EX

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1 轴套材质
Bushing Material

1.1 EX 产品介绍
EX Brief Description

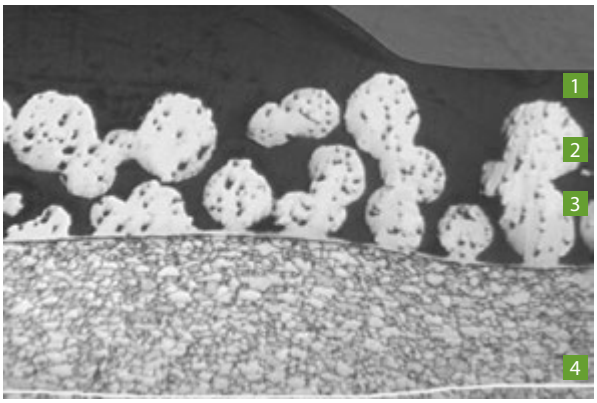
EX 是用碳钢基材、青铜粉、改性聚甲醛等其它润滑剂材料经过特殊工艺制造而成的边界无铅自润滑产品，具有环保的特点。它不仅具有一定的化学性能，同时具有良好的物理性能和机械性能，可应用在各种低速中载，取代传统轴承的滑动、转动、摆动及直线往复运动部位，因减磨层表面有储油孔便于装配前涂抹油脂，工作时具有摩擦系数低、走合性能好、耐磨损等特点。

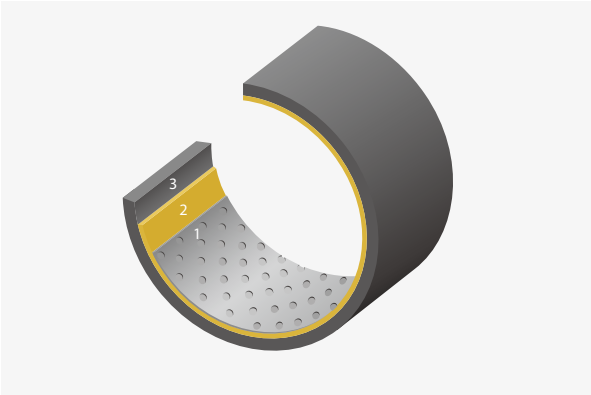
EX tri-layer low maintanence plain bushing have a base of lower carbon steel, onto which a porous bronze layer is sintered. Acetalcopolyer (POM) is impregnated into the intersice of this bronze layer after rolling process completed. Lubrication indents are stamped into this layer. EX has good physical & mechanical properties, also has certainly chemical properties. This material has good machining performance if required.

1.2 EX 产品断面微观组织及工作机理
EX Material

1 减摩层，厚度为0.3~0.5mm，是聚甲醛与润滑剂等减摩材料的混合物，通过制板工艺进入铜粉组织内部和覆在铜层表面。工作面表层有储油孔，可以显著地降低摩擦系数及很好的保护对磨部件。
2 青铜粉层，作为自润滑层的附着体。
3 低碳钢层，工作中起到良好的承载和散热作用。
4 镀铜层，具有良好的耐腐蚀性。

1 Self-lub. Layer POM 0.3-0.5mm.
After rolling process completed, POM are filled in intersice of bronze layer, lubrication indents are stamped, which are full of oil grease, which will be removed and transferred on the mating surface, forms a physically lubricating film, which will reduced the firction coe. and protect the mating shaft.
2 Porous bronze layer;
The layer provides bonded strength of self-lub. Layer.
3 Steel Backing
The layer provides load & thermal conductivity
4 Copper / Tin layer.





1.3 EX 产品技术参数
EX Material Characteristics

产品技术参数	Material Characteristics		
最大承载 P	**Max. Load Capacity**		
静载	Static Load	N/mm^2	140
动载	Dynamic Load	N/mm^2	70
最高线速度 V	**Max. Speed**		
预润滑	Pre-Lubricated	m/s	2.0
油脂润滑连续	Oil Grease Lubrication Continuous Operation	m/s	>2.0
最高PV值(干摩擦)	**Max. Pv Value**	N/mm2 · m/s	2.8
摩擦系数	**Coefficient of Friction**	μ	0.05~0.20
使用温度	**Operating Temperature Range**	°C	-40~110
导热系数	**Thermal Conductivity**	w/m · k	42
热膨胀系数	**Coefficient of Thermal Expansion**	λST	$11 \cdot 10K^{-6}$

※ 推荐在装配时内孔涂润滑油脂 Initial pre-lubrication at assembly is necessary.

2 轴承选型、接触面形式、装配
Bushing Design, Mating Surface, Install

2.1 轴套选型
Bushing Design

与轴承寿命有关的六个因素:

(1) 载荷 P [N/mm^2] Load

载荷越大，轴承使用寿命越短；载荷波动越大，对轴承寿命的影响也越大，轴承寿命越短；无论在任何情况下，最大载荷不可超过理论最大允许负载值。载荷大小等于实际工作载荷除以轴承的投影面积，公式为P=F/(D*B)。

(2) 速度 V [m/s]与PV 值

Velocity V & PV Value

轴承的工作寿命取决于PV值的大小，即实际负载 P [N/mm^2] 与滑动速度 V [m/s]乘积，PV值越小，轴承寿命越长。

(3) 温度 T [°C]

Tempture

轴承的寿命也取决于轴承使用时的温度，因此在设计选型时应尽量考虑相关部件的散热特性。

(4) 对磨部件的表面粗糙度

与轴承对磨的部件接触面粗糙度应在Ra0.2~Ra0.8之间，轴承在装配和使用的过程中不可有锐利的介质损坏轴承的工作表面。

(5) 对磨部件表面材料，对磨部件表面粗糙度是影响轴套使用寿命的一个因素，一般情况下某表面要求达到≤0.4μm ka。

(6) 其他因素如轴承座的设计、润滑条件等

Factors of bushing service life:

(1) Operation load is an important factor for bushing service life, and steady load is beneficialful for it. Generally, the specific load determined by the type of loading, and should not exceed theoretic value. Specifica load obtained from operation load divided by the projected are a of bushing.

(2) Bushing service life determined by PV Valve, PV= PxV. PV value is smaller, service life of bushing is longer.

(3) Environment tempture and Thermal

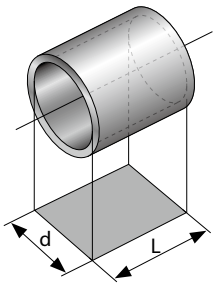
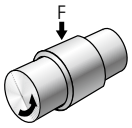
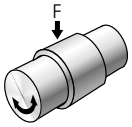
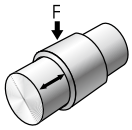
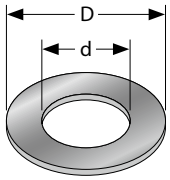
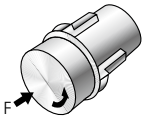
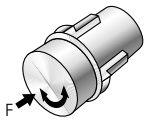
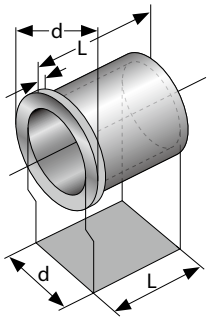
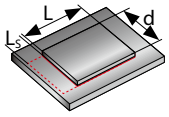
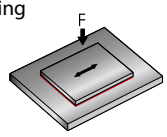
Generated from the different movements like Oscillating, rotary & reciprocating will influence the bushing service life. The resions has higher thermal expansion rate with poor thermal conductivity. It is necessary to control the bushing size and clearance.

(4) The roughness of mating surface should be Ra 0.2-Ra 0.8. During the process of installing, the sharp or burrs etc forbidden to damge the mating surface.

