DEEP GROVE BALL BEARINGS

Luna
Bearings, Automation & Power Transmission

59, Bibijan Street, Second Floor, Moiz Manzil, Mumbai - 400003
Tel : +91-22-40786110, 23455052, 23455152, 23427671, 23432811
Fax : 23427773
Email : luna@vsnl.com / sales@lunabearings.com
Web : www.lunabearings.com / www.luna.co.in

KHS-LG
KHS-LG INDUSTRIES CO., LTD.

KHS-LG®

move with us

Content

1. Manufacturing Procedure

Outer ring

Inner ring

Steel ball

Cage

Assembly

2. Structure and Characteristics of Rolling Bearings

2.1 Structure and Classification

Rolling bearing (below abbreviated as bearing)is commonly composed of inner ring,outer ring,roller and cage.According to the rolling category,it is divided into ball bearing and roller bearing.Please refer to Table2.1 to see the bearing conceptual diagram with the representative structure.

2.2 Structure and Features

The rolling bearing has the following characteristics:

(1) It is equipped with high standard and ample specifications with fine interchangeability.

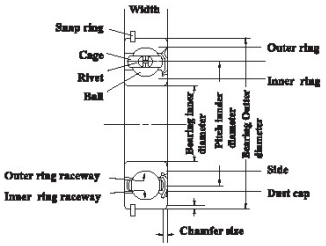
(2) Commonly it can simultaneously bear radial load

(3) It is applicable for using in high and low temperature.

(4) It is fit for using in high speed condition.

Single–row deep groove ball bearing is the structure with the widest application in rolling bearings.The bearing can simultaneously bear radial load and axial load.It is fit for using in the occasions such as high–speed rotation,low noise etc.

Apart from open–type,it also has the bearing with steel shield ,e.g.608ZZ and the bearing with rubber seal ring,e.g.608–2RS.



Single row deep groove ball bearing

Chart 2.1

3. Bearing Selection Methods

The performance amd other requirements on bearing turn diversified when the market is exerting increasingly strict requirement on the performance of various mechanical devices and instruments where rolling bearings is used.

In order to choose the most applicable bearings among vast structures and sizes,it should be researched into from multiple angles.

While choosing the bearings,firstly the customers normally will make an approximate decision to the bearing structure according to the bearing arrangement of the shafting,installation,disassembly difficulty degree,bearing allowable space&size,bearing market competitive power etc.

Secondly,the customers can comparatively research into various mechanical design lives and all kinds of durability limits to the used bearings and decided by the bearing dimensions at the same time.

While selecting the bearings,only put the bearing fatigue life into consideration is not correct.what is more,it should fully research into the lubricating grease life,wear–ability,noise etc,caused by the lubricating grease ageing.

Besides,according to different uses,it is necessary to choose the specially–designed bearings out of the requirements such as accuracy,clearance,cage structure,lubricating grease and so on .

But there is no definite sequence and rule to the bearing selection.Top priority should be given to the conditons and performances repuired by bearings.It is especially practical to consider the most related items to the bearings.Please contact with KHS–LG in choosing the bearings with mew machinery,special use conditions or special ambient conditions.

As an ordinary referential example to bearing selection,its procedures have been indicated in Table3.1

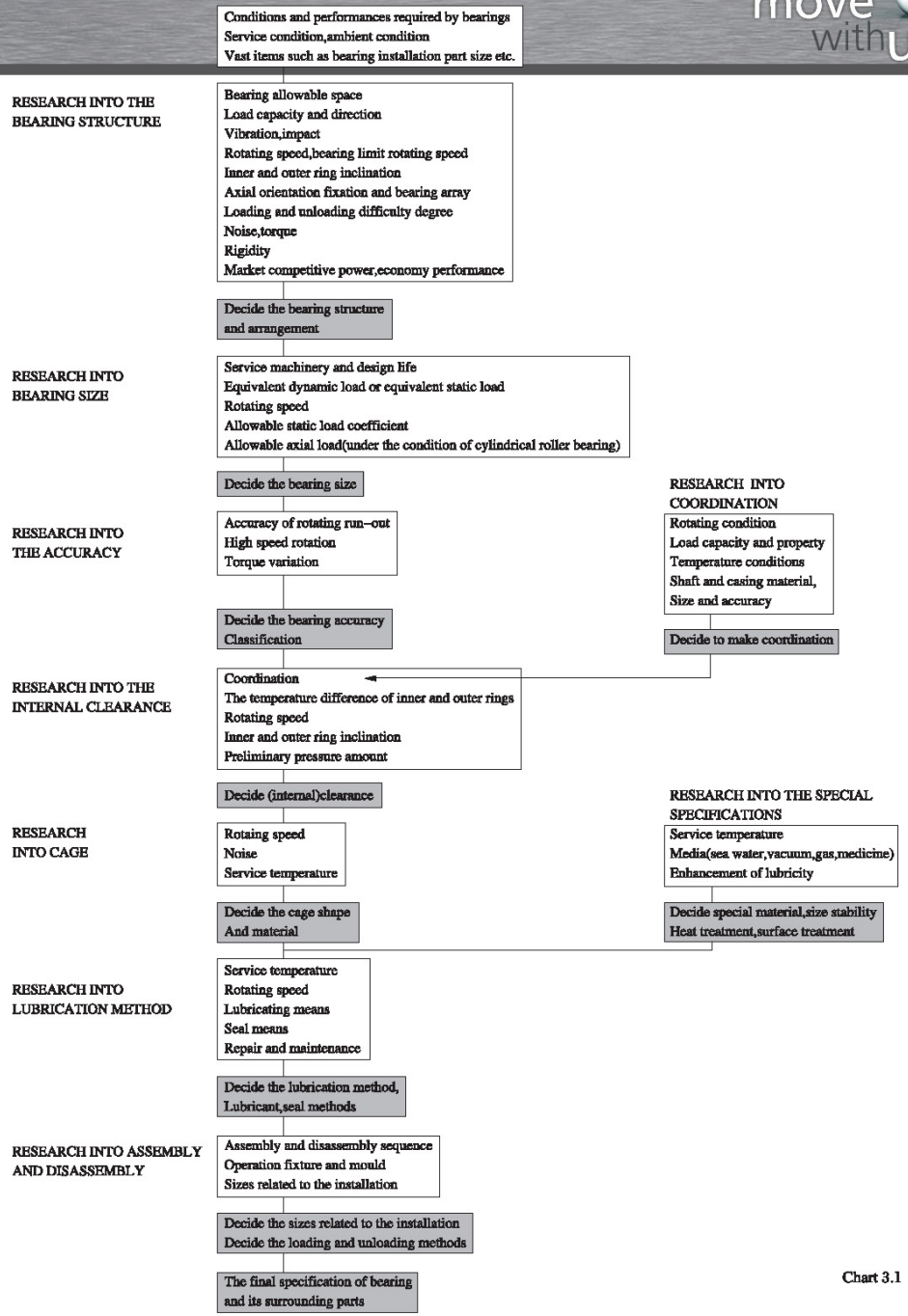


Chart 3.1

4. Selection of Bearing Size

4.1Bearing life

After certain period of the bearing running,the bearings accuracy will be lowered,the noise and vibration will be increased with lubricating grease ageing.the running face has been stripped because of fatigue. Therefore the bearing can not be used any more.The service life of this kind of bearing is called the bearing life in a broad sense.

They are respectively named as accuracy life,noise life,lubricating grease life,rolling fatigue life etc.

4.1.1、Rated fatigue life

Rated fatigue life refers to total frequency of bearing running with 90%reliability to the same model bearings under the same operating conditons.Under a certain rotating speed,it usually indicates the rated fatigue life by counting the total running period.

In reseach it usually takes the fatigue life as bearing life.

4.2、Basic dynamic load rating

4.2.1、Basic dynamic load rating functions as the constant load to the static external ring.

Under this kind of load,the rated fatigue life is 1 million revolutions,rpm.

4.2.2、Basic rated life of ball bearing

(Total rotary number) $L10=(\frac{C}{P})^3$ ……(4.1)

It indicates the relations amid basic rated transient load,equivalent moving load and basic rated life.

(Time) $L10h=\frac{10^6}{60n}(\frac{C}{P})^3$ ……(4.2)

It is more convenient to indicate the life by time when the bearing is rotated at a constant speed,as it is shown in Formula(4.2).

In the formula,

L10——the basic rated life （10^6 rpm.）.

L10h———the basic rated life .

P———the equivalent moving load,N（kgf）

C———the basic dynamic load rating, N（kgf）

n———the rotating speed(rpm)

4.2.3、Revise the basic dynamic load rating according to the specific temperature

When the rolling bearings have been used under heat conditions,the bearing hardness will be redced,the fatigue life will be lowered than that for use in normal temperature.Therefore the basic dynamic load rating.should be assessed a little smaller correspondingly.

Ct=ft × C……(4.3)

In the formula:

Ct——the basic dynamic load according to the temperature correction

ft ———the temperature coefficient (Table4.1)

C———the basic dynamic load rating.

When the bearing is used under high temperatures above 120℃，it should commonly be implemented with size stability treatment

Table 4.1

Bearing temperature ℃	125	150	175	200	250
Temperature coefficient ft	1.00	1.00	0.95	0.90	0.75

Code	S0	S1	S2
Temperature ℃	200℃	250℃	300℃
Ring hardness HRC	59~64	57~62	55~59

4.2.4 Revised rated fatigue life

The basic formula of the rated fatigue life

Ball bearing $L10=(\frac{C}{P})^3$ ……(4.4)

L10 is rated fatigue life with 90% reliability.with the improvement of the rolled steel adopted by the bearings,the fatigue life will be extended accordingly.it can uset the following compensation coefficient to revise the rated fatigue life. Ln=a1a2a3L10……(4.5)

Ln indicates the fatigue life with the considerations of the steering response,material modification.lubricating condition.

