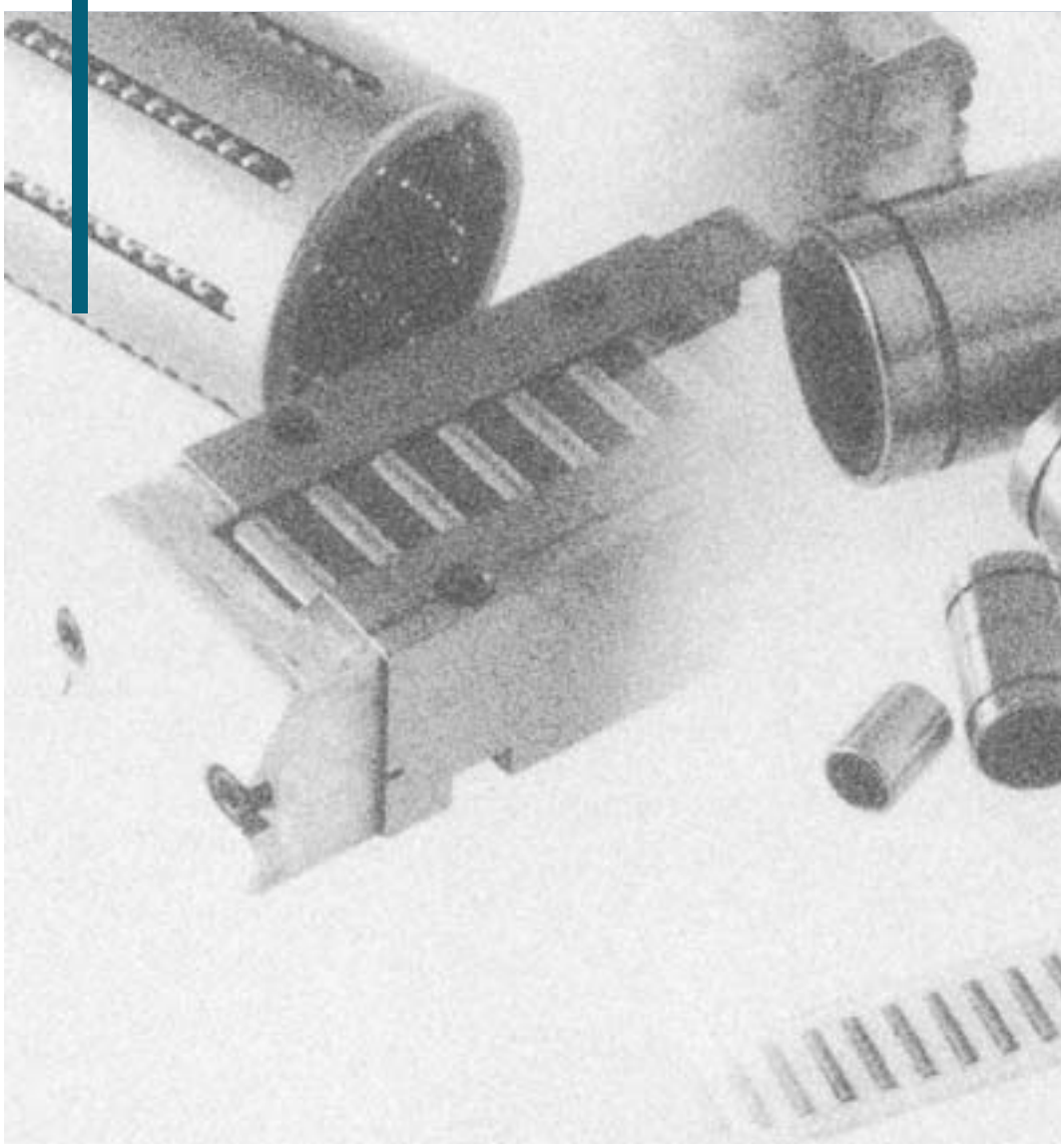
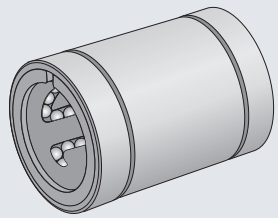
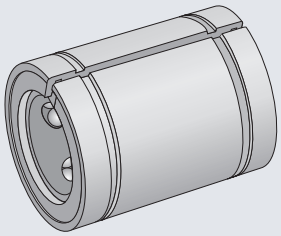
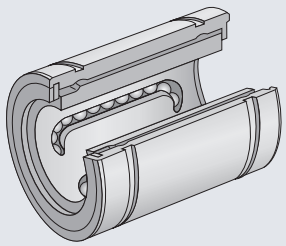
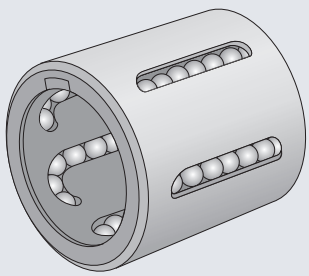
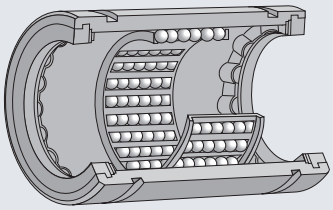
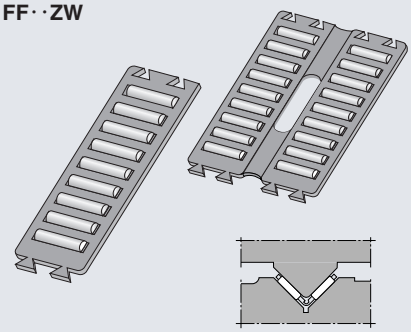
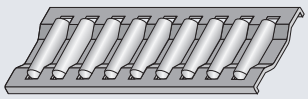
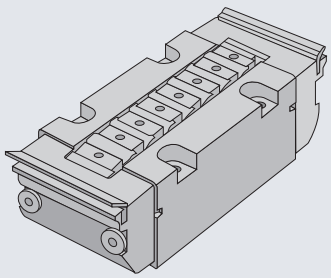
LINEAR BALL BEARINGS:
Solid, Drawn Cup, Stroke, Linear Flat Roller, and Linear Roller Bearing Types



