

1. Bearing materials

The internal design of **SLB** track rollers is the same as in single row or Double-row Angular Contact Ball Bearings. The units can carry axial loads in both directions and, due to the thickness of the outer ring, large radial loads. The standard products are produced from high quality bearing steel, with a hardness of 58 to 62 HRC. Some types are also available in stainless steel (440C) with hardness >58 HRC.

The track rollers contained in this catalogue are produced with standard tolerances (ISO 492) and standard clearance (Normal).

The track rollers are produced in two distinct families. Cylindrical or crowned outer ring and profiled outer ring.

These track rollers are available in single and double row design. They are available with straight cylindrical OD or crowned profile OD. The crowned OD is used to reduce the edge stresses caused by possible misalignment errors. The cylindrical OD can provide increased support due to the longer contact profile.

These products are used typically on flat surfaces. Some of the most common applications are:

- transfer rolls
- idler rollers
- Support rollers
- Straightening rolls

2. Shields and seals

2.1 Types

2.1.1 Track rollers LR 2, LR 2..RRU

These single row ball track rollers are available in following different versions.

- LR 2..X-2RS: cylindrical OD, with light contact seals.
- LR 2..X-2RSR: crowned cylindrical OD, with contact seals.
- LR 2..2RS: crowned OD, with light contact seals.
- LR 2..2RSR: crowned OD, with contact seals.
- LR 2..RRU: crowned OD with contact seals protected by a metal shield, inner ring with increased width to allow additional lubricant storage.

2.1.2 Track rollers LR 52, LR 53

These are double row angular contact ball track rollers. Due to their internal design, they can carry axial loads of large magnitude. They are available in three versions:

- LR 52..2RS, LR 53..2RS: crowned OD, with light contact seals.
- LR 52..X-2Z, LR 53..X-2Z: cylindrical OD, with metal shields.
- LR 52..2Z, LR 53..2Z: crowned OD, with metal shields.

The track rollers with profiled outer ring are basically Double-row Angular Contact Ball Bearings with a reinforced and profiled outer ring. The outer ring profile allows the units to operate on round shafts or other types of profiled raceways. The outer profile can have three different designs;

- Track rollers with gothic arch groove - type LFR

2.2 Types - Track rollers LFR

The track rollers series LFR can be used on round shafts with diameter from 4 mm to 50 mm. The contact between track roller gothic arch groove profile and shaft is on two points.

This allows the units to carry loads in both axial and radial direction.

The track rollers are available with either shields 2Z or contact seals 2RS.

They are available with either non-contacting seals 2RS or contact seals 2RSR.

3. Bearing tolerances

3.1 Standard of tolerances

Track roller bearing "tolerances" or dimensional accuracy and running accuracy, are regulated by ISO standard (rolling bearing tolerances). For dimensional accuracy, these standards prescribe the tolerances necessary when installing bearings on shafts or in housings.

Running accuracy is defined as the allowable limits for bearing runout during operation.

Table 3.1 Comparison of tolerance classifications of national standards

Standard		Tolerance class				
International Organization for Standardization (ISO)	ISO	P0	P6	P5	P4	P2
Deutsches Institut für Normung (DIN)	DIN	Normal class Class 6X	Class 6	Class 5	Class 4	Class 2
American National Standards Institute (ANSI)	JIS	ABEC-1	ABEC-3	ABEC-5	ABEC-7	ABEC-9

3.2 Tolerances for radial bearings

Table 3.2 Inner rings

(Unit : μm)

Nominal bore diameter d mm		Single plane mean bore diameter deviation Δd_{mp}									Single radial plane bore diameter variation V_{dp}												
											diameter series 9					maxidiameter series 0.1							
		class 0	class 6	class 5	class 4 ¹	class 2 ¹	class 0	class 6	class 5	class 4	class 2	class 0	class 6	class 5	class 4	class 2							
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
10	18	0	-8	0	-7	0	-5	0	-4	0	-2.5	10	9	5	4	2.5	8	7	4	3	2.5		
18	30	0	-10	0	-8	0	-6	0	-5	0	-2.5	13	10	6	5	2.5	10	8	5	4	2.5		
30	50	0	-12	0	-10	0	-8	0	-6	0	-2.5	15	13	8	6	2.5	12	10	6	5	2.5		

Table 3.3 Inner rings

(Unit : μm)