L10—the rated fatigue life with 90% reliability

a1—the reliability cefficient

a2—the bearing characterization factor

a3—the service condition coefficient

please refer to Table 4.2 for a1 value with high than 90% of the reliability.

Reliability coefficient a1 value

Table 4.2

%	90	95	96	97	98	99
a1	1.00	0.62	0.53	0.44	0.33	0.21

If the beraing is not tilted,and it uses the lubricating oil with high viscosity ,2 can be set to(a2 × a3)value.

4.3 Calculation of bearing load

4.3.1 Load coefficient

Though it can calculate the radial load and axial load the result is not exact.The load which actually effects the bearing is usually larger than the calculated value because of the mechanical vibration impact.The load value can be worked out according to the following formula:

Fr=fw · Frc……4.6

Fa=fw · Fac……4.7

Among them, Fr,Fa ——the load（N）.{kgf} which effects the bearing.

Frc,Fac—the theoretically calculated load (N).{kgf}

Please refer to table 4.3 for the load coefficient of fw.

Load coefficient fw

Running condition	Use occasion examples	fw
Non-impact smooth running	Motor,machine tool,air-conditioner	1~1.2
Ordinary running	Air blower,compressor,elevator,crane paper-making machinery	1.2~1.5
Running with vibretion,impact	Construction machinery,stone crusher (abrasive wheel) vibrating screen,calender	1.5~3

Table 4.3

4.4 Equivalent dynamic load

Most of the bearings undertake the synthetic load of radial load and axial load.it also has a varied kind of load conditions.Therefore it can not directly compare the actual bearing load with the basic dynamic load rating.Therefore we should convert the actual load to the imaginary load with defined size and orientation which through the bearing center,then make analysis&comparison.The bearing has the same life as the actual load under conditions of the imaginary load.

This converted imaginary load is called the equivalent moving load.

4.4.1、The calculation of the equivalent dynamic load

The equivalent dynamic load of radial bearing can be calculated according to the following formula:

P=XFr+YFa ……4.8

Among them:

p—the equivalent dynamic load(N).{kgf}

Fr—the radial load(N).{kgf}

Fa—the axial load(N).{kgf}

X—the radial load coefficient

Y—the axial load coefficient

4.5、Basic rated static load and equivalent static load

4.5.1、Basic rated static load

Basic rated static load (Co)is a static load that creats the contacting press between the bearing raceway and the ball which endures the max Stress.

Ball bearing 4200Mpa(428kgf /mm^2)

In the contact part which bears such kind of contact stress,the sum total of the permanent deformation volume from the ball and raceway groove is about 0.0001 times of the ball package diameter.

4.5.2 Equivalent static load

Equivalent static load is an imaginary load.That is when the bearing is in a static mode or the rotating speed is extremely low. The contact stress of ball and raceway groove which bear the max.load is the same as that under actual load conditions.

The equivalent static load of radial bearing will adopt the larger value which results from the following two formulas.

Po=XoFr+YoFa ……4.9

Po= Fr

Among them:

Po—–the equivalent static load (N).{kgf}

Fr——the radial load (N).{kgf}

Fa——the axial load (N).{kgf}

Xo—the static radial load coefficient

5. Bearing Limit Rotating Speed

Rolling bearing has a defined rotating speed limit.There are the limit rotating speeds of bearing with grease lubrication and oil lubrication in the bearing size table.it is an allowable rotating speed of the bearings with standard design under ordinary load conditions.When the bearing rotating speed exceeds70% of the limit rotating speed.it should choose the superior lubricating grease or oil with high speed and superior performance.

5.1 Correction of the limit rotating speed

When the bearing is under the service condition ,that under the load (P)exceeds 8%of the basic rated load or the axial load Fa is higher than 20% radial load Fr.the limit rotating speed should times the correction factor.

See Table 5.1,5.2

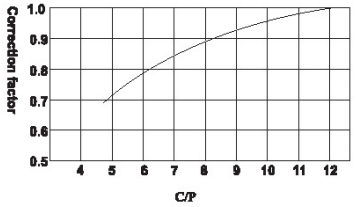


Chart 6.1 Correct the limit rotating speed according to the bearing load

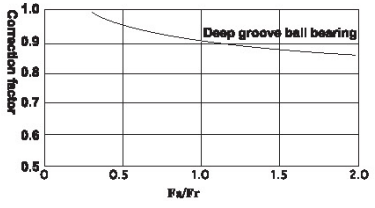


Chart5.2 Correction to limit rotating speed under synthetic load

6. Main Sizes and Codes of Bearings

6.1 Major sizes

Please refer to Table 6.1 for the major sizes of rolling bearing it mainly has bearing inner diameter(d),bearing outer diameter(D),bearing width (B),chamfer dimension(r)etc.All the major dimensions have been stipulated in the National standard of GB/T273.3.

In the Major size table,other sizes which are opposite to internal diameter code,internal diameter size will be shown according to the diameter series and dimension series.

Diameter series refers to the outer diameter of staged bearing series comparing with the inner diameter of standard bearing.

Dimension series refers to the combination between width and diameter series.

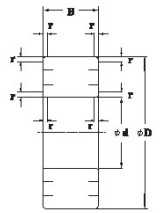
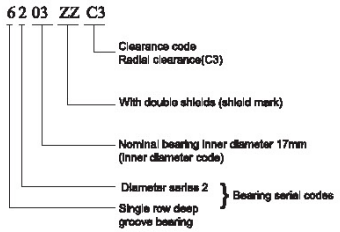


Chart6.1 Radial ball bearing
Radial roller bearing

6.2 Bearing codes

Rolling bearing code shows the bearing's structure , major size,rotating accuracy,internal clearance,specification.it is composed of the basic and auxiliary codes. Example 1



(Example 1)

7. Bearing Accuracy

There are stipulations to the rollre bearing major size tolerance, admittance value, rotating precision in the National standard of GB/T307.1。The following is acomparison table between these tolerance and ISO、JIS standards

Standard allowable tolerance grades					
GB/T307.1	P0	P6	P5	P4	P2
ISO 492	Normal class	Class 6	class 5	class 4	class 2
JIS B 1514	JIS 0级	JIS 6级	JIS 5级	JIS 4级	JIS 2级
AFBMA STD.20	ABEC-1	ABEC-3	ABEC-5	ABEC-7	ABEC-9

Table 1: Inner ring tolerances (finished product) **Tolerance unit: μm**

Tolerances Class	d mm		Δdmp		Δds		Vdsp Diameter series			Vdmp	Kia	Sd	Sia	ΔBs		VBs
							9	0、1	2、3、4							
	Exceed	to	max	min	max	min	max			max				max	min	max
P0 (ABEC-1)	0.6	2.5	0	-8	/	/	10	8	6	6	10	/	20	0	-40	12
	2.5	10		-8			10	8	6	6	10		20		-120	15
	10	18		-8			10	8	6	6	10		20		-120	20
	18	30		-10			13	10	8	8	13		24		-120	20
	30	50		-12			15	12	9	9	15		24		-120	20
	50	80		-15			19	19	11	11	20		30		-150	25
P6 (ABEC-3)	0.6	2.5	0	-7	/	/	9	7	5	5	5	/	10	0	-40	12
	2.5	10		-7			9	7	5	5	6		10		-120	15
	10	18		-7			9	7	5	5	7		10		-120	20
	18	30		-8			10	8	6	6	8		12		-120	20
	30	50		-10			13	10	8	8	10		12		-120	20
	50	80		-12			15	15	9	9	10		15		-150	25
P5 (ABEC-5)	0.6	2.5	0	-5	/	/	5	4		3	4	7	7	0	-40	5
	2.5	10		-5			5	4		3	4	7	7		-40	5
	10	18		-5			5	4		3	4	7	7		-80	5
	18	30		-6			6	5		3	4	8	8		-120	5
	30	50		-8			8	6		4	5	8	8		-120	5
	50	80		-9			9	7		5	5	8	8		-150	6
P4 (ABEC-7)	0.6	2.5	0	-4	0	-4	4	3		2	2.5	3	3	0	-40	2.5
	2.5	10		-4		-4	4	3		2	2.5	3	3		-40	2.5
	10	18		-4		-4	4	3		2	2.5	3	3		-80	2.5
	18	30		-5		-5	5	4		2.5	3	4	4		-120	2.5
	30	50		-6		-6	6	5		3	4	4	4		-120	3
	50	80		-7		-7	7	5		3.5	4	5	4		-150	4