Linear Ball Bearings

Type		Applied shaft diameter (mm)	Composition of nominal number
KLM 	This type composed of an outer ring, steel balls and a cage is a cylindrical bearing for the most universal applications, which ensures precise and smooth infinite linear motion due to its outer ring of high rigidity.	ϕ3～ϕ40	KLM 06 L Tail code Inscribed circle diameter Type code
KLM··S 	his type is composed of an outer ring, steel balls and a cage. And both of the outer ring and the cage have an axial slit, as illustrated, so as to enable to shrink the inscribed circle diameter of the cage by pressing the outer ring in radial direction from the housing and to thereby adjust radial clearance from shaft. Thus, this type also ensures precise and smooth infinite linear motion.	ϕ16～ϕ40	KLM 30 S Tail code Inscribed circle diameter Type code
KLM··P 	This type is composed of an outer ring, steel balls and a cage. And the outer ring and the cage are of arc sectional shape, from which one row of balls (equivalent to 50˚ to 60˚ degree spacing) is removed. Thus, the arc cross-sectional ring and cage with 50˚ to 60˚ degree opening allows the bearing assy to pass through a shaft support truss or a shaft support stand on midway of the shaft stroke. This type also ensures precise and smooth infinite linear motion, similarly to other types. The bearing radial clearance can be also adjusted.	ϕ16～ϕ40	KLM 30 P LL Tail code Tail code Inscribed circle diameter Type code
KH 	This type is composed of an outer ring, steel balls and a cage and the outer ring is cylindrical similarly to that of Type KLM and drawn from a steel plate by precision deep drawing, then enabling to design a compact bearing construction of low section and lightweight. This type also ensures precise and smooth infinite linear motion similarly to other types.	ϕ6～ϕ50 With seal ϕ10～ϕ50	KH 20 30 LL Tail code Width Inscribed circle diameter Type code

Components	Infinite motion	Finite motion	Rotating motion	Remarks
Inscribed circle diameter: ϕ6 L: Single-side seal	○	—	×	The cages of the bearing types KLM, KLM, S, KLM,P and KH are all molded from polyamide resin and, therefore, these bearing types shall be used at allowable temperature 120˚C and, under continuous running, at 100˚C and less. Furthermore, the operating temperature shall be held within the range of -25 to 100˚C to prevent deterioration of seal and grease. These bearing types can't rotate.
Inscribed circle diameter: ϕ6 S: Clearance-adjustable type	○	—	×	
Inscribed circle diameter: ϕ30 P: Open type LL: Double-side seal	○	—	×	
Inscribed circle diameter: ϕ20 Width: 30 LL: Double-side seal	○	—	×	

Type		Applied shaft diameter (mm)	Composition of nominal number
KD 	This type composed of an outer ring, steel balls and a cage is a cylindrical bearing for the most universal applications, which ensures precise and smooth infinite linear motion due to its outer ring of high rigidity.	Shaft diameter ϕ10～ϕ80	**KD 20 32 45 LL** Tail code Width Outer diameter Inscribed circle diameter Type code
FF **FF··ZW** 	This type composed of a cage and needle rollers ensures smooth reciprocating motion of less friction actor by being inserted between two planes in relative position. The cage made of polyamide resin is provided with grooved joint at its both ends so several cages can be jointed together into one unit.	Roller diameter ϕ2～ϕ3.5	**FF 25 18 ZW** Tail code Width Roller diameter ×10 Type code
BF（RF） 	This type composed of a cage and needle rollers ensures smooth reciprocating motion of less friction factor by being inserted between two planes in relative position. Press-formed steel plate cage (BF) and polyamde resin cage (RF) are selectively available. However, in the case of this bearing type several bearings can't not be jointed together into one unit.	Roller diameter ϕ3～ϕ7	**BF 30 20 / 1000** Cage overall length Width Roller diameter ×10 Type code
RLM 	This type is composed of a track frame, a separator and rollers. This type has the function enabling cylindrical rollers to circulate within the track frame and ensures infinite linear motion on a plane.	Section height 16～38	**RLM 26 × 86** Bearing overall length Section height Type code

