SELF-LUBRICATING BEARING

SAVI 萨维
Self-lubricating Bearing

自润滑免维护滑动轴承

SAVI Solid-lubricating and Maintenance-free Sliding Bearings

嘉兴萨维精密机械有限公司
Jiaxing Savi Precision Machinery Co., Ltd.

精益求精

我们的承诺是始终不渝地创造新业绩

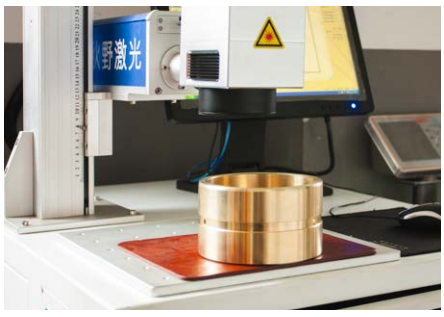
Excellence

Our commitment is to consistently
create new achievements

SAVI 萨维

Self-lubricating Bearing

关于萨维 Savi Introduction



嘉兴萨维精密机械有限公司地处长三角浙江嘉善，东距上海南距杭州，北距苏州都不超百公里， 水陆运输交通极为方便。长期研究开发无油自润滑轴承，经过多年的努力已相继开发了 JDB 固体润滑轴承（石墨铜套）、实体浇铸铜套、SF-1（DU）系列无 油自润滑轴承、SF-2(DX) 系列边界润滑轴承、JF800 系列双金属轴承、FB090 系列青铜卷制轴承、工程塑料轴承（EP）、塑料直线滑动轴承 (LIN)、陶瓷滚动轴承、纤维缠绕轴承等几大系列的产品。

公司将在轴承型号的选择，应用，性能测试，技术交流等方面向用户提供完善的服务，使客户达到提 高效率，降低消耗，节约成本，保护环境的目的。我们的轴承工程师将为您解决一系列的轴承问题，欢迎广大客户前来咨询，洽谈！

Jiaxing Savi Precision Machinery Co., Ltd. is located in Jiashan, Zhejiang Yangtze River Delta, south west of Shanghai, Hangzhou, Suzhou, do not exceed one hundred kilometers north, water and land transport is extremely convenient. Long-term research and development of oil-free self-lubricating bearings, after years of effort have successively developed JDB solid lubricating bearings (graphite copper sleeve), solid casting copper sleeve, SF-1 (DU) oil-free self-lubricating bearings, SF-2 (DX) series boundary lubricating bearings, JF800 series bimetal bearings, FB090 bronze series of rolling bearings, plastic bearings (EP), plastic linear plain bearings (LIN), ceramic bearings, filament-wound bearings, and other major series of products.

The company will provide better services to users in the bearing model selection, application, performance testing, technical exchanges, etc., enabling customers to achieve improve efficiency, reduce consumption, save costs and protect the environment. Our engineers will solve your bearing series bearing problems, welcome customers to consult, negotiate!

产品目录
Product Catalog

JDB 固体润滑轴承
JDB Solid-lubricating Bearings

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JDB 固体润滑轴承
JDB Solid-Lubricant Bearings

合金材料 Alloy Material

型号 Type / 对应牌号 Corresponding Brands	JDB-1	JDB-2	JDB-3	JDB-4	JDB-5
国际牌号 GB1776-87 China Brands GB1776-87	ZCuZn25 Al6Fe3Mn3	ZCuSn6 Zn6Pb3	钢 (steel)+ ZCuSn6 Zn6Pb3	GCr15	HT250
国际 ISO1338 International ISO1338	GCuZn25 Al6Fe3Mn3	GCuSn6 Zn6Pb3	钢 (steel)+ CuSn6Zn6Pb3 Fe3Ni5	B1	-
德国 DIN Germany DIN	G-CuZn25 Al5	GB-CuSn5 Zn5Pb5	钢 (steel)+ CuSn6Zn6 Pb3Ni	100Cr6	-
日本JIS Japan JIS	HBsC4	BC6	BC6	SUJ2	FC250
美国 ASTM/UNS America ASTM/UNS	C86300	C83600	C83600	52100	Class40
英国标准（BS） England Standard	HTB2	LG2	LG2	-	-

技术参数 Technical Data

型号 Type / 性能指标 Performance index	JDB-1	JDB-2	JDB-3	JDB-4	JDB-5
最大动承载 P (N/mm^2) Max Move Load Capacity	100	60	70	250	60
最大滑动速度 V (m/s) Max Sliding Speed	干(dry) 0.4 油(oil) 0.5	2	2	0.1	0.5
最高PV值 ($N/mm^2 \cdot m/s$) Max PV Value Limit	3.8	0.5	0.6	2.5	0.8
密度 ρ (g/cm^3) Density	8.0	8.0	7.6	7.8	7.3
抗拉强度 (N/mm^2) Tensile Strength	＞600	＞250	＞500	＞1500	＞250
延伸率 (%) Elongation	＞10	＞4	＞10	-	-
硬度 (HB) Hardness	＞210	＞80	＞80	HRC＞55	＞160
最高使用温度℃ Max Working Temperature	300	350	300	350	400
摩擦系数 μ Friction coefficient			油润滑：0.03 Oil Lubrication:0.03		干摩擦：0.16 Dry Friction:0.16

JDB 固体润滑轴承
JDB Solid-Lubricant Bearings

材料合金化学成份 Alloy Chemical Compositions

化学元素 Chemical elements	JDB-1	JDB-2	JDB-3	JDB-4	JDB-5
Cu (%)	Rest	Rest	Rest	-	-
Sn (%)	-	6	6	-	-
Zn (%)	25	6	6	-	-
Ni (%)	-	-	-	-	-
Al (%)	6	-	-	-	-
Fe (%)	3	-	-	Rest	Rest
Mn (%)	3	-	-	0.20 ~ 0.40	0.905 ~ 1.3
Cr (%)	-	-	-	1.30 ~ 1.65	-
C (%)	-	-	-	0.95 ~ 1.05	2.5 ~ 4
Si (%)	-	-	-	0.15 ~ 0.35	1.0 ~ 1.3
Pb (%)	-	3	3	-	-

固体润滑剂 Solid Lubricants

固体润滑剂 Lubricant	高纯石墨+添加剂 SL1 Graphite	SL4+MoS_2 PTFE+MoS_2+CF
特性 Features	很好的耐磨性和化学稳定性，使用温度＜400℃ Good wear performance and chemical stability, temperature limit 400℃	极低的摩擦系数和很好的水润滑性，使用温度＜300℃ Lowest friction coefficient and good water lubrication, temperature limit 300℃
典型用途 Typical application	应用于一般机械，在大气中使用 Suit for general machines and under atmosphere	应用于水、海水润滑、如船舶 Suit for water and seawater lubricant, such as ship

镶嵌式固体润滑轴承的优点
The Advantages of the Solid-lubricant-Embedded Bearings

1、无给油可使用
Dry operation.

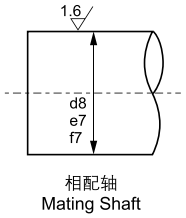
2、高载荷、低转速的情况，仍可发挥优越的性能
Can be Performed well with high load and low speed.

3、往返运动、摇摆运动、起动停止频繁等油膜形成困难的场所，仍可发挥优越的耐磨性
Rreciprocating motion, wagging motion, start and stop frequently are difficulty for keeping oil film. It still may play advantageous of wear-resistance.

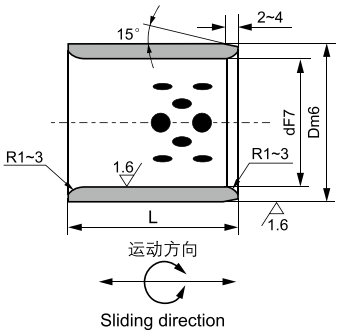
4、优越的耐药品性及耐蚀性
Excellent chemical resistance and anti-corrosion.

5、设计灵活、简单、方便，丰富的标准品，可配标准轴心使用
Flexible, simple, convenient and abundant designing of standard, can be choosed by standard axes.

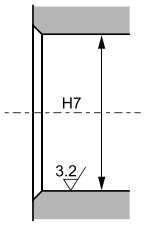
JDB 自润滑直套轴承标准公制尺寸
JDB Self-lubricating Straight Bearings Standard Metric Size



相配轴
Mating Shaft



Sliding direction



相配座孔
Mating Housing

单位Unit: mm

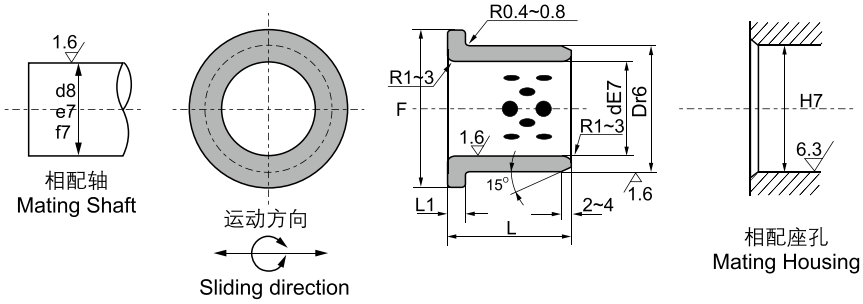
d	D	d F7		D m6		L $^{-0.10}_{-0.30}$												
						8	10	12	15	16	20	25	30	35	40	50	60	70	80
8	12	8	+0.028 +0.013	12	+0.018 +0.007	081208	081210	081212	081215										
10	14	10		14		101408	101410	101412	101415	101416	101420								
12	18	12		18			121810	121812	121815	121816	121820	121825	121830						
13	19	13		19			131910	131912	131915	131916	131920	131925	131930						
14	20	14	+0.034 +0.016	20			142010	142012	142015	142016	142020	142025	142030						
15	21	15		21			152110	152112	152115	152116	152120	152125	152130	152135					
16	22	16		22	+0.021 +0.008		162210	162212	162215	162216	162220	162225	162230	162235	162240				
18	24	18		24			182410	182412	182415	182416	182420	182425	182430	182435	182440				
20	28	20		28			202810	202812	202815	202816	202820	202825	202830	202835	202840	202850			
22	32	22	+0.041 +0.020	32				223212	223215	223216	223220	223225	223230	223235	223240	223250			
25	33	25		33				253312	253315	253316	253320	253325	253330	253335	253340	253350	253360		
30	38	30		38				303812	303815	303816	303820	303825	303830	303835	303840	303850	303860		
35	45	35		45	+0.025 +0.009						354520	354525	354530	354535	354540	354550	354560	354570	
40	50	40	+0.050 +0.025	50							405020	405025	405030	405035	405040	405050	405060	405070	405080
45	55	45		55									455530	455535	455540	455550	455560	455570	455580
50	60	50		60									506030	506035	506040	506050	506060	506070	506080