(5) Material of Mating Surface will effected service life of bushing the mating surface finish should ≤0.4μm ka.

(6) Other Factors like Design of housing, Lubrication condition etc

2.2 PV值 PV Value

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 washer	翻边法兰面速度计算按上述垫片计算公式。 Use above formulas for thrust washer	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 washer
滑块 Slide Plate 	1.往复运动 Reciprocating motion 	$\frac{F}{BL}$ $\left\{\frac{10^2F}{WL}\right\}$	$\frac{2cS}{10^3}$ $\left\{\frac{2cS}{10^3}\right\}$	$\frac{2FcS}{10^3BL}$ $\left\{\frac{FcS}{5WL}\right\}$

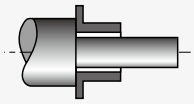
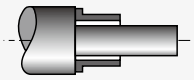
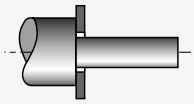
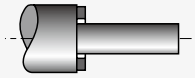
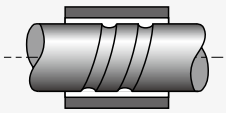
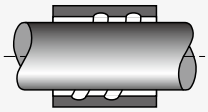
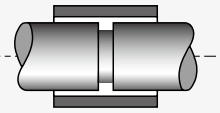
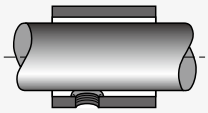
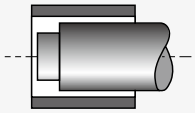
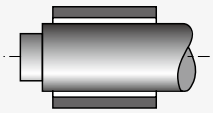
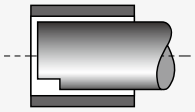
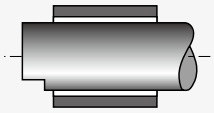
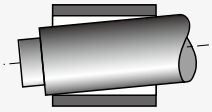
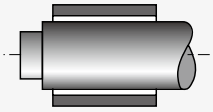
F：承载 load ····· N {kgf}
N：转速 Rotate speed ····· S-1{rpm}
c：往复圆周速度或摇摆 Cylindrical velocity of reciprocating or oscillating motion ····· S-1{cpm}
S：往复运动距离 Reciprocating distance ····· m {mm}
θ：摇摆角度 Oscillating angle ····· rad { }
d：轴套内径 Bushing ID ····· mm {mm}
D：轴套外径 Bushing OD ····· mm {mm}
L：轴套长度 Bushing length ····· mm {mm}
W：板材或滑动宽度 Stirp/Slide width ····· mm {mm}

3 轴套装配
Bushing Installation

3.1 轴套接触面设计
Bushing Arrangememt Design

错误的装配形式会破坏或缩短轴承的使用寿命，下面列出了相关的装配形式，请在设计时参考：

Wrong assemble will broken or reduced useful life the following assemble should be referred when design:

	错误 Error	正确 Correct
翻边套与轴肩接触形式 Flang Bushing & Shaft		
垫片与轴肩接触形式 Thrust Washer & Shaft		
轴套与轴的油槽形式 Bushing & Shaff oil grooves		
润滑油槽及油孔的形式 Oil grooves & Oil hole		
轴肩与轴套的接触面形式 Bushing & Shaft		
轴槽与轴套的接触面形式 Shaft groove & Bushing		
轴与轴套的同心度装配要求 Concentricity between Shaft & Bushing		

3.2 轴套座孔设计
Housing Design

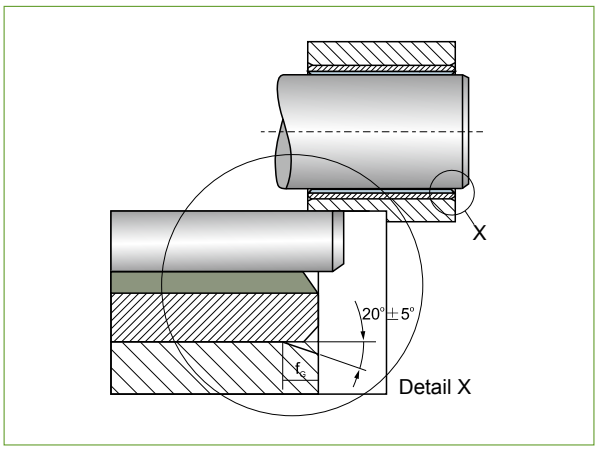
直套装配设计

为了更易于装配，轴承的座孔均应有一个倒角，如表。

Bushing

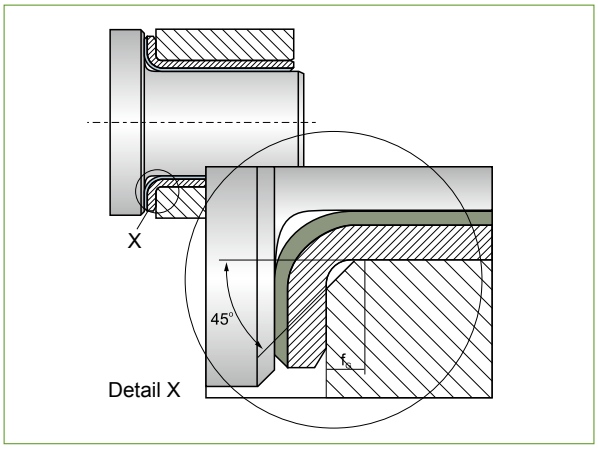
It's necessary there should have a chamfer on housing bore, it make bushing easier to be pressed into housing.

座孔 Housing bore diameter d_G	倒角 Chamfer with f_G
$d_G \leq 30$	0.8±0.3
$30 < d_G \leq 80$	1.2±0.4
$80 < d_G \leq 180$	1.8±0.8
$180 < d_G$	2.5±1.0



翻边套装配设计
Flange Bushing

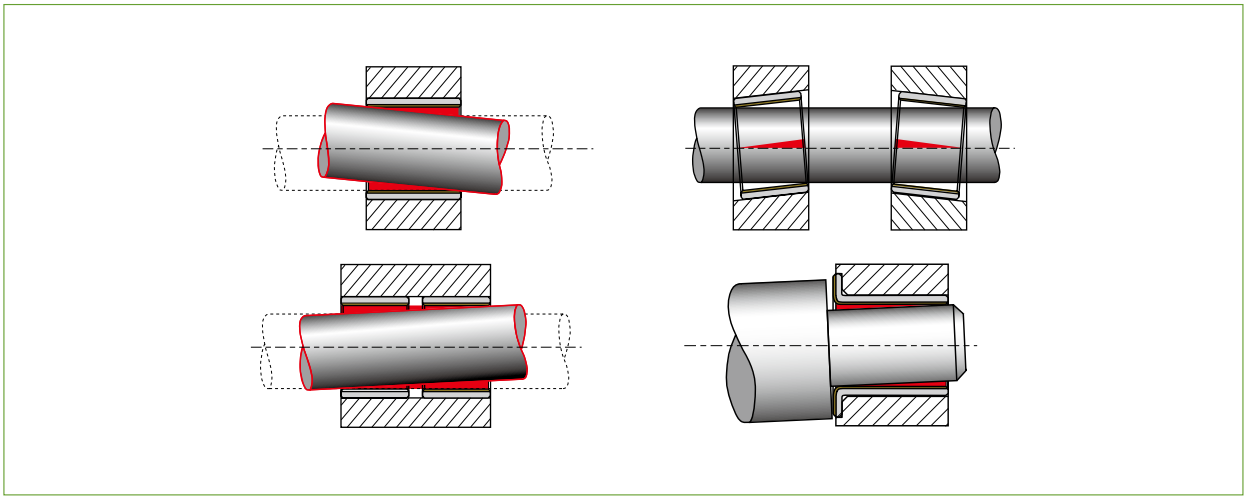
座孔 Housing bore diameter d_G	倒角 Chamfer with f_G
$d_G \leq 10$	1.2±0.2
$180 < d_G$	1.7±0.2



