0. This characteristic bond strength in the neighbouring planes is very weak. Therefore cleavage always occur along the planes. Separation of one planes from another by cleavage can occur far more rapidly if suitable tensile stresses are available. For steel on graphite or graphite on graphite the friction is of the order $\mu \sim 0.1$. As the temperature increases the coefficient of friction decreases.

Molybdenum Disulfide :

Molybdenum Disulfide resembles graphite in many ways. It has a layer structure in which the bonds between the Molybdenum & sulphur atoms are relatively short while the separation between the layers of sulphur atoms is relatively large. Since the bonding between the neighbouring sulphur planes is weak so that cleavage easily occurs between them. Natural MoS_2 can often be obtained as large single crystals, but the synthetic material is produce in the form of very small particles. Uptp 800^{0}C MoS_2 retain its low coefficient of friction. Other materials are mica, talc & boron nitride etc. which show similar properties.

Polytetra Floro Ethylene (PTFE)

The structure of PTFE is highly crystalline & the material has appreciable mechanical strength. PTFE give a small area of contact & weak interfacial adhesion so that the resulting coefficient of friction is low. PTFE has the following major defects as a practical bearing material

1. It is not strong enough mechanically.
2. It is poor conductor of heat.
3. It has a coefficient of expansion.
4. At high speeds the friction of PTFE rapidly rises to values of $\mu = 0.3$
5. PTFE get hot, expand & stick if it is used as bearing material.

Self Lubrication

The self lubrication products that develop the solid lubrication film are available as follows :

1. **Bearing with embedded solid lubricant :** Formed solid lubricant are embedded in the base metal.
2. **Bearing with shielded solid lubricant :** The base metal surface is shielded with solid lubricants.
3. **Bearing with distributed solid lubricant :** Particles of solid lubricant are distributed on the base metal.

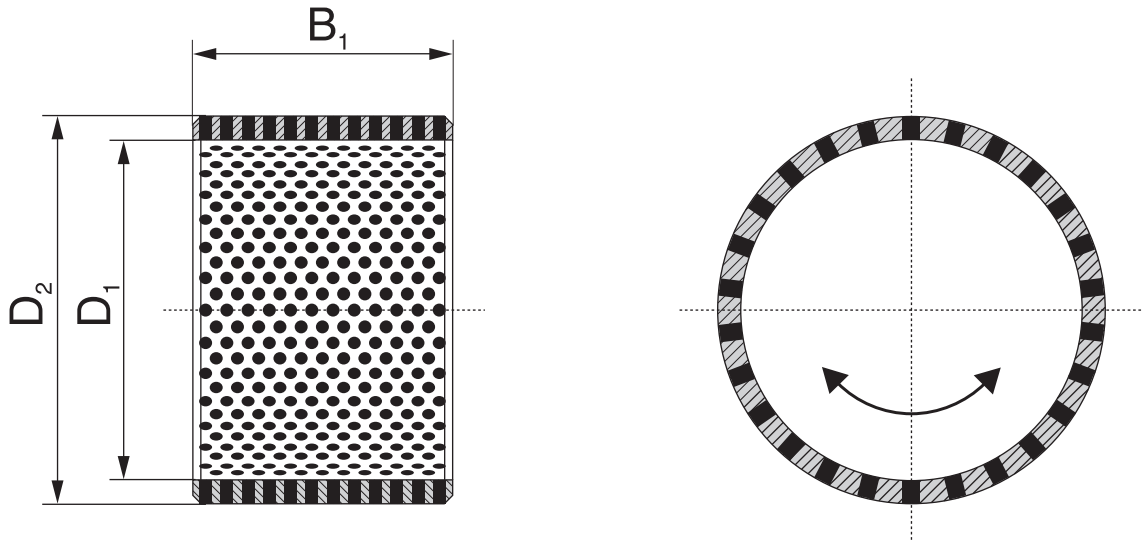
It is necessary to apply grease on the sliding surface area before initial use.

Embedded solid lubricants develop self lubrication film on the friction surface of the base metal. It shows excellent performance in load resistance, lubrication on the friction with solid lubricant & durability of film. The bearing is suitable for operation without lubrication for a long period of time.

Base metals are special copper alloy, cast iron (FG260) showing excellent mechanical strength & friction characteristics. Along with the sliding time, lubricant supplied from embedded solid lubricants forms a strong film through frictional mechano-chemical reaction on the sliding surface. If this solid lubrication film is partially broken. It is immediately compensated by supply from embedded solid lubricant. Therefore the bearing shows excellent durability without consumption of the lubrication film that may cause abnormal wear, compared to the convential multiple layer bearings. It also may not cause seizure due to shortage of oil impregnated bearings. Since load is supported by high strength base metal, the load resistance is much greater than that of general sintered bearings.

Technical Data

The direction of movement determines the arrangement of the lubrication plugs.



Material : Copper alloy + Solid lubricants

PLAIN BEARING, RADIAL

Recommended Dimensions

Standard No.				D1	D2	B1
APBR	50	60	35	50	60	35
APBR	50	60	50			50
APBR	50	60	65			65
APBR	55	65	40	55	65	40
APBR	55	65	55			55
APBR	55	65	70			70
APBR	60	75	45	60	75	45
APBR	60	75	60			60
APBR	60	75	75			75
APBR	65	80	45	65	80	45
APBR	65	80	65			65
APBR	65	80	80			80
APBR	70	85	50	70	85	50
APBR	70	85	70			70
APBR	70	85	85			85
APBR	75	90	55	75	90	55
APBR	75	90	75			75
APBR	75	90	90			90
APBR	80	95	60	80	95	60
APBR	80	95	80			80
APBR	80	95	100			100
APBR	85	100	60	85	100	60
APBR	85	100	85			85
APBR	85	100	105			105
APBR	90	105	65	90	105	65
APBR	90	105	90			90
APBR	90	105	115			115
APBR	95	115	70	95	115	70
APBR	95	115	95			95
APBR	95	115	120			120
APBR	100	120	75	100	120	75
APBR	100	120	100			100
APBR	100	120	125			125
APBR	110	130	80	110	130	80
APBR	110	130	110			110
APBR	110	130	140			140
APBR	120	140	90	120	140	90
APBR	120	140	120			120
APBR	120	140	150			150
APBR	140	160	100	140	160	100
APBR	140	160	140			140
APBR	140	160	175			175
APBR	150	170	110	150	170	110
APBR	150	170	150			150
APBR	150	170	185			185
APBR	180	205	135	180	205	135
APBR	180	205	180			180
APBR	180	205	225			225
APBR	200	225	150	200	225	150
APBR	200	225	200			200
APBR	200	225	250			250
APBR	225	250	170	225	250	170
APBR	225	250	225			225
APBR	225	250	250			250