JDB 自润滑直套轴承标准公制尺寸
JDB Self-lubricating Straight Bearings Standard Metric Size

单位Unit: mm²

d	D	dF7		Dm6		L -0.10 -0.30											
						30	35	40	50	60	70	80	100	120	130	140	150
50	62	50	+0.050 +0.025	62		506230	506235	506240	506250	506260	506270						
50	65	50		65		506530	506535	506540	506550	506560	506570	506580	5065100				
55	70	55		70		557030	557035	557040	557050	557060	557070	557080	5570100				
60	74	60		75	+0.030 +0.011	607430	607435	607440	607450	607460	607470	607480	6074100				
60	75	60		75		607530	607535	607540	607550	607560	607570	607580	6075100				
63	75	63		75			637535	637540	637550	637560	637570	637580	6375100				
65	80	65		80			658035	658040	658050	658060	658070	658080	6580100				
70	85	70	+0.060 +0.030	85			708535	708540	708550	708560	708570	708580	7085100				
70	90	70		90			709035	709040	709050	709060	709070	709080	7090100				
75	90	75		90				759040	759050	759060	759070	759080	7590100				
75	95	75		95				759540	759550	759560	759570	759580	7595100	7595120			
80	96	80		96	+0.035 +0.013			809640	809650	809660	809670	809680	8096100	8096120	8096130		
80	100	80		100				8010040	8010050	8010060	8010070	8010080	80100100	80100120	80100130	80100140	
90	110	90		110					9011050	9011060	9011070	9011080	90110100	90110120	90110130	90110140	
100	120	100		120						10012060	10012070	10012080	100120100	100120120	100120130	100120140	
110	130	110	+0.071 +0.036	130								11013080	110130100	110130120	110130130	110130140	
120	140	120		140								12014080	120140100	120140120	120140130	120140140	
125	145	125		145									125145100	125145120	125145130	125145140	
130	150	130		150	+0.040 +0.015								130150100	130150120	130150130	130150140	130150150
140	160	140	+0.083 +0.043	160									140160100	140160120	140160130	140160140	140160150
150	170	150		170									150170100	150170120	150170130	150170140	150170150
160	180	160		180									160180100	160180120	160180130	160180140	160180150

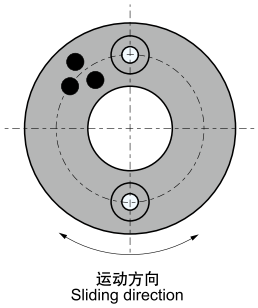
JFB 自润滑翻边轴承标准公制尺寸
JFB Self-lubricating Flange Bearings Standard Metric Size

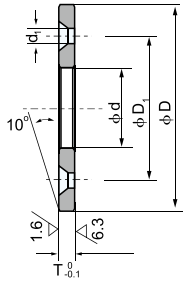


单位Unit: mm

d	D	d E7		D r6		F	L_1	$L^{-0.10}_{-0.30}$									
								15	20	25	30	35	40	50	60	80	100
10	14	10	+0.040 +0.025	14	+0.034 +0.023	22	2	1015	1020								
12	18	12		18		25		1215	1220								
13	19	13		19		26		1315	1320								
14	20	14	+0.050 +0.032	20		27	3	1415	1420	1425							
15	21	15		21	+0.041 +0.028	28		1515	1520	1525	1530						
16	22	16		22		29		1615	1620	1625	1630						
20	30	20		30		40			2020	2025	2030	2035					
25	35	25	+0.061 +0.040	35		45			2520	2525	2530	2535	2540				
30	40	30		40		50			3020	3025	3030	3035	3040	3050			
35	45	35		45	+0.050 +0.034	60				3525	3530	3535	3540	3550			
40	50	40		50		65	5				4030	4035	4040	4050			
45	55	45	+0.075 +0.050	55		70					4530	4535	4540	4550	4560		
50	60	50		60	+0.060 +0.041	75						5035	5040	5050	5060		
55	65	55		65		80							5540	5550	5560		
60	75	60		75	+0.062 +0.043	90							6040	6050	6060	6080	
70	85	70	+0.090 +0.060	85		105	7.5							7050	7060	7080	
75	90	75		90	+0.073 +0.051	110								7550	7560	7580	75100
80	100	80		100		120									8060	8080	80100
90	110	90		110		130									9060	9080	90100
100	120	100	+0.107 +0.072	120	+0.076 +0.054	150	10								10060	10080	100100
120	140	120		140	+0.088 +0.063	170									12060	12080	120100

JTW 自润滑止推垫片标准公制尺寸
JTW Self-lubricating Thrust Washer Standard Metric Size

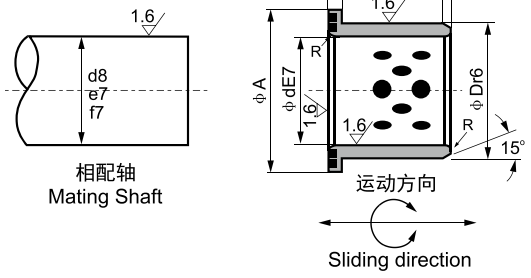


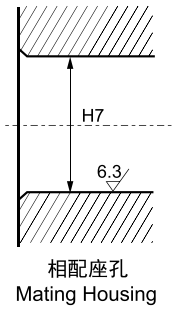


单位Unit: mm

型号规格 Standard No.	ϕ d	ϕ D	T 0 -0.10	ϕ D_1	螺孔 Bolt Hole 平头螺钉 Crop Bolt	ϕ d_1	孔数 Bore Number
JDB-JTW-10	10.2	30	3	20	M3	3.5	2
JDB-JTW-12	12.2	40		28			
JDB-JTW-13	13.2						
JDB-JTW-14	14.2						
JDB-JTW-15	15.2	50		35			
JDB-JTW-16	16.2						
JDB-JTW-18	18.2						
JDB-JTW-20	20.2		5	40	M5	6	4
JDB-JTW-25	25.2	55		45			
JDB-JTW-30	30.2	60		50			
JDB-JTW-35	35.2	70	7	60	M6	7	
JDB-JTW-40	40.2	80		70			
JDB-JTW-45	45.3	90		75			
JDB-JTW-50	50.3	100	8	85			
JDB-JTW-55	55.3	110		90	M8	9	
JDB-JTW-60	60.3	120		95			
JDB-JTW-65	65.3	125	10	100			
JDB-JTW-70	70.3	130		110			
JDB-JTW-75	75.3	140		120			
JDB-JTW-80	80.3	150		140	M10	11	
JDB-JTW-90	90.5	170		160			
JDB-JTW-100	100.5	190		175			
JDB-JTW-120	120.5	200					

JFBB 自润滑翻边轴套标准公制尺寸
JFBB Self-lubricant Flange Bushings Standard Metric Size

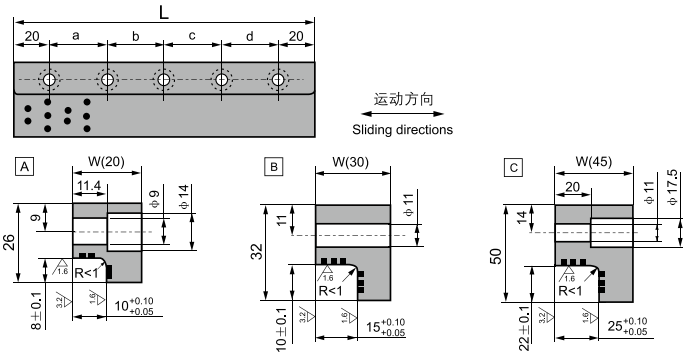




单位unit:mm

型号规格 Standard No.	ϕ d E7		ϕ D r6		ϕ A	L1	L
JDB-JFBB-12 × 15	12	+0.050 +0.032	18	+0.034 +0.023	25	11	15
JDB-JFBB-16 × 20	16		22	+0.041 +0.028	30	15	20
JDB-JFBB-20 × 25	20	+0.061 +0.040	28		36	20	25
JDB-JFBB-25 × 30	25		33		43	25	30
JDB-JFBB-30 × 35	30	+0.075 +0.050	38	+0.050 +0.034	48	30	35
JDB-JFBB-40 × 45	40		50		60	40	45
JDB-JFBB-50 × 55	50	+0.090 +0.060	62	+0.060 +0.041	75	49	55
JDB-JFBB-60 × 65	60		74	+0.062 +0.043	90	58	65

JSP 滑板标准公制尺寸
JSP Wear Plate Standard Metric Size



单位Unit: mm²

型号规格 Standard No.	W	L	螺孔 Bolt Hole a	b	c	d	螺孔 Size	数量Q'ty	图示 Sketch
JDB-JSP-20 × 100	20	100	60	——	——	——	M8	2	A
JDB-JSP-20 × 150		150	55	55	——	——		3	
JDB-JSP-20 × 200		200	55	50	55	——		4	
JDB-JSP-30 × 100	30	100	60	——	——	——	M10	2	B
JDB-JSP-30 × 150		150	55	55	——	——		3	
JDB-JSP-30 × 200		200	55	50	55	——		4	
JDB-JSP-30 × 250		250	70	70	70	——		4	
JDB-JSP-45 × 200	45	200	55	50	55	——		4	C
JDB-JSP-45 × 250		250	70	70	70	——		4	
JDB-JSP-45 × 300		300	65	65	65	65		5	
JDB-JSP-45 × 350		350	80	75	75	80		5	

FZ 钢球保持架
FZ Ball Retainer Bearing

优点与用途 Advantages and Application

传统的具有相对运动的孔与轴是有一定间隙的，并孔与轴之间运动磨擦系数较大，使用钢球保持圈后，使轴与孔不直接接触，而是通过中间微量过盈的钢球，因而运动精度高，滚动摩擦代替动摩擦，滚动灵活，摩擦系数小，使用寿命长，在既有转动、又有移动的场合，用无油或加油的轴套与轴相配合，虽然能满足，但运动精度较低，用滚动轴承，只能满足轴相对转动的场合，而钢球保持圈，则上述二个条件均得到满足，目前已广泛应用于冷冲模滚动模架、高精度机床、机床附件以及要求高精度轴向或轴径向同时运动场合。

As the traditional work-craft has some grudge between bushing with posts, and the coefficient of friction is larger. now we have changed the work-ways to steel-ball directly face to face guide bushing, so the precision is improved. it composes of both active roll and lower friction coefficient, now they have been widely used in punching machine, die machine, high precision machine which need rotation and vertical motion.