Components	Infinite motion	Finite motion	Rotating motion	Remarks
Inscribed circle diameter: ϕ20 Outer diameter: ϕ32 Width: 45	—	○	○	The operating temperature shall be held within the range of -25 to 100˚C, to prevent deterioration of seal and grease.
Roller diameter: f2.5 Width: 18 ZW: Double-row type	○	—	×	Due to its resin cage, this bearing shall be used at allowable temperature 90˚C and, under continuous running, at 80˚C and less. The double-row type has an elastic joint on the cage center so double rows of flat rollers can be bent to any optional angle along the elastic joint by heating them in oil of 70 to 90˚C. By cooling down the double-row rollers with the bent angle held unchanged for several seconds after having bent them to any optional angle, the bent shape of the double rows can be held unchanged so that the double-row rollers can be mounted on a V-shaped surface as illustrated.
Roller diameter: f3 Width: 20 Cage length: 1000	○	—	×	Where the resin cage RF is used, the bearing shall be used at allowable temperature 90˚C and, under continuous running, at 80˚C and less. The standard length of the bearing unit with BF cage is 1000 mm. The standard length of the bearing unit with RF cage is 705 mm. Two or more bearings of this type can't be jointed with each other, but it can be supplied at any desired length on request.
Section height: 26 Bearing overall length: 86	○	—	×	

Linear Ball Bearings, Solid and Drawn Cup Types

Four to nine rows of balls are configured equally in the outer ring (outer cylinder). The ball rows circulate in axial direction while being guided by the cage. Thus, these bearing types move infinitely on a shaft in axial direction. However, these bearing types can't rotate.

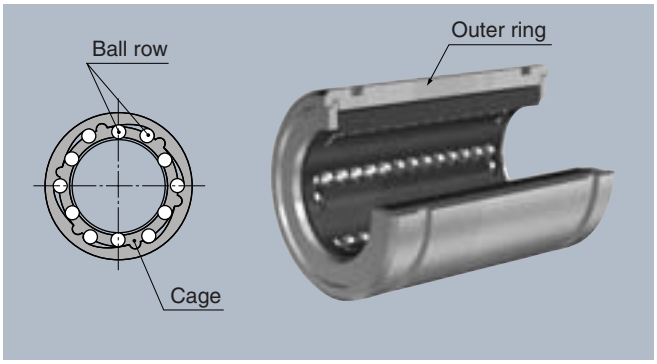


Fig. 1

Dimensional accuracy

The respective accuracy of the boundary dimensions , inscribed circle diameter (F_w) , outer diameter (D), and width (C) of **Type KLM** (solid type bearing) are as described in applicable Dimensions Table. Same bearing with higher dimensional accuracy is offerable on special request. Feel free to contact **NTN** when such a bearing is needed.

For Type KH (drawn cup type), its outer ring is so thin-walled that it deforms inevitably to some extent in the manufacturing processes, particularly heat-treating process, but it is so designed as to be restored normally from such deformation and fulfill its specific function with the required accuracy by being press-fitted in a housing with the required dimensional accuracy.

Feel free to contact **NTN** for the method of measuring the dimensional accurracy.

Bearing fit

The use of a shaft or a housing with the dimensional tolerance shown in **Table 1** would ensure proper radial clearance. Where further small radial clearance is wanted or preload is applied, the radial clearance is adjusted using a split housing or otherwise bearing fit required for smaller clearance or preload is selected.

Table 1 Bearing fit

Type	Shaft	Housing
series KLM Solid type	g6 (g5)	H7 (H6)
series HK Drawn-cup type	h6 (j5)	H7 (H6) - steel series - K7 (K6) - light metal alloy series -

Note) The parenthesized data is applied to shaft/housing subjected to higher accuracy or of vertical construction.

Shaft and housing requirements

Any shaft /housing on/in which these bearing types are fitted must meet the requirements specified in **Table 2**.

Table 2 Shaft and housing requirements

Characteristics	Shaft	Housing
Roundness (max)	IT3	IT4
Cylindricality (max)	IT2	IT4
Surface roughness (max.)	0.4a	1.6a
Surface hardness	HRC58～64	—
Hardened layer depth (min)	0.4mm	—

How to mount

The housing for **Type KLM** (solid type) can't be fixed perfectly with interference only and, therefore, must be fixed in axial direction using a snap ring.

On the other hand, **Type KH** (drawn cup type) needs no axial fixing by a snap ring because it is press-fitted in a housing with interference. For press-fitting, press the outer ring at its stamped mark side(hardened side) using a mandrel illustrated in **Fig.2**.