Nominal bore diameter d mm		Single radial plane bore diameter variation V_{dp}					Mean single plane bore diameter variation V_{dmp}					Inner ring radial runout K_{ia}					Face runout with bore S_d		
		maxidiameter series 2,3,4																	
		class 0	class 6	class 5	class 4	class 2	class 0	class 6	class 5	class 4	class 2	class 0	class 6	class 5	class 4	class 2	class 5	class 4	class 2
over	incl.	max.				max.				max.				max.				max.	
10	18	6	5	4	3	2.5	6	5	3	2.0	1.5	10	7	4	2.5	1.5	7.0	3.0	1.5
18	30	8	6	5	4	2.5	8	6	3	2.5	1.5	13	8	4	3.0	2.5	8.0	4.0	1.5
30	50	9	8	6	5	2.5	9	8	4	3.0	1.5	15	10	5	4.0	2.5	8.0	4.0	1.5

Table 3.4 Inner rings

(Unit : μm)

Nominal bore diameter d mm		Inner ring axial runout (with side) S_{ia} ²			Inner ring width deviation ΔB_s									Inner ring width variation V_{Bs}									
					normal						modified ³												
					class 0,6		class 5,4		class 2		class 0,6		class 5,4	class 0		class 6		class 5	class 4		class 2		
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
10	18	7	3	1.5	0	-120	0	-80	0	-80	0	-250	0	-250	20	20	5	2.5	1.5				
18	30	8	4	2.5	0	-120	0	-120	0	-120	0	-250	0	-250	20	20	5	2.5	1.5				
30	50	8	4	2.5	0	-120	0	-120	0	-120	0	-380	0	-250	20	20	5	3.0	1.5				

- Note: ❶ The dimensional difference Δd_s of bore diameter to applied for class 4 and 2 is the same as the tolerance of dimensional difference Δd_{mp} of average bore diameter. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 against Class 4, and to all the diameter series against Class 2.
- ❷ To be applied for deep groove ball bearing and angular contact ball bearings.
- ❸ To be applied for individual raceway rings manufactured for combined bearing use.

Symbols: Δd_{mp} : deviation of the mean bore diameter from the nominal ($\Delta d_{mp} = d_{mp} - d$).

V_{dp} : bore diameter variation; difference between the largest and smallest single bore diameters in one plane.

V_{dmp} : mean bore diameter variation; difference between the largest and smallest mean bore diameters of one ring or washer.

K_{ia} : radial runout of assembled bearing inner ring and assembled bearing outer ring, respectively.

S_d : side face runout with reference to bore (of inner ring).

S_{ia} : side face runout of assembled bearing inner ring and assembled bearing outer ring, respectively.

ΔB_s : deviation of single inner ring width or single outer ring width from the nominal ($\Delta B_s = B_s - B$ etc.)

V_B : ring width variation; difference between the largest and smallest single widths of inner ring and of outer ring, respectively.

Table 3.5 Outer rings (Unit : μm)

Nominal Outside diameter D mm		Single plane mean outside diameter deviation ΔD_{mp}										Single radial plane outside diameter variation V_{Dp}										
												diameter series 9					max diameter series 0.1					
												class 0	class 6	class 5	class 4 ^❶	class 2 ^❶	class 0	class 6	class 5	class 4	class 2	class 0
over	incl.	high	low	high	low	high	low	high	low	high	low	0	6	5	4	2	max.	0	6	5	4	2
6	18	0	-8	0	-7	0	-5	0	-4	0	-2.5	10	9	5	4	2.5	8	7	4	3	2.5	
18	30	0	-9	0	-8	0	-6	0	-5	0	-4.0	12	10	6	5	4.0	9	8	5	4	4.0	
30	50	0	-11	0	-9	0	-7	0	-6	0	-4.0	14	11	7	6	4.0	11	9	5	5	4.0	
50	80	0	-13	0	-11	0	-9	0	-7	0	-4.0	16	14	9	7	4.0	13	11	7	5	4.0	
80	120	0	-15	0	-13	0	-10	0	-8	0	-5.0	19	16	10	8	5.0	19	16	8	6	5.0	

Table 3.6 Outer rings (Unit : μm)

Nominal Outside diameter D mm		Single radial plane outside diameter variation V_{Dp}					Single radial plane outside diameter variation V_{Dp} ^❶		Mean single plane outside diameter variation V_{Dmp}				
		max diameter series 2,3,4					capped bearings diameter series						
		class 0	class 6	class 5	class 4	class 2	2,3,4 class 0	0,1,2,3,4 class 6	class 0	class 6	class 5	class 4	class 2
over	incl.	max.					max.	max.		max.			
6	18	6	5	4	3	2.5	10	9	6	5	3	2.0	1.5
18	30	7	6	5	4	4.0	12	10	7	6	3	2.5	2.0
30	50	8	7	5	5	4.0	16	13	8	7	4	3.0	2.0
50	80	10	8	7	5	4.0	20	16	10	8	5	3.5	2.0
80	120	11	10	8	6	5.0	26	20	11	10	5	4.0	2.5

Symbols: ΔD_{mp} : deviation of the mean outside diameter from the nominal ($\Delta D_{mp} = D_{mp} - D$).