Table 2: Outer ring tolerances (finished product) **Tolerance unit: μm**

Tolerances Class	D mm		ΔDmp		ΔDs		VDsp Open			Close	VDmp	Kea	SD	Sea	ΔCs		VCs
							9	0、1	2、3、4	2、3、4							
	Exceed	to	max	min	max	min	max				max				max	min	max
P0 (ABEC-1)	2.5	6	0	-8	/	/	10	8	6	10	6	15	/	24	ΔBs equals VBs at same bearing inner ring		
	6	18		-8			10	8	6	10	6	15		30			
	18	30		-9			12	9	7	12	7	15		40			
	30	50		-11			14	11	8	16	8	20		40			
	50	80		-13			16	13	10	20	10	25		40			
	80	120		-15			19	19	11	26	11	35		45			
P6 (ABEC-3)	2.5	6	0	-7	/	/	9	7	5	9	5	8	/	12			
	6	18		-7			9	7	5	9	5	8		15			
	18	30		-8			10	8	6	10	6	9		20			
	30	50		-9			11	9	7	13	7	10		20			
	50	80		-11			14	11	8	16	8	13		20			
	80	120		-13			16	16	10	20	10	18		22			
P5 (ABEC-5)	2.5	6	0	-5	/	/	5	4			3	5	8	8			
	6	18		-5			5	4			3	5	8	8			
	18	30		-6			6	5			3	6	8	8			
	30	50		-7			7	5			4	7	8	8			
	50	80		-9			9	7			5	8	8	10			
	80	120		-10			10	8			5	10	9	11			
P4 (ABEC-7)	2.5	6	0	-4	0	-4	4	3			2	3	4	5			
	6	18		-4		-4	4	3			2	3	4	5			
	18	30		-5		-5	5	4			2.5	4	4	5			
	30	50		-6		-6	6	5			3	5	4	5			
	50	80		-7		-7	7	5			3.5	5	4	5			
	80	120		-8		-8	8	6			4	6	5	6			

8. Bearing Measuring Methods

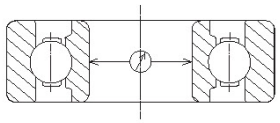
In GB/T307.2, the measurement methods for precisions of rolling bearings are specified, and its general contents are indicated as follows:

In the aspects of size precision

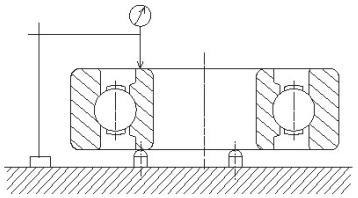
1. Bearing bore diameter (d) Chart 8–1
2. Bearing outside diameter (D) Chart 8–2
3. Inner ring width (B) Chart 8–3
4. Outer ring width (C) Chart 8–4

In the aspect of Rotational Precision

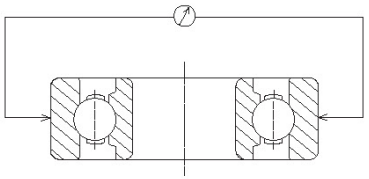
1. Verticality of Inner Ring Face to bore (Sd) Chart 8–5
2. Verticality of Outer Ring Outside Surface to End Face (SD) Chart 8–6
3. Radial Runout of assembled bearing inner ring (Kia) Chart 8–7
4. Radial Runout of assembled bearing outer ring (Kea) Chart 8–8
5. Axial Runout of assembled bearing inner ring (Sia) Chart 8–9
6. Axial Runout of assembled bearing outer ring (Sea) Chart 8–10



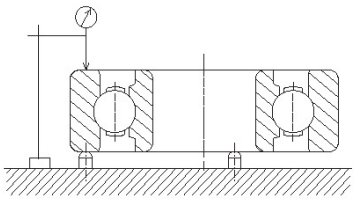
Bearing bore diameter (d) Chart 8-1



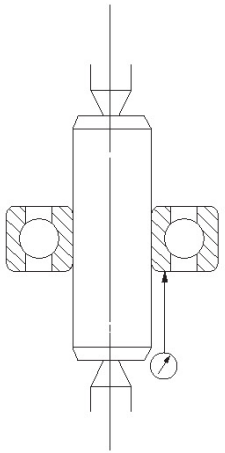
Inner ring width (B) Chart 8-3



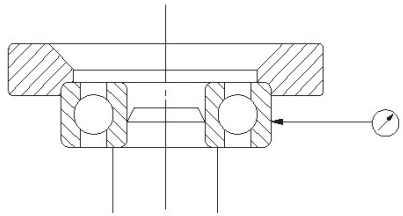
Bearing outside diameter (D) Chart 8-2



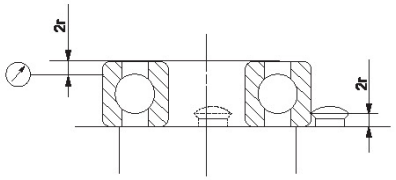
Outer ring width (C) Chart 8-4



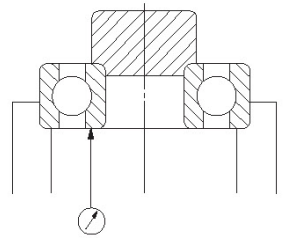
Verticality of Inner Ring Face to bore (Sd) Chart 8-5



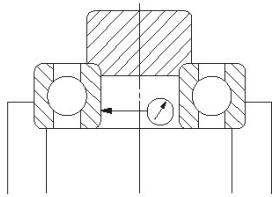
Radial Runout of assembled bearing outer ring (Kea) Chart 8-8



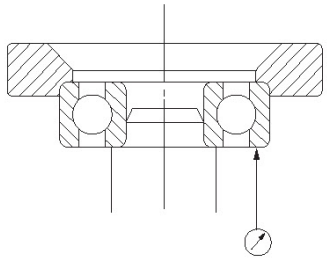
Verticality of Outer Ring Outside Surface to End Face (SD) Chart 8-6



Axial Runout of assembled bearing inner ring (Sia) Chart 8-9



Radial Runout of assembled bearing inner ring (Kia) Chart 8-7



Axial Runout of assembled bearing outer ring (Sea) Chart 8-10

9. Bearing Internal Clearances

The bearing internal clearance is the moving amout from moving another ring due to one ring (inner ring or outer ring) is fixed.
The radial internal clearance is amout of radial direction moving.The axial internal clearance is amount of axial direction moving.(Chart 9.1)
The internal clearance in operation greatly influences bearing performance including fatigue life,heart–generation,noise,and vibration etc.
Chart 9.1 bearing internal clearances

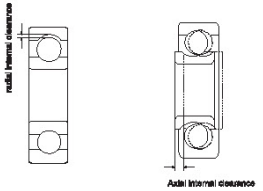


Chart9.1 Bearing internal clearances

To obtain accurate measurements,the clearance is generally measured by applied a specified measuring load on the bearing.
Therefore,the measuring clearance (sometimes called theoretical clearance is always slightly larger than the actually clearance.It means the amount of elastic deformation be increase.)

9.1 Selection of bearing internal clearances

The internal clearance after subtracting the decrease from the theoretical internal clearance is called "mouting clearance".
The internal clearance after subtracting the radial clearance due to temperature difference between inner rings with outer rings is called "effective clearance".
The internal clearance during bearing mouting at machine and bared a lot of loads rotating ,means the effective clearance plus the clearance is occurred after elastic deformation by bearing load, is called "operating clearance".
As chart 9.2 showing, the longest fatigue life of a bearing can be expected when the effective clearance is slightly negative,but an excessive negative clearance will greatly shorten the bearing life.Therefor ,when selection the internal clearance,selecting the operating clearance equal zero or a slightly positive amout would be proper.
Chart 9.2 The relationship of operating clearance with bearing fatigue life.

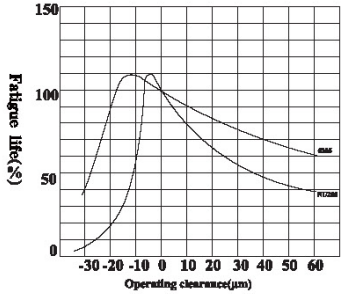


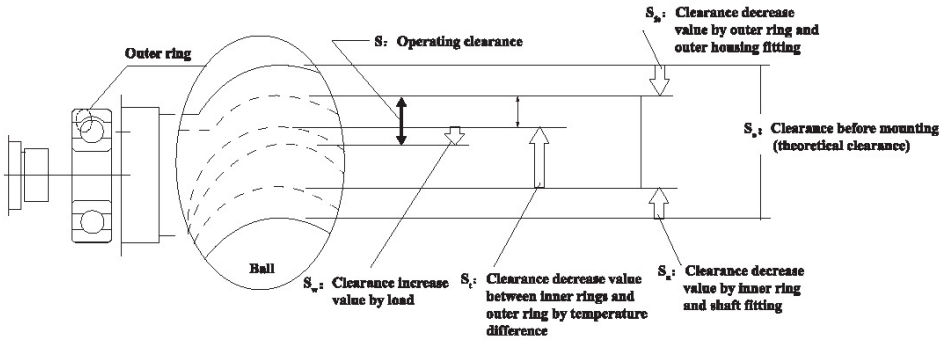
Chart9.2 The relationship between operating clearance and fatigue life

In addition,in order to advance rigidity or reduce the noise of bearing.the operating clearance should be selected much more negative. The operating clearance should be selected much more positive when the temperature of bearing is raised strongly.It must according using condition to detall analysis.

9.2 Operating clearances

The table 9.1 is applicable to calculate the amount of operating clearance for steel shaft and steel housing.