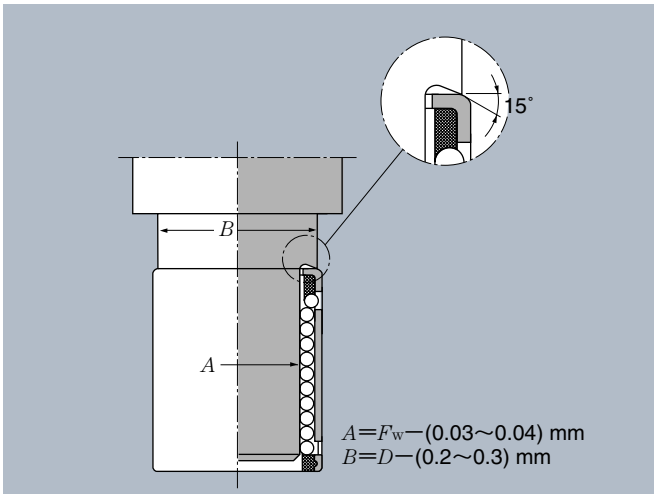
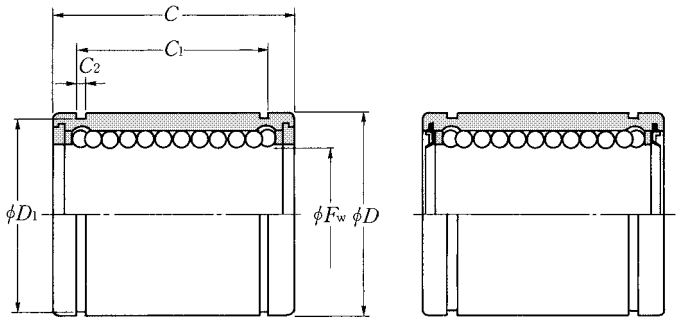


Fig. 2 Series KH

Accessories

Shafts, shaft support stands and housings exclusive for **NTN** linear ball bearings are also offerable. Feel free to contact **NTN** for the detailed information.

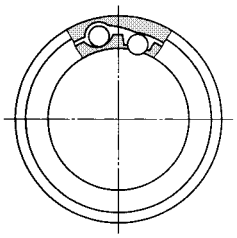
Type KLM **Type KLM··LL**
Type KLM··S **Type KLM··SLL**
Type KLM··P **Type KLM··PLL**



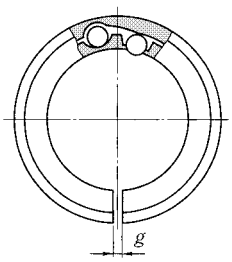
With seal

F_w 3～35mm

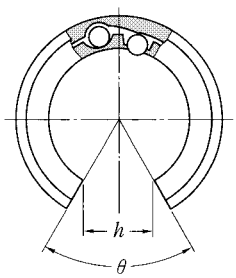
Boundary dimensions mm									Basic load ratings N		Basic load ratings kgf		Bearing numbers	Number of ball rows	Mass kg
F_w	D	C	C_1 ±0.240	C_2	D_1	g	h	θ	dynamic C_r	static C_{or}	dynamic C_r	static C_{or}			(approx.)
3 $^{0}_{-0.008}$	7 $^{0}_{-0.010}$	10 $^{0}_{-0.120}$	—	—	—	—	—	—	51	40	5	4	KLM03	4	0.002
4 $^{0}_{-0.008}$	8 $^{0}_{-0.010}$	12 $^{0}_{-0.120}$	—	—	—	—	—	—	71	52	7	5.5	KLM04	4	0.003
5 $^{0}_{-0.009}$	10 $^{0}_{-0.010}$	15 $^{0}_{-0.120}$	—	—	—	—	—	—	118	90	12	9	KLM05	4	0.005
6 $^{0}_{-0.009}$	12 $^{0}_{-0.010}$	19 $^{0}_{-0.120}$	13.3	1.1	11.5	—	—	—	130	107	13	11	KLM06	4	0.009
8 $^{0}_{-0.009}$	15 $^{0}_{-0.010}$	17 $^{0}_{-0.120}$	11.3	1.1	14.3	—	—	—	116	94	12	9.5	KLM08	4	0.012
	15 $^{0}_{-0.010}$	24 $^{0}_{-0.120}$	17.3	1.1	14.3	—	—	—	234	187	24	19	KLM08-1	4	0.017
10 $^{0}_{-0.009}$	19 $^{0}_{-0.012}$	29 $^{0}_{-0.120}$	21.7	1.3	18	—	—	—	435	297	45	30	KLM10	4	0.028
12 $^{0}_{-0.009}$	22 $^{0}_{-0.012}$	32 $^{-0}_{-0.120}$	22.7	1.3	21	—	—	—	480	380	49	39	KLM12	5	0.042
13 $^{0}_{-0.009}$	23 $^{0}_{-0.012}$	32 $^{0}_{-0.120}$	22.7	1.3	22	—	—	—	540	455	55	47	KLM13	5	0.045
	28	37	26.5	1.6	27	—	—	—	875	670	89	68	KLM16	5	0.075
16 $^{0}_{-0.009}$	28 $^{0}_{-0.012}$	37 $^{0}_{-0.120}$	26.5	1.6	27	0.6	—	—	875	670	89	68	KLM16S	5	0.075
	28	37	26.5	1.6	27	—	8.2	60°	875	670	89	68	KLM16P	4	0.062
	32	42	30.3	1.6	30.5	—	—	—	1 190	985	121	100	KLM20	6	0.10
20 $^{0}_{-0.010}$	32 $^{0}_{-0.014}$	42 $^{0}_{-0.120}$	30.3	1.6	30.5	0.6	—	—	1 190	985	121	100	KLM20S	6	0.10
	32	42	30.3	1.6	30.5	—	8.6	50°	1 190	985	121	100	KLM20P	5	0.085
	40	59	40.7	1.85	38	—	—	—	2 640	2 340	269	239	KLM25	6	0.22
25 $^{0}_{-0.010}$	40 $^{0}_{-0.014}$	59 $^{0}_{-0.120}$	40.7	1.85	38	0.6	—	—	2 640	2 340	269	239	KLM25S	6	0.22
	40	59	40.7	1.85	38	—	10.8	50°	2 640	2 340	269	239	KLM25P	5	0.19
	45	64	44.2	1.85	43	—	—	—	2 540	2 360	259	241	KLM30	6	0.26
30 $^{0}_{-0.010}$	45 $^{0}_{-0.014}$	64 $^{0}_{-0.120}$	44.2	1.85	43	0.6	—	—	2 540	2 360	259	241	KLM30S	6	0.26
	45	64	44.2	1.85	43	—	13.0	50°	2 540	2 360	259	241	KLM30P	5	0.22
	52	70	49.2	2.2	49	—	—	—	3 400	2 970	345	305	KLM35	6	0.40
35 $^{0}_{-0.012}$	52 $^{0}_{-0.017}$	70 $^{0}_{-0.120}$	49.2	2.2	49	1.2	—	—	3 400	2 970	345	305	KLM35S	6	0.40
	52	70	49.2	2.2	49	—	15.1	50°	3 400	2 970	345	305	KLM35P	5	0.34