同轴度
Concentricity

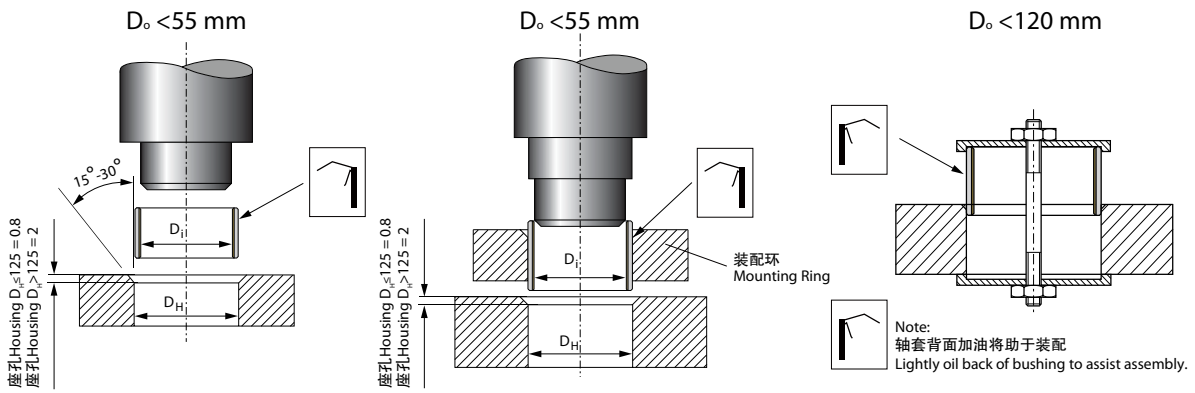
精确的同轴度对所有的轴承装配都是一个重要的考虑因素。轴承在一个轴套（或两个）长度内的不同轴度或在止推垫圈直径值内的不同轴度不应该超过0.020mm，如图所示

Concentricity is an impontant factor for bushing installction.

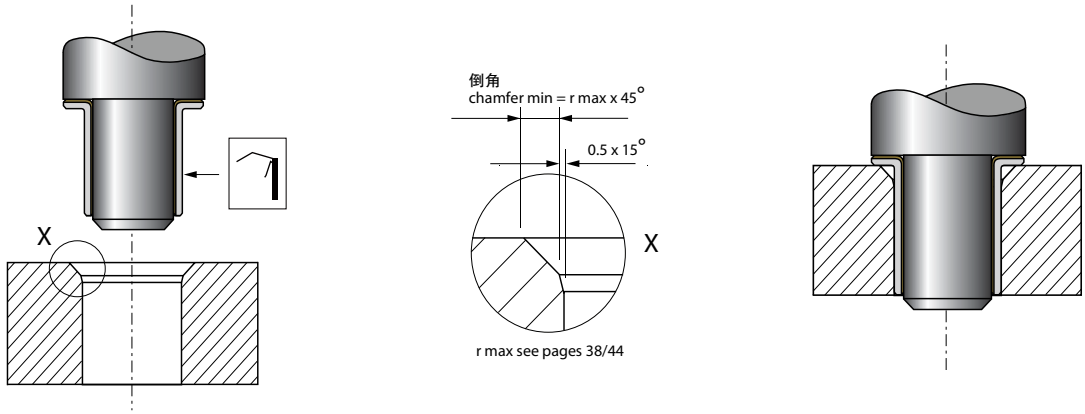


3.3 轴套压装
Bushing Installation

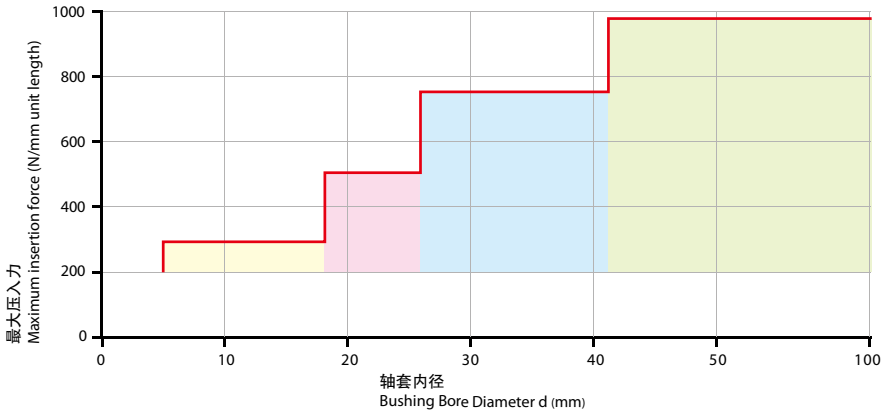
直套压装
Fitting of Cylindrical Bushing



翻边轴套压装
Fitting of Flanged Bushing



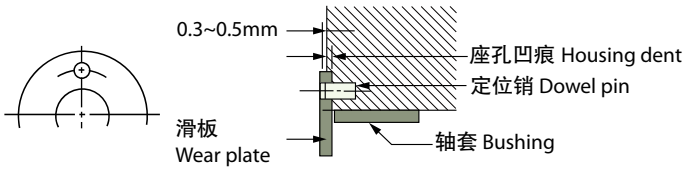
压入力
Insertion Forces



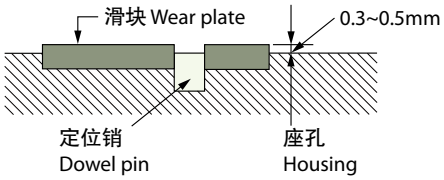
3.4 止推垫片和滑块装配
Thrust washers & Plate Installation

装配止推垫片和滑块时座孔肩有凹穴， 定位销则应用于防止产品旋转。
Housing should have hollow dents for installing thrust washer and sliding plates. Dowel pins used for prevent turning.

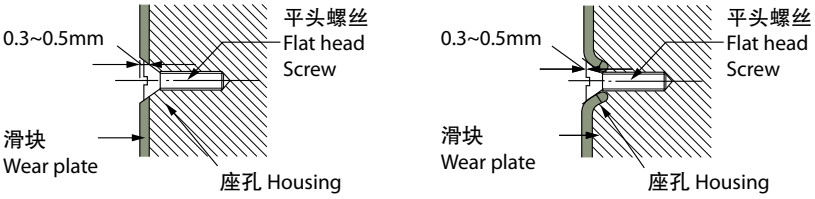
定位销应用（止推垫片）
Dowel Pin Application (Thrust Washer)



滑块镶嵌装配（滑板）
Inlaid Installation (Plate)



平头螺丝应用
Flat Head Screw Application



1 安装后，垫圈的内径不能碰到旋转轴。
After install, ID of washer can not contact shaft.

2 垫圈的钢背与轴承座相接触。
Backing of washer contact housing.

3 定位销应比止推垫圈表面下凹0.25～0.50mm。
Dowel pin should 0.25 ~ 0.50mm lower than surface of thrust washer

4 平头螺丝应比止推垫圈表面下沉0.25～0.50mm。
Flat head screw should 0.25 ~ 0.50mm lower than surface of thrust washer.