Table 9.1 Calculation methods for operating clearance



Mounting clearance (S)	$S=S_o-(S_f+S_{t1}+S_{t2})+S_w$	
Clearance decrease value by fit (S_f)	(Hollow Shaft) $S_{fi}=d_{eff}\cdot\frac{d}{D_r}\cdot\frac{1-\frac{d_r^2}{d^2}}{1-\frac{d_r^2}{D^2}}$ (Solid Shaft) $S_{fi}=d\ \frac{d}{D_r}$	($D_h\neq\infty$) $S_{fo}=d_{eff}\cdot\frac{D_r}{D}\cdot\frac{1-\frac{D_r^2}{D_h^2}}{1-\frac{D_r^2}{D_r^2}}$ ($D_h=\infty$) $S_{fo}=d_{eff}\frac{D_r}{D}$
Clearance decrease value by temperature difference between inner ring and outer rin	Related with housing situation, generally supposing outer ring expansion amount is zero, and calculating it approximately using follo wing equation: $S_{t1}=a(D_i\cdot t_i-D_r\cdot t_r)$	Where, Therefore,$S_{t1}+S_{t2}$can calculate. by following equation $S_{t1}+S_{t2}=a\cdot D_i\cdot t_i+2a\cdot D_r\cdot t_2$
Clearance decrease value by the roller temperature rising	$S_{t2}=2a\cdot D_r\cdot t_r$	$t_i$is the temperature difference between inner ring with outer ring $t_i=t_i-t_e$ t_2t is the temperature difference between roller with outer ring $t_2=t_i-t_e$

In the table 9.1

S ： Operating clearance，mm
So： Theoretical clearance，mm
Sf： Clearance decrease value by fit，mm
Sfi： The expansion value in raceway diameter of inner ring，mm
Sfo： The shrinkage value in raceway diameter of outer ring, mm
St1： Clearance decrease value by temperature difference between inner ring and outer ring，mm
St2 ： Clearance decrease value by the roller temperature rising, mm
Sw： Clearance increase value by load, mm
deff： Effective interference value of inner ring,mm
d ： Nominal bearing bore diameter，mm
do：Hollow Shaft bore diameter, mm
Di： Raceway diameter of inner ring，mm
Ball bearing·····$D_i \fallingdotseq 0.2(D+4d)$
Roller bearing·····$D_i \fallingdotseq 0.25(D+3d)$

Deff ： Effective interference of outer ring， mm
Dh：Housing outer diameter， mm
De：Raceway diameter of outer ring，mm
Ball bearing·····$D_e \fallingdotseq 0.2(4D+d)$
roller bearing·····$D_e \fallingdotseq 0.25(3D+d)$
D：Nominal bearing outer ring diameter
a：The coefficient of linear expansion in bearing steel （$12.5\times10-6$）1/℃
Dr：Average of roller diameter，mm
Ball bearing·····$D_r \fallingdotseq 0.2(D-d)$
roller bearing·····$D_r \fallingdotseq 0.25(D-d)$
ti：Inner ring temperature，℃
te：Outer ring temperature，℃
tr：Roller temperature，℃

regarding shafts housings are not steel;adopting the statistic method that usually is used during analyzes auto bearing internal clearance,or analysis using special condition's internal clearance,please contact with KHS–LG .

Table 9.2 Selecting clearances out of standard

Use condition	Examples	Example for selection clearances
Big interference when heavy load or shock load	Railway vehicle axl	C3
Vibration load or shock load,all tight fits for outer ring and inner ring should be used	Vibrating screen, Main electromtor for railway vehicl, Final speed reducer device for tractor	C3、C4 C4 C4
Bend of shaft is bigger	Auto trailing wheel	C5
Be heating up on shaft and inner ring	Paper dryer, Axle neck for rolling mill.	C3、C4 C3
All of inner rings and outer ring should beclearance fitting	Axle neck for rolling mill	C2
Decrease noise and vibration rotating when rotating	micro motor	C2、C2、CM
Through adjusted mounting clearance to decrease axial flounce	Lathe spindle	C9NA、C1NA

9.3 Bearing clearance and specification

Clearance is gap amid bearing inner ring,outer ring and ball package.Bearing has radial clearance and axial clearance.

9.3.1 Deep–groove ball bearing radial clearance

Unit: μm

Nominal bearing inner diameter d (mm)		Rdial clearance									
		C2		CN		C3		C4		C5	
Exceed	Below	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2.5	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120

9.3.2 Radial internal clearance of small （D≥9，d＜10）and miniature（D＜9）bearing

Unit: μm

Clearance mark	MC1		MC2		MC3		MC4		MC5		MC6	
Clearance	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	0	5	3	8	5	10	8	13	13	20	20	28

Note:Standard clearance is MC3

9.3.3 Radial clearance of motor bearing

Inner diameter d (mm)		Radial clearance CM	
Over	To	Min	Max
2.5	10	3	10
10	18	4	11
18	30	5	12
30	50	9	17

10. Bearing Fits

10.1 The purpose of fits

The purpose of fits is let bearing inner ring or outer ring all are fixed firmly with shaft or housing,in case any circumferential sliding is occurred on the matching surface.This kind of sliding which is called "creeping" will cause many problems,such as :abnormal heating,the matching surface become abraded (abrasive metallic particles entering the interior of the bearing)and vibration etc.It leads bearing could not fully exert the function.

Therefore, it is important to let rings have tight fit in order to they are firmly fixed with shaft or housing.

10.2 The dimension tolerance and fit of shaft or housing

The metric dimension tolerance of shaft and housing bore is based on ISO 286,selecting the dimension tolerance from this standard to decide the fit situation between shaft,housing and bearing.

Regarding the dimension tolerance of shaft or housing bore&the fit relationship of bearing of grade 0 precision,

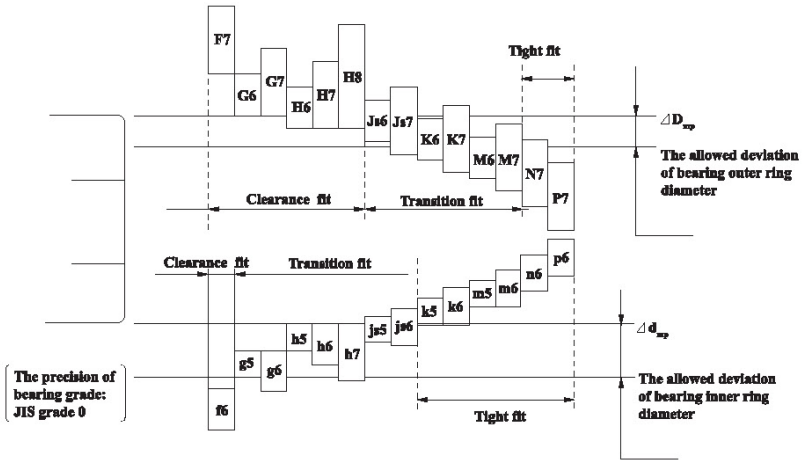


Chart10.1 The relationship between shaft the tolerance dimension of housing and fitting

10.3 Selection of fits

It should fully be considered the bearing usage condition when selects fits.

It should be considered the following items generally:

△ Types and magnitude of load

△ The distributing of operational temperature

△ The inner clearance of bearing

△ The processing quality of shaft and housing,material and housing thickness as well as structure

△ Means of bearing mounting and dismounting

△ Whether or not use matching surface to avoid the heat expansion of shaft

△ The type and dimension of bearing

10.4 Recommended Fits

As section 10.3 described,many factors must be considered when selecting the proper fit,such as the characteristics and bearing load magnitudes,temperature differences,and methods of bearing mounting and dismounting.But in fact selecting the fitting,previous experience should be referred.

The fits for metric series bearings are used,as Table 10.4 showing.The recommended fits for some common applications are shown in Table10.5~10.6

Table10.4 The general fits of metric series bearings

(1)Fits of Radial Bearings with inner diameter surface

The precision grade of bearing	Inner ring rotating load or indeterminate direction load								Inner ring stationary load	
	Tolerance range of shaft									
grade 0, 6X grade, grade 6	r6	p6	n6	m6 m5	k6 k5	js6 js5	h5	h6 h5	g6 g5	f 6
grade 5	—	—	—	m5	K4	js4	h4	h5	—	—
Fits	Tight fit					Transition fit			Clearance fit	

(2)Fits of Radial Bearings with outer diameter surface

The precision grade of bearing	Outer ring stationary load				Indeterminate direction load or outer ring rotating load				
	Tolerance range of bore								
grade 0, 6X grade, grade 6	G7	H7 H6	J_s7 J_s6	—	Js7 Js6	K7 K6	M7 M6	N7 N6	P7
grade 5	—	H5	J_s5	K5	—	K5	M5	—	—
Fits	Clearance fit		Transition fit						Tight fit

Table10.5 Fits of Radial Bearings (grade 0, 6X grade , grade6) with shafts

Load conditions		Ball bearings Exal	Ball bearings to	Tolerance area of shaft	Remarks	Examples
Inner ring rotating load rindeter minate direcion load	Light or variable loads	– 18 100 –	18 100 200 –	h5 js6 k6 m6	Using js5,k5,and m5 to instead of js6, k6,and m6 where high accuracy is required	Electrical instruments Machining tools, Pumps, Blowers, Transport vehicles
	Normal Load	– 18 100 140	18 100 140 200	js5 k5 m5 m6	For single–row angular contact ball bearing, because the internal clearance does not need be considered, so using k6 , m6 to instead of k5 , m5	Motors , Turbines , Internal–combustion Engines , Woodworkers
	Heavy load or Shock load			n6 p6 r6	It is necessary that internal clearance is bigger than standard clearance	Railway vehicles,axles, main electromotor for railway vehicles etc
Inner ring stationary load	Inner ring must be moved easily on shaft	Full shaft diamete		g6	Use g5 where high accuracy is required . In order to easy moving f6 could be used for large bearings	Where with fix shaft
	Inner ring do not be moved easily on shaft			h6	Use h5 where high accuracy is required.	Tension Pulleys, Running pulleys
Center axial load only				js6		

light loads indicate basic rating rotating loads(Cr)less than6%, noamal loads indicate basic rating rotating loads(Cr)more than 6%and less than 12%, heavy loads indicate basic rating rotating loads (Cr)more than 12%

Remark: This table is applicable to solid steel shafts only.