Type KLM
(Standard type)



Type KLM··S
(Clearance-adjustable type)

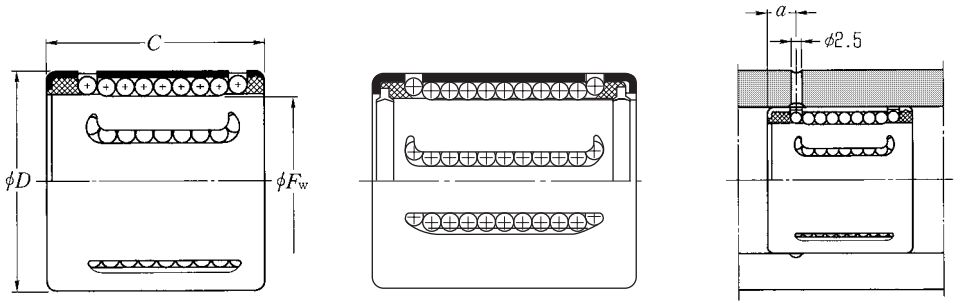


Type KLM··P
(Open type)

F_W 40mm

Boundary dimensions mm									Basic load ratings N		Basic load ratings kgf		Bearing numbers	Number of ball rows	Mass kg
F_W	D	C	C_1 ±0.300	C_2	D_1	g	h	θ	dynamic C_r	static C_{or}	dynamic C_r	static C_{or}			(approx.)
40 $^{0}_{-0.012}$	60 $^{0}_{-0.017}$	80 $^{0}_{-0.120}$	60.3	2.1	57	—	—	—	3 950	3 750	400	385	**KLM40**	6	0.62
	60 $^{0}_{-0.017}$	80 $^{0}_{-0.120}$	60.3	2.1	57	1.2	—	—	3 950	3 750	400	385	**KLM40S**	6	0.62
	60 $^{0}_{-0.017}$	80 $^{0}_{-0.120}$	60.3	2.1	57	—	17.2	50°	3 950	3 750	400	385	**KLM40P**	5	0.53

Type KH
Type KH··LL



With seal

F_w 6～50mm

Boundary dimensions mm				Bearing numbers	Basic load ratings N dynamic	static	kgf dynamic	static	Number of ball rows	Mass kg
F_w	D	C	$a^{1)}$		C_r	C_{or}	C_r	C_{or}		(approx.)
6	12	22	4	**KH0622**[2)]	380	225	39	23	4	0.007
8	15	24	5	**KH0824**[2)]	420	255	43	26	4	0.012
10	17	26	5	**KH1026**[2)]	480	325	49	33	4	0.015
12	19	28	6	**KH1228**	605	495	62	51	5	0.018
	19	28	6	**KH1228LL**	605	495	62	51	5	0.018
14	21	28	6	**KH1428**	600	505	61	51	5	0.021
16	24	30	7	**KH1630**	775	600	79	61	5	0.027
	24	30	7	**KH1630LL**	775	600	79	61	5	0.027
20	28	30	7	**KH2030**	1 050	880	107	90	6	0.033
	28	30	7	**KH2030LL**	1 050	880	107	90	6	0.033
25	35	40	8	**KH2540**	1 930	1 560	197	159	6	0.066
	35	40	8	**KH2540LL**	1 930	1 560	197	159	6	0.066
30	40	50	8	**KH3050**	2 700	2 450	275	250	7	0.095
	40	50	8	**KH3050LL**	2 700	2 450	275	250	7	0.095
40	52	60	9	**KH4060**	4 250	4 000	435	410	8	0.18
50	62	70	9	**KH5070**	5 300	5 700	540	580	9	0.24

Note 1) Showing a-value from the side face with stamped mark thereon.
2) Imported product from INA, Germany.