Standard No.				D1	D2	B1	
APBR	250	278	190	250	278	190	
APBR	250	278	250			250	
APBR	250	278	315			315	
APBR	280	310	210	280	310	210	
APBR	280	310	280			280	
APBR	280	310	350			350	
APBR	300	332	225	300	332	225	
APBR	300	332	300			300	
APBR	300	332	375			375	
APBR	350	385	260	350	385	260	
APBR	350	385	350			350	
APBR	350	385	435			435	
APBR	400	440	300	400	440	300	
APBR	400	440	400			400	
APBR	400	440	500			500	
APBR	450	495	340	450	495	340	
APBR	450	495	450			450	
APBR	450	495	580			580	
APBR	500	550	375	500	550	375	
APBR	500	550	500			500	
APBR	500	550	625			625	
APBR	550	605	415	550	605	415	
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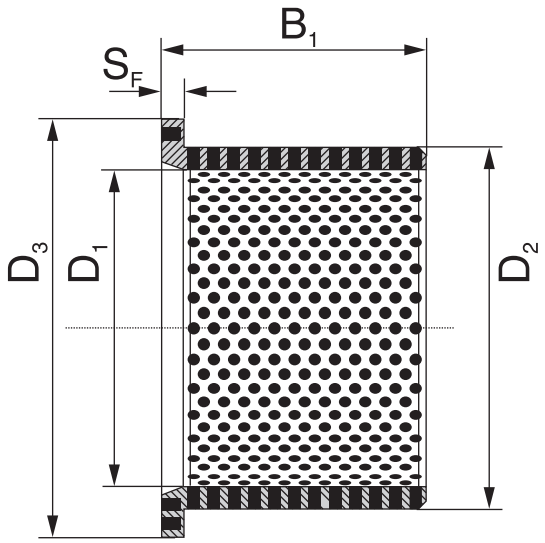
APBR	600	660	600			600	
APBR	600	660	750			750	*
APBR	650	715	490	650	715	490	
APBR	650	715	650			650	
APBR	650	715	815			815	*
APBR	700	770	525	700	770	525	
APBR	700	770	700			700	
APBR	700	770	875			875	*
APBR	750	825	560	750	825	560	
APBR	750	825	750			750	*
APBR	750	825	940			940	*
APBR	800	880	600	800	880	600	
APBR	800	880	800			800	*
APBR	800	880	1000			1000	*
APBR	850	935	640	850	935	640	
APBR	850	935	850			850	*
APBR	850	935	1060			1060	*
APBR	900	990	675	900	990	675	
APBR	900	990	900			900	*
APBR	900	990	1125			1125	*
APBR	950	1045	710	950	1045	710	*
APBR	950	1045	950			950	*
APBR	950	1045	1200			1200	*
APBR	1000	1100	750	1000	1100	750	*
APBR	1000	1100	1000			1000	*
APBR	1000	1100	1250			1250	*
APBR	1200	1320	900	1200	1320	900	*
APBR	1200	1320	1200			1200	*
APBR	1200	1320	1500			1500	*

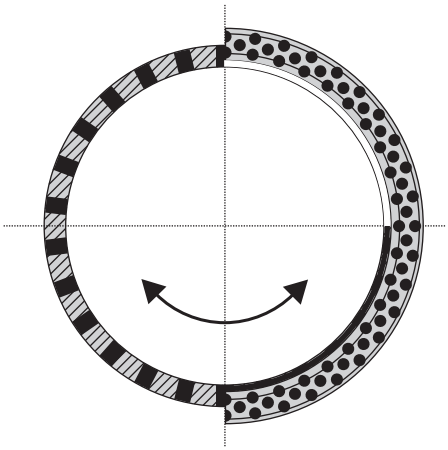
(All Dimension in mm)

* Length of bearing subdivided (2 x 0.5) for production reasons.

Technical Data

The direction of movement determines the arrangement of the lubrication plugs.





Material : Copper alloy + Solid lubricants

FLANGED BEARING

Recommended Dimension

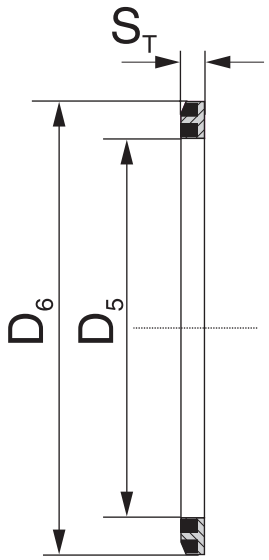
Standard No.				D1	D2	D3	SF	B1
AFB	50	60	B1	50	60	80	5	
AFB	55	60	B1	55	60	85	5	
AFB	60	75	B1	60	75	90	7.5	
AFB	65	85	B1	65	85	95	7.5	
AFB	70	85	B1	70	85	100	7.5	
AFB	75	90	B1	75	90	105	7.5	
AFB	80	95	B1	80	95	110	7.5	
AFB	85	100	B1	85	100	115	7.5	
AFB	90	105	B1	90	105	120	7.5	
AFB	95	115	B1	95	115	125	10	
AFB	100	120	B1	100	120	140	10	
AFB	110	130	B1	110	130	150	10	
AFB	120	140	B1	120	140	160	10	
AFB	140	160	B1	140	160	180	10	
AFB	150	170	B1	150	170	190	10	
AFB	180	205	B1	180	205	230	12.5	
AFB	200	225	B1	200	225	250	12.5	
AFB	225	250	B1	225	250	275	12.5	
AFB	250	278	B1	250	278	300	14	
AFB	280	310	B1	280	310	340	15	
AFB	300	332	B1	300	332	360	16	
AFB	350	385	B1	350	385	420	17.5	
AFB	400	440	B1	400	440	480	20	
AFB	450	495	B1	450	495	530	22.5	
AFB	500	550	B1	500	550	600	25	
AFB	550	605	B1	550	605	650	25	
AFB	600	660	B1	600	660	720	25	
AFB	650	715	B1	650	715	780	25	
AFB	700	770	B1	700	770	840	25	
AFB	750	825	B1	750	825	900	25	
AFB	800	880	B1	800	880	960	25	
AFB	850	935	B1	850	935	1020	25	
AFB	900	990	B1	900	990	1080	25	
AFB	950	1045	B1	950	1045	1140	25	
AFB	1000	1100	B1	1000	1100	1200	25	
AFB	1200	1320	B1	1200	1320	1440	25	

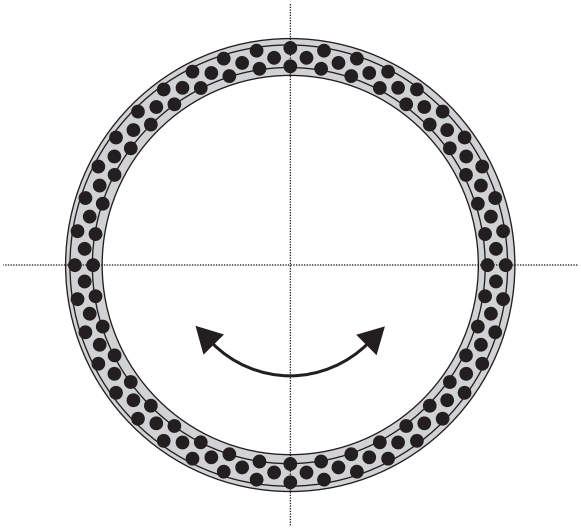
On Request

(All Dimension in mm)