4 产品应用 Application

4.1 EX 产品应用 EX Application

EX 轴套通常被推荐用于间断运行和边界润滑的环境中，特别是轴套内孔的油穴设计，很好的适用于不能连续不断或重复加油的场合，但在无润滑条件下，EX轴套的工作长短取决于承载，表面速度，具体的环境温度等的相互作用。同时，轴套内表面的塑料层可以在加工成型前留有余量，在装入座孔后可加工到更好的装配尺寸。

EX bushings have been recommended for application involving intermittent operation or boundary lubrication. Base on the unique lubrication-retaining pockets on surface, EX bushings are well suitable for application, where lubricant can not be supplied continuously or repeated. Under the no lubrication, the EX operating life depends on interaction of the specific load, surface velocity and temperature etc. EX bushings can be supplied as machining allowance on POM, it can be machined to Better assembly dimensions after installed into housing.

具体的应用。

Detailed application.

下列是有关EX轴承的部分具体应用

The following list covers some of the many types of EX bearing applications.

汽车工业
Automotive

悬挂系统，悬挂接头, 大王销主件，汽车驱动联合铰链，转向及连杆机构，转向及关节接头，后部底盘铰链等。

Suspension system, suspension joints, king-pin assemblies, automobile driving joint hinges, steering and other linkages, steering and articulation joints, rear chassis hinges etc.

农业机械和食品机械
Agricultural Machinery/Equipments

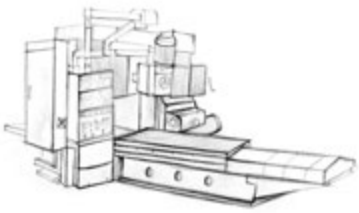
齿轮箱、离合器、收割机主销轴承、前桥支点轴承、转向托辊轴承箱、拖拉机的配件中的起重齿轮、播种设备等。

Gearbox, clutch, kingpin bearings for harvesters, front axle pivot bearings, steering idler box bearings, seeding equipment, etc.

机床制造工业
Machine Tool Building Industry

磨床、铣床、钻机主轴、精密磨床的偏心驱动单元等。

Grinding machines, milling machines, spindles in drill; Eccentric drive unit in precision grinding machines etc



4.1 EX 产品应用
EX Application

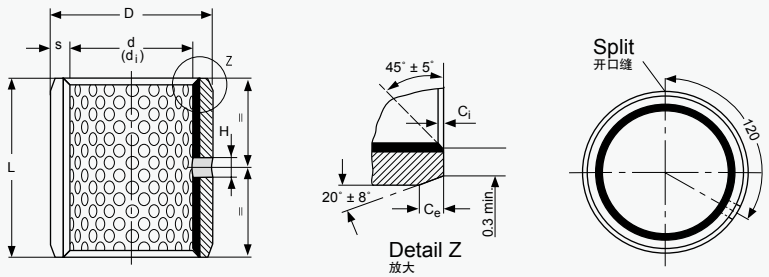
其它应用
Other Applications

油齿轮泵、旋转器支持轴承、液压泵变量斜盘耳轴轴承、液压缸和气动缸活塞杆导承、叉车变速箱、起重机变速箱和传输托链链轮、车输送机、蜗杆传动齿轮等。

Oil gear pumps, support bearings in rotary actuators; variable swash plate trunnion bearings in hydraulic pumps, piston rod guide in hydraulic and pneumatic cylinders; Transfer gearbox for forklift trucks, gearbox and in idler chain sprockets for crane transmissions, car conveyors, worm drive gear, etc.

5 规格和公差 Specification & Tolerance

5.1 EX 直套规格及公差 EX Sleeve Bushing Specification & Tolerance



尺寸：毫米
All dimensions in mm

尺寸和公差参照ISO 3547
Dimensions and Tolerances according to ISO 3547

内外倒角尺寸表 Inside & Outide Chamfers

壁厚 Wall thickness S	内倒角 Inside Chafmer C_i	外倒角 Outside Chamfer C_e
1.00	0.30±0.20	0.60±0.40
1.50	0.40±0.30	0.60±0.40
2.00	0.40±0.30	1.20±0.40
2.50	0.60±0.30	1.80±0.60

直套型号标注方式 Bushing Symbol

直套型号标注方式 Bushes Symbol	EX - □	××	××
直套型号 Bushing Type			
直套内径 Bushing I.D.			
直套高度 Bushing Length			

内径 Internal Diameter			外径 External Diameter			高度 Length	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	装配后内径 Φd_i	外径 D	装配座孔 Housing-ΦD_H	理论外径公差 O.D. ΦD_t	ID<80 L±0.25 ID>80 L±0.50	S		
10	10.000 9.978	10.108 10.040	12	12.018 12.000	+0.065 +0.030	10	0.980 0.955	3	EX 1010
						12		4	EX 1012
						15			EX 1015
						20			EX 1020
12	12.000 11.973	12.108 12.040	14	14.018 14.000		10		3	EX 1210
						12		4	EX 1212
						15			EX 1215
						20			EX 1220
						25			EX 1225
14	14.000 13.973	14.108 14.040	16	16.018 16.000		15			EX 1415
						20			EX 1420
						25			EX 1425
15	15.000 14.973	15.108 15.040	17	17.018 17.000		10		3	EX 1510
						12		4	EX 1512
						15			EX 1515
						20			EX 1520
						25			EX 1525

内径 Internal Diameter			外径 External Diameter			高度 Length	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	装配后内径 Φd_i	外径 D	装配座孔 Housing-ΦD_H	理论外径公差 O.D. ΦD_t	ID<80 L±0.25 ID>80 L±0.50	S		
16	16.000 15.973	16.108 16.040	18	18.018 18.000	+0.065 +0.030	15	0.980 0.955	4	EX 1615
						20			EX 1620
					+0.075 +0.035	25			EX 1625
18	18.000 17.973	18.111 18.040	20	20.021 20.000		15			EX 1815
						20			EX 1820
						25			EX 1825
20	20.000 19.967	20.131 20.050	23	23.021 23.000		10	1.475 1.445		EX 2010
						15			EX 2015
						20			EX 2020
						25			EX 2025
						30			EX 2030
22	22.000 21.967	22.131 22.050	25	25.021 25.000		15		6	EX 2215
						20			EX 2220
						25			EX 2225
						30			EX 2230
25	25.000 24.967	25.131 25.050	28	28.021 28.000		15			EX 2515
						20			EX 2520
						25			EX 2525
						30			EX 2530
28	28.000 27.967	28.155 28.060	32	32.025 32.000	+0.085 +0.045	20	1.970 1.935		EX 2820
						25			EX 2825
						30			EX 2830
30	30.000 29.967	30.155 30.060	34	34.025 34.000		20			EX 3020
						30			EX 3030
						40			EX 3040
32	32.000 31.961	32.155 32.060	36	36.025 36.000		20			EX 3220
						30			EX 3230
						35			EX 3235
						40			EX 3240
35	35.000 34.961	35.155 35.060	39	39.025 39.000		20			EX 3520
						30			EX 3530
						35			EX 3535
						40			EX 3540
						50			EX 3550

