

## Total Introduction

### 1. Bearing Code

#### Composition of the bearing codes

Bearing code is consisted of essential code, prefix and suffix, the arrangement is as below:

Prefix + Essential Code + Suffix

#### 1.1 Prefix: to denote bearing structure and material, etc.

##### Prefixes:

- H-----Ultra high speed
- N-----Cylindrical roller bearing
- NN-----Double row or multi-row cylindrical roller bearing
- S-----Stainless steel, XEZ Precision normally use SUS 440C
- QJ-----Four-point angular contact ball bearings
- NPPB-----Spherical outer ring deep groove ball bearings
- X-----Overlong service life

#### 1.2 Essential code: to denote basis type, structure and size of bearing, it is the basis of bearing code.

Rolling bearing essential code = type code + size code + bore code

Type code:

- 0-----Double row angular contact ball bearing
- 1-----Self-aligning ball bearing
- 3-----Tapered roller bearing
- 4-----Double row deep groove ball bearing
- 5-----Thrust ball bearing
- 6-----Deep groove ball bearing
- 7-----Angular contact ball bearing
- 8-----Thrust cylindrical roller bearing

#### 1.3 Suffix: normal denote inner structure, seal structure, cage and material, bearing material, tolerance, internal clearance and grease or oil, etc.

##### Suffixes:

- C-----Contact angle is 15°
- AC-----Contact angle is 25°
- ASK-----Outer ring has lubricating groove and lubricating holes, taper 1:12
- B-----Contact angle is 40°, but in 32XX and 33XX, the contact angle is 25°
- DA-----Split inner ring, contact angle is 45°
- E-----Tapered roller bearing, reinforced
- K-----Tapered bore, taper 1: 12
- K30-----Tapered bore, taper 1: 30
- HQ1-----Rolling element is ceramic ball

- R-----Outer ring flange
- N-----Outer ring has snap groove
- NR-----Outer ring has snap groove with snap ring
- NPPB-----Spherical outer ring, two seals
- V-----Full complement ball bearing

### Suffixes related to seal and shield structure:

- RS-----One side with seal (contact)
- 2RS-----Two sides with seals (contact)
- RZ-----One side with seal (non-contact)
- 2RZ-----Two sides with seals (non-contact)
- Z-----One side with shield
- ZZ-----Two sides with seals
- RSZ-----One side with shield, the other side with contact seal
- RZZ-----One side with shield, the other side with non-contact seal
- ZN-----One side with shield, the other side with snap groove
- ZNR-----One side with shield, the other side of outer ring with snap groove and snap ring
- ZNB-----One side with shield, the same side of outer ring with snap groove
- 2ZN-----Two sides with shield, outer ring with snap groove

### Suffixes related to cage:

- J-----Steel cage, normally use SPCC or 08F
- M-----Brass cage, ball riding
- MA-----Brass cage, outer ring guided
- T-----Solid window type cage, textile laminated phenolic resin.
- TV-----Glass-fibre reinforced polyamide, ball riding
- TVP-----Window type cage, glass-fibre reinforced polyamide, ball riding

**Suffixes related to precision** are according to GB/T307.1-2005, such as ,P0、 P6、 P5、 P4、 P2, etc., equivalent to ISO492: 2002

Suffixes on rolling bearing internal clearance are according to GB/T4604-2006, there are C2、 CM、 C0、 C3、 C4 and C5 series

### Suffixes on bearing sets;

- DB----- O arrangement
- DF-----X arrangement
- DT-----Tandem arrangement

And, there are other suffixes, such as, Z, ZV of vibration, friction torque, working temperature, lubrication, brand, etc.