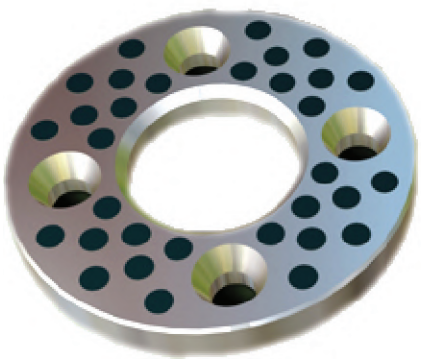
Technical Data

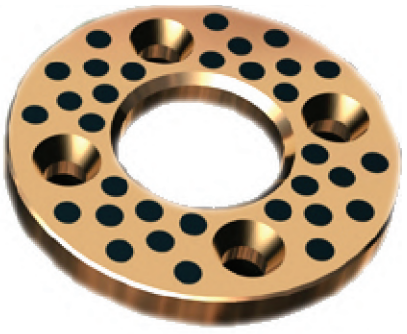
The direction of movement determines the arrangement of the lubrication plugs.





Material : Copper alloy + Solid lubricants





THRUST WASHER

Recommended Dimension

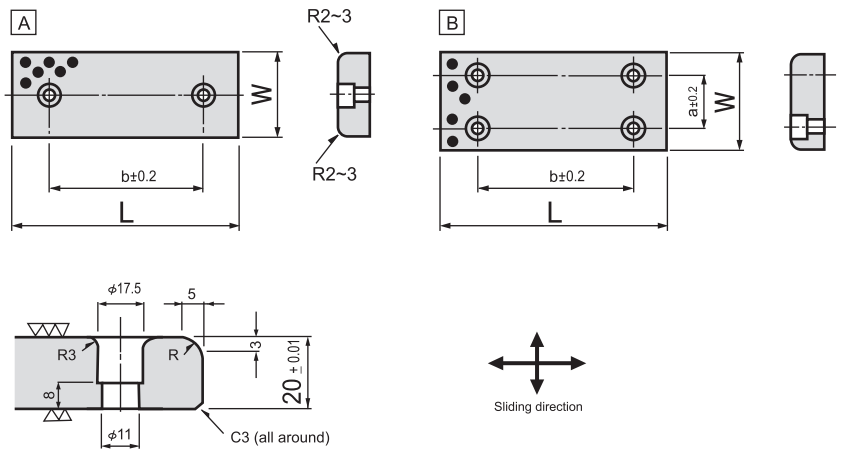
Standard No.		D5	D6	ST
ATW	80		80	5
ATW	85		85	5
ATW	90		90	7.5
ATW	95		95	7.5
ATW	100		100	7.5
ATW	105		105	7.5
ATW	110		110	7.5
ATW	115		115	7.5
ATW	120		120	7.5
ATW	125		125	10
ATW	140		140	10
ATW	150		150	10
ATW	160		160	10
ATW	170		170	10
ATW	180		180	10
ATW	190		190	10
ATW	230	185	230	12.5
ATW	250	205	250	12.5
ATW	275	230	275	12.5
ATW	300	255	300	14
ATW	340	285	340	15
ATW	360	305	360	16
ATW	420	355	420	17.5
ATW	480	405	480	20
ATW	530	455	530	22.5
ATW	600	510	600	25
ATW	650	560	650	25
ATW	720	610	720	25
ATW	780	660	780	25
ATW	840	710	840	25
ATW	900	760	900	25
ATW	960	810	960	25
ATW	1020	860	1020	25
ATW	1080	910	1080	25
ATW	1140	960	1140	25
ATW	1200	1010	1200	25
ATW	1440	1210	1440	25

(All Dimension in mm)

Special copper alloy is used as the base metal with special solid lubricants embedded. The slide plate of this type has excellent wear-resistance.

ABWP

Material : Copper Alloy + Lubricant Buttons



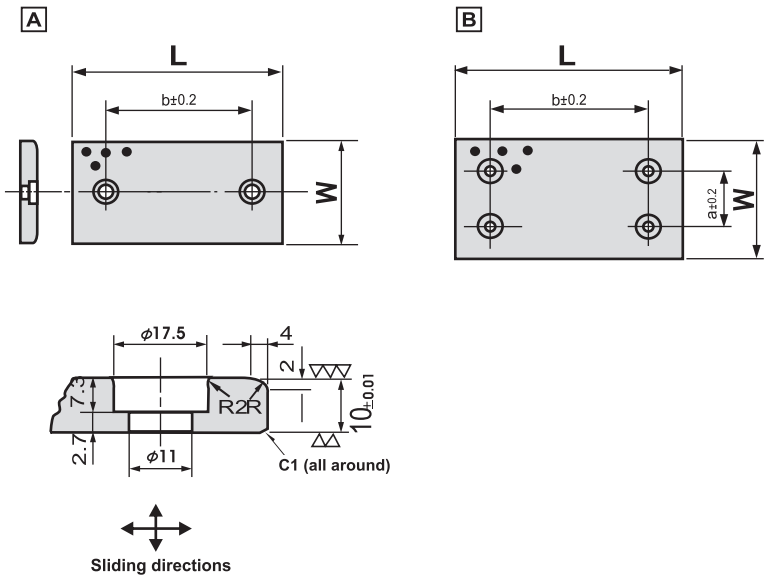
Note: The sliding direction is longitudinal side only for sizes W=28 and W=38

Standard No.	W	L	a	b	Sketch
ABWP- 28X 75	28	75	—	45	A
ABWP- 28X100		100		50	
ABWP- 28X150		150		100	
ABWP- 38X 75	38	75	—	45	
ABWP- 38X100		100		50	
ABWP- 38X150		150		100	
ABWP- 48X 75	48	75	—	45	
ABWP- 48X100		100		50	
ABWP- 48X125		125		75	
ABWP- 48X150		150		100	
ABWP- 48X200		200		150	
ABWP- 58X 75	58	75	—	45	
ABWP- 58X100		100		50	
ABWP- 58X150		150		100	
ABWP- 75X 75	75	75	—	25	
ABWP- 75X100		100		50	
ABWP- 75X125		125		75	
ABWP- 75X150		150		100	
ABWP- 75X200		200		150	
ABWP-100X100	100	100	50	50	B
ABWP-100X125		125		75	
ABWP-100X150		150		100	
ABWP-100X200		200		150	
ABWP-100X250		250		200	
ABWP-100X300		300		200	
ABWP-125X125	125	125	50	75	
ABWP-125X150		150		100	
ABWP-125X200		200		150	
ABWP-125X250		250		200	
ABWP-125X300		300		200	
ABWP-125X350		350		200	
ABWP-150X150	150	150	100	100	
ABWP-150X200		200		150	
ABWP-150X250		250		200	

Special copper alloy is used as the base metal with special solid lubricants embedded. The slide plate of this type has good wear-resistance. This thin plate of 10 mm thickness is designed to save space and is applicable for pads, heels or cams.