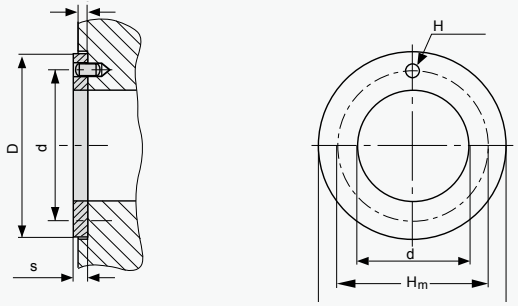
内径 Internal Diameter			外径 External Diameter			高度 Length	壁厚 Wall Thickness	油孔直径 Oil Hole-ΦH	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	装配后内径 Φd_i	外径 D	装配座孔 Housing-ΦD_H	理论外径公差 O.D. ΦD_t	ID<80 L±0.25 ID>80 L±0.50	S		
40	40.000 39.961	40.155 40.060	44	44.025 44.000	+0.085 +0.045	20	1.970 1.935	8	EX 4020
						30			EX 4030
						40			EX 4040
						50			EX 4050
45	45.000 44.961	45.195 45.080	50	50.025 50.000		25	2.460 2.415		EX 4520
						30			EX 4530
						40			EX 4540
						45			EX 4545
						50			EX 4550
50	50.000 49.961	50.200 50.080	55	55.030 55.000		40			EX 5040
						50			EX 5050
						60			EX 5060
55	55.000 54.954	55.200 55.080	60	60.030 60.000		20			EX 5520
						25			EX 5525
						30			EX 5530
						40			EX 5540
						50			EX 5550
						60			EX 5560
60	60.000 59.954	60.200 60.080	65	65.030 65.000	+0.100 +0.055	30			EX 6030
						40			EX 6040
						60			EX 6060
						70			EX 6070
65	65.000 64.954	65.262 65.100	70	70.030 70.000		40	2.450 2.384	8	EX 6540
						50			EX 6550
						60			EX 6560
						70			EX 6570
70	70.000 69.954	70.262 70.100	75	75.030 75.000		40			EX 7040
						50			EX 7050
						65			EX 7065
						70			EX 7070
						80			EX 7080
75	75.000 74.954	75.262 75.100	80	80.030 80.000		40		9.5	EX 7540
						60			EX 7560
						80			EX 7580

内径 Internal Diameter			外径 External Diameter			高度 Length	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_s	装配后内径 Φd_i	外径 D	装配座孔 Housing-ΦD_H	理论外径公差 O.D. ΦD_t	ID<80 L±0.25 ID>80 L±0.50	S		
80	80.000 79.954	80.267 80.100	85	85.035 85.000	+0.120 +0.070	40	2.450 2.384	9.5	EX 8040
						60			EX 8060
						80			EX 8080
						100			EX 80100
85	85.000 84.946	85.267 85.100	90	90.035 90.000		30			EX 8530
						40			EX 8540
						60			EX 8560
						80			EX 8580
						100			EX 85100
90	90.000 89.946	90.267 90.100	95	95.035 90.000		40			EX 9040
						60			EX 9060
						80			EX 9080
						90			EX 9090
						100			EX 90100
95	95.000 94.946	95.267 95.100	100	100.035 100.000		60			EX 9560
						100			EX95100
100	100.000 99.946	100.267 100.100	105	105.035 105.000		50			EX 10050
						60			EX 10060
						80			EX 10080
						95			EX 10095
						115			EX 100115
105	105.000 104.946	105.267 105.100	110	110.035 110.000		60			EX 10560
						110			EX 105110
						115			EX 105115
110	110.000 109.946	110.267 105.100	115	115.035 115.000		60			EX 11060
						110			EX 110110
						115			EX 110115
115	115.000 114.946	115.267 115.100	120	120.035 120.000		50			EX 11550
						70			EX 11570
120	120.000 119.946	120.280 120.130	125	125.040 125.000	+0.170 +0.100	60			EX 12060
						100			EX 120100
						110			EX 120110
125	125.000 124.937	125.280 125.130	130	130.040 130.000		60			EX 12560
						100			EX 125100
						110			EX 125110

内径 Internal Diameter			外径 External Diameter			高度 Length	壁厚 Wall Thickness	油孔直径 Oil Hole-ΦH	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	装配后内径 Φd_i	外径 D	装配座孔 Housing-ΦD_H	理论外径公差 O.D. ΦD_t	ID<80 L±0.25 ID>80 L±0.50	S		
130	130.000 129.937	130.280 130.130	135	135.040 135.000	+0.170 +0.100	50	2.435 2.380	9.5	EX 13050
						60			EX 13060
						80			EX 13080
						100			EX 130100
135	135.000 134.937	135.280 138.130	140	140.040 140.000		60			EX 13560
						80			EX 13580
140	140.000 139.937	140.280 140.130	145	145.040 145.000		50			EX 14050
						60			EX 14060
						80			EX 14080
						100			EX 140100
150	150.000 149.937	150.280 150.130	155	155.040 155.000		50			EX 15050
						60			EX 15060
						80			EX 15080
						100			EX 1501003
160	160.000 159.937	160.280 160.130	165	165.040 165.000		50			EX 16050
						60			EX 16060
						80			EX 16080
						100			EX 160100
170	170.000 169.937	170.280 170.130	175	175.040 175.000		50			EX 17050
						60			EX 17060
						80			EX 17080
						100			EX 170100
180	180.000 179.937	180.286 180.130	185	185.046 185.000	+0.210 +0.130	50			EX 18050
						60			EX 18060
						80			EX 18080
						100			EX 180100
190	190.000 189.928	190.286 190.130	195	195.046 195.000		50			EX 19050
						60			EX 19060
						80			EX 19080
						100			EX 190100
						120			EX 190120
200	200.000 199.928	200.286 200.130	205	205.046 205.000		50			EX 20050
						60			EX 20060
						80			EX 20080

内径 Internal Diameter			外径 External Diameter			高度 Length	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	装配后内径 Φd_i	外径 D	装配座孔 Housing-ΦD_H	理论外径公差 O.D. ΦD_t	ID<80 L±0.25 ID>80 L±0.50	S		
200	200.000 199.928	200.286 200.130	205	205.046 205.000	+0.210 +0.130	80	2.435 2.380	9.5	EX 20080
						100			EX 200100
						120			EX 200120
220	220.000 219.928	220.286 220.130	225	225.046 225.000		50			EX 22050
						60			EX 22060
						80			EX 22080
						100			EX 220100
						120			EX 220120
240	240.000 239.928	240.286 240.130	245	245.046 245.000		50			EX 24050
						60			EX 24060
						80			EX 24080
						100			EX 240100
						120			EX 240120
250	250.000 249.928	250.292 250.130	255	255.052 255.000	+0.260 +0.170	50			EX 25050
						60			EX 25060
						80			EX 25080
						100			EX 250100
						120			EX 250120
260	260.000 259.919	260.292 260.130	265	265.052 265.000		50			EX 26050
						60			EX 26060
						80			EX 26080
						100			EX 260100
						120			EX 260120
280	280.000 279.919	280.292 280.130	285	285.052 285.000		50			EX 28050
						60			EX 28060
						80			EX 28080
						100			EX 280100
						120			EX 280120
300	300.000 299.919	300.292 300.130	305	305.052 305.000		50			EX 30050
						60			EX 30060
						80			EX 30080
						100			EX 300100
						120			EX 300120

5.2 EX 垫片规格及公差
EX Thrust washer Specification & Tolerance



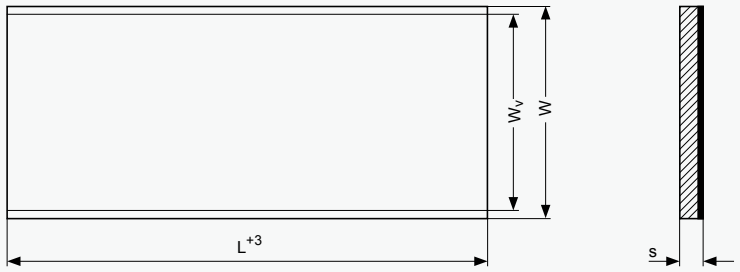
尺寸：毫米
All dimensions in mm

垫片型号标注方式
Washer Symbol

垫片型号标注方式 Washer Symbol	WC	××	EX - □
垫片 Washer			
垫片内径 Washer I. D.			
垫片型号 Washer Type			