### 1.4 Now, 6204 2RS J P63 Z2V2 SRL is taken as a sample to explain the code method

- 6-----Type code, 6 means deep groove ball bearing
- 2-----Size code, there are 0, 2, 3, for example, 6001, 620, 6304
- 04-----Bore code, 00 denote 10 mm in bore diameter, 01 denote 12mm, 02 denote 15mm, for other bore codes which more than 02, the calculation method is, bore code X 5= ID, for example, 04 X 5= 20(mm), 05 means 25mm, etc.
- 2RS-----seal code, two sides with contact type seal, rubber material is NBR.
- J-----Cage code, steel cage
- P63-----Code of precision and internal clearance, precision is P6, internal clearance is C3.
- Z2V2-----Code of vibration, vibration acceleration is Z2, vibration is V2. According to speed grade, vibration series are divided into V2,V3,V4. According to acceleration, there are grades of Z1, Z2, Z3, Z4 and no exceptional voice bearing
- SRL-----Code of grease, there are kinds of grease, normally can be divided into normal grease, low temperature grease, high temperature grease, low noise grease, etc.

## 2. Material

### 2.1 Chemical Element

#### 2.1.1 Chrome Steel

Standard	Symbol	Chemical element						
		C	Si	Mn	Cr	Mo	P	O(×PPM)
						≤	≤	≤
GB/T18254	GCr15	0.95-1.05	0.15-0.35	0.25-0.45	1.40-1.65	0.10	0.025	15
AISI/ASTM A295	52100	0.93-1.05	0.15-0.35	0.25-0.45	1.35-1.60	0.10	0.025	15
NF	100C6	0.95-1.05	0.15-0.35	0.25-0.45	1.40-1.65	0.10	0.025	15
JIS	SUJ2	0.95-1.10	0.15-0.35	≤0.50	1.30-1.60	0.08	0.025	15
JIS	SUJ3	0.95-1.10	0.40-0.70	0.90-1.15	0.90-1.20	0.08		15
JIS	SUJ4	0.95-1.10	0.15-0.35	≤0.50	1.30-1.60	0.10-0.25		15
S≤0.025		Mi≤0.30		Cu≤0.25				

#### 2.1.2 Martensitic Stainless Steel:

Standard	Symbol	Chemical element						
		C	Si	Mn	Cr	Mo	P	O(×PPM)
						≤	≤	≤
JISG4303	SUS440C	0.95-1.20	≤1	≤1	16-18		0.03	
AISI	440C	0.95-1.10	≤1	≤1	16-18	0.40-0.65	0.025	
GB	9Cr18	0.90-1.00	≤0.8	≤0.8	17-19		0.035	
S≤0.025		Mi≤0.75		Cu≤0.50				

#### 2.1.3 Cage Material

Standard	Symbol	Chemical element						
		C	Si	Mn	Cr	Mo	P	O(×PPM)
						≤	≤	≤
JISG 3141	SPCC	≤0.12		≤0.50			0.04	

## 2. 2 Material Property

Material	Rings and ball	Chrome steel	Stainless steel
	Cage	Cold-rolled strip(SPCC BQB402)、 Stainless steel plate (1Cr18)	Polyamide (Nylon 66) ,etc.
Shield	Cold-rolled strip(SPCC BQB402)、 Stainless steel plate (1Cr18)		Stainless steel plate
Seal ring	Rubber (NBR、Viton) +Frame (SPCC BQB402) , PTFE		NBR+SPCC BQB402, PTFE
Property	Use temperature	Lower than 120℃	
	Dynamic load rating	Heavy	
			About 80% of that of chrome steel

Static load rating	Heavy		About 80% of that of chrome steel
Friction torque	Low		High
Purpose	Normal or high precision	High speed	Anticorrosion, standing high temperature

### 3. Bearing type and suitable precision grade

Bearing type	Standard	Suitable precision grade					
Deep groove ball bearings	GB307-2005	P0		P6	P5	P4	P2
Double row ball bearings		P0		P6			
Angular contact ball bearings		P0		P6	P5	P4	P2
Angular contact thrust ball bearings				P6	P5	P4	P2
Spherical outer ring ball bearings		P0		P6			
Double inner ring rolling bearings				P6	P5	P4	P2
Self-aligning ball bearings		P0					
Cylindrical roller bearings		P0		P6	P5	P4	P2
Tapered roller bearings		P0		P6	P5	P4	
Nonstandard bearings		P0		P6	P4		