ABTWP

Material : Copper Alloy + Lubricant Buttons



Note: The sliding direction is longitudinal side only for sizes W=28 W=38
Use thin head allen bolts M10x20 for clamping.

Standard No.	W	L	a	b	Sketch
ABTWP- 28X75	48 28	75	—	45	A
ABTWP- 28X100		100		50	
ABTWP- 28X125		125		75	
ABTWP- 28X150		150		100	
ABTWP- 38X75	38 75	75	—	45	
ABTWP- 38X100		100		50	
ABTWP- 38X125		125		75	
ABTWP- 38X150		150		100	
ABTWP- 48X75	100	75	—	45	
ABTWP- 48X100		100		50	
ABTWP- 48X125		125		75	
ABTWP- 48X150		150		100	
ABTWP- 48X200		200		150	
ABTWP- 75X75	125	75	—	25	
ABTWP- 75X100		100		50	
ABTWP- 75X125		125		75	
ABTWP- 75X150		150		100	
ABTWP- 75X200		200		150	
ABTWP- 100X100	100	100	50	50	B
ABTWP-100X125		125		75	
ABTWP-100X150		150		100	
ABTWP-100X200		200		150	
ABTWP-100X250		250		200	
ABTWP-125X150	125	150	50	100	
ABTWP-125X200		200		150	
ABTWP-125X250		250		200	
ABTWP-150X150	150	150	100	100	
ABTWP-150X200		200		150	

Fits and tolerances for reliable operation

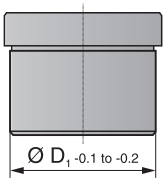
For sliding bearings with an outer diameter D_1 greater than 300 mm the fits must be determined according to the actual requirements. For this purpose please contact our technical department. The subsequent proposals are valid for sliding bearings with a diameter D_1 smaller than 300 mm.

Description	Tolerance
Housing bore	H7
Outer diameter of bearing under normal operating conditions (t 80° C)	r6 / s6
Bearing bore prior to installation into housing	E8
Bearing bore after installation into housing (approx. within) The press-fit leads to a contraction of the bearing bore from E8 to approx. H10	H10
Tolerance of bearing length	average
Surface finish standard of housing bore	(ISO:N8) R_a to 3.2 μm
Sureface finish standard of shaft, ground	R_a 0.2 to 0.8 μm
Tolerance of shaft: under normal operating conditions (t <80° C)	c8 / d8

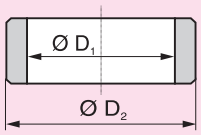
AVI Oilless bearings are installed into the housing with interference or super cooling. The housing bore of R_a = 3.2 μm. To facilitate bearing installation, the housing bore should be provided with a lead in chamfer of 1 mm x 15° to 20°. Depending on the application, customised fits and tolerances are possible. Please contact our technical department.

Mounting of AVI Oilless bearings by press-fitting

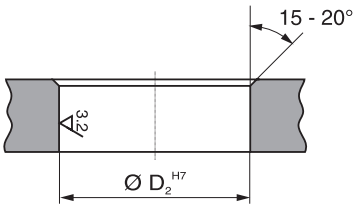
Press-fit mandrel



AVI Oilless bearing



Housing



Press-fit procedure

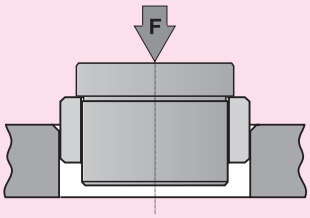


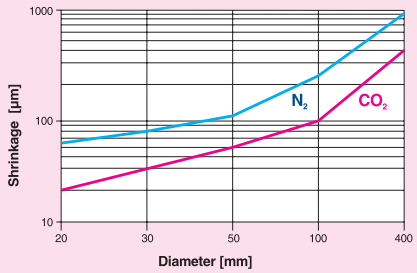
Figure 3.1 – Press-fitting of AVI Oiless radial bearings

Mounting of AVI Oilless bearings by supercooling

AVI Oilless bearings may also be supercooled to faciliate assembly. The shrinkage (s) is calculated using the following equation:

$$s = 0.8 \times \alpha_1 \times \Delta T \times D_2 \text{ (mm)}$$

where:
α_1 = linear coefficient of thermal expansion (1/10^{6}K)
ΔT = temperature difference (°C)
D_2 = outer diameter (mm)

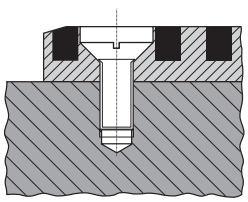


If using dry ice (CO_2), we recommend using a wodden box fully lined with polystyrene as a cooling container. An insulating lid ensures quicker cooling of the bearings. Always wear protective goggles and gloves when handling dry ice or liquid nitrogen, as well as the cooled parts. In order to ensure uniform supercooling, the dry ice should be crushed into walnut size. It takes between 0.5 and 2 hours for complete cooling of the bearings. The supercooled parts can then be inserted without effort into the housing bore.
AVI recommends supercooling with liquid Nitrogen for bearings $D_1 < 200$ mm and dry ice for $D_1 > 200$ mm.

Figure 3.2 – Supercooling installation

Mounting of AVI Oilless sliding strips

Countersunk screws



Mechanical location

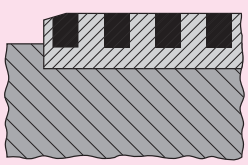


Figure 3.3 – Fastening of AVI Oilless sliding strips

Sealing

The structure of the **AVI Oilless** bearings enables dirt particles to become embedded in the relatively soft solid lubricant plug thus reducing damage to the bearing and shaft. This embedding process allows the bearing to be used without performance restrictions. However, if the ingress of highly abrasive partlicles cannot be avoided it is advisable to seal the bearing area.

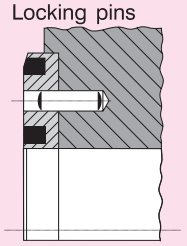
Mounting of AVI Oilless thrust washers

Thrust washers should be fixed on the outer diameter e.g. in a recess of the housing. The inner diameter of the thrust washer must exceed the shaft diameter in order to avoid wear and chip removal. Thrust washers can also be fixed with locking pins if there is no suitable recess in the housing.