内径 Internal Diameter d		外径 External Diameter D		壁厚 Thickness s	定位孔中心 Dowel Hole PCD-Φ H_m±0.12	定位孔直径 Dowel Hole-Φ H	Recess Depth H_a	型号 Part No
min.	max.	min.	max.	max. min.	max. min.	±0.005"	max. min.	
12.00	12.25	23.75	24.00	1.50 1.45	18	1.75	1.20 0.80	**WC 10 EX**
14.00	14.25	25.75	26.00		20	2.25		**WC 12 EX**
16.00	16.25	29.75	30.00		22			**WC 14 EX**
18.00	18.25	31.75	32.00		25			**WC 16 EX**
20.00	20.25	35.75	36.00		28	3.25		**WC 18 EX**
22.00	22.25	37.75	38.00		30			**WC 20 EX**
24.00	24.25	41.75	42.00		33			**WC 22 EX**
26.00	26.25	43.75	44.00		35			**WC 24 EX**
28.00	28.25	47.75	48.00		38	4.25		**WC 25 EX**
32.00	32.25	53.75	54.00		43			**WC 30 EX**
38.00	38.25	61.75	62.00		50			**WC 35 EX**
42.00	42.25	65.75	66.00		54			**WC 40 EX**
48.00	48.25	73.75	74.00	1.95 2.00	61		1.70 1.30	**WC 45 EX**
52.00	52.25	77.75	78.00		65			**WC 50 EX**

5.3 EX 板材规格及公差
EX Strip Specification & Tolerance



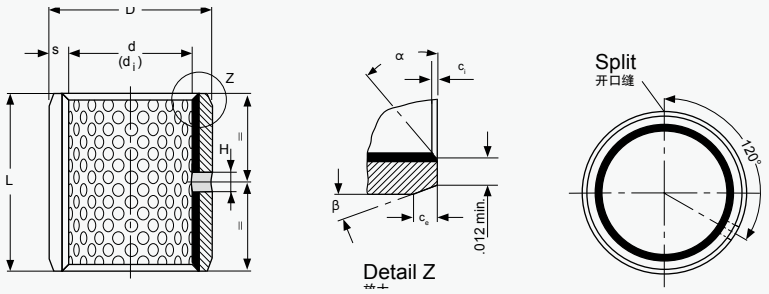
尺寸：毫米
All dimensions in mm

板材标注方式
Strip Symbol

板材标注方式 Strip Symbol	WC	×××	×××	EX - □
板材 Strip				
板材厚度 Strip Wall Thickness				
板材宽度 Strip Width				
板材型号 Strip Type				

长度 Length L	宽度 Width W_v	壁厚 Thickness S-0.05	型号 Part No
500	130－150	1.00	**S 100 90 EX**
	130－150	1.50	**S 152 00 EX**
	130－150	2.00	**S 202 00 EX**
		2.50	**S 252 00 EX**

5.4 EX 英制直套规格及公差
EX Inch Sleeve Bushing Specification & Tolerance



尺寸：英寸
All dimensions in inch

尺寸和公差参照ISO 3547
Dimensions and Tolerances according to ISO 3547

内外倒角尺寸表
Inside & Outide Chamfers

壁厚 Wall thickness	内倒角 ID Chamfer		外倒角 OD Chamfer	
	C_i	α	C_e	β
0.0315"	0.008"- 0.024"	30°- 45°	0.004"- 0.012"	30°- 45°
0.0471"	0.020"- 0.040"	20°- 30°	0.005"- 0.025"	40°- 55°
0.0627"-0.0928"	0.020"- 0.040"	15°- 25°	0.005"- 0.025"	40°- 50°

直套型号标注方式
Bushing Symbol

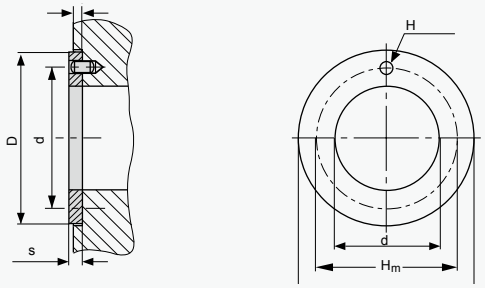
直套型号标注方式 Bushes Symbol	××	EX - □	××
直套内径 Bushing I. D.			
直套型号 Bushing Type			
直套高度 Bushing Length			

内径 Internal Diameter			外径 External Diameter		高度 Width	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_s	供货内径 Φd_i	外径 D	装配座孔 D_H	L±0.01"	S		
3/8	0.3648 0.3639	0.3694 0.3667	15/32	0.4694 0.4687	0.375	0.0510 0.0500	无孔 No hole	06 EX 06
					0.500		5/32	06 EX 08
					0.750			06 EX 12
7/16	0.4273 0.4263	0.4319 0.4292	17/32	0.5319 0.5312	0.500			07 EX 08
					0.750			07 EX 12
1/2	0.4897 0.4887	0.4944 0.4917	19/32	0.5944 0.5937	0.375			08 EX 06
					0.500			08 EX 08
					0.625			08 EX 10
					0.875			08 EX 14
9/16	0.5522 0.5512	0.5569 0.5542	21/32	0.6569 0.6562	0.500			09 EX 08
					0.750			09 EX 12
5/8	0.6146 0.6136	0.6195 0.6167	23/32	0.7195 0.7187	0.500			10 EX 08
					0.625			10 EX 10
					0.750			10 EX 12
					0.875			10 EX 14
3/4	0.7390 0.7378	0.7444 0.7412	7/8	0.8758 0.8750	0.500	0.0669 0.0657		12 EX 08
					0.750			12 EX 12
					1.000			12 EX 16

内径 Internal Diameter			外径 External Diameter		高度 Width	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	供货内径 Φd_i	外径 D	装配座孔 D_H	L±0.01"	S		
$^7/_8$	0.8639 0.8627	0.8694 0.8662	1	1.0008 1.0000	0.750	0.0669 0.0657	$^1/_4$	14 EX 12
					0.755			14 EX 14
					1			14 EX 16
1	0.9888 0.9876	0.9944 0.9912	$1^1/_8$	1.1258 1.1250	0.750			16 EX 12
					1			16 EX 16
					1.500			16 EX 24
$1^1/_8$	1.1138 1.1126	1.1202 1.1164	$1^9/_{32}$	1.2822 1.2812	0.750	0.0824 0.0810		18 EX 12
					1			18 EX 16
$1^1/_4$	1.2387 1.2371	1.2452 1.2414	$1^{13}/_{32}$	1.4072 1.4062	0.750			20 EX 12
					1			20 EX 16
					1.250			20 EX 20
					1.750			20 EX 28
$1^3/_8$	1.3635 1.3619	1.3702 1.3664	$1^{17}/_{32}$	1.5322 1.5312	1			22 EX 16
					1.375			22 EX 22
					1.750			22 EX 28
$1^1/_2$	1.4884 1.4868	1.4952 1.4914	$1^{21}/_{32}$	1.6572 1.6562	1		$^5/_{16}$	24 EX 16
					1.250			24 EX 20
					1.500			24 EX 24
					2			24 EX 32
$1^5/_8$	1.6133 1.6117	1.6202 1.6164	$1^{25}/_{32}$	1.7822 1.7812	1			26 EX 16
					1.500			26 EX 24
$1^3/_4$	1.7383 1.7367	1.7461 1.7415	$1^{15}/_{16}$	1.9385 1.9375	1	0.0980 0.0962		28 EX 16
					1.500			28 EX 24
					1.750			28 EX 28
					2			28 EX 32
$1^7/_8$	1.8632 1.8616	1.8713 1.8665	$2^1/_{16}$	2.0637 2.0625	1.500			30 EX 16
					1.875			30 EX 30
					2.250			30 EX 36
2	1.9881 1.9863	1.9963 1.9915	$1^3/_{16}$	2.1887 2.1875	1			32 EX 16
					1.500			32 EX 24
					2			32 EX 32
					2.500			32 EX 40