产品简介 Intruduction

FZH（铜基）、FZL（铝基）、FZP（树脂基）钢球保持固，分别以铜合金、硬铝合金、POM树脂为基体，在其外圆表面上，加工出排列有序、大小适当，形状特殊的孔穴，在其孔穴中镶入滚动轴承钢球。采用最新的沟槽圆周锁球工艺，有效地解决了传统式锁球和压痕式锁球不能完全防止钢球脱落的难题。孔底加工出90° 止口使钢球在孔内自由转动而不脱落。由于钢球的直径大于保持圈的壁厚，所以在使用时钢球高出保持圈内、外圆表面，直接与相配的孔与轴接触，使基体(保持圈)浮于中间，并相配的孔与轴半径之差小于钢球直径，即钢球与之配合为过盈配合，配合精度高，轴与孔相对运动灵活。是保持圈的更新换代产品。

FZH, FZL, FZP, ball retainer are as copper, aluminium, POM base. they are machined some regular holes and embedded the steel-ball into. The new work-craft will prevent the ball getting out of as old. as the ball diameter is larger than the retainer s thickness, so it will face to face directly with 90° guide bushing, that will bring high precision match now the ball retainer series items are designed to rotate on the post, as well as maintainits vertical motion. we believe this will give you the benefit of increasing accijracy.

相配零件的要求
Requirements for Installed Components

1.导套：材料GCrl5、YB9，热处理，硬度HRC62~66，技术条件按GB/T12446与轴配合应具有0.01-0.02径向过盈量，表面粗糙度为

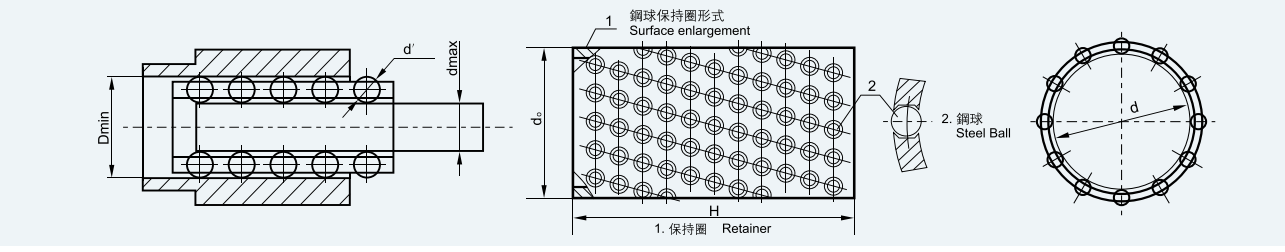
2.轴：材料GCrl5、YB9，热处理，硬度HRC62~66，技术条件按GB/T12446，轴的公差采用h5，表面粗糙度为 $\sqrt{0.05}$

3.测量：用通用的测量手段（气动量仪、外径千分尺、内径千分表等）测量轴导套和钢球的尺寸偏差值，即可求出配合后的过盈量，即Ymax=dmax+2d'-Dmln，要求过盈量为0.01-0.02mm²

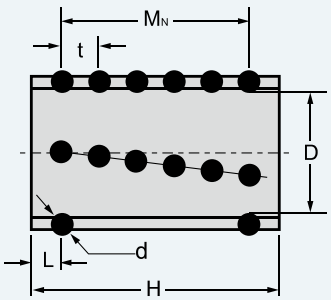
1. Guide bushing: material GCrl5, YB9, heat treament HRC62-66, technique condition according to GB/T12446. Request 0.01-0.02mm² the surface roughness is $\sqrt{0.05}$

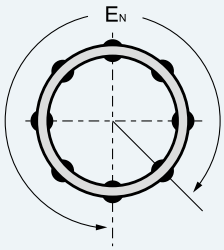
2. Guidie posts: matrial GRrl5, TB9, heat treament HRC62-66, the tolerance of shaft is h5, the surface roughness is $\sqrt{0.05}$

3.Size test: it is tested by outside micrometer & dial gauge as usual. The ymax (ymax+2d'-dmin) request 0.01-0.02 mm²



FZ 钢球保持架
FZ Ball Retainer Bearing





Model	D	H	d	E_N	M_N	Balls	t	L
FZ(X)-1950	19	50	3	12	8	96	5.5	5.75
FZ(X)-1960	19	60	3	12	10	120	5.5	5.25
FZ(X)-2050	20	50	3	12	8	96	5.5	5.75
FZ(X)-2060	20	60	3	12	10	120	5.5	5.25
FZ(X)-2250	22	50	3	14	8	112	5.5	5.75
FZ(X)-2260	22	60	3	14	10	140	5.5	5.25
FZ(X)-2360	23	60	3	14	10	140	5.5	5.25
FZ(X)-2475	24	75	3	16	13	208	5.45	4.8
FZ(X)-2550	25	50	3	16	8	128	5.5	5.75
FZ(X)-2560	25	60	3	16	10	160	5.5	5.25
FZ(X)-2575	25	75	3	16	13	208	5.45	4.8
FZ(X)-2775	27	75	3	16	13	208	5.45	4.8
FZ(X)-2860	28	60	4	14	8	112	6.5	7.25
FZ(X)-2875	28	75	4	14	11	154	6.5	5.0
FZ(X)-3060	30	60	4	14	8	112	6.5	7.25
FZ(X)-3075	30	75	4	14	11	154	6.5	5.0
FZ(X)-3260	32	60	4	16	8	128	6.5	7.25
FZ(X)-3275	32	75	4	16	11	176	6.5	5.0
FZ(X)-3290	32	90	4	16	13	208	6.5	6.0
FZ(X)-3685	36	85	4	16	12	192	6.5	6.75
FZ(X)-3690	36	90	4	16	13	208	6.5	6.0
FZ(X)-3870	38	70	5	16	8	128	8.0	7.0
FZ(X)-3890	38	90	5	16	11	176	7.9	5.5
FZ(X)-4090	40	90	5	16	11	176	7.9	5.5
FZ(X)-4590	45	90	5	18	11	198	7.9	5.5
FZ(X)-45110	45	110	5	18	13	234	8.0	7.0
FZ(X)-5090	50	90	5	20	11	220	7.9	5.5
FZ(X)-50110	50	110	5	20	13	260	8.0	7.0
FZ(X)-6090	60	90	5	22	11	242	7.9	5.5
FZ(X)-60110	60	110	5	22	13	286	8.0	7.0
FZ(X)-80130	80	130	5	28	15	420	8.0	9.0

设计资料

DESIGN DATA

轴承 PV 值
PV value of the bushing

定义 Definition

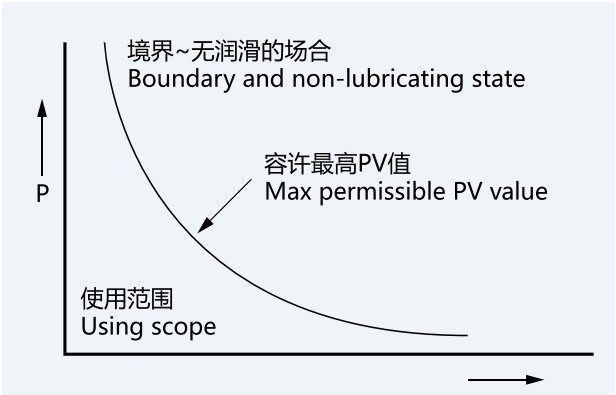
○ 负载压力 P: 定义为负荷除以轴承承受面的正投影面积（单位：N/mm2);
○ 运转速度 V：定义为对偶面上的相对线速度（单位：m/s）；
○ PV 值：定义为轴承压力 P 和速度 V 的乘积（单位：N/mm·m/s）；
○ 容许最高 PV 值：< 容许最高压力 P × 容许最高速度 V（单位：N/mm2·m/s）。

○ Load Pressure P:Load pressure equals to the result gained by making the value of load pressure divide the vertical shade projected by the load-shouldering surface of the bushing (Unit: N/mm).
○ Running Velocity V: Defined running velocity as the relative linear velocity against the mating surface (Unit: N/mm).
○ PV Value:Define PV value as the result gained by multiplying the load value P and the velocity V (Unit: N/mm·m/s).
○ permissible PV value:Max permissible value shall be smaller than the value gained by multiplying the max permissible pressure and the max permissible velocity. (Unit: N/mm·m/s).

容许最高 PV 值 Max permissible PV value

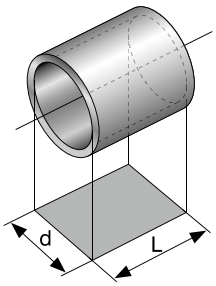
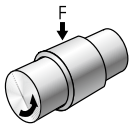
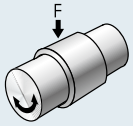
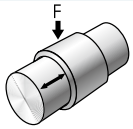
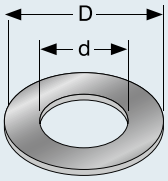
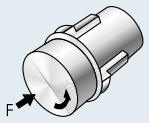
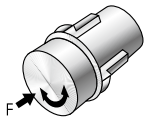
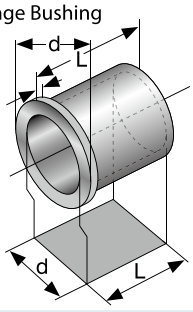
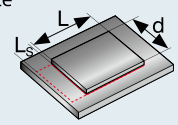
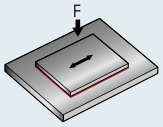
PV 值达到极限值时，轴承可以短时间的运转。在连续的运转时，容许最高 PV 值的选择取决于运转寿命的要求。设计时要求：容许最高 PV 值 < 容许最高压力 P* 容许最高速度 V。见右图：

The bushing can run for a short time when achieves its max PV value. It's the running service life requirement that decides the requirement for the value. In bushing design, we require that the max permissible PV value shall be smaller than the value gained by multiplying the max permissible load pressure and the max permissible running velocity.