Note:

- The locking pins should be recessed below the bearing surface with sufficient allowance for wear.
- Screws should be countersunk below the bearing surface also observing sufficient allowance for wear.
- Ensure that the inside diameter of the washer does not touch the shaft after assembly.

Locking pins



Screw

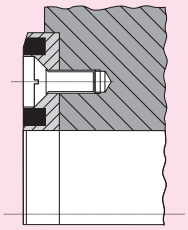


Figure 3.4 – Fastening of AVI Olless thrust washers

Properties of Non-Ferrous Metals

Composition & Physical Properties

S.No.	Designation	ASTM standard		Proportional weights		Physical properties (Min.)						
		Standard	Alloy No.	DIN	ASTM	Density	0.2% Strain	Tensile strength	Strain	E-Modulus	Hardness	Application
						ρ	δ_y	δ_T				
				%	%	g/cm³	MPa	MPa	%	MPa	HB	
01	CuSn7ZnPb	B 584	C932 00	Cu 81 - 85 Sn 6 - 8 Zn 3 - 5 Pb 5 - 7 permissible max portions Ni 2.0 Sb 0.3	Cu 81 - 85 Sn 6.3 - 7.5 Zn 2 - 4 Pb 6 - 8 Ni 1 Sb 0.35	8.8	120	240	15	106.000	65	Standard Material for the most application
	CuSn7ZnPb	B271	C932 00			8.8	130	270	13	106.000	75	
	CuSn7ZnPb	B505	C932 00			8.8	120	270	16	106.000	70	
02	CuSn12Pb	B 505	C925 00	Cu 84 - 87 Sn 11 - 13 Pb 1 - 2 permissible max portions Ni 2.0 Sb 0.2 P 0.2	Cu 85 - 88 Sn 10 - 12 Pb 1 - 1.5 Ni 0.8 - 1.5	8.7	140	280	7	112.000	85	Material for high loads and/or corrosion stress attack
03	CuAl10Ni	B 584	C955 00	Cu min 75 Al 8.5 - 11.0 Ni 4.0 - 6.5 Fe 3.5 - 5.5 permissible max portions Mn 3.3	Cu min 78 Al 10 - 11.5 Ni 3 - 5.5 Fe 3 - 5 Mn max 3.5	7.6	270	600	12	122.000	140	Material for extreme loads and/or high corrosive environments
	CuAl10Ni	B 30	C955 00			7.6	300	600	14	122.000	150	
	CuAl10Ni	B 271	C955 00			7.6	300	700	13	122.000	160	
	CuAl10Ni	B 205	C955 00			7.6	300	700	13	122.000	160	
04	CuZn25Al5	B 584	C863 00	Cu 60 - 67 Al 3 - 7 Fe 1.5 - 4 Mn 2.5 - 5 Zn rest permissible max. portions Ni max. 3	Cu 60 - 66 Al 5 - 7.5 Fe 2 - 4 Mn 2.5 - 5 Zn 22 - .28 Ni max. 1	8.2	450	750	8	115.000	180	Material for highest loads without corrosive attack
	CuZn25Al5	B 30	C863 00			8.2	480	750	8	115.000	180	
	CuZn25Al5	B 271	C863 00			8.2	480	750	5	115.00	190	

Bearing Properties

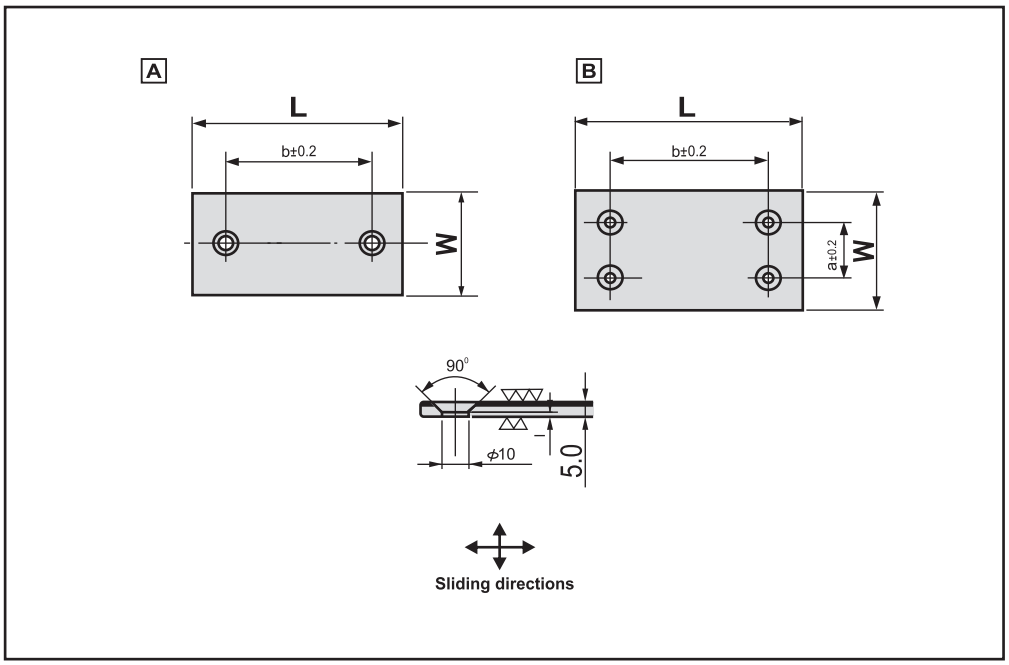
S.No.	Max permissible load	Max sliding speed	Max $\bar{p}U$ value	Temperature Range		Friction coefficient	Friction coefficient	Min Shaft hardness	shaft surface finish
		Dry	Dry	Max.	Min.	Dry	In-water		optimal
	MPa	m/s	MPa x $\frac{m}{s}$	°C	°C			HB	µm
1	75	0.4	1.0	250	-100	0.10 - 0.12	0.08 -0.12	180	0.2 - 0.8
2	110	0.4	1.0	250	-100	0.10 - 0.12	0.08 - 0.12	180	0.2 - 0.8
3	150	0.4	1.5	250	-100	0.10 - 0.13	0.08 - 0.12	300	0.2 - 0.8
4	150	0.4	1.5	250	-100	0.12 - 0.15	not recommended	300	0.2 - 0.8

Self Lubricating Sliding Strips

ASLSS

This is made up of self lubricating sliding material. The sliding layer is applied to stainless steel backing with 0.2 to 0.4 mm porous tin bronze sintered layer. The pores are filled with Polytetra fluoro ethylene (PTFE) and other wear reducing additives during rolling process.

The bearings combine good wear resistance properties due to sintered bronze layer and good lubrication properties of a PTFE mixture. This composite structure results in good dimensional stability and thermal conductivity.