Linear Ball Bearings, Stroke Type

The bearing cage with multiple ball rows (several balls per row) configured circumferentially therein can move within the outer ring in both circumferential and axial directions. Thus, this bearing type can rotate and reciprocate (but at a limited stroke) on a shaft.

Bearing construction

Maximum available length of the reciprocal stroke is two times as long as the stroke at which the cage can reciprocate within the outer ring. The outer ring is provided at its both ends with a snap ring acting as a stopper and a wave spring is provided between the snap ring and the cage to damp a shock acting on the cage as well as to prevent wear of the cage.

In addition to the standard type, a special type with synthetic rubber seal (Tail code: **LL**) on the both ends of its outer ring is also available.

Dimensional accuracy of Bearing

Table 1 the bearing tolerance.

Table 1 Dimensional accuracy

Characteristics	Dimensional tolerance
Ball inscribed circle diameter (F_w) Outer ring outer diameter (D)	F6 h5

Bearing fit and radial clearance

Any linear ball bearings must be used with radial clearance as less as possible. Particularly where linear ball bearing is applied to a vertical shaft or high accuracy is required, it is desirable to select and combine appropriate bearing and shaft for securing radial clearance in the range of 0 to -10 μm (by preloading). **Table 2** shows the bearing fits on shaft and in housing.

Table 2 Bearing fits

Operating conditions	Shaft	Housing
Usual operating conditions	k5 (m5)	H6 (H7)
Vertical shaft and high accuracy applications	n5 (p5)❶	J6 (J7)

❶ Selective fit

Shaft and housing requirements

Table 3 specifies the requirements for shaft and housing which of the outer surfaces are used as the direct raceway.

Table 3 Shaft and housing requirements

Characteristics	Shaft	Housing
Roundness (max)	IT2	IT4
Cylindricality (max)	IT2	IT4
Surface roughness (max)	0.2a	1.6a
Surface hardness	HRC58～64	—
Hardened layer depth (min)	0.4mm	—

How to mount

This bearing type can't be fixed perfectly to a housing with interference only and, therefore, it is fixed in axial direction using a snap ring. (Refer to **Fig. 1**)

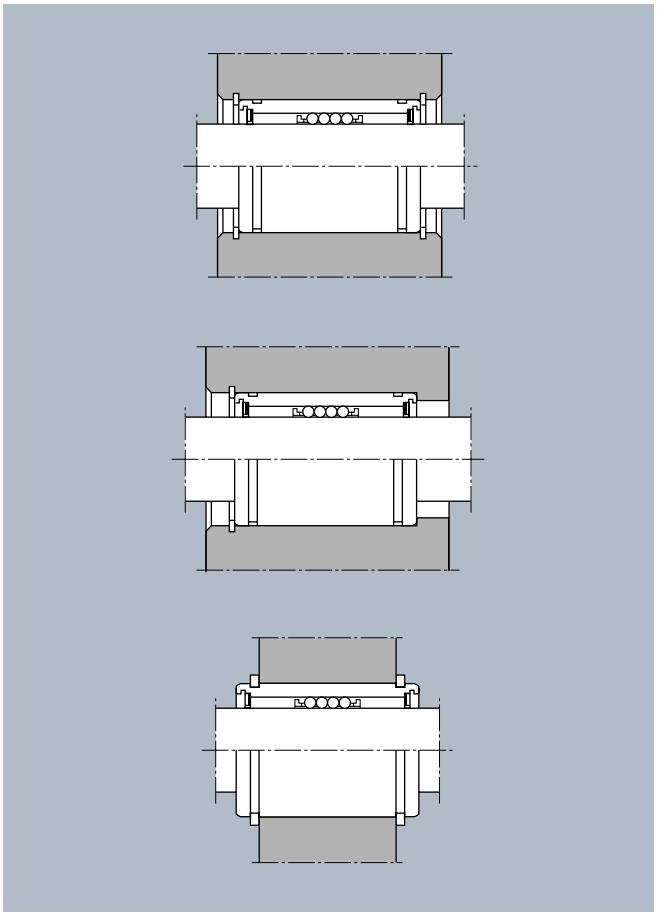


Fig. 1 Axial fixing of bearing

For adjusting the cage so it locates at the outer ring center after a shaft was mounted, push the cage in the arrow direction in **Fig. 2** by inserting the shaft into the outer ring that was press-fitted in the housing. (**Fig. 2**)