容许最高 PV 值
Max permissible PV value

轴承 PV 值
PV value of the bushing

轴套 BUSHING		压力 PRESSURE, P PN/mm² {kgf/cm²}	速度 VELOCITY, V m/s {m/min}	PV值 PV Value N/mm²*m/s {kgf/cm²*m/min}
直套 Sleeve Bushing 	1.径向单向旋转 Rotating motion in single direction of radial journal 	$\frac{F}{dL}$ $\left\{\frac{10^2F}{dL}\right\}$	$\frac{\pi dn}{10^3}$ $\left\{\frac{\pi dn}{10^3}\right\}$	$\frac{\pi Fn}{10^3L}$ $\left\{\frac{\pi Fn}{10L}\right\}$
	2.摇摆运动 Oscillating motion 	$\frac{F}{dL}$ $\left\{\frac{10^2F}{dL}\right\}$	$\frac{dC\theta}{10^3}$ $\left\{\frac{\pi dc\theta}{180\times10^3}\right\}$	$\frac{FC\theta}{10^3L}$ $\left\{\frac{\pi Fc\theta}{180\times10^2L}\right\}$
	3.往复运动 Reciprocating motion 	$\frac{F}{dL}$ $\left\{\frac{10^2F}{dL}\right\}$	$\frac{2cS}{10^3}$ $\left\{\frac{2cS}{10^3}\right\}$	$\frac{2FcS}{10^3dL}$ $\left\{\frac{FcS}{5dL}\right\}$
止推垫片 Thrust Washer 	1.旋转 Rotating motion 	$\frac{4F}{\pi(D^2-d^2)}$ $\left\{\frac{400F}{\pi(D^2-d^2)}\right\}$	$\frac{\pi Dn}{10^3}$ $\left\{\frac{\pi Dn}{10^3}\right\}$	$\frac{4FDn}{10^3(D^2-d^2)}$ $\left\{\frac{4FDn}{10(D^2-d^2)}\right\}$
	2.摇摆运动 Oscillating motion 	$\frac{4F}{\pi(D^2-d^2)}$ $\left\{\frac{400F}{\pi(D^2-d^2)}\right\}$	$\frac{DC\theta}{10^3}$ $\left\{\frac{\pi Dc\theta}{180\times10^3}\right\}$	$\frac{4FDC\theta}{10^3\pi(D^2-d^2)}$ $\left\{\frac{4FDc\theta}{180\times10(D^2-d^2)}\right\}$
翻边轴套 Flange Bushing 	1.直套 Sleeve Bushing	翻边直套承载计算用上述直套承载计算公式，但 L=l+t。 Use above formulas for sleeve bushing (L=l+t)	翻边直套轴速度计算用上述直套速度计算公式。 Use above formulas for sleeve bushing	翻边直套轴PV值计算用上述直套PV值计算公式。 Use above formulas for sleeve bushing
	2.法兰面 Flange surface	翻边法兰面承载计算按上述垫片承载计算公式。 Use above formulas for thrust whsher	翻边法兰面速度计算按上述垫片计算公式。 Use above formulas for thrust whsher	翻边法兰面PV值计算按上述垫片PV值计算公式。 Use above formulas for thrust whsher
滑块 Slide Plate 	1.往复运动 Reciprocating motion 	$\frac{F}{BL}$ $\left\{\frac{10^2F}{WL}\right\}$	$\frac{2cS}{10^3}$ $\left\{\frac{2cS}{10^3}\right\}$	$\frac{2FcS}{10^3BL}$ $\left\{\frac{FcS}{5WL}\right\}$

F ：承载 ····· N {kgf}
N ：转速 ····· S-1{rpm}
c ：往复圆周速度或摇摆 ····· S-1{cpm}
S ：往复运动距离 ····· m {mm²}
θ ：摇摆角度 ····· rad { }
d ：轴套内径 ····· mm² {mm²}
D ：轴套外径 ····· mm² {mm²}
L ：轴套长度 ····· mm² {mm²}
W ：板材或滑动宽度 ····· mm² {mm²}

轴承的尺寸设计
Design of the bushing's dimension

轴承内径 Inside diameter of the bushing

轴承内径，一般由配合轴的轴径所决定。

Generally, the inside diameter of the bushing depends on the diameter of its mating axis.

轴承长度 Length of the bushing

轴承的长度由轴承面压决定。长度越长，其所承受的面压相对减少，轴承负载较轻，但此时可能造成偏位接触，或冷却效果降低，导致轴承寿命减短，故对此情况特别注意；相反的，轴承长度太短时，润滑油很快从轴承面流出，因此很难形成油膜，轴承性能即降低。一般地，轴承长度 / 轴承内径 L/d=0.5 ~ 3，但须特别注意在高负荷重时，易引起偏位接触，高速时易引起的发热情形，此种条件宜取 L/d<1.0 较适当。

The length of the bushing depends on the size of the pressure-shouldering surface. The longer the bushing, the less pressure at the surface, for the longer bushing, the load on the bushing is relatively lessened. But simultaneously, it may result in deviation contact or lower cooling efficiency and thus shorten the service life of the bushing. On the contrary, if the length of the bushing is too short, lubricating grease may quickly flow out of the bushing. Therefore, it hardly forms a grease film and capability of the bushing is accordingly debased.

(L/d 对轴承影响的比较表，特别是含油轴承)

A comparison of L/d's effect on the bushings, especially oil lubricating bushings

短轴承（d>L)Short bushing（d>L)	比较条件 Comparison items	长轴承（d<L)Long bushing（d<L)
小 Small	油膜压力 Force on the oil film	大 Great
多 Strong	冷却能力 Cooling ability	少 Weak
不能太大 Can not be too high	面压 Surface pressure	可取大值 Can be high
高 High	轴承偏位荷重的安全性 Safety against beating deviation	低 Low
小 Weak	轴承的刚性 Bushing rigidity	大 Strong
小 Week	吸振能力 Shock absorbing ability	大 Strong
小 Small	空间 Space	大 Large

轴承壁厚 Bushing thickness

标准自润滑复合轴承，壁厚小为其主要优点之一，标准壁厚为 0.5mm, 0.75mm, 1.0mm, 1.5mm, 2.0mm, 2.5mm。

非标滑动轴承，在设计轴承厚度时，主要参考数据厚径比：SB/D。

A) 薄壁金属滑动轴承，厚径比 SB/D=0.03 ~ 0.06

B) 厚壁金属滑动轴承，厚径比 SB/D=0.08 ~ 0.12

C) 塑料树脂滑动轴承，厚径比 SB/D=0.1 ~ 0.15

The main advantage of standard composite self-lubricating bushings rest with their thin wall thickness. Standard thickness can be 0.5mm, 0.75mm, 1.0mm, 1.5mm, 2.0mm, 2.5mm.

In thickness design of the non-standard gliding bushing, the designer could consult the following proportion of SB and D.

A) For thin wall thickness gliding metallic bushing, proportion between SB and D equals to 0.03 ~ 0.06.

B) For thin wall thickness gliding metallic bushing, proportion between SB and D equals to 0.08 ~ 0.12

C) For plastic gliding bushing, proportion between SB and D equals to 0.1 ~ 0.12

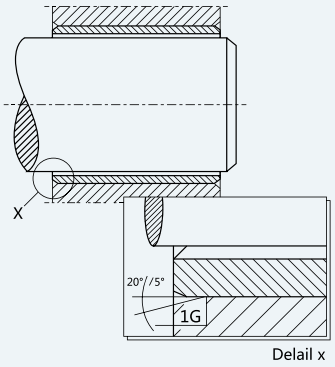
相配座孔的设计
Design of the matinghousing

直轴承 Cylindrical bushing

相配座孔应倒角 fG × 20o ± 5o，fG 的大小根据座孔直径 dH。

For cylindrical bushing, its mating housing must be chamfered according to the formula:
fG × 20o ± 5. Value of fG depends on dH, the diameter of the housing.

座孔直径 Diameter of the housing dH	倒角尺寸 Chamfered fG
dH≤30	0.8 ± 0.3
30<dH≤80	1.2 ± 0.4
80<dH≤180	1.8 ± 0.8
180<dH	2.5 ± 1.0

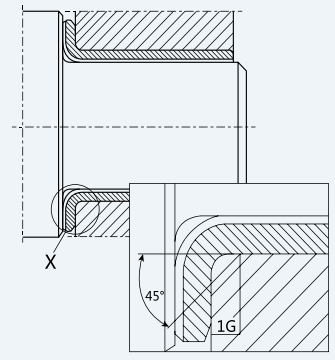


翻边轴承 Flanged bushing

对于翻边轴承相配座孔，座孔要求提供足够大的倒角以防止翻边轴承翻边半径处的变形。相配座孔倒角 fG × 45o ± 5°

As to the housing mating for flanged bushings, it requires the housing being chamfered big enough to avoid the deformation at the flanged circle. The housing mating shall be chamfered according to the formula: fG × 45o ± 5°

座孔直径 Diameter of the housing dH	倒角尺寸 Chamfered fG
dH≤10	1.2 ± 0.2
10<dH	1.7 ± 0.2



轴承倒角 Bushing Chamfer

为了便于相配轴的安装和避免轴承产生偏位负荷。轴承长度方向内外必须倒角，倒角尺寸如下所示：

In order to make fixing easier and avoid deviation load, the bushing must be inner and outer chamfered in the direction of its length. Dimension of the chamfer are showing in the following form.