Standard No.	W	L	a	b	Sketch
ASLSS- 28X75	28	75	—	45	A
ASLSS- 28X100		100		50	
ASLSS- 28X125		125		75	
ASLSS- 28X150		150		100	
ASLSS- 38X75	38	75	—	45	
ASLSS- 38X100		100		50	
ASLSS- 38X125		125		75	
ASLSS- 38X150		150		100	
ASLSS- 48X75	48	75	—	45	
ASLSS- 48X100		100		50	
ASLSS- 48X125		125		75	
ASLSS- 48X150		150		100	
ASLSS- 48X200		200		150	
ASLSS- 75X75	75	75	—	25	
ASLSS- 75X100		100		50	
ASLSS- 75X125		125		75	
ASLSS- 75X150		150		100	
ASLSS- 75X200		200		150	
ASLSS- 100X100	100	100	50	50	B
ASLSS-100X125		125		75	
ASLSS-100X150		150		100	
ASLSS-100X200		200		150	
ASLSS-100X250		250		200	
ASLSS-125X150	125	150	50	100	
ASLSS-125X200		200		150	
ASLSS-125X250		250		200	
ASLSS-150X150	150	150	100	100	
ASLSS-150X200		200		150	

Material Property	Unit	Value
Max. permitted static load	MPa	250
Max. permitted dynamic load	MPa	80
Max. Sliding Speed	m/s	2
Friction coefficient	μ	0.03 to 0.25
Temperature range	°C	-150 to + 250

Metal Impregnated Graphite Materials For Mechanical Applications





Grade	Impregnation	Density (g/cc)	Flexural strength (psi)	Compressive strength (psi)	Young's modulus (psi X 10^6)	Rockwell Hardness	Thermal conductivity Btu x hr-1 x ft-1 x0F-1)	Coefficient of thermal expansion in/in/0F x10-6	Porosity (open) vol %	Temperature resistance 0F in ox .atm	Temperature resistance 0F in red atm.	Typical applications
EK 20	-	1.70	8000	22500	3.2	105 HR 5/100	7	1.7	11.0	660	2200	Wet running bearings, High loaded seals, bearings
EK 2200 ■	Resin	1.82	11000	29000	3.4	110 HR 5/100	7.5	2.2	2.5	400	400	
EK 2201 ■	Resin	1.82	11000	29000	3.4	110 HR 5/100	8	2.1	2.5	500	500	
EK 2203 ■	Resin	1.80	10000	28500	3.2	110 HR 5/100	8	2.1	2.5	350	350	Seals, bearings
EK 2209	-	1.77	9500	27500	3.7	110 HR 5/100	8.5	2.0	2.5	660	750	
EK 3205	Antimony	2.30	12500	37500	4.4	120 HR 5/100	10.5	2.2	2.5	660	1000	
EK 2230 ■	Resin	1.85	8500	23000	3.2	110 HR 5/100	8	3.6	2.5	400	400	
EK 2239	-	1.80	8000	21500	2.9	105 HR 5/100	9	2.5	2.5	660	750	High loaded seals, bearings
EK 3235	Antimony	2.47	9500	30500	4.4	105 HR 5/100	12	2.8	2.5	660	1000	
EK 24	-	1.70	8500	26000	2.6	105 HR 5/100	8	2.3	8.0	660	2200	High volume seals, bearings
EK 2240 ■	Resin	1.80	10000	29000	2.8	110 HR 5/100	8.5	2.8	2.5	400	400	
EK 2241 ●■	Resin	1.80	10000	29000	2.8	110 HR 5/100	8.5	2.6	2.5	500	500	Seals, bearings for dry running, mixed running
EK 2243 ■	Resin	1.78	8500	27500	2.6	110 HR 5/100	9	2.5	2.5	350	350	
EK 3245	Antimony	2.20	11500	36000	3.2	120 HR 5/100	12	2.7	2.5	660	1000	
EK 25	-	1.69	6500	18000	2.3	100 HR 5/100	5	2.5	7.0	660	1750	Seals, bearings for dry running, mixed running
EK 2250	Resin	1.80	7000	23000	2.5	110 HR 5/100	6	2.8	2.5	400	400	
EK 3255	Antimony	2.15	11000	32000	3.0	120 HR 5/100	7	2.9	2.5	660	1000	
EK 60	-	1.73	11500	17500	3.2	80 HR 5/100	3.5	6.1	No	350	350	Vanes for high load, Compressor Vanes, parts for pumps
V 1771	-	1.69	10000	21500	2.5	100 HR 5/100	2.9	9.9	No	428	428	
V 1352	-	1.62	11000	29000	2.6	110 HR 5/100	1	9.4	No	350	350	
V 1640 ■	-	1.69	12500	30500	2.0	110 HR 5/100	2	8.9	No	350	350	

■ Materials are certified for use in potable water and / or in foodstuff.

●■ Materials are certified for use in oxidizing atmosphere.

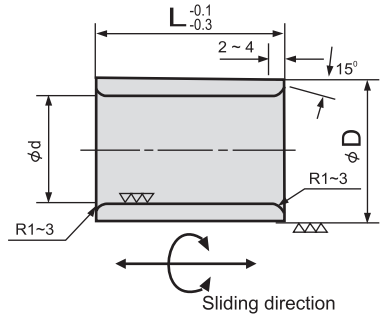
GRAPHITE MAKE : SGL GROUP / GERMANY

Metal Impregnated Graphite Bearing AGMB

Graphite-metal alloy bearings are available in different grades depending upon the applications. Any size range , cylindrical with or without grooves, flange type, split , metal backed or as per customised drawings can be supplied. Graphite-metal alloy bearings can be used in many manufacturing and processing industries like steel plants, chemical and refinery , paper industry etc.

Applications such as Turbines, Pumps, Valves, Conveyors, Ovens, Dryers, Mixers and many more.

AGMB



Standard No.	Dimension		
	I.D. ϕ d	O.D.ϕ D	L -0.1 -0.3
AGMB - 253312	25	33	12
AGMB - 253315	25	33	15
AGMB - 253316	25	33	16
AGMB - 253320	25	33	20
AGMB - 253325	25	33	25
AGMB - 253330	25	33	30
AGMB - 253335	25	33	35
AGMB - 253340	25	33	40
AGMB - 253350	25	33	50
AGMB - 253360	25	33	60
AGMB - 253512	25	35	12
AGMB - 253515	25	35	15
AGMB - 253516	25	35	16
AGMB - 253520	25	35	20
AGMB - 253525	25	35	25
AGMB - 253530	25	35	30
AGMB - 253535	25	35	35
AGMB - 253540	25	35	40
AGMB - 253550	25	35	50
AGMB - 283820	28	38	20
AGMB - 283825	28	38	25
AGMB - 283830	28	38	30
AGMB - 283840	28	38	40
AGMB - 303812	30	38	12
AGMB - 303815	30	38	15
AGMB - 303820	30	38	20
AGMB - 303825	30	38	25
AGMB - 303830	30	38	30
AGMB - 303835	30	38	35
AGMB - 303840	30	38	40
AGMB - 303850	30	38	50
AGMB - 303860	30	38	60
AGMB - 304020	30	40	20
AGMB - 304025	30	40	25
AGMB - 304030	30	40	30
AGMB - 304035	30	40	35
AGMB - 304040	30	40	40
AGMB - 304050	30	40	50
AGMB - 304060	30	40	60
AGMB - 314030	31	40	30