内径 Internal Diameter			外径 External Diameter		高度 Width	壁厚 Wall Thickness	油孔直径 Oil Hole-Φ H	型号 Part No
内径 d	装配轴径 Shaft-Φd_S	供货内径 Φd_i	外径 D	装配座孔 D_H	L±0.01"	S		
$2^1/_4$	2.2378 2.2360	2.2463 2.2415	$2^7/_{16}$	2.4387 2.4375	2.010 1.990	0.0980 0.0962	$^5/_{16}$	**36 EX 32**
					2.260 2.240			**36 EX 36**
					2.510 2.490			**36 EX 40**
$2^1/_2$	2.4875 2.4857	2.4963 2.4915	$2^{11}/_{16}$	2.6887 2.6875	2.010 1.990			**40 EX 32**
					2.510 2.490			**40 EX 40**
$2^3/_4$	2.7351 2.7333	2.7457 2.7393	$2^{15}/_{16}$	2.9387 2.9375	2.010 1.990	0.0991 0.0965		**44 EX 32**
					2.510 2.490			**44 EX 40**
					3.010 2.990			**44 EX 48**
					3.510 3.490			**44 EX 56**
3	2.9849 2.9831	2.9959 2.9893	$3^3/_{16}$	3.1889 3.1875	2.010 1.990		$^3/_8$	**48 EX 32**
					3.010 2.990			**48 EX 48**
					3.760 3.740			**48 EX 60**
$3^1/_2$	3.4844 3.4822	3.4959 3.4893	$3^{11}/_{16}$	3.6889 3.6875	2.510 2.490			**56 EX 40**
					3.010 2.990			**56 EX 48**
					3.760 3.740			**56 EX 60**
4	3.9839 3.9817	3.9959 3.9893	$4^3/_{16}$	4.1889 4.1875	3.010 2.990			**64 EX 48**
					3.760 3.740			**64 EX 60**
					4.760 4.740			**64 EX 76**

5.5 EX 英制垫片规格及公差
EX Inch Thrust washer Specification & Tolerance



尺寸：英寸
All dimensions in inch

垫片型号标注方式
Washer Symbol

垫片型号标注方式 Washer Symbol	EX - □	WC	××
垫片型号 Washer Type			
垫片 Washer			
垫片内径 Washer I. D .			

内孔 Nominal Diameter Φd		外径 Outside Φ D		壁厚 Thickness s	装配孔大小 Dowel hole ΦH	装配孔中心距 Dowel Hole PCD $ΦH_m$	装配深度 Recess Depth H_a	型号 Part No
min.	max.	min.	max.	max. min.	max. min.	±0.005"	max. min.	
0.500	0.510	0.865	0.875	0.0660 0.0625	0.077 0.067	0.6870	0.050 0.040	EX 06
0.562	0.572	0.990	1.000			0.7810		EX 07
0.625	0.635	1.115	1.125		0.109 0.099	0.8750		EX 08
0.687	0.697	1.177	1.187			0.9370		EX 09
0.750	0.760	1.240	1.250			1.0000		EX 10
0.812	0.822	1.365	1.375			1.0940		EX 11
0.875	0.885	1.490	1.500		0.140 0.130	1.1870		EX 12
1.000	1.010	1.740	1.750			1.3750		EX 14
1.125	1.135	1.990	2.000		0.171 0.161	1.5620		EX 16
1.250	1.260	2.115	2.125			1.6870		EX 18
1.375	1.385	2.240	2.250			1.8120		EX 20
1.500	1.510	2.490	2.500		0.202 0.192	2.0000		EX 22
1.625	1.635	2.615	2.625			2.1250		EX 24
1.750	1.760	2.740	2.750			2.2500		EX 26
2.000	2.010	2.990	3.000	0.0970 0.0935		2.5000	0.080 0.070	EX 28
2.125	2.135	3.115	3.125			2.6250		EX 30
2.250	2.260	3.240	3.250			2.7500		EX 32

6 轴公差表(250)
Shaft Tolerance Table (250)

>	≤	c9	d8	e7	e8	f7	g6	h5	h6	h7	h8	js6	js7	k6	m6	n6	p6	p7	r6	s6
-	3	-60 -85	-20 -34	-14 -24	-14 -28	-6 -16	-2 -8	0 -4	0 -6	0 -10	0 -14	±3	±5	+6 0	+8 +2	+10 +4	+12 +6	+16 +6	+16 +10	+20 +14
3	6	-70 -100	-30 -48	-20 -32	-20 -38	-10 -22	-4 -12	0 -5	0 -8	0 -12	0 -18	±4	±6	+9 +1	+12 +4	+16 +8	+20 +12	+24 +12	+23 +15	+27 +19
6	10	-80 -116	-40 -62	-25 -40	-25 -47	-13 -28	-5 -14	0 -6	0 -9	0 -15	0 -22	±4.5	±7	+10 +1	+15 +6	+19 +10	+24 +15	+30 +15	+28 +19	+32 +23
10	18	-95 -138	-50 -77	-32 -50	-32 -59	-16 -34	-6 -17	0 -8	0 -11	0 -18	0 -27	±5.5	±9	+12 +1	+18 +7	+23 +12	+29 +18	+36 +18	+34 +23	+39 +28
18	24	-110 -162	-65 -98	-40 -61	-40 -73	-20 -41	-7 -20	0 -9	0 -13	0 -21	0 -33	±6.5	±10	+15 +2	+21 +8	+28 +15	+35 +22	+43 +22	+41 +28	+48 +35
24	30																			
30	40	-120 -182	-80 -119	-50 -75	-50 -89	-25 -50	-9 -25	0 -11	0 -16	0 -25	0 -39	±8	±12	+18 +2	+25 +9	+33 +17	+42 +26	+51 +26	+50 +34	+59 +43
40	50	-130 -192																		
50	65	-140 -214	-100 -146	-60 -90	-60 -106	-30 -60	-10 -29	0 -13	0 -19	0 -30	0 -46	±9.5	±15	+21 +2	+30 +11	+39 +20	+51 +32	+62 +32	+60 +41	+72 +53
65	80	-150 -224																	+62 +43	+78 +59
80	100	-170 -257	-120 -174	-72 -107	-72 -126	-36 -71	-12 -34	0 -15	0 -22	0 -35	0 -54	±11	±17	+25 +3	+35 +13	+45 +23	+59 +37	+72 +37	+73 +51	+93 +71
100	120	-180 -267																	+76 +54	+101 +79
120	140	-200 -300	-145 -208	-85 -125	-85 -148	-43 -83	-14 -39	0 -18	0 -25	0 -40	0 -63	±12.5	±20	+28 +3	+40 +15	+52 +27	+68 +43	+83 +43	+88 +63	+117 +92
140	160	-210 -310																	+90 +65	+125 +100
160	180	-230 -330																	+93 +68	+133 +108
180	200	-240 -355	-170 -242	-100 -146	-100 -172	-50 -96	-15 -44	0 -20	0 -29	0 -46	0 -72	±14.5	±23	+33 +14	+46 +17	+60 +31	+79 +50	+96 +50	+106 +77	+151 +122
200	225	-260 -375																	+109 +80	+159 +130
225	250	-280 -395																	+113 +84	+169 +140
250	280	-300 -430	-190 -271	-110 -162	-110 -191	-56 -108	-17 -49	0 -23	0 -32	0 -52	0 -81	±16	±26	+36 +14	+52 +20	+66 +34	+88 +56	+108 +56	+126 +94	+190 +158
280	315	-330 -460																	+130 +98	+202 +170
315	355	-360 -500	-210 -299	-125 -182	-125 -214	-62 -119	-18 -54	0 -25	0 -36	0 -57	0 -89	±18	±28	+40 +4	+57 +21	+73 +37	+98 +62	+119 +62	+114 +108	+226 +190
355	400	-400 -540																	+150 +114	+244 +208
400	450	-440 -595	-230 -327	-135 -198	-135 -232	-68 -131	-20 -60	0 -27	0 -40	0 -63	0 -97	±20	±31	+45 +5	+63 +23	+80 +40	+108 +68	+131 +68	+166 +126	+272 +232
450	500	-480 -635																	+172 +132	+292 +252