Standard GB/T307-2005 divides bearing precision grade into P2, P4, P5, P6, P0. The contrast to ISO、JIS, DIN, ANSI is as below:

Standard	Precision				
GB/T307-1994	B	C	D	E	G
GB/T307-2005	P2	P4	P5	P6	P0
ISO	CLASS2	CALSS4	CLASS5	CLASS6	NORMAL CLASS
DIN	P2	P4	P5	P6	P0
ANSI	ABEC9	ABEC7	ABEC5	ABEC3	ABEC1
JIS	JIS2	JIS4	JIS5	JIS6	JIS0

### 4. Precision Selection

Property requirement	Examples	Suitable precision grade
Inserts have high runout precision	Acoustics instruments, Video instrument principal axis(DVR, recorder)	P4
	Radar, Rotating shaft of paraboloid antenna	P5、P4、P2
	Machine tool spindle	P5、P4、P2
	Electronic computer, Disk principal axis	P5
	Roll neck for aluminum foil	P4
	Support bearings in multilevel rolling mill	
High rotating speed	Supercharger	P5、P4
	Principal axis in jet engine, Auxiliaries	P5、P4
	Centrifugal machine	P5、P4

	Liquefied natural gas pump Principal axis in turbo molecular pump, Protecting bearings Machine tool spindle Tensioner	P5 P5、P4 P5、P4、P2 P5、P4
Friction or friction vibration is small	Control instrument (synchronous motor, servo motor, peg-top gimbal mount) Measuring instrument Machine tool spindle	P4 P5 P5、P4、P2
Normal precision	Small size motor, Wheel gearing, Cam gear, Generator、Low induction synchronous servomotor, Pressure rotor, Printer, Photocopier, Detecting instrument	P0、P6

### 5. Internal Clearance and Norm value

Before the bearing is mounted on a shaft or inserted into a housing, fix outer or inner ring, and move the other ring which is not fixed in radial or axial direction, the movement is the internal clearance, according to the moving direction, it can be divided into radial clearance and axial clearance.

Large or small of internal clearance in rotating or working clearance has effect to bearing on fatigue strength, temperature, noise and vibration, etc.

To get a stable value, normally a specified measure load will be added on bearing when internal clearance of a bearings should be measured, so the measured value will be bigger than actual value or theoretical internal clearance, because flexible deformation brought about by measuring load is also be measured.

But for roller bearing, this flexible deformation is too small to take into consideration.

Internal clearance of a un-mounted bearing normally shown as theoretical clearance.

#### • Nominal value (unit: $\mu\text{m}$ )

Nominal ID	MC1 series		MC2 series		MC3 series		MC4 series		MC5 series		MC6 series	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0~9	0	5	3	8	5	10	8	13	13	20	20	28
Nominal ID	C2 series		EMQ series		C0 series		C3 series		C4 series		C5 series	
0~10	0	7	4	11	2	13	8	23	14	29	20	37
10~18	0	9	4	11	3	18	11	25	18	33	25	45
18~24	0	10	5	12	5	20	13	28	20	36	28	48
24~30	1	11	5	12	5	20	13	28	23	41	30	53
30~40	1	11	9	17	6	20	15	33	28	46	40	64
40~50	1	11	9	17	6	23	18	36	30	51	45	73
50~65	1	15	12	22	8	28	23	43	38	61	55	90
65~80	1	15	12	22	10	30	25	51	46	71	65	105
80~100	1	18	18	30	12	36	30	58	53	84	75	120
100~120	2	20	18	30	15	41	36	66	61	97	90	140
120~140	2	23	18	30	18	48	41	81	71	114	105	160
140~160	2	23	18	30	18	43	46	91	81	130	120	180

### 6 Internal Clearance Selection

When bearing is mounted on a shaft or insert a housing, a expansion or shrink will take place because of interference fit, the internal clearance, after reduce expansion or shrink brought about by interference fit from theoretical clearance, is "mounting clearance".