Table10.6

Fits of Ridial Bearing (grade 0,grade6X,grade 6)with housings

Load Condition Housings	Load types 1)		Outer ring can be or not be axially moved 2)	Tolerance range for housing bore	Remarks	Examples
Whole unit or half type	Outer ring stationary load	Random load	Easily to move	H7	The big difference in temperature between large bearing or outer ring with housing, G7 can be used	Genneral bearing mechanism, Railway vehicle axle, Axle box transmission mechanism
		Light or normal loads		H8	——	
		The temperature is high on the shaft and inner ring		G7	The big difference in temperature between large bearing or outer ring with housing, F7 can be used	Dry cylinder
Whole unit		High accuracy rotating is requirde under normal or light loads	Impossible to be moved in principle	K6	Mainly appropriated for roller bearing	
			Possible to be moved	J_s6	Mainly appropriated for ball bearing	
		Low noise rotating is required	Easily to move	H6	——	
	Indeterminate direction load	Light or normal loads	Generally possible to be moved	J_s7	Where high accuracy is requiredso using Js6 K6,to instead of J_s7,K7	Electromotor, pumps, crankshaft headstocks
		Normal or heavy load	Impossible to be moved in principle	K7		
		Heavy shock load	Impossible to be moved	M7	——	Main electromotor for railway vehicle
	Outer ring rotating load	Light or variable load	Impossible to be moved	M7	——	Conveyor rollers, ropeway running pulleys,tension pullrys
		Heavey shock load		N7	Mainly appropriated for ball bearing	Hub with ball bearing
		Thin–wall housings and with heavy or heavy shock load		P7	Mainly appropriated for roller bearing	Hub with roller bearing

Note: Load types refer to table 10.5。

Remarks: This table is applicable to cast iron and steel housings only。

11. Bearing Materials

11.1 Ring and ball package material

Bearing ring and ball package usually use high carbon chromium bearing steel GCr15(Table 11.1)
The chemical composition of GCr15 has uniform specifications all over the world.
e.g.American AISL52100,German DIN100Cr6,Japanese SUJ2
Table 11.1 High carbon chromium bearing steel

Table11.1 High carbon chromium bearing steel

Specification	Trademark	Chemical compostion (%)						
		C	Si	Mn	S	P	Cr	Mo
GB/T18254	GCr15	0.95~1.05	0.15~0.35	0.25~0.45	Below 0.025	Below 0.025	1.40~1.65	–
DIN	100Cr6	0.95~1.10	0.15~0.35	Below 0.50	Below 0.025	Below 0.025	1.30~1.60	Below 0.08
JIS G 4805	SUJ2	0.95~1.10	0.15~0.35	Below 0.50	Below 0.025	Below 0.025	1.30~1.60	Below 0.08
ASTM A 295	52100	0.98~1.10	0.15~0.35	0.25~0.45	Below 0.025	Below 0.025	1.30~1.60	Below 0.10

It also uses stainless steel with fine anti–corrosive performance according to special use. please refer to table 11.2 for the chemical composition

Table11.2 The Chemical Composition Of Stainless Steel For Rolling Bearing

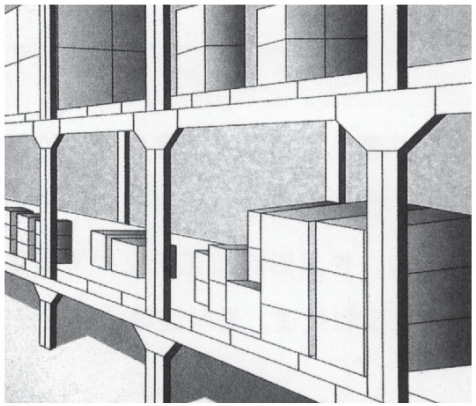
Specification	Trademark	Chemical compostion (%)						
		C	Si	Mn	S	P	Cr	Mo
GB/T3086	9Cr18	0.90~1.00	Below 0.80	Below 0.80	Below 0.030	Below 0.035	17.00~19.00	–
JIS G 4303	SUS440C	0.95~1.20	Below 1.00	Below 1.00	Below 0.030	Below 0.040	16.00~18.00	Below 0.75

cage material
the puched material is low carbon steel

Table11.3 The Chemical Composition Of Steel Plate And Carbon Steel For Bearing Cage

Difference	Specofocation	Trademark	Chemical compostion (%)				
			C	Si	Mn	P	S
Steel plate for punched cage	JIS G 3141	SPCC	Below 0.12	–	Below 0.50	Below 0.04	Below 0.045

12. Bearing Handling



Rolling bearing is a precision part, and make sure to use it carefully with caution to maintain its degree of precision. These are the matters of concerns requiring special attentions when rolling bearing is used as to maintain clean the bearing, to avoid strong impact, and to prevent rustiness.

12.1 Storage of Bearing:

Bearing is to be coated with anti–rusting agent, and packed for delivery. It can be stored for a number of years if the environment of storage is suitable and the package is under good condition. Attention shall be paid to the following during storage of bearing:

(1) To be stored on sites under the condition of a relative humidity below 60%

(2) Not to be placed directly on ground, it is most advisable to place bearing on a bench that is at least off ground by 20cm. (Chart 12.1).

(3) Pay attention to height during selection and placement, it is not allowed for too many of bearings to be selected and placed.

12.2 Installation of Bearing

During bearing installation, it may injure bearing if iron hammer and other tools are used to directly knock the end face of bearing. On this account, make sure to apply uniform pressure on the circumference of the ring for it to be fitted in place. Indentation or scar may be generated on the rolling face if a ring (such as outer ring of a certain party) is applied with pressure, for the ring (such as inner ring of the other party) to be pressed in through a rolling element, and it shall be avoided.

Bearing shall be installed on a clean and dry working site. Especially for the assembly of super–small and ultra–small ball bearings, the performance of bearing would be greatly affected if there is any invasion of dust, and therefore, such bearings shall be assembled in the dust–free rooms, and size precision, shape precision, as well as degree of smoothness for the installation parts of bearing must be inspected, to confirm that these requirements are within the scope of permitted allowances. In addition to the above concerns, attention shall be paid as well to the following:

(1) Fitting face of shaft and casing (seat)

Burr, bruise, bulge, rust trace and oil stain etc must be removed, and additionally a small segment of the end face is to be coated with lubricant, and it will be easier for spindle to be oil pressed in place. Refer to Chart 12.2 for its operating procedure.

(2) Fabricating tools for assembly

For punching or pressing machines and other fabricating tools for assembly, proper sizes are to be selected for the contact parts with bearing, and the dirt, burr, and cutting scrap, etc on the installation tools must be removed.

(3) Setout of Bearing

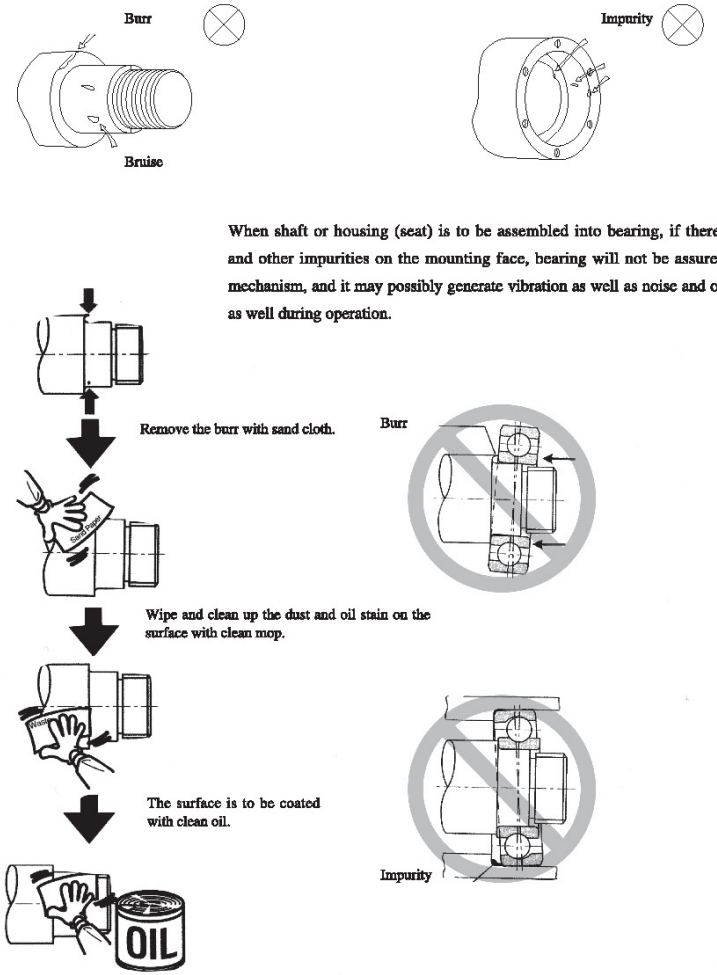
Bearing must be unpacked only prior to installation. Bearing is a very high–precision product made during a very clean manufacturing

process, and please don't apply any other processing to it, such as cleaning.

(4) Bearing of small shrink range

Assembly of bearing with fairly small shrink range can be approximately divided into the steps of shaft press–in, housing (seat) press–in, and equal pressure press–in of shaft and housing (seat), as indicated in Chart 12.3. The assembly method is to press down the end face of the ring with sleeve under ambient temperature, to press in the bearing with support of sleeve, with the press–in force applied to the center of bearing (force to be applied on inner ring when bearing is to be mounted on shaft, and force to be applied on the outer ring when bearing shall be installed on housing (seat), so that the entire circumference of ring is pressed in uniformly. However, when many bearings are to be installed, hand power press or oil press shall be used. When non–separating type of bearings must be installed onto shaft and housing (seat) at the same time, sizing block is to be used for both inner and outer rings to be pressed into the shaft and housing (seat) under equal pressure.