2.5 壁厚 Wall thickness	外倒角尺寸 Out Chamfer Dimension	内倒角尺寸 Inner Chamfer Dimension
≤0.5	去毛刺 Burr polished	去毛刺 Burr polished
0.75	0.5 ± 0.3 × 20°	0.3+0.2 × 45°
1.0	0.6 ± 0.3 × 20°	0.3+0.2 × 45°
1.5	0.6 ± 0.3 × 20°	0.4+0.2 × 45°
2.0	1.2 ± 0.3 × 20°	0.6+0.2 × 45°
2.5	1.8 ± 0.3 × 20°	0.6+0.2 × 45°

相配轴的设计
Design of the mating axis

直套安装 Straight set of installation

自润滑轴承的性能在很大程度上受相配轴材料表面粗糙度、硬度、表面是否电镀处理的影响，高质量的相配轴表面能够延长轴承的寿命，相反粗糙的相配轴表面会降低轴承的寿命。

Surface roughness, hardness and plating of the mating axis will have great influence on the capability of the self-lubricating bushing. High-quality surface of the mating axis can prolong the life of the bushing while rough surface will shorten the life of the bushing.

相配轴表面粗糙度 Surface roughness of the mating axis

a) 在流体润滑条件下使用的自润滑轴承，相配轴表面粗糙度大时，轴与轴承的凸起部分会切断油膜，造成两者直接接触，所以要求相配轴表面做镜面加工，从而尽可能缩小油膜间隙，使其接近流体润滑的状态，如此轴承性能便可提高。

a) When self-lubricating bushings being used in the condition of fluid lubrication and the surface of the mating axis is faily rough, the convex points on the bushing and its axis will cut the oil film and thus the surface of the axis and the bushing will directly contact with each other. therefore, to improve the capability of the bushing, it requires polishing the surface of the mating axis as smooth as a mirror, thus can reduce the clearance of the oil film and make the film work well.

b) 大多数自润滑轴承在干摩擦或边界润滑条件下使用，不需要像流体润滑条件下那样要求相配轴表面做镜面加工，只要控制其相配轴表面粗糙度 Ra=0.32 ~ 1.25 的范围即可。

b) For most self-lubricating bushings applied in the condition of dry friction or marginal lubrication,a controlled roughness from 0.32 to 1.25 is acceptable and there is no need to polish the surface of the mating axis as smooth as a mirror.

相配轴硬度 Hardness of the mating axis

无硬性杂质侵入时，使用下表推荐的轴材料及硬度，即可得到良好的效果；相反地，尽可能使用硬度较高的相配轴材料。

If there is no hard article in the lubricating condition, good performance can be achieved by using bushing materials and hardness recommended in the following form. If not, it would be better to use the harder material for the mating axis.

	轴材质 Material quality of the axis	硬度 Hardness
自润滑轴承 Self-lubricating bushing	SS41(Q255B) 一般结构钢 Common Structural steel	HB220 以上 Above 220
	S25C(25#) 以上碳素结构钢 Carbon Structural Steel	左列轴材质的硬度依此类推
	SUS、SUH 耐腐蚀性钢（高温·水中用）镀铬钢等 SUS、SUH anti-erosion steel(in high temperature and water), and chrome plated steel,etc.	

在高负荷、摇摆运动的条件下，必须将相配轴进行热处理，热处理后的硬度依据材料类推。

Under running condition with heavy load and rapid swing, the mating axis must be heat-treated. The after treatment hardness will be decided by the material of the axis.

相配轴的设计
Design of the mating axis

相配轴表面处理 Surface treatment of the mating axis

相配轴表面处理的目的在于：

a) 提高耐腐蚀性

b) 提高表面硬度

c) 使表面平滑，提高润滑性。

Aim of this treatment:

a) Improve anti-erosion quality

b) Strengthen surface hardness

c) Smooth the surface and enhance lubricating capability

在相配轴上电镀，可提高其耐腐蚀性，而且有效的降低粗糙摩耗，以及提高润滑性等; 相配轴生锈时，所产生的硬氧化物与异物侵入，同样是摩耗原因之一，因此，建议使用者在相配轴上镀硬铬。若在海水中等类似的腐蚀条件下，相配轴必须电镀上二至三层硬铬。

If the mating axis was plated, it can not only improve the anti-erosion capability but also will enhance the lubricating capability, as with a plated coating, friction can be effectively decreased. Hard oxides and other impurities caused by the axis rust constitute one of the main abrasion causes. Therefore, we recommend the user to have the mating axis chrome plated. If the bushings are going to be used in sea water or similar erosive conditions, their mating axis must be chrome plated for 2 or 3 layers.

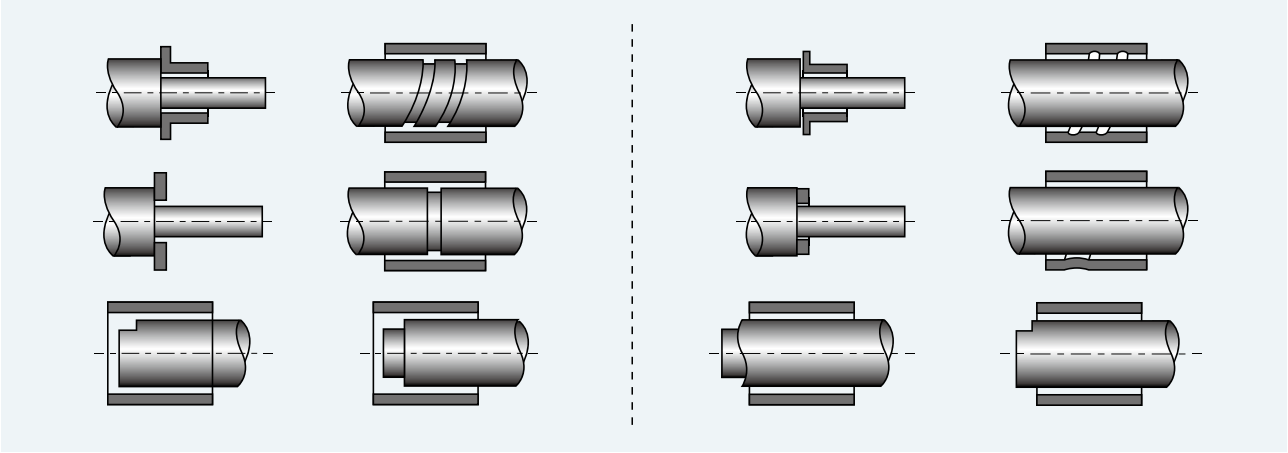
相配轴的机构设计 Structural design of the mating axis

相配轴表面粗糙、尖角毛刺、沟槽会损坏滑动层，如下图所示：

Surface roughness and keen-edged burrs or dents on the surface of the mating axis will destroy the gliding layer. Please see the following illustration for the qualified mating axis.

不正确的相配轴结构
Qualified

正确的相配轴结构
Unqualified



轴承使用寿命的计算
Calculation for the service life of bushing

自润滑轴承的寿命，除激烈的烧焦情况外，通常是以轴承内径的磨耗来决定的。自润滑轴承在干摩擦状态、边界润滑、流体润滑状态下使用，其磨耗情形有很大差异。决定自润滑轴承寿命主要因素有：负载特性及方向、润滑条件、运转速度、环境温度、相配轴硬度、对偶面的粗糙度、相配轴材料、周围空气（气体）的性质等，所以通过计算来求取确切的磨耗量是非常困难的。

With the exception of being burnt, the service life of self-lubricating bushing depends on the abrasion degree of the bushing's inner diameter. In conditions like dry friction, boundary lubrication and oil lubrication, the abrasion of the same bushing will be different. Main factors that may influence the service life are: character and direction of the load, lubrication condition, running speed, environment temperature, hardness of the mating axis, roughness of the mating surface, material of the mating axis, air quality around etc. Therefore, it's difficult to calculate the actual abrasion quantity.

在不考虑速度及负荷对轴承的影响、轴承运动方向的差异、润滑的种类、配合间隙的大小、表面粗糙度及杂志渗入程度 --- 等等因素，可以给出磨耗量 W 计算的经验公式：

Regardless the factors like influence from the load and speed, difference caused by running direction, kinds of lubricating oil, mating clearance, roughness and impurities penetration degree, the abrasion W can be calculated by the following formula.

$W=K\cdot P\cdot V\cdot T$ (mm^2)

P: 负载压力 Load pressure(N/mm^2)

V: 运转速度 Running velocity(m/s)；

K: 摩耗系数 Abrasion coefficient(mm^2/ ($N/mm^2\cdot$ m/s· Hr))

T: 运转时间 Running time (Hr)

不同润滑条件下，实验所得的摩耗系数 K 值见下表：

Abrasion coefficient K gained under different lubrication conditions in the laboratory. Consult the following form for K value.

润滑条件 Lubrication conditions $mm^2/(N/mm^2\cdot$ m/s· Hr)	
无润滑（干摩擦） Non-lubrication(dry friction)	3×10^{-3} ~ 6×10^{-4}
定期润滑（边界润滑） Periodical lubrication(marginal lubrication)	3×10^{-4} ~ 6×10^{-5}
油润滑（流体润滑） Oil lubrication(fluids lubrication)	3×10^{-5} ~ 6×10^{-6}

轴承装配过盈量的计算
Calculation of interference for bushing fixing

轴承压入座孔前：轴承外径 > 座孔内径。这种过盈装配后，在座孔里面产生较强的应力，使轴承内圆保证有较高的圆度，又能更好地固定住轴承，防止轴承在座孔内打滑磨损。过盈量的计算按下列公式：

Before the bushing is pressed into the housing: as the outside diameter of the bushing is bigger than the inside diameter of the housing, strong pressure can be available in the housing. And also this kind of fixing can assure the roundness of the bushing and make the bushing well fixed, avoiding abrasion caused by sliding of the bushing in the housing. The interference can be calculated by the following formula:

○ 过盈量最小值 б min= 轴承外径最小值 Dmin- 座孔内径最大值 DHmax

○ 过盈量最大值 б max= 轴承外径最大值 Dmax- 座孔内径最小值 DHmin

○ Min interference = Min OD of the bushing- Max ID of the housing

○ Max interference = Max OD of the bushing- Min ID of the housing

轴承装配后内径的计算
Calculation of the after-fixing inside diameter of the bushing

假设忽略装配后座孔的膨胀量。装配后轴承计算按下列公式：

Afer bushing mounting, providing that there is no expansion of the housing, the calculation can be carried out by the following formula.