In this condition, insert slowly the shaft up to the center point of the reciprocating stroke and, thereafter, further push-in the shaft by 1/2 of the stroke. (**Fig. 3**) Then, return the shaft by 1/2 of the stroke to thereby locate the cage at the outer ring center and the shaft at the center point of the reciprocating stroke. (**Fig. 4**)

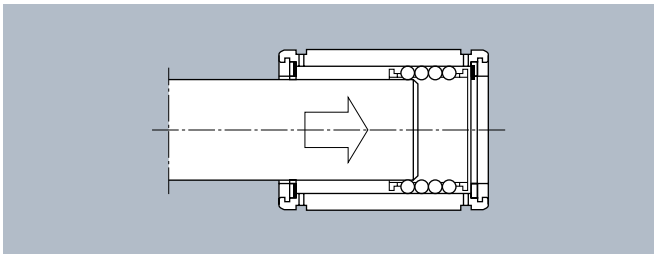


Fig. 2

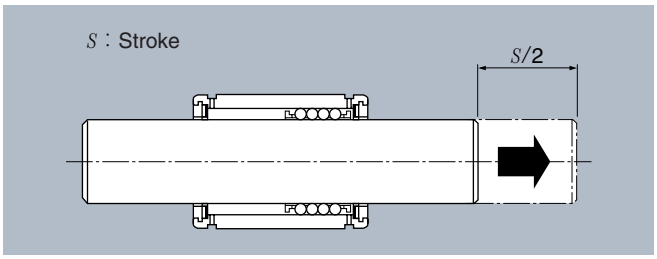


Fig. 3

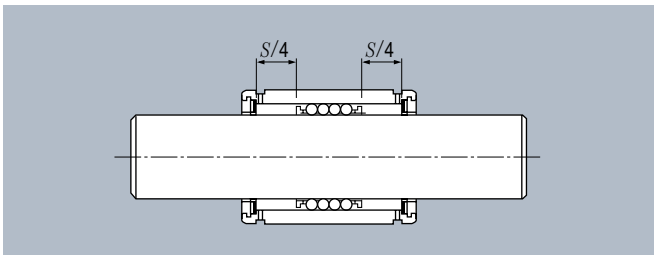
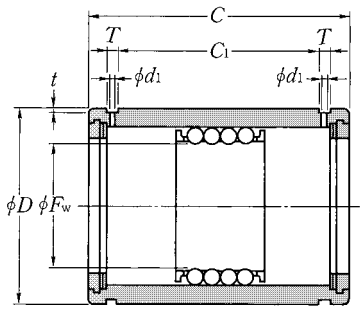


Fig. 4

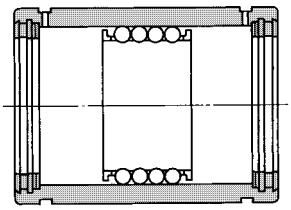
The outer ring must be press-fitted so its grease feed hole locates at load non-acting side.

Where moment load acts on a bearing due to use of a vertical shaft, the load could act on the grease feed hole. Caution it.

Type KD
Type KD··LL



Type KD
(Open type)



Type KD··LL
(With seal)

F_W 10～80mm

Boundary dimensions mm										Bearing numbers		Basic load ratings N				Mass (approx.) kg	
						Type KD		Type KD··LL				dynamic	static	dynamic	static		
F_W F6	D h5	$C^{1)}$	T	t	d_1	C_1	Max. stroke	C_1	Max. stroke	Type KD	Type KD··LL	C_r	C_{or}	C_r	C_{or}	Type KD	Type KD··LL
10	19	30	1.7	0.4	1.5	22.7	27	15.5	19	**KD101930**	**KD101930LL**	725	535	74	55	0.028	0.030
12	23	32	1.7	0.4	1.5	24.5	30	17.1	22	**KD122332**	**KD122332LL**	925	725	94	74	0.052	0.055
16	28	37	1.7	0.5	1.5	29.1	33	21.1	26	**KD162837**	**KD162837LL**	1 490	1 070	152	110	0.073	0.078
20	32	45	2.2	0.5	2	35.8	55	26.8	46	**KD203245**	**KD203245LL**	1 680	1 230	171	125	0.100	0.105
25	37	45	2.2	0.6	2	35.8	55	26.8	46	**KD253745**	**KD253745LL**	1 890	1 410	193	144	0.115	0.120
30	45	65	2.7	0.7	2.5	53.5	81	45.1	73	**KD304565**	**KD304565LL**	3 850	3 100	390	315	0.265	0.265
35	52	70	2.7	0.7	2.5	58.5	90	50.1	79	**KD355270**	**KD355270LL**	4 200	3 500	430	355	0.405	0.405
40	60	80	2.7	0.7	2.5	68.3	103	59.9	93	**KD406080**	**KD406080LL**	5 900	4 750	600	485	0.635	0.635
45	65	80	2.7	0.7	2.5	68.3	103	59.9	93	**KD456580**	**KD456580LL**	6 450	5 300	655	540	0.675	0.680
50	72	100	3.2	1	3	86.4	136	77.4	125	**KD5072100**	**KD5072100LL**	8 500	6 850	870	695	1.00	1.02
55	80	100	3.2	1	3	86.4	136	77.4	125	**KD5580100**	**KD5580100LL**	9 250	7 550	945	770	1.34	1.36
60	85	100	3.2	1	3	86.4	136	77.4	122	**KD6085100**	**KD6085100LL**	9 900	8 250	1 010	845	1.41	1.43
70	95	100	3.2	1	3	86.4	136	77.4	122	**KD7095100**	**KD7095100LL**	10 600	9 000	1 090	920	1.61	1.63
80	110	100	3.2	1.2	3	86	129	77	116	**KD80110100**	**KD80110100LL**	13 300	10 900	1 360	1 110	2.37	2.40