Standard No.	Dimension		
	I.D. ϕ d	O.D.ϕ D	L -0.1 -0.3
AGMB - 314040	31	40	40
AGMB - 324230	32	42	30
AGMB - 324240	32	42	40
AGMB - 354425	35	44	25
AGMB - 354430	35	44	30
AGMB - 354435	35	44	35
AGMB - 354440	35	44	40
AGMB - 354450	35	44	50
AGMB - 354460	35	44	60
AGMB - 354520	35	45	20
AGMB - 354525	35	45	25
AGMB - 354530	35	45	30
AGMB - 354535	35	45	35
AGMB - 354540	35	45	40
AGMB - 354550	35	45	50
AGMB - 354560	35	45	60
AGMB - 384830	38	48	30
AGMB - 384840	38	48	40
AGMB - 405020	40	50	20
AGMB - 405025	40	50	25
AGMB - 405030	40	50	30
AGMB - 405035	40	50	35
AGMB - 405040	40	50	40
AGMB - 405050	40	50	50
AGMB - 405060	40	50	60
AGMB - 405070	40	50	70
AGMB - 405080	40	50	80
AGMB - 405525	40	55	25
AGMB - 405530	40	55	30
AGMB - 405535	40	55	35
AGMB - 405540	40	55	40
AGMB - 405550	40	55	50
AGMB - 405560	40	55	60

Standard No.	Dimension		
	I.D. ⌀ d	O.D.⌀ D	L $^{-0.1}_{-0.3}$
AGMB - 455530	45	55	30
AGMB - 455535	45	55	35
AGMB - 455540	45	55	40
AGMB - 455550	45	55	50
AGMB - 455560	45	55	60
AGMB - 455630	45	56	30
AGMB - 455635	45	56	35
AGMB - 455640	45	56	40
AGMB - 455650	45	56	50
AGMB - 455660	45	56	60
AGMB - 456030	45	60	30
AGMB - 456035	45	60	35
AGMB - 456040	45	60	40
AGMB - 456050	45	60	50
AGMB - 456060	45	60	60
AGMB - 456070	45	60	70
AGMB - 456080	45	60	80
AGMB - 506030	50	60	30
AGMB - 506035	50	60	35
AGMB - 506040	50	60	40
AGMB - 506050	50	60	50
AGMB - 506060	50	60	60
AGMB - 506070	50	60	70
AGMB - 506080	50	60	80
AGMB - 506230	50	62	30
AGMB - 506235	50	62	35
AGMB - 506240	50	62	40
AGMB - 506250	50	62	50
AGMB - 506260	50	62	60
AGMB - 506270	50	62	70
AGMB - 506530	50	65	30
AGMB - 506540	50	65	40
AGMB - 506550	50	65	50
AGMB - 506560	50	65	60
AGMB - 506570	50	65	70
AGMB - 506580	50	65	80
AGMB -5065100	50	65	100
AGMB - 557040	55	70	40
AGMB - 557050	55	70	50
AGMB - 557060	55	70	60
AGMB - 557070	55	70	70
AGMB - 607430	60	74	30
AGMB - 607435	60	74	35
AGMB - 607440	60	74	40
AGMB - 607450	60	74	50
AGMB - 607460	60	74	60
AGMB - 607470	60	74	70
AGMB - 607480	60	74	80
AGMB - 607530	60	75	30
AGMB - 607535	60	75	35
AGMB - 607540	60	75	40
AGMB - 607550	60	75	50
AGMB - 607560	60	75	60
AGMB - 607570	60	75	70
AGMB - 607580	60	75	80
AGMB -6075100	60	75	100
AGMB - 637560	63	75	60
AGMB - 637570	63	75	70
AGMB - 637580	63	75	80
AGMB - 658050	65	80	50
AGMB - 658060	65	80	60
AGMB - 658070	65	80	70
AGMB - 658080	65	80	80

Standard No.	Dimension		
	I.D. ⌀ d	O.D.⌀ D	L $^{-0.1}_{-0.3}$
AGMB - 708535	70	85	35
AGMB - 708540	70	85	40
AGMB - 708550	70	85	50
AGMB - 708560	70	85	60
AGMB - 708570	70	85	70
AGMB - 708580	70	85	80
AGMB - 7085100	70	85	100
AGMB - 709050	70	90	50
AGMB - 709060	70	90	60
AGMB - 709070	70	90	70
AGMB - 709080	70	90	80
AGMB - 759060	75	90	60
AGMB - 759070	75	90	70
AGMB - 759080	75	90	80
AGMB - 7590100	75	90	100
AGMB - 759560	75	95	60
AGMB - 759570	75	95	70
AGMB - 759580	75	95	80
AGMB - 7595100	75	95	100
AGMB - 809640	80	96	40
AGMB - 809650	80	96	50
AGMB - 809660	80	96	60
AGMB - 809670	80	96	70
AGMB - 809680	80	96	80
AGMB - 8096100	80	96	100
AGMB - 8096120	80	96	120
AGMB - 8010040	80	100	40
AGMB - 8010050	80	100	50
AGMB - 8010060	80	100	60
AGMB - 8010070	80	100	70
AGMB - 8010080	80	100	80
AGMB - 80100100	80	100	100
AGMB - 80100120	80	100	120
AGMB - 80100140	80	100	140
AGMB - 8510080	85	100	80
AGMB - 9011030	90	110	30
AGMB - 9011050	90	110	50
AGMB - 9011060	90	110	60
AGMB - 9011070	90	110	70
AGMB - 9011080	90	110	80
AGMB - 90110100	90	110	100
AGMB - 90110120	90	110	120
AGMB - 10012060	100	120	60
AGMB - 10012070	100	120	70
AGMB - 10012080	100	120	80
AGMB - 100120100	100	120	100
AGMB - 100120120	100	120	120
AGMB - 100120140	100	120	140
AGMB - 11013080	110	130	80
AGMB - 110130100	110	130	100
AGMB - 110130120	110	130	120
AGMB - 12014080	120	140	80
AGMB - 120140100	120	140	100
AGMB - 120140120	120	140	120
AGMB - 120140140	120	140	140
AGMB - 125145100	125	145	100
AGMB - 125145120	125	145	120
AGMB - 130150100	130	150	100
AGMB - 130150130	130	150	130

Sintered Self Lubricating Bearings

Sintered Porous Metal Bearings are Powder metallurgical parts, the starting materials are obviously metal powder. The metal powder used are specifically produced to give flow and compacting characteristics and at the same time ensure best mechanical strength, porosity for oil retention and self lubrication in its finished form.