○ 轴承内径最小值 dmin= 座孔内径最小值 Dmin-2× 轴承壁厚最大值 S

○ 轴承内径最大值 dmax= 座孔内径最大值 Dmin-2× 轴承壁厚最小值 S

○ Min ID of the bushing d=Min ID of the housing D-2 × Max thickness of the bushing S

○ Max ID of the bushing d=Min ID of the housing D-2 × Min thickness of the bushing S

轴承装配后配合间隙的计算
Clearance calculation after bushing fixing

轴承装配后，轴承的内径和轴之间保证合理的间隙是非常有必要的。配合间隙的计算按下列公式：

It's necessary to have an approptiate clearance between the inner surface of the bushing and the axis after bushing mounting. The matching clearance can be calculated by the following formula:

○ 间隙最小值△ min= 装配后轴承内径最小值 d min- 轴径最大值 dj max

○ 间隙最大值△ max= 装配后轴承内径最大值 d max- 轴径最小值 dj min

○ Min clearance △ min=Min ID of the bushing after fixing d min-Max diameter of the axis djmax

○ Max clearance △ max=Min ID of the bushing after fixing d max-Min diameter of the axis djmin

轴承的装配
Bushing fixing

装配时压入力 F 的计算公式
Formula for calculation the pressing-in force when fix the bushing

$$F=0.9\cdot t\cdot b\cdot \triangle \cdot \frac{б}{D} Б\ (N)$$

t: 除去复合层后基本的厚度 (mm^2)

b: 轴承高度 (mm^2)

△ : 应力系数 =1.9 × 105（ N/mm^2)B

б max: 过盈量 (mm^2)

D: 轴承外径 (mm^2)

< 注 >：此时轴承外圆与座孔内圆之间的摩擦系数通常在 0.15 左右。

举例说明：

KDB100 2015(标准产品) 压入 ϕ 23 +0.021 0 的座孔，求此时的压入力 F 大小。

计算：

知壁厚 SB=1.5mm^2，复合层厚 0.3mm^2，基体厚度 t=1.5-0.3=1.2mm^2；轴承高度 b=15；轴承外径 D=23mm^2; 过盈量 б min=0.014mm^2，过盈量 б max=0.075mm^2。

t: Thickness of the bushing after polymer laymers had removed(mm^2)

b: Height of the bushing(mm^2)

△ : Stress coefficient=1.9 × 105（ N/mm^2)B

б max: interference(mm^2)

D: OD of the bushing (mm^2)

Note: In this case, value of friction coefficient between the bushing backing and the Housing is around 0.15.

Case illustrtion

Calculating the pressing-in force F used to press KDB100 2015(standard)the housing ϕ 23+0.021 0

Calculation:

Pre-known: Wall thickness S=1.5mm2, thickness of the polymer layer=0.3mm^2, thickness of the base plate t=1.5-0.3=1.2mm^2; height of the bushing b=15; OD of the bushing D=23mm^2, surplus=0.014mm^2, surplus=0.075mm^2

$$Fmin=0.9\cdot t\cdot b\cdot \triangle \cdot \frac{б\ max}{D}=0.9\times 1.2\times 15\times 1.9\times 105\times \frac{0.014}{23}(N)\approx 1880(N)$$

$$Fmax=0.9\cdot t\cdot b\cdot \triangle \cdot \frac{б\ max}{D}=0.9\times 1.2\times 15\times 1.9\times 105\times \frac{0.075}{23}(N)\approx 10040(N)$$

所以，安装时压入力 F=1880 ~ 10040 N。

Therefore, the pressing in force for fixing F=1880 ~ 10040 N

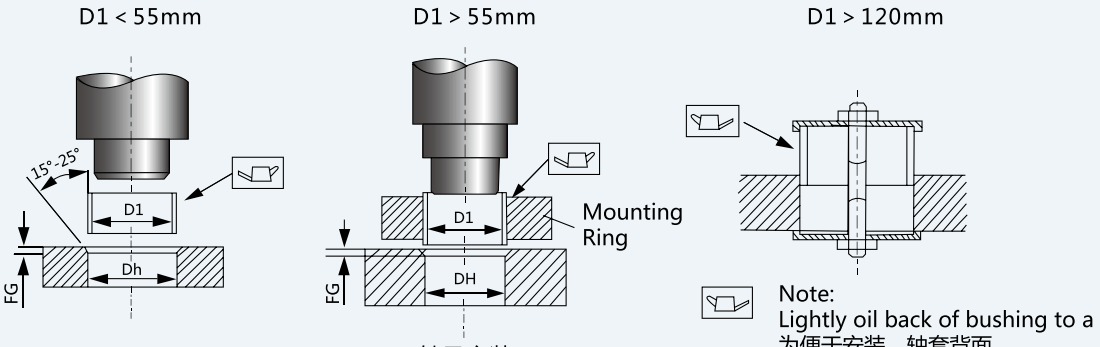
装配方法 Fixing methods

1）直轴承的装配方法 Fixing methods for cylindrical bushings

芯轴引导棒的直径比安装后的轴承直径小 0.1 ~ 0.3mm^2。芯轴最好进行热处理。为便于压装，可在轴承外径面上图一点油，请勿以铁锤直接敲打衬套的端面等冲击方法压入；安装大直径 d>55mm^2 轴承时，必须采取措施，校准轴承接缝。

Diameter of the pressing-in arbor is 0.1 ~ 0.3mm^2 smaller than the diameter of the bushing. It's better to have the core axis heat-treated. For easier fixing, we can add a light coating of oil on the bushing backing. Make sure not to fix the bushing into the housing by hammering its end surface. When the diameter of the bushing is more than 55mm^2, necessary measures must be taken to calibrate the seam position of bushing.

轴承的装配
Bushing fixing

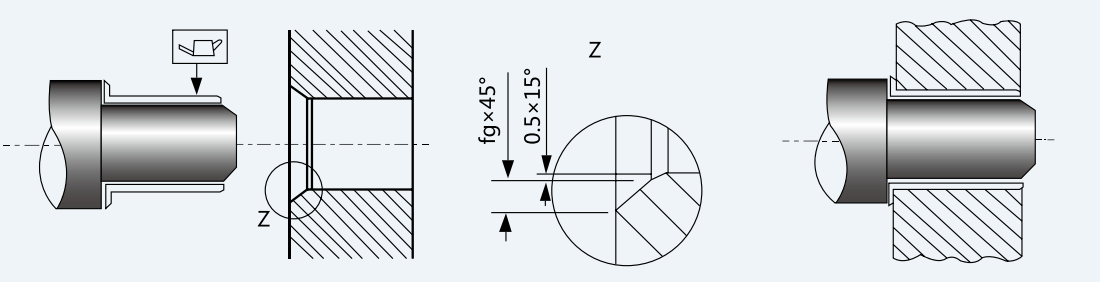


轴承安装
Fitting of bushing

2) 翻边轴承的装配方法 Fixing methods for flanged bushings

对于翻边轴承，装配时翻边处的半径应该考虑，座孔要求提供足够大的倒角，以防止翻边轴承翻边半径处的变形。翻边轴承的压装方法和直轴承基本相同，但要求翻边轴承压装芯轴凸缘外径比直轴承压装芯轴凸缘外径大些。

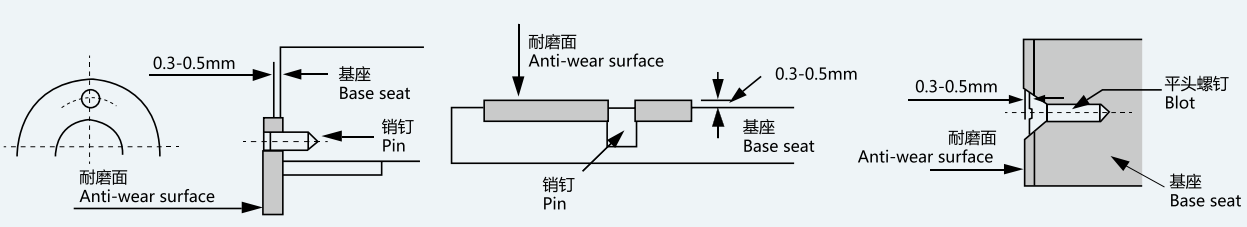
For flanged bushings, the radius at the flanged folds must be taken into account. A sufficiently large chamfer must be provided on the housing to prevent flanged bush fouling in the area of the radius. Fixing methods for the flanged bushings are similar to that for cylindrical bushings. However, the diameter of the convex part on the pressing-in arbor for flanged bushings needs to be a little bigger.



3) 止推垫片、平板的装配方法 Fixing methods for thrust washers and gliding plate.

我们推荐采用定销、沉头镙钉安装止推垫片， 采用镶嵌式安装平板。安装止推垫片或平板时，要求润滑层比基座高 0.3 ~ 0.5mm^2 thick.

We recommend using a single dowel or countersunk head screw to fix the thrust washer. For the gliding plate we recomend the methods of enchasing. When fix the thrust washer or the gliding plate, the sliding layer shall be 0.3~0.5mm^2 thicker than base seat.



固定销钉安装
Installing the fixed pin

镶嵌式安装（平板）
Embeded fixing(Plate)

沉头镙钉安装
Blot fixing

轴承的装配
Bushing fixing

假如采用以上方法安装不合适或者不经济的话，可采用粘着剂、激光焊接或高温焊接。采用粘着剂安装时，可以不用固定销，但其效果较差。粘着剂以环氧树脂系的合成树脂较适合。当使用激光焊接或高温焊接时，不应该超过润滑层的最高承受温度。

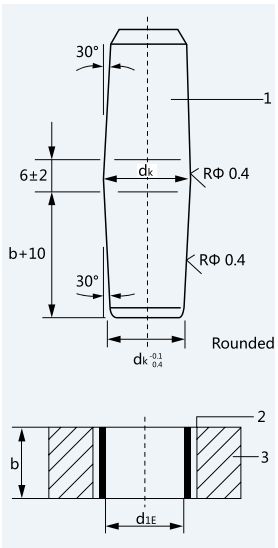
If the above fixing methods are not appropriate or economic, you can adopt laser welding, adhesive fixing or high temperature welding. When using adhesive fixing, dowel is optional, but the fixing effect may not be good. Adhesives like oxidized rosin and synthetic rosin is more appropriate. When using laser welding or high temperature welding, the temperature shall not excess the max temperature that the lubricating layer could bear.