Other precautions: For example it is not allowed for them to be assembled in by means of knocking with metal hammer, to avoid injury and the invasion of dust, as indicated in Chart 12.4.

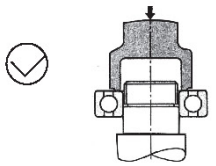


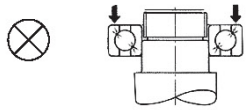
When shaft or housing (seat) is to be assembled into bearing, if there is burr, dust, and other impurities on the mounting face, bearing will not be assured with correct mechanism, and it may possibly generate vibration as well as noise and other anomalies as well during operation.

Chart 12.2 Operating Flow for Shaft and Housing (Seat) Fitting Face

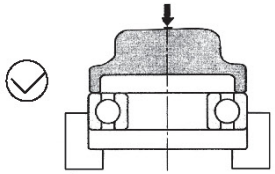
Force Application (Assembly–in) Face

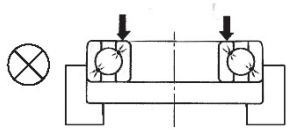
Sides for Not Allowable (Erroneous) Force Application



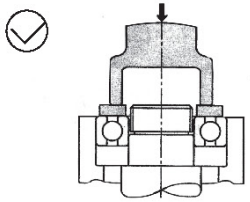


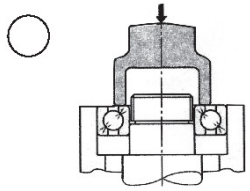
Shaft Press–in





Housing (Seat) Press–in





Press–in of Shaft and Housing (Seat) under Equal Pressure

Chart 12.3 Assembly Method and Injury Cases

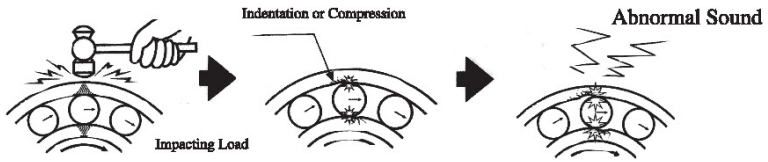
（1）Suitable tools are to be selected for press–in with pressing machine

It is not allowed for assembly–in to be performed by means of knocking with iron hammer, which may cause injury to bearing.

（2）Weakness of Bearing

1. Weak capacity for being impacted:

Revolving movement is endured on a very small contact face between the raceway face of bearing and the rolling element, and in this case any overload and force of impact will give rise to indentation on the contacting face. On this account, knocking and dropping must be avoided from occurrence.



2. Dust is also the fatal injury of bearing:

If bearing is invaded with dust internally during revolving movement, it will also give rise to the injury on raceway face and the surface of rolling element, which may generate abnormal sound and dissatisfactory revolving cases with bearing.

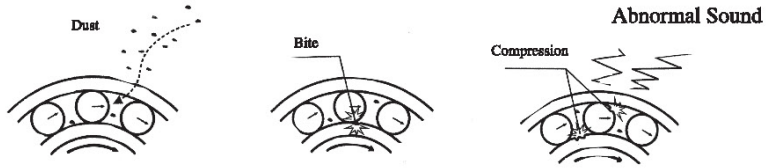


Chart 12.4 Notices for Bearing Assembly

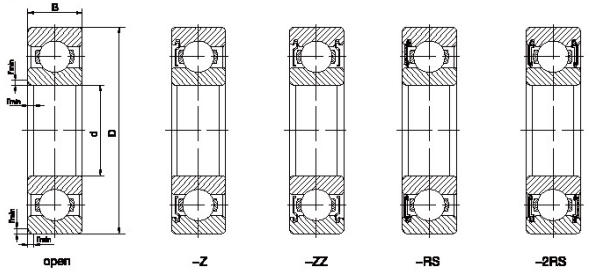
13. The Grease No. and Function

KHS–LG GREASE DATA SHEET

Manufacturer	Brand	Viscosity	Base oil	Drop point ℃	Consistency	Oprrating temperature range℃	Selection criteria
Esso	Beacon325	(Lithium)	(Diester)	193	290	–60~+120	Low–temperture grease
	Andok B	(Nathium)	(Mineral)	260	280	–40~+120	normal temperature grease
	Andok 260	(Nathium)	(Mineral)	200	250	–30~+150	normal temperature grease
	Polyrex EM	(Diurea)	(Mineral)	260	288	–40~+180	high temperature low noise
	Polyrex EP2	(Urea)	(Mineral)	280	280	–40~+180	high temperature low noise
	UNIREX N2	(Lithium)	(Mineral)	250	280	–40~+180	high temperature grease
	UNIREX N3	(Lithium)	(Mineral)	250	235	–40~+180	high temperature grease
Kyodo Yushi	NS Hilube (Ns7)	(Lithium)	(Diester)	190	255	–40~+130	normal temperature grease
	Multemp PS2	(Lithium)	(Diester)	189	280	–50~+110	Low–temperture grease
	Multemp (SRL)	(Lithium)	(Ester)	191	245	–40~+150	low noise grease
	Multemp SC–A	(Urea)	(Mineral)	≥260	280	0~+160	normal temperature grease
	Multemp ET150	(Urea)	(Mineral)	≥260	280	–10~+160	normal temperature grease
	Multemp LT2	(Lithium)	(Ester)	280	190	–60~+130	Low–temperture grease
	Multemp SRH	鋰基 (Lithium)	(Ester)	250	201	–40~+150	Low–temperture grease
	Multemp SB–M	(Diurea)	(Synthetic oil)	220	260	–40~+200	high temperature high speed grease
	Multemp SC–C	(Diurea)	(Synthetic oil)	280	300	–40~+200	high temperature water–pump grease
	Multemp ET–K	(Diurea)	(Synthetic oil)	280	300	–40~+200	high temperature high speed alternators grease
	Raremax Super N	(Diurea)	(Mineral+ Synthetic oil)	254	251	–40~+200	high temperature low noise

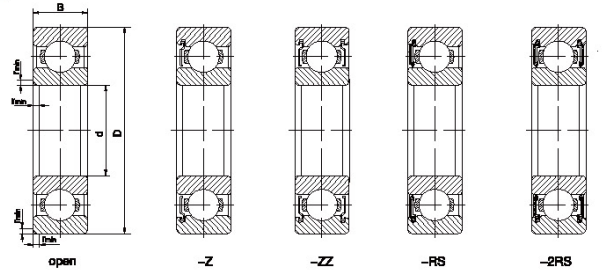
Manufacturer	Brand	Viscosity	Base oil	Drop point ℃	Consistency	Oprrating temperature range℃	Selection criteria
Kluber	Staburags NBU12	(Barium)	(Mineral)	220	270	–35~+150	normal temperature grease
	Isoflex NBU15	(Barium)	(Diester Mineral)	220	280	–30~+130	normal temperature grease
	Asonic GLY32	(Lithium)	(Synthetic oil)	190	265~295	–50~+140	Low–temperture grease
	Asonic GLY72	Polyhamstoff	(Ester Mineral)	250	250~280	–40~+180	high temperature low noise
	Barrierta L55/2	(PTFE)	(Fluoinated)		280	–35~+260	high temperature grease
	Asonic HQ72–102	(Polyurea)	(Ester)	240	250~280	–40~+180	high temperature and low noise grease
	Petamo GHY133	(Polyurea)	(Synthetic Mineral oil)	240	250~280	–25~+150	normal temperature grease
	Petamo GHY443	(Polyurea)	(Ester)	250	250~280	–20~+180	high temperature longevity grease
Shell	Alvania No.2	(Lithium)	(Mineral)	182	272	–25~+120	normal temperature grease
	Alvania No.3	(Lithium)	(Mineral)	183	233	–20~+135	normal temperature grease
	Alvania RLQ2	(Lithium)	(Mineral)	195	266	–50~+150	low noise、high speed grease
	Alvania EP2	(Lithium)	(Mineral)	185	276	–10~+100	normal temperature grease
	Aero shell No.7	Microgel	(Mineral)	≥260	288	–70~+150	Low–temperture grease
	Aero shell No.15A	(PTFE)	(Diester)	≥260	280	–70~+260	high–low temperature grease
Mobil	Mobil 22	(Lithium)	(Diester Mineral)	192	274	–50~+140	Low–temperture grease
	Mobil 28	(Bentonite)	(Synthetic hydrocarbon)	≥260	280	–60~+180	high–low temperature grease
	XHP 222	(Lithium)	(Mineral)	260	280	–30~+140	normal temperature grease
	HP 222	(Lithium)	(Mineral)	270	285	–30~+160	normal temperature grease
Chevron	Chevron SRI–2	(Urea)	(Mineral)	247	280	–30~+177	high temperature grease
China Hangu	Hangu 2	(Lithium)	(Mineral)	198	280	–10~+130	low noise
	TSA–L	(Lithium)	(Synthetic oil)	198	275	–60~+140	low temperature low noise
Egols	Egols–8088	(Lithium)	(Mineral)	190	265	–30~+120	low noise
	Egols–8008	(Diurea)	(Synthetic oil)	260	300	–40~+200	high temperature high speed alternators grease