Because of the temperature difference in bearing interior, a variation will take place, the clearance, after reduce variation from mounting clearance, is effective clearance.

The clearance of a bearing when it is mounted in a machine and bearing a certain load, i.e., effective clearance add up to flexible deformation brought about by the load on bearing, is "working clearance".

When working clearance is title negative-value, the fatigue life is the longest but will largely reduce with the negative-value increase, so when select suitable clearance, it is better to make working clearance is zero or relatively positive.

In addition, if the rigidity need to be increased or noise need to be decreased, working clearance should be even more negative, while if temperature of bearing will increase much when work, working clearance should be even more larger in positive, concrete analysis should be made according to working conditions.

## 7. Standard Lubricants

When there is no special instruction, **Precision** will use standard lubricants as below,

Lubricant brand	Basic type	Working temperature(°C)	Application range
Chevron SRI-2	Mineral grease	-30~180	Stand high temperature, water resistance
Shell Alvania 2	Mineral grease	-35~120	Long service life, wide usage
Shell Doliun R	Petroleum grease	-40~150	Anticorrosion, water resistance
Kyodo Yoshi SRL	Compound grease	-40~150	Low noise, Low torque
Mobil HP	Lithium Chromium compound grease	-30~110	Bear vibration, anticorrosion
Dupont Krytox240AC	Fluorination grease	-35~290	Stand high temperature
Exxon Beacon 325	Compound grease	-55~120	Common grease lubricant

## 8. Vibration and Vibration Acceleration

### 8.1 Single Bearing Vibration Acceleration Limiting Value

ID (mm)	ID series 0			ID series 2				ID series 3			
	Z1	Z2	Z3	Z1	Z2	Z3	Z4	Z1	Z2	Z3	Z4
10	39	35	30	39	36	32	27	41	37	34	29
12	40	36	31	40	36	32	27	42	37	34	29
15	41	37	32	41	38	33	28	43	39	35	30
17	41	37	32	42	38	33	28	44	39	35	30
20	42	38	33	43	39	35	30	45	40	36	31
25	43	39	35	44	40	37	33	46	41	38	34
30	44	40	36	45	41	38	34	47	42	39	35
32	45	41	37	46	42	39	35	48	43	40	36
35	46	42	38	47	43	40	36	49	44	41	37
40	48	43	39	49	44	41	37	51	46	42	38

## Bearing

45	50	45	42	51	46	43	40	53	48	44	41
50	51	47	44	52	48	45	42	54	50	46	43
55	53	49	46	54	50	47	44	56	51	48	45
60	55	51	48	56	51	48	45	58	53	50	47

### 8.2 Single Bearing Vibration Speed Grade Limiting Value

Bore mm	V1			V2			V3			V4		
	Low Fry.	Medium Fry.	High Fry.	Low Fry.	Medium Fry.	High Fry.	Low Fry.	Medium Fry.	High Fry.	Low Fry.	Medium Fry.	High Fry.
10	115	75	65	85	55	45	50	30	25	40	9	10
12	115	75	65	85	55	45	50	30	25	40	9	10
15	145	95	80	105	73	55	60	41	30	47	13	13
17	145	95	80	105	73	55	60	41	30	47	20	20
20	175	120	95	125	95	70	75	55	40	55	20	20
25	175	120	95	125	95	70	75	55	40	55	25	27
30	195	145	125	145	115	95	85	70	55	65	30	35
32	195	145	125	145	115	95	85	70	55	65	30	35
35	195	145	125	145	115	95	85	70	55	65	37	40
40	235	175	155	175	145	125	105	85	75	77	45	45
45	235	175	155	175	145	125	105	85	75	77	55	55
50	275	195	195	205	155	155	120	95	95	90	65	65
55	275	215	195	205	175	175	120	105	105	90	65	65
60	315	215	235	235	175	195	140	105	125	95	75	75