轴承安装后内径的校准 Inside diameter alignment after fixing

1) 卷制轴承内径的校准 Inside diameter alignment for common bushings

轴承安装后，通常可以直接使用。在配合间隙要求增大、或安装时由于配合过盈量太大而造成内孔变形时，可采用下图所示整形工具使轴承内孔达到所要求的尺寸，整形工具直径 d 不宜太大，否则会降低轴承寿命。见图。

Normally the bushing can be immediately put into use after it has been fixed. But if there's need to enlarge the matching clearance or due to too much surplus the inner bore of the bushing deformed, we can use the following showed molding tools to make the inner bore meet the required dimensions. Diameter of the molding tools shall not be too big; otherwise, life of the bushing may decrease. Please see the picture:

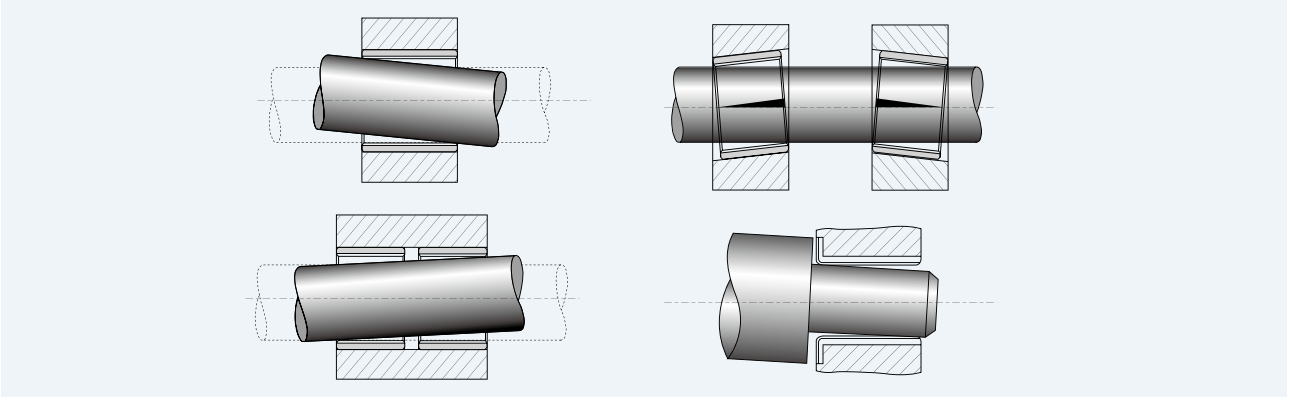


轴承内径 Dia of the axis d	要求内径 Required ID dE	整形工具直径 Diameter of the shaping tools dk
d	d	d+0.03
	d+0.02	d+0.06
	d+0.03	d+0.08
	d+0.04	d+0.10

2) 相配轴的校准 Alignment of the mating arbor

不论是径向还是轴向滑动轴承，为了避免负荷集中，安装时都要对其平行度进行校准，要求在整个宽度范围内，轴与轴承之间平行度不超出 0.02mm^2。

In order to avoid load centralization, when fixing the bushing, radial or axial movement, parallelism between the bushing and the arbor must be aligned. It requires the parallelism not exceed 0.02mm^2.



初始装配后轴承的维护
Bushing maintenance after initial fixing

装配后刚开始使用轴承时，应低载缓慢运转，这样做有以下好处：

For the first running after bushing was fixed, the bushing shall be worked under situations of light load and low speed, which will have the following benefits:

1) 使轴与轴承表面凹凸不平的平滑化，使支持轴承荷重的局部凸出面平滑

2) 修正轴承变形所致的安装误差，及凹凸的表面平滑，增加接触面积。

1) Smooth the surface of the bushing and its mating axis and smooth the partial convex part that shoulder load.

2) Rectify fixing tolerance caused by bushing deformation; smooth the surface and increase contact surface.

轴承的储存
Bushing store

轴承提供卷装或袋装，外纸箱或木箱，轴承应储藏在干净清洁、防锈的环境下。

贮存时要注意避免以下场所：

1) 阳光能直射的场所。

2) 高温高湿的场所。

3) 有水、酸碱腐蚀性液体的场所。

4) 避免重物放置其上、防止其变形。

Bushings will initially be roll packed or plastic bag packed and then will be secondly packed in carton or wooden box. Packed bushings shall be stored in clean and rust-resistant environment.

Avoid storing bushings in the following places

1) Place vertically in the sun

2) Place of high temperature and moisture

3) Place with water and other acid or alkali erosive liquids.

4) Do not place heavy articles on the carton to avoid bushing deformation

卷制轴承的检验方法
Checking methods for wrapped bushes

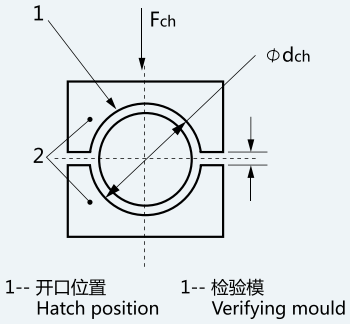
卷制轴承外径的检验方法 Methods for checking the outside diameter

1) 加压检测法（根据 DIN1494-2 检验方法 A) Load checking

检验胎由两半圆检验模组成，检验时，用校准芯轴 dch.2 校准零位，轴承的开缝置于检验模的顶部，然后两半模相向施加检验载荷 Fch, 由读数装置获得检验模下移的距离△ z。

The checking rig consists of two checking block halves. Align the "zero" position of the checking blocks by a setting plug dch. 2 and make the bush's split place at the upper halve of the checking blocks and then add the same checking load Fch on both of the checking halves. Read the moving distance of the halves displayed on the distance indicator and record the reading △ z.

卷制轴承的检验方法
Checking methods for wrapped bushes



DIN1494-2 测试 Testing A

检验模和芯棒
Verify mould and mandrel

dch1=dch2= mm²

试验力
Testing load

Fch=

极限
Limit

△ 2= e= mm²

外径
Outer diameter

D= to mm²

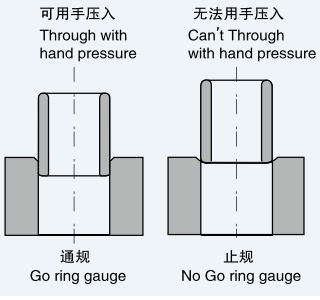
2）环规检测法（根据 DIN 1494-2 检验方法 B） Measuring of gauge

检验采用通、止环规进行检测，用手（最大力 250N) 可将轴承推入并通过通环规；相同力情况下，不能进入止环规。

注：在某些情况下，例如：卷制轴承不圆或接缝太大，检验精度可能受到影响。

The checking is carried out by two ring gauges,a "GO" ring gauge and a "NO GO" ring gauge. It must be possible to press the bushing in "GO" ring gauge with hand pressure(max 250N). With the same force it must not be possible to press the bushing in "NO GO" ring gauge.

Note: In some cases, such as the bushing with roundness problem,or the butt joints not close tightly, the accuracy of the checking may be affected.

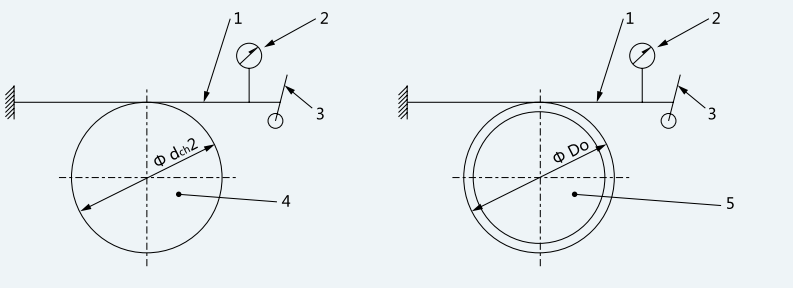


3）带尺检测法（根据 ISO3547-2 检验方法 D） Measuring of rule

为了测量尺寸较大的轴承外径，可以用带尺来测量圆周长。用测量带尺在轴承宽度的中线上沿轴承 360° ，施加足够的拉力使用使开口闭合。测量带尺绕外径等于轴承公称外径 Do 的定位芯轴进行标定。指示装置放置于测量带尺的自由端，并调至标定尺寸。在轴承检验完成后，周长指示装置读数△ ZD 应为轴承测量值与定位芯轴标定值的差。由此，可计算轴承的外径 Do。

The checking is carried out by two ring gauges,a "GO" ring gauge and a "NO GO" ring gauge. It must be possible to press the bushing in "GO" ring gauge with hand pressure(max 250N). With the same force it must not be possible to press the bushing in "NO GO" ring gauge.

Note: In some cases, such as the bushing with roundness problem,or the butt joints not close tightly, the accuracy of the checking may be affected.