60 PRODUCT SERIES



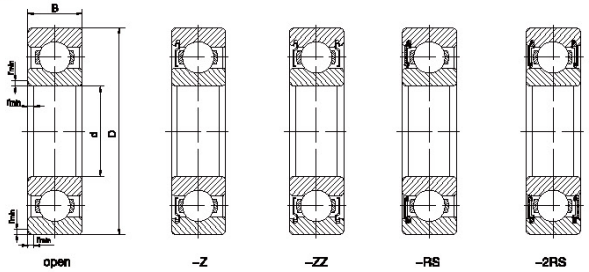
Bearing No.					Load Rating (kN)		Limiting Speed (rpm)			Boundary dimensions (mm)				Weight
Open	with shields		with seals		Cr	Cor	Grease		Oil	d	D	B	rmin	Close (kg)
							RS 2RS	Open Z . ZZ	Open Z . ZZ					
605	605–Z	605–ZZ	605–RS	605–2RS	1.33	0.55	38000	40000	50000	5	14	5	0.2	0.005
606	606–Z	606–ZZ	606–RS	606–2RS	1.51	0.74	34000	38000	45000	6	17	6	0.3	0.006
607	607–Z	607–ZZ	607–RS	607–2RS	2.22	0.91	32000	36000	43000	7	19	6	0.3	0.007
608	608–Z	608–ZZ	608–RS	608–2RS	3.32	1.38	28000	34000	40000	8	22	7	0.3	0.012
609	609–Z	609–ZZ	609–RS	609–2RS	3.35	1.40	24000	32000	38000	9	24	7	0.3	0.016
6000	6000–Z	6000–ZZ	6000–RS	6000–2RS	4.58	1.98	22000	31000	36000	10	26	8	0.3	0.019
6001	6001–Z	6001–ZZ	6001–RS	6001–2RS	5.10	2.38	18000	28000	32000	12	28	8	0.3	0.021
6002	6002–Z	6002–ZZ	6002–RS	6002–2RS	5.58	2.85	15000	24000	28000	15	32	9	0.3	0.026
6003	6003–Z	6003–ZZ	6003–RS	6003–2RS	6.00	3.25	13000	22000	26000	17	35	10	0.3	0.039
6004	6004–Z	6004–ZZ	6004–RS	6004–2RS	9.38	5.02	11000	18000	20000	20	42	12	0.6	0.069
6005	6005–Z	6005–ZZ	6005–RS	6005–2RS	10.06	5.67	9500	15000	18000	25	47	12	0.6	0.075
6006	6006–Z	6006–ZZ	6006–RS	6006–2RS	13.20	8.25	8000	13000	15000	30	55	13	1.0	0.090
6007	6007–Z	6007–ZZ	6007–RS	6007–2RS	16.20	10.30	6700	11000	13000	35	62	14	1.0	0.100
6008	6008–Z	6008–ZZ	6008–RS	6008–2RS	17.00	11.80	6000	10000	12000	40	68	15	1.0	0.019
6009	6009–Z	6009–ZZ	6009–RS	6009–2RS	21.00	14.80	5600	9000	11000	45	75	16	1.0	0.024
6010	6010–Z	6010–ZZ	6010–RS	6010–2RS	22.00	16.20	5000	8500	10000	50	80	16	1.0	0.026

62 PRODUCT SERIES



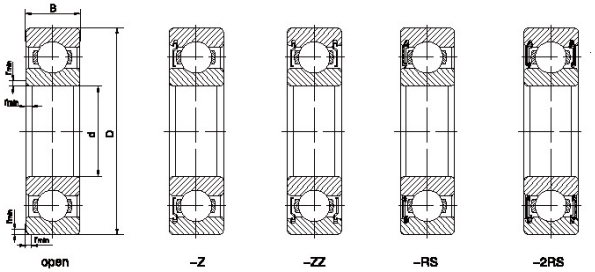
Bearing No.					Load Rating (kN)		Limiting Speed (rpm)			Boundary dimensions (mm)				Weight
Open	with shields		with seals		Cr	Cor	Grease		Oil	d	D	B	rmin	Close (kg)
							RS 2RS	Open Z . ZZ	Open Z . ZZ					
624	624–Z	624–ZZ	624–RS	624–2RS	1.16	0.40	38000	40000	48000	4	13	5	0.2	0.003
625	625–Z	625–ZZ	625–RS	625–2RS	1.88	0.68	32000	36000	43000	5	16	5	0.3	0.005
626	626–Z	626–ZZ	626–RS	626–2RS	2.22	0.91	30000	32000	40000	6	19	6	0.3	0.008
627	627–Z	627–ZZ	627–RS	627–2RS	3.32	1.38	28000	30000	36000	7	22	7	0.3	0.014
628	628–Z	628–ZZ	628–RS	628–2RS	3.35	1.40	24000	28000	34000	8	24	8	0.3	0.016
629	629–Z	629–ZZ	629–RS	629–2RS	4.45	1.95	22000	28000	34000	9	26	8	0.3	0.020
6200	6200–Z	6200–ZZ	6200–RS	6200–2RS	5.10	2.38	18000	24000	30000	10	30	9	0.6	0.030
6201	6201–Z	6201–ZZ	6201–RS	6201–2RS	6.82	3.05	17000	22000	28000	12	32	10	0.6	0.036
6202	6202–Z	6202–ZZ	6202–RS	6202–2RS	7.65	3.75	14000	20000	24000	15	35	11	0.6	0.046
6203	6203–Z	6203–ZZ	6203–RS	6203–2RS	9.58	4.78	12000	17000	20000	17	40	12	0.6	0.065
6204	6204–Z	6204–ZZ	6204–RS	6204–2RS	12.84	6.20	11000	15000	18000	20	47	14	1.0	0.105
6205	6205–Z	6205–ZZ	6205–RS	6205–2RS	14.01	6.98	9000	13000	15000	25	52	15	1.0	0.125
6206	6206–Z	6206–ZZ	6206–RS	6206–2RS	19.50	11.30	7500	11000	13000	30	62	16	1.0	0.205
6207	6207–Z	6207–ZZ	6207–RS	6207–2RS	25.70	15.30	6300	9500	11000	35	72	17	1.1	0.284
6208	6208–Z	6208–ZZ	6208–RS	6208–2RS	29.51	18.14	5600	8500	10000	40	80	18	1.1	0.366
6209	6209–Z	6209–ZZ	6209–RS	6209–2RS	31.50	20.40	5300	7500	9000	45	85	19	1.1	0.420
6210	6210–Z	6210–ZZ	6210–RS	6210–2RS	35.00	23.20	4800	7100	8500	50	90	20	1.1	0.459

63 PRODUCT SERIES



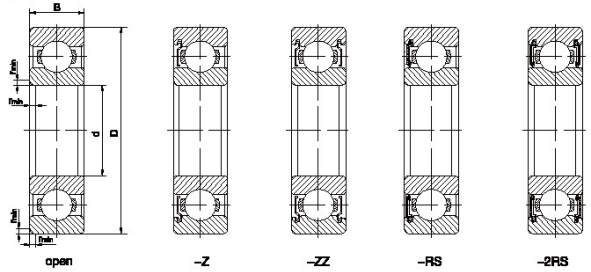
Bearing No.					Load Rating (kN)		Limiting Speed (rpm)			Boundary dimensions (mm)				Weight
Open	with shields		with seals		Cr	Cor	Grease		Oil	d	D	B	rmin	Close (kg)
							RS 2RS	Open Z . ZZ	Open Z . ZZ					
634	634–Z	634–ZZ	634–RS	634–2RS	0.73	0.67	32000	36000	43000	4	16	5	0.3	0.005
635	635–Z	635–ZZ	635–RS	635–2RS	2.88	1.08	30000	32000	40000	5	19	6	0.3	0.008
636	636–Z	636–ZZ	636–RS	636–2RS	3.30	1.37	28000	30000	36000	6	22	7	0.3	0.014
637	637–Z	637–ZZ	637–RS	637–2RS	4.55	1.97	22000	28000	34000	7	26	9	0.3	0.025
638	638–Z	638–ZZ	638–RS	638–2RS	4.55	1.97	22000	28000	34000	8	28	9	0.3	0.029
639	639–Z	639–ZZ	639–RS	639–2RS	5.10	2.38	20000	24000	30000	9	30	10	0.6	0.036
6300	6300–Z	6300–ZZ	6300–RS	6300–2RS	7.65	3.48	17000	22000	26000	10	35	11	0.6	0.049
6301	6301–Z	6301–ZZ	6301–RS	6301–2RS	9.72	4.23	16000	20000	24000	12	37	12	1.0	0.059
6302	6302–Z	6302–ZZ	6302–RS	6302–2RS	11.50	5.42	13000	17000	20000	15	42	13	1.0	0.082
6303	6303–Z	6303–ZZ	6303–RS	6303–2RS	13.56	6.56	11000	15000	18000	17	47	14	1.0	0.109
6304	6304–Z	6304–ZZ	6304–RS	6304–2RS	15.93	7.81	10000	14000	17000	20	52	15	1.1	0.142
6305	6305–Z	6305–ZZ	6305–RS	6305–2RS	22.40	11.50	8000	11000	13000	25	62	17	1.1	0.229
6306	6306–Z	6306–ZZ	6306–RS	6306–2RS	26.70	15.00	6700	9500	12000	30	72	19	1.1	0.34
6307	6307–Z	6307–ZZ	6307–RS	6307–2RS	33.50	19.20	6000	8500	10000	35	80	21	1.5	0.464
6308	6308–Z	6308–ZZ	6308–RS	6308–2RS	40.50	24.00	5300	7500	9000	40	90	23	1.5	0.636
6309	6309–Z	6309–ZZ	6309–RS	6309–2RS	53.00	32.00	4800	6700	8000	45	100	25	1.5	0.829
6310	6310–Z	6310–ZZ	6310–RS	6310–2RS	62.00	38.50	4300	6000	7500	50	110	27	2.0	1.06