Manufacturing Process

Forming (or Compacting) → **Sintering** → **Sizing** → **Oil impregnation**

Material : SINTERED BRONZE / IRON SINTERED **As Per IS : 3980 : 1982**

RANGE : Plain & Flanged Bushes, Self aligned Bushes, Solid Rod, Plate & different profile components as per drawings/samples.

APPLICATION : Sintered Bronze Bushes are used for High Speed application (up to 18000 rpm) Iron Sintered Bushes are used for speed (upto 3000 rpm).

MATERIALS COMPOSITION

GRADE I, COPPER BASE				
ELEMENTS	**CLASS A%**	**B3%**	**B2%**	**B2%**
IRON (Fe)	1.00 Max	48-50	38-40	28-30
Tin (Sn)	8-9.5	4-6	4-6	4-6
CARBON (C)	2.0 Max	2.0	2.0	2.0
IMPURITIES	2.0	2.0	2.0	2.0
COPPER (Cu)	BAL.	BAL.	BAL.	BAL.

MATERIALS COMPOSITION

GRADE II, IRON BASE				
ELEMENTS	**CLASS A%**	**B3%**	**B2%**	**B2%**
COPPER (Cu)	1.00Max	9-11	BAL.	1.5-3.5
CARBON (C)	0.25 Max	0.25	0.25	0.25
IMPURITIES	2.0	2.0	2.0	2.0
IRON (Fe)	BAL.	BAL	BAL.	BAL.

Sintered Self Lubricating Plain Bearings

Sr.No.	I.D.	O.D.	Length
1	4	6	5
2	4	6	8
3	4	7	8
4	4	8	6
5	5	8	10
6	5	10	12
7	6	8	08/12/20
8	6	9	6/7.5
9	6	10	05/10/12/20
10	6	12	10/16/18/20
11	1/4"	3/8"	3/4"
12	1/4"	1/2"	3/8"
13	7	10	9
14	7	10	9
15	7.95	16.5	15.4
16	8	10	12
17	8	12	8/10/12/16
18	8	12	20/25
19	8	12.7	12/19/25.4
20	8	14	10.5
21	8	14.2	7.4
22	8	16	25.4
23	8	22	7
24	9	13	10/12
25	3/8"	1/2"	3/8"/3/4"/1"
26	3/8"	1/2"	1-1/4"
27	3/8"	5/8"	3/4"
28	9.5	18	25
29	10	12	18/12/15/20
30	10	14	12/15/20
31	10	15	8/10
32	10	16	10/20
33	10	20	5
34	12	14	10/15/20
35	12	15	10/15/20
36	12	15.1	8
37	12	16	12/14/15/20/30
38	12	18	12/15/20/25
39	1/2"	5/8"	24
40	1/2"	5/8"	1/2"/3/4"
41	13	15	17.5
42	14	18	12/20
43	15	19	16
44	15	20	20

Sr.No.	I.D.	O.D.	Length
45	5/8"	3/4"	5/8"
46	5/8"	7/8"	3/8"
47	16	18	15/20
48	16	19	25
49	16	20	10/16/20/30
50	16	22	9.5
51	16	22	16/19/25
52	16.45	19.55	16/19/25
53	17	19	13
54	17	20	13/20
55	18	20	15
56	18.65	25.45	31.7/50
57	3/4"	7/8"	3/4"
58	3/4"	1"	1/2" / 5/8" / 3/4" / 1"
59	20	23	15/25
60	20	25	10/20/25/32
61	20	26	16/20/25
62	20	28	25/30
63	20	30	20
64	22	26	25
65	22	27	20
66	7/8"	1"	1/2"
67	25	30	30
68	25	32	32
69	25	35	20/40
70	1"	1-1/4"	5/8"/1"
71	27	39	20
72	1.085"	1.375"	0.719"
73	28.5	35	35
74	30	35	25
75	30	38	20/40
76	30	40	30/40/60
77	1-3/8"	1-5/8"	3/4"/7/8"
78	35	40	30
79	35	45	50
80	1-1/2"	1-3/4"	1-3/4"
81	40	44	32
82	40	47	12
83	40	50	30
84	45	50	24
85	50	60	50
86	2"	2-1/2"	1-1/2"
87	56	60	16
88	-	-	-

Note : Sintered bushes are available in metric (mm) & inches as per above sizes.

Sintered Self Lubricating Flanged Bearings

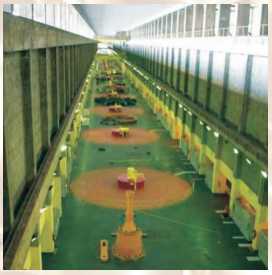
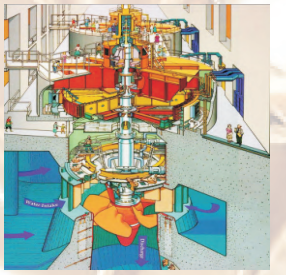
Sr.No.	Flange Dia.	O.D.	I.D.	Total Length	Flange Thickness
1	10	7.5	3	2.5	1
2	9	7	4	6	1.5
3	9	7	4	7.5	1.5
4	10	8	5	3	1
5	10	8	5	5	1
6	12	10	5	4	1
7	12	10	5	8	1
8	14	10	6	7	2
9	14	10	6	16	2
10	12.5	11	6	8	2.5
11	20	14	6	25	2
12	1/2"	3/8"	1/4"	1/2"	1/16"
13	14	11.5	7	13	1.5
14	16	10	8	8	1.3
15	16	12	8	16	2
16	18	14	8	8	3
17	19	14	8	10	1
18	20	14	8	4	2
19	5/8"	1/2"	3/8"	1"	19/64"
20	16	14	10	9.2	1.2
21	20	16	10	25	3
22	22	16	10	8	3
23	25	16	10	20	5
24	25	22	10	10.5	4.5
25	17.5	15.9	11.1	17	2.1
26	22	18	12	17	2
27	24	18	12	15	3
28	20	16	12.7	20	3
29	24	20	12.7	10	4.5
30	16	20	14	22	3
31	23	21	15	14	3
32	1"	3/4"	5/8"	7/8"	1/8"
33	27	20	16	25	3
34	28	22	16	25	4
35	32	25	18	25	4
36	33.33	25.5	19.1	19	3.17
37	30	25	20	8	2
38	34	25	20	15	3
39	32	26	20	26	3
40	35	28	20	20	4
41	1-1/2"	1-1/4"	1"	3/4"	1/8"
42	44	38	32	6.5	2
43	45	42.	36	15	3
44	55	46	36	15	3
45	68	60	50	40	5

Note : Sintered bushes are available in metric (mm) & inches as per above sizes.

Notes

MANUFACTURING FACILITIES

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