1- 精密的测量线；
Precise measuring line
2- 千分表；
Dial indicator
3- 拉力板手；
Pulling spanner
4- 定位芯轴；
Locating spindle
5- 卷制轴承
Wrapped bushing

A) 用定位芯轴校定
Verified by locating spindle

b) 轴承的检验
Measuring of bush

卷制轴承的检验方法
Checking methods for wrapped bushes

卷制轴承内径的检验方法 Inside diameter checking methods for wrapped bushing

1) 塞规检测法（根据 DIN 1494-2 检验方法 C) Plug gauge checking

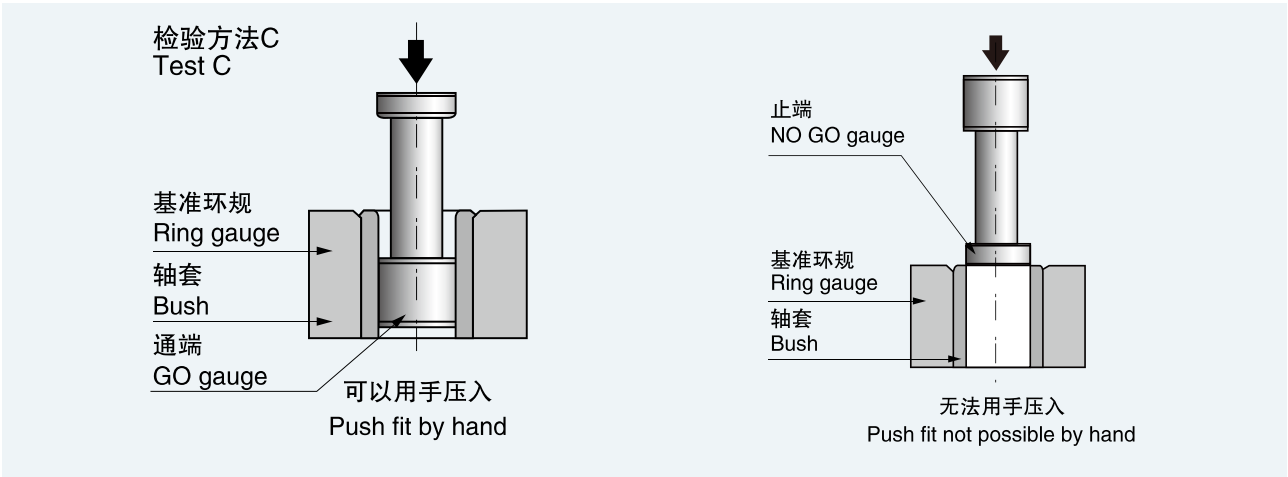
将卷制轴承压入 H7 中值环规，用塞规检测轴承内径。

Press the bush into the ring gauge, the tolerance class of which is H7, and check the inside diameter of the bushing with plug gauges.

2) 壁厚千分尺检测法 Wall thickness micrometer checking methods

用壁厚千分尺检测轴承壁厚，来间接计算轴承内径。注意：根据 DIN1494-2，切记在图纸上不能同时标注检测轴承壁厚和内径。

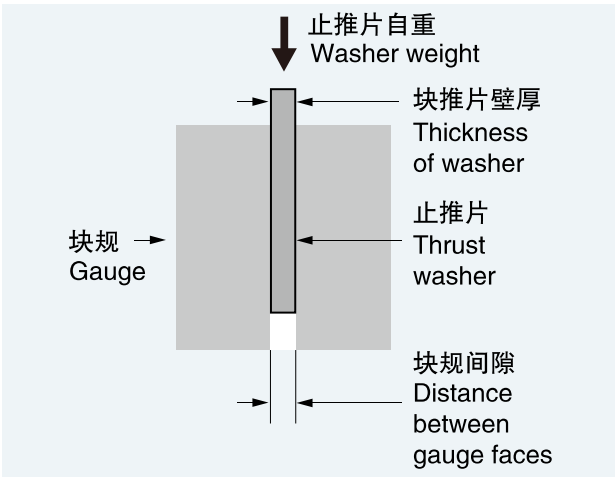
Check the wall thickness of the bushing a wall thickness micrometer and then calculate out the value of the inside diameter. According to ISO3547-2 make sure not to mark both the wall thickness and inside diameter on the drawing.



止推片检验方法 Thrust washer test method

除了厚度公差以外， 垫片的平行度对于垫片和对磨件的使用寿命同样重要。 我们使用比较有效的检验方法来检测垫片的平行度，让垫片依靠自重来通过两个平行块； 当然平行块必须大于垫片本身的规格。

Beside the thickness, the flatness of washer is also important for service life of washer and grinding parts' . We use very helpful test in which the washer falls through the gap between two plain parallel plates of a gauge with its own weight. The plates must be big enough to cover the whole washer.



表面粗糙度对照表
Surface Roughness Table

中国 GB 1031-83 ≈ISO 468-83			英国 BS 1134-61		美国 ASAB 46.1-62		德国 DIN4763-60			瑞士 VSM 10321-62		意大利 UNI 13963-60		波兰 PN 58/M 042-51			捷克 CSNo 14450-61			日本 JIS B0601-70			
Ra (μ)	Rz Ry (μ)	Code	Ra (μ in)(μ)	Code	Ra (μ in)(μ)	Code	Ra (μ)	Rz (μ)	Code	Ra (μ)	Code	Ra (μ)		Ra (μ)	Rz (μ)	Code	Ra (μ)	Rz (μ)	Code	Ra (μ)	Rz (μ)	Rmax (μ)	Code
0.008	0.032													0.01	0.05	√14							
0.01	0.04	0.012 0.008					0.01	0.04															
0.012	0.05																0.012	0.05		(0.0125a)		(0.05S)	
0.016	0.063						0.016	0.063						0.02	0.10	√13							
0.02	0.08	0.025																					
0.025	0.10		1(0.025)		1(0.025)		0.025	0.10		0.025	N1	0.025					0.025	0.10			0.1Z	0.1S	
0.032	0.125													0.04	0.20	√12							
0.04	0.16	0.05					0.04	0.16															
0.05	0.20		2(0.05)		2(0.05)					0.05	N2	0.05					0.05	0.20		0.05a	0.2Z	0.2S	
0.063	0.25						0.063	0.25						0.08	0.40	√11							
0.08	0.32	0.10			3(0.08)							0.08											
0.10	0.40		4(0.10)		4(0.10)		0.10	0.40		0.1	N3	0.1					0.10	0.40		0.1a	0.4Z	0.4S	
0.125	0.50				5(0.125)							0.12		0.16	0.80	√10							
0.16	0.63	Rz0.8			6(0.16)		0.16	0.63				0.16											
0.20	0.80		8(0.2)		8(0.2)					0.2	N4	0.2					0.20	0.80		0.2a	0.8Z	0.8S	
0.25	1				10(0.25)		0.25	1				0.25		0.32	1.60	√9							
0.32	1.25	Rz1.6		16 C LA 8-16 C LA or 8.16 C LA	13(0.32)							0.3							6.3				
0.40	1.6		16(0.4)		16(0.4)		0.40	1.60		0.4	N5	0.4					0.40	1.60		0.4a	1.6Z	1.6S	
0.50	2				20(0.5)					0.5	N6	0.5		0.63	3.20	√8							
0.63	2.5	0.80			25(0.63)		0.63	2.5				0.6											
0.8	3.2		32(0.8)		32(0.8)	16 √						0.8					0.80	3.2		0.8a	3.2Z	3.2S	
1	4				40(1)	16 8 √	1	4				1		1.25	6.30	√7							
1.25	5	1.60			50(1.25)							1.2											
1.6	6.3		63(1.6)		63(1.6)		1.6	6.3		1.6	N7	1.6					1.6	6.3		1.6a	6.3Z	6.3S	
2	8				80(2)							2		2.5	10	√6							
2.5	10	3.2			100(2.5)		2.5	10				2.5											
3.2	12.5		125(3.2)		125(3.2)					3.2	N8	3					3.2	12.5		3.2a	12.5Z	12.5S	
4	16				160(4)		4	16				4		5	20	√5					(18Z)	(18S)	
5	20	6.3			200(5)							5											
6.3	25		250(6.3)		250(6.3)		6.3	25		6.3	N9	6					6.3	25		6.3a	25Z	25S	
8	32											8		10	40	√4					35Z	35S	
10	40	Rz50					10	40				10											
12.5	50		500(12.5)		500(12.5)					12.5	N10	12					12.5	50		12.5a	50Z	50S	
16	63						16	63						20	80	√3							
20	80	25			800(20)																(70Z)	(70S)	
25	100		1000(25)		1000(25)		25	100		25	N11	25					25	100		25a	100Z	100S	
32	125													40	160	√2					140S		
40	160	Rz200					40	160															
125	200									50	N12						50	200		(50a)	200Z	200S	S
63	250						63	250						80	320	√1					280Z	280S	
80	320	100																					
250	400						100	400									100	400		(100a)	400Z	400S	
							160	630	S												560Z	560S	
							250	1000															
								1600															
								2500															

μ=0.000001m=0.001mm

μin=0.000001 in=0.0254μ

常用硬度值对照表
Common uesd Hardness comparison form

洛氏 HRC	肖氏 HS	维氏 HV	布氏 HBS（30D²）	布氏 d/mm² (10/3000)	洛氏 HRC	肖氏 HS	维氏 HV	布氏 HBS（30D²）	布氏 d/mm² (10/3000)
70		1037	-	-	40	53.5	377	370	3.17
69		997	-	-	39	52.3	367	360	3.21
68	96.6	959	-	-	38	51.1	357	350	3.26
67	94.6	923	-	-	37	50	347	341	3.30
66	92.6	889	-	-	36	48.8	338	332	3.34
65	90.5	856	-	-	35	47.8	329	323	3.39
64	88.4	825	-	-	34	46.6	320	314	3.43
63	86.5	795	-	-	33	45.6	312	306	3.48
62	84.5	766	-	-	32	44.5	304	298	3.52
61	83.1	739	-	-	31	43.5	296	291	3.56
60	81.4	713	-	-	30	42.5	289	283	3.61
59	79.7	688	-	-	29	41.6	281	276	3.65
58	78.1	664	-	-	28	40.6	274	269	3.70
57	76.5	642	-	-	27	39.7	268	263	3.74
56	74.9	620	-	-	26	38.8	261	257	3.78
55	73.5	599	-	-	25	37.9	255	251	3.83
54	71.9	579	-	-	24	37	249	245	3.87
53	69.1	561	-	-	23	36.3	243	240	3.91
52	67.7	543	-	-	22	35.5	237	234	3.95
51	66.3	525	501	2.73	21	34.7	231	229	4.00
50	65.5	509	488	2.77	20	34	226	225	4.03
49	63.7	493	474	2.81	19	33.2	221	220	4.07
48	62.6	478	461	2.85	18	32.6	216	216	4.11
47	61059.7	463	449	2.89	17	31.9	211	211	4.15
46	57.1	449	436	2.93	16	-	-	-	-
45	55.9	436	424	2.97	15	-	-	-	-
44	58.4	413	413	3.01	14	-	-	-	-
43	57.1	401	401	3.05	13	-	-	-	-
42	55.9	391	391	3.09	12	-	-	-	-
41	54.7	388	380	3.13	11	-	-	-	-

SAVI 萨维
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