Note 1) The tolerance for dimension-C is 0, -0.120 mm against $F_W \leqq 50$ mm and 0, -0.150 mm against $F_W > 50$ mm.

Linear Flat Rollers

Linear Flat Rollers

This bearing type composed of a needle roller and flat cage assembly (needle rollers are configured in the flat cage) ensures smooth reciprocating motion with less friction coefficient.

Types

For **Type FF**, the polyamide resin cage has a dovetail joint groove on its both ends so that several cages can be jointed together into one unit.

For **Type FF··ZW**, two rows of needle rollers are configured in the cage and the cage has an elastic joint on its center so as to enable to bend two rows of flat rollers to any optional angle at the elastic joint by heating them in oil of 70 to 90˚C. The two roller rows bent to any optional angle can hold the bent shape unchanged, even under normal operating temperature, by being cooled down for several seconds, with the bending angle held unchanged.

For **Type BF**, the cage is press-formed from steel plate and the standard length of the bearing unit is 1000 mm. For **Type RF**, the cage is of polyamide resin and the standard length of the bearing unit is 705 mm. The both are unavailable for cage to cage inter-jointing, but a bearing unit of any desired length is offerable upon request. Feel free to contact **NTN** for the detailed information.

Needle roller tolerance

The needle rollers contained in the flat roller cage are manufactured within the dimensional tolerance range of 0 to -2 mm against the nominal diameter (D_w).

Raceway surface requirements

Table 1 shows the requirements for raceway surface applied to the linear flat roller bearings.

Table 1 Raceway surface requirements

Characteristics	Tolerance
Surface roughness (max)	0.2a
Surface hardness ❶	HRC58～64
Effective hardened layer depth (min)	0.4mm
Mounting accuracy (max)❷	0.1 mm per 1000 mm

❶ Where raceway surface hardening not allowed, a quenched spring plate may be used.
❷ Mounting accuracy is expressed with an inclination value in **Fig. 1.**

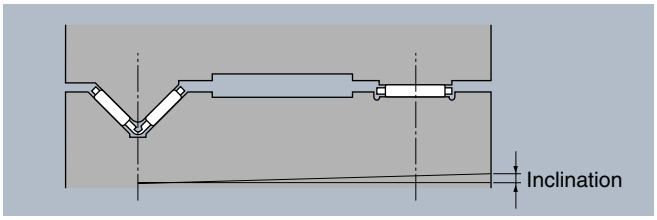


Fig. 1

How to mount

Theoretically the linear flat roller bearing moves by 1/2 of table moving stroke in same direction as the table moving direction. The relationship of bed length (L) - stroke (S) - cage length (L_1) can be expressed in **formula (1)**. (**Fig. 2**)

$$L=S/2+L_1 \quad \cdots\cdots (1)$$

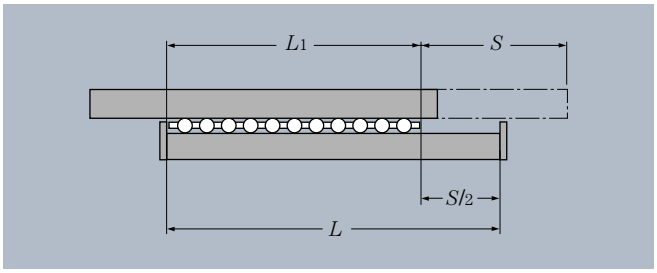


Fig. 2

The linear flat roller bearing results in moving deviation due to profile deviation of raceway surface, uneven load or vibration. Therefore, the table or the bed must be equipped with a stopper at its end portion to prevent over-run of the flat roller bearing. (**Fig. 5**)

Figs. 3 and **4** illustrate application examples of the linear flat roller bearing unit.

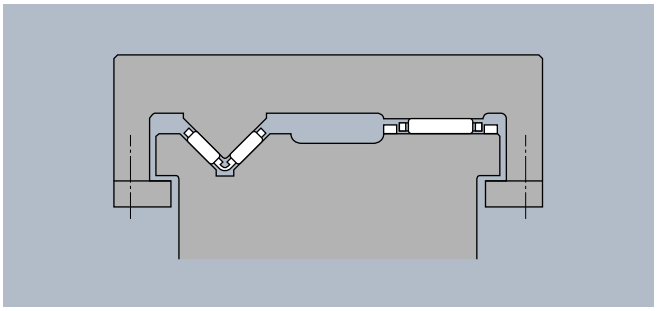


Fig. 3 General application