V_{Dp} : outside diameter variation; difference between the largest and smallest single outside diameters in one plane.

V_{Dmp} : mean outside diameter variation; difference between the largest and smallest mean outside diameters of one ring or washer.

Table 3.7 Outer rings

(Unit : μm)

Nominal Outside diameter D		Outer ring radial runout K_{ea}					Outside surface inclination SD			Outside ring axial runout Sea ^⑦			Outer ring width deviation ΔC_s	Outer ring width variation V_{cs}			
mm		class 0	class 6	class 5	class 4	class 2	class 5	class 4	class 2	class 5	class 4	class 2		class 0,6	class 5	class 4	class 2
over	incl.	max.					max.			max.			all type	max.			
6	18	15	8	5	3	1.5	8	4	1.5	8	5	1.5	Identical to	Identical to	5	2.5	1.5
18	30	15	9	6	4	2.5	8	4	1.5	8	5	2.5	ΔB_s of inner	ΔB_s and V_{bs}	5	2.5	1.5
30	50	20	10	7	5	2.5	8	4	1.5	8	5	2.5	ring of same	of inner	5	2.5	1.5
50	80	25	13	8	5	4.0	8	4	1.5	10	5	4.0	bearing	ring of same	6	3.0	1.5
80	120	35	18	10	6	5.0	9	5	2.5	11	6	5.0		bearing	8	4.0	2.5

Note: ⑤ The dimensional difference ΔD_s of outer diameter to be applied for classes 4 and 2 is the same as the tolerance of dimensional difference ΔD_{mp} of average outer diameter. However, the dimensional difference is applied to diameter series 0,1,2,3 and 4 against Class 4, and also to all the diameter series against class 2.

⑥ To be applied in case snap rings are not installed on the bearings.

⑦ To be applied for Track Roller Bearings.

Symbols: K_{ea} : radial runout of assembled bearing inner ring and assembled bearing outer ring, respectively.

SD : outside inclination variation: variation in inclination of outside cylindrical surface to outer ring side face.

Sea : side face runout of assembled bearing inner ring and assembled bearing outer ring, respectively.

ΔC_s : deviation of single inner ring width or single outer ring width from the nominal ($\Delta B_s = B_s - B$ etc.)

V_{cs} : ring width variation; difference between the largest and smallest single widths of inner ring and of outer ring, respectively.

4. Bearing fits

Track rollers are precision machine elements. These products must be very carefully handled before and during fitting. Their trouble-free operation depends largely on the care taken during fitting

4.1 Compatibility and miscibility

The anti-corrosive preservation oil used for rolling bearings is compatible and miscible with oils and greases with a mineral oil base. Compatibility should be checked if the following are used:

- synthetic lubricants
- thickeners other than lithium or lithium complex soaps.

If there is an incompatibility, the anti-corrosive oil should be washed out before greasing, particularly in the following cases:

- lubricants based on PTFE/alkoxyfluoroether
 - lubricants with a polycarbamide thickener
- and if
- the lubricant is changed
 - the rolling bearings are contaminated.

If in doubt, please contact the relevant lubricant manufacturer.

4.2 Guidelines for fitting

- The assembly area must be kept clean and free from dust
- Protect bearings from dust, contaminants and moisture
 - contaminants have a detrimental influence on the running and operating life of rolling bearings
- Inspect the housing bore and shaft/axis seating for
 - dimensional and geometrical tolerances
 - cleanliness
- Lightly oil the bearing ring seating surfaces or rub with solid lubricant
- Do not cool the bearings excessively
 - Moisture due to condensation can lead to corrosion in the bearings and bearing seatings
- After fitting
 - charge ungreased rolling bearings with lubricant
 - check the correct functioning of the bearing arrangement.

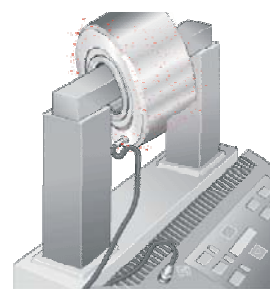
4.3 Fitting tools

- Induction heating device (see figure below)
- Heating cupboard
 - heating up to $+80^{\circ}\text{C}$

Mechanical or hydraulic press

- fitting sleeves should be used which cover the whole circumference of the bearing ring end faces
- Hammer and fitting sleeve
 - light hammer blows should be centrally directed on the fitting sleeve

Note: Fitting forces must never be directed through the rolling elements.
Direct blows on the bearing rings must be avoided.



Heating with an induction heater

4.4 Dismantling guidelines

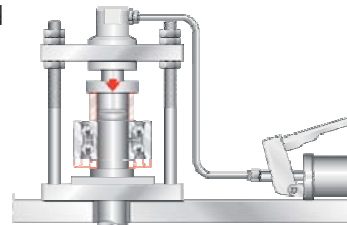
- Dismantling should be taken into consideration in the original design of the bearing location
- If the bearings are to be reused:
 - direct blows on the bearing rings should be avoided
 - dismantling forces should not be applied through the rolling elements
 - bearings should be carefully cleaned once dismantled
 - do not use a concentrated or hard flame.

4.5 Fitting and dismantling of yoke type track rollers (ball type)

- If the tolerance zone is unfavourable: the bearing should be pressed into place using a fitting press (see figure below)
- The inner ring must be fitted such that the pressing-in force is distributed uniformly on the end face of the inner ring.

Note: Fitting forces must not be directed through the rolling elements.
It must be ensured that the seals are not damaged during fitting.

- Track rollers must be secured axially according to the advice given.



Fitting of the yoke type track roller using a fitting press

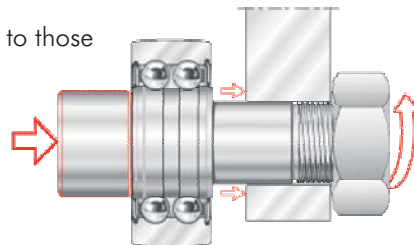
Note: Extraction forces must not be directed through the outer ring. This could damage the rolling elements and seals.

4.6 Fitting and dismantling of stud type track rollers (ball type)

Stud type track rollers are fitted and dismantled by methods similar to those used for yoke type track rollers (see figure below).

Note: The tightening torques given in the dimension table must be observed. Only then can the permissible radial load be ensured.

Screws and nuts of grade ≥ 8.8 must be used.



Fitting of a stud type track roller

5. Bearing internal clearance

Track Roller Bearing internal clearance (initial clearance) is the amount of internal clearance a bearing has before being installed on a shaft or in a housing. The internal clearance values for **SLB** Track roller bearing classes are shown in tables 5.1

Table 5.1 Radial internal clearance of track roller bearings (Unit : μm)

Nominal bore diameter d (mm)		C2		Normal		C3		C4	
over	Incl.	min.	max.	min.	max.	min.	max.	min.	max.
-	10	6	12	8	15	15	22	22	30
10	18	6	12	8	15	15	24	30	40
18	30	6	12	10	20	20	32	40	55
30	50	8	14	14	25	25	40	55	75

6. Lubrication

6.1 Track rollers series LR 2...are supplied grease filled. (The lithium soap grease).

6.2 Track rollers series LR 52...are supplied grease filled. (The lithium soap grease).

6.3 Track rollers LFR

The units are supplied with lifetime grease lubrication

The size with an outside diameter 52 mm or greater have a lubrication hole in the inner ring. To prevent mixing of greases with different characteristics, please insure to perform the lubrication of the units with lubricants that have the same characteristics as the grease used at the factory. Mounting bolts are available in both eccentric

7. Load rating and life

If the track rollers operate on a flat surface/raceway, the outer ring deforms (fig.1)

When compared with a bearing mounted in a suitable housing, track rollers have the following characteristics:

- Modified load distribution

This is accounted for by using the load factors C_w and C_{ow} when calculating the life.

- Alternating bending stress on the outer ring

This is taken into account by the load coefficients F_{rperm} and F_{roperm} (see dimension tables). The stresses must not exceed the allowable limits.

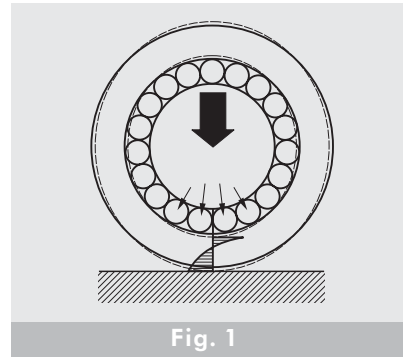


Fig. 1

7.1 Load ratings and life calculation

The dynamic load rating of the track roller is determined by the fatigue limit of the material. The life of the track roller is defined as the period of use before the pearance of fatigue. The ability of a track roller to carry dynamic loads is statistically derived.

7.1.1 Life calculation

The formula to calculate the nominal life is as follows:

$$L = \left(\frac{C_w}{P}\right)^3$$

$$L_h = \frac{833}{H \cdot n_{osz}} \left(\frac{C_w}{P}\right)^3$$

$$L_h = \frac{1666}{V_m} \left(\frac{C_w}{P}\right)^3$$

L = nominal life in 10^5 m reached by 90% of a statistically significant number of apparently identical bearing operating under the same loading condition before the onset of metal fatigue.

L_h [h] = nominal life in hours

C_w [N] = dynamic load rating. Is the load that would yield a nominal life of 105 m.

P [N] = equivalent dynamic load

H [m] = stroke

n_{osz} [min^{-1}] = frequency of operation

V_m [m/min] = mean operating velocity

7.1.2 Radial dynamic limit load F_{rperm}

When selecting the product it is necessary to insure that no loading condition will exceed the allowable load.

8. Bearing handling

8.1 Storage

The bearings should be stored:

- in dry, clean rooms with the temperature as constant as possible
- at a relative humidity of max. 65%.

The storage period for greased and sealed bearings is limited by the shelf life of the grease.

8.2 Removal from packaging

Perspiration from handling leads to corrosion. Hands should be kept clean and dry and gloves worn if necessary.

Bearings should only be removed from their original packaging immediately before assembly.

If only a few bearings are taken out of a multi-piece package preserved by volatile corrosion inhibitor paper, the package must be closed again immediately

- the protective vapour phase is only effective when the package is closed
- the bearings which have been taken out must be greased or oiled immediately.

9. Allowable speed

As bearing speed increases, the temperature of the bearing also increases due to friction heat generated in the bearing interior. If the temperature continues to rise and exceeds certain limits, the efficiency of the lubricant start to fail down drastically, and the bearing can no longer continue to operate in a stable manner. Therefore, the maximum speed at which it is possible for the bearing to continuously operate without the generation of excessive heat beyond specified limits, is called the allowable speed (r/min). The allowable speed of a bearing depends on the type of bearing, bearing dimensions, type of cage, load, lubricating conditions, and cooling conditions.

The allowable speeds listed in the bearing tables for grease and oil lubrication are for **SLB** track roller under normal operating conditions, correctly installed, using the suitable lubricants with adequate supply and proper maintenance. Moreover, these values are based on normal load conditions ($P \leq 0.09C$, $F_a/F_r \leq 0.3$). For track roller with contact seals, the allowable speed is determined by the peripheral lip speed of the seal.

For track roller to be used under heavier than normal load conditions, the allowable speed values listed in the bearing tables must be multiplied by an adjustment factor. The adjustment factors f_L and f_C are given in Figs. 9.1 and 9.2.

Under such high speed operating conditions, when special care is taken, the standard allowable speeds given in the bearing tables can be adjusted upward. The maximum speed adjustment values, f_B , by which the bearing table speeds can be multiplied, are shown in Table 9.1. However, for any application requiring speeds in excess of the standard allowable speed, please consult **SLB** Engineering.

Fig.9.1 Value of adjustment factor f_L depends on bearing load

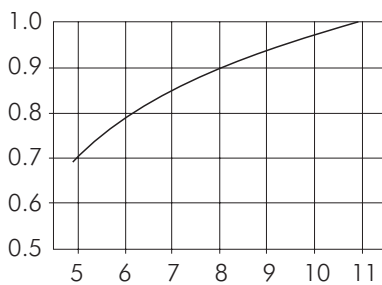


Fig.9.2 Value of adjustment factor f_C depends on combined load

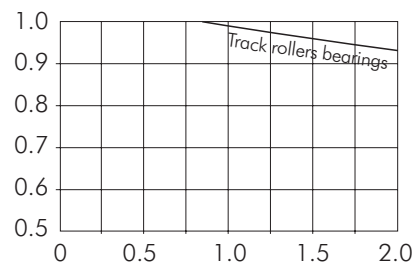


Table 9.1 Adjustment factor, f_B , for allowable number of revolutions

Type of bearing	Adjustment factor f_B
Track rollers bearings	2.0