68 PRODUCT SERIES



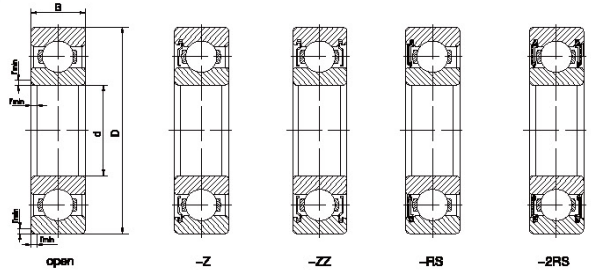
Bearing No.					Load Rating (kN)		Limiting Speed (rpm)			Boundary dimensions (mm)				Weight
Open	with shields		with seals		Cr	Cor	Grease		Oil	d	D	B	rmin	Close (kg)
							RS 2RS	Open Z . ZZ	Open Z . ZZ					
686	686–Z	686–ZZ	686–RS	686–2RS	1.08	0.44	38000	40000	50000	6	13	3.5/5	0.15	0.001
687	687–Z	687–ZZ	687–RS	687–2RS	1.17	0.51	34000	40000	45000	7	14	3.5/5	0.15	0.002
688	688–Z	688–ZZ	688–RS	688–2RS	1.61	0.71	28000	36000	43000	8	16	4/5	0.2	0.003
689	689–Z	689–ZZ	689–RS	689–2RS	1.33	0.66	24000	36000	43000	9	17	4/5	0.2	0.004
61800	61800–Z	61800–ZZ	61800–RS	61800–2RS	1.60	0.75	24000	34000	40000	10	19	5	0.3	0.005
61801	61801–Z	61801–ZZ	61801–RS	61801–2RS	1.92	1.04	20000	32000	38000	12	21	5	0.3	0.007
61802	61802–Z	61802–ZZ	61802–RS	61802–2RS	2.07	1.18	17000	28000	34000	15	24	5	0.3	0.008
61803	61803–Z	61803–ZZ	61803–RS	61803–2RS	2.18	1.28	15000	26000	30000	17	26	5	0.3	0.008
61804	61804–Z	61804–ZZ	61804–RS	61804–2RS	3.45	2.25	13000	22000	26000	20	32	7	0.3	0.020
61805	61805–Z	61805–ZZ	61805–RS	61805–2RS	3.70	2.65	10000	18000	22000	25	37	7	0.3	0.022
61806	61806–Z	61806–ZZ	61806–RS	61806–2RS	4.04	3.14	9000	15000	18000	30	42	7	0.3	0.026
61807	61807–Z	61807–ZZ	61807–RS	61807–2RS	4.27	3.59	7500	14000	16000	35	47	7	0.3	0.03
61808	61808–Z	61808–ZZ	61808–RS	61808–2RS	6.35	5.55	6700	12000	14000	40	52	7	0.3	0.034
61809	61809–Z	61809–ZZ	61809–RS	61809–2RS	6.60	6.15	6000	11000	13000	45	58	7	0.3	0.040
61810	61810–Z	61810–ZZ	61810–RS	61810–2RS	6.40	6.20	5300	9500	11000	50	65	7	0.3	0.057

69 PRODUCT SERIES



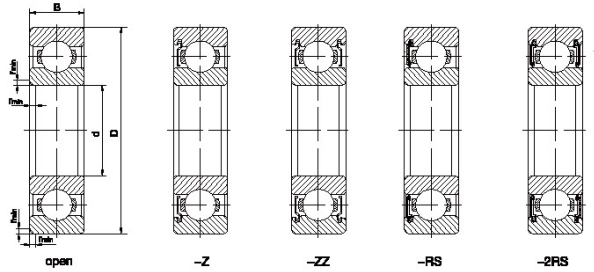
Bearing No.					Load Rating (kN)		Limiting Speed (rpm)			Boundary dimensions (mm)				Weight
Open	with shields		with seals		Cr	Cor	Grease		Oil	d	D	B	rmin	Close (kg)
							RS 2RS	Open Z . ZZ	Open Z . ZZ					
695	695–Z	695–ZZ	695–RS	695–2RS	1.07	0.42	40000	43000	50000	5	13	4	0.2	0.0025
696	696–Z	696–ZZ	696–RS	696–2RS	1.88	0.68	36000	40000	45000	6	15	5	0.3	0.0043
697	697–Z	697–ZZ	697–RS	697–2RS	1.61	0.71	28000	36000	43000	7	17	5	0.3	0.0048
698	698–Z	698–ZZ	698–RS	698–2RS	2.22	0.91	28000	36000	43000	8	19	6	0.3	0.0068
699	699–Z	699–ZZ	699–RS	699–2RS	2.48	1.09	24000	34000	40000	9	20	6	0.3	0.0085
61900	61900–Z	61900–ZZ	61900–RS	61900–2RS	2.70	1.27	22000	32000	38000	10	22	6	0.3	0.011
61901	61901–Z	61901–ZZ	61901–RS	61901–2RS	3.38	1.48	20000	30000	36000	12	24	6	0.3	0.013
61902	61902–Z	61902–ZZ	61902–RS	61902–2RS	4.00	2.02	17000	26000	30000	15	28	7	0.3	0.016
61903	61903–Z	61903–ZZ	61903–RS	61903–2RS	4.30	2.32	15000	24000	28000	17	30	7	0.3	0.018
61904	61904–Z	61904–ZZ	61904–RS	61904–2RS	6.55	3.60	12000	19000	22000	20	37	9	0.3	0.036
61905	61905–Z	61905–ZZ	61905–RS	61905–2RS	6.65	4.20	10000	16000	19000	25	42	9	0.3	0.042
61906	61906–Z	61906–ZZ	61906–RS	61906–2RS	7.25	5.00	8500	14000	17000	30	47	9	0.3	0.049
61907	61907–Z	61907–ZZ	61907–RS	61907–2RS	8.00	5.67	7500	12000	15000	35	55	10	0.6	0.086
61908	61908–Z	61908–ZZ	61908–RS	61908–2RS	13.70	10.00	6300	11000	13000	40	62	12	0.6	0.112
61909	61909–Z	61909–ZZ	61909–RS	61909–2RS	14.10	10.90	5600	9500	12000	45	68	12	0.6	0.126
61910	61910–Z	61910–ZZ	61910–RS	61910–2RS	14.50	11.70	5300	9000	11000	50	72	12	0.6	0.135

R PRODUCT SERIES



Bearing No.					Load Rating (kN)		Limiting Speed (rpm)		Boundary dimensions (mm)			
Open	with shields		with seals		Cr	Cor	Grease	Oil	d	D	B	rmin
R4	R4–Z	R4–ZZ	R4–RS	R4–2RS	1.13	0.56	38000	45000	6.35	15.875	4.978/4.978	0.3
R4A	R4A–Z	R4A–ZZ	R4A–RS	R4A–2RS	1.79	0.88	36000	43000	6.35	19.05	5.556/7.144	0.3
R6	R6–Z	R6–ZZ	R6–RS	R6–2RS	2.56	1.35	32000	38000	9.525	22.225	5.556/7.144	0.3
R8	R8–Z	R8–ZZ	R8–RS	R8–2RS	5.10	2.38	26000	32000	12.7	28.575	6.35/7.938	0.3
R10	R10–Z	R10–ZZ	R10–RS	R10–2RS	6.00	3.25	22000	26000	15.875	34.925	7.144/8.731	0.8
R12	R12–Z	R12–ZZ	R12–RS	R12–2RS	7.90	4.45	17000	19000	19.05	41.275	7.938/11.112	0.8
—	—	—	—	99502H	7.65	3.75	14000	24000	15.875	34.925	11	0.6
1641	1641–Z	1641–ZZ	1641–RS	1641–2RS	10.06	5.67	10000	14000	25.552	50.8	14.288	1.0

PRODUCT SERIES



Bearing No.					Load Rating (kN)		Limiting Speed (rpm)			Boundary dimensions (mm)			
Open	with shields		with seals		Cr	Cor	Grease		Oil	d	D	B	rmin
							RS 2RS	Open Z . ZZ	Open Z . ZZ				
62000	62000–Z	62000–ZZ	62000–RS	62000–2RS	4.45	1.95	22000	30000	36000	10	26	10	0.3
62200	62200–Z	62200–ZZ	62200–RS	62200–2RS	5.10	2.38	18000	24000	30000	10	30	14	0.6
62201	62201–Z	62201–ZZ	62201–RS	62201–2RS	6.82	3.05	17000	22000	28000	12	32	14	0.6
62202	62202–Z	62202–ZZ	62202–RS	62202–2RS	7.65	3.75	14000	20000	24000	15	35	14	0.6
62203	62203–Z	62203–ZZ	62203–RS	62203–2RS	9.58	4.78	12000	17000	20000	17	40	16	0.6
62204	62204–Z	62204–ZZ	62204–RS	62204–2RS	12.84	6.20	11000	15000	18000	20	47	18	1.0
62205	62205–Z	62205–ZZ	62205–RS	62205–2RS	14.01	6.98	9000	13000	15000	25	52	18	1.0
16100	16100–Z	16100–ZZ	16100–RS	16100–2RS	5.10	2.38	17000	27000	32000	10	28	8	0.3
16001	—	—	—	—	5.10	2.38	—	28000	32000	12	28	7	0.3
16002	—	—	—	—	5.58	2.85	—	24000	28000	15	32	8	0.3
16003	—	—	—	—	6.00	3.25	—	22000	26000	17	35	8	0.3
16004	—	—	—	—	7.90	4.45	—	18000	20000	20	42	8	0.6
16005	—	—	—	—	8.40	5.15	—	15000	18000	25	47	8	0.6
16006	—	—	—	—	13.20	8.25	—	13000	15000	30	55	9	1.0

NOTES