7 座孔公差表(250)
Housing Tolerance Table (250)

>	≤	B10	C9	D8	E7	E8	F7	G7	H6	H7	H8	JS7	K7	M7	N7	P7	R7	S7	T7
-	3	+180 +140	+85 +60	+34 +20	+24 +14	+28 +14	+16 +6	+12 +2	+6 0	+10 0	+14 0	±5	0 -10	-2 -12	-4 -14	-6 -16	-10 -20	-14 -24	-
3	6	+188 +140	+100 +70	+48 +30	+32 +20	+38 +20	+22 +10	+16 +4	+8 0	+12 0	+18 0	±6	+3 -9	0 -12	-4 -16	-8 -20	-11 -23	-15 -27	-
6	10	+208 +150	+116 +80	+62 +40	+40 +25	+47 +25	+28 +13	+20 +5	+9 0	+15 0	+22 0	±7	+5 -10	0 -15	-4 -19	-9 -24	-13 -28	-17 -32	-
10	14	+200 +150	+138 +95	+77 +50	+50 +32	+59 +32	+34 +16	+24 +6	+11 0	+18 0	+27 0	±9	+6 -12	0 -18	-5 -23	-11 -29	-16 -34	-21 -39	-
14	18																		
18	24	+244 +160	+162 +110	+98 +65	+61 +40	+73 +40	+41 +20	+28 +7	+13 0	+21 0	+33 0	±10	+6 -15	0 -21	-7 -28	-14 -35	-20 -41	-27 -48	-
24	30																		-33 -54
30	40	+270 +170	+182 +120	+119 +80	+75 +50	+89 +50	+50 +25	+34 +9	+16 0	+25 0	+39 0	±12	+7 -18	0 -25	-8 -33	-17 -42	-25 -50	-34 -59	-39 -64
40	50	+280 +180	+192 +130																-45 -70
50	65	+310 +190	+214 +140	+146 +100	+90 +60	+106 +60	+60 +30	+40 +10	+19 0	+30 0	+46 0	±15	+9 -21	0 -30	-9 -39	-21 -51	-30 -60	-42 -72	-55 -85
65	80	+320 +200	+224 +150														-32 -62	-48 -78	-64 -94
80	100	+360 +220	+257 +170	+174 +120	+107 +72	+125 +72	+71 +36	+47 +12	+22 0	+35 0	+54 0	±17	+10 -25	0 -35	-10 -45	-24 -59	-38 -73	-58 -93	-78 -113
100	120	+380 +240	+267 +180														-41 -76	-66 -101	-91 -126
120	140	+420 +260	+300 +200	+208 +145	+125 +85	+148 +85	+83 +43	+54 +14	+25 0	+40 0	+63 0	±20	+12 -28	0 -40	-12 -52	-28 -68	-48 -88	-77 -117	-107 -147
140	160	+440 +280	+310 +210														-50 -90	-85 -125	-119 -159
160	180	+470 +310	+330 +230														-53 -93	-93 -133	-131 -171
180	200	+525 +340	+355 +240	+242 +170	+146 +100	+172 +100	+96 +50	+61 +15	+29 0	+46 0	+72 0	±23	+13 -33	0 -46	-14 -60	-33 -79	-60 -106	-105 -151	-149 -195
200	225	+565 +380	+375 +260														-63 -109	-113 -159	-163 -209
225	250	+605 +420	+395 +280														-67 -113	-123 -169	-179 -225
250	280	+690 +480	+430 +300	+271 +190	+162 +110	+191 +110	+108 +56	+69 +17	+32 0	+52 0	+81 0	±26	+16 -36	0 -52	-14 -66	-36 -88	-74 -126	-138 -190	-198 -250
280	315	+750 +540	+460 +330														-78 -130	-150 -202	-220 -272
315	355	+830 +600	+500 +360	+299 +210	+182 +125	+214 +125	+119 +62	+75 +18	+36 0	+57 0	+89 0	±28	+17 -40	0 -57	-16 -73	-41 -98	-87 -144	-169 -226	-247 -304
355	400	+910 +680	+540 +400														-93 -150	-187 -224	-273 -330
400	450	+1010 +760	+595 +440	+327 +230	+198 +135	+232 +135	+131 +68	+83 +20	+40 0	+63 0	+97 0	±31	+18 -45	0 -63	-17 -80	-45 -108	-103 -166	-209 -272	-307 -370
450	500	+1090 +840	+635 +480														-109 -172	-229 -292	-337 -400

8 卷制轴套检测
Wrapped Bushing Measurement

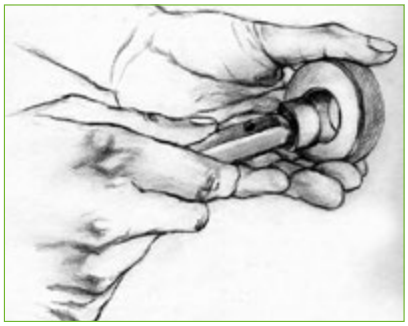
在自由状态下，卷制类轴套有一定的开口缝，不能精确的测量外径和内径。所以，卷制类轴承的内外径应有专业的测量工具和设备进行。
In free state, wrapped bushing will not be closed, which is impossble to accurately measure External diameter & Internal diameter. When wrapped bushing Measured, special gauges and test equipments is necessary.

外径检测
Test external diameter
ISO 3547-2 TEST B

轴套用力压入环规通规（最大加力250N）通过
Press the bushing into Go ring gange. And push bushing throngh by hand (Max. force 250N)
用上述同样方法和相同力压入环规止端不通过
Use the above same way & press, bushing can not go into No Go ring gauge.

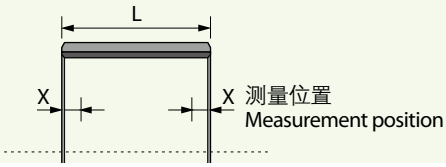
内径检测
Test Internal diameter
ISO 3547-2 TEST C

当轴套压入环规，塞规通端通过用较小力，塞规止端通过用较大力不超过250N
Press the bushing into ring gauge. The Go plug gauge could be inserted by a light pressure. The No Go plug gauge could not be inserted by heary pressure (Max.force 250N)
注意：轴套压入环规，轴套外径可能会永久减小
Note: When the bushing is pressed into ring gauge, external diameter could be permanent reduction.



壁厚测量
Wall thickness Meaurment

轴套壁厚测量: 按轴套高度在轴套轴向上测量一点，两点或三点。
The wall thickness of bushing is measured by professional gauge at one, two, or three positions according to bushing length.



L [mm]	X [mm]	Measurement position
L≤15	L/2	1
15＜L≤50	4	2
50＜L≤90	6 and L/2	3
L＞90	8 and L/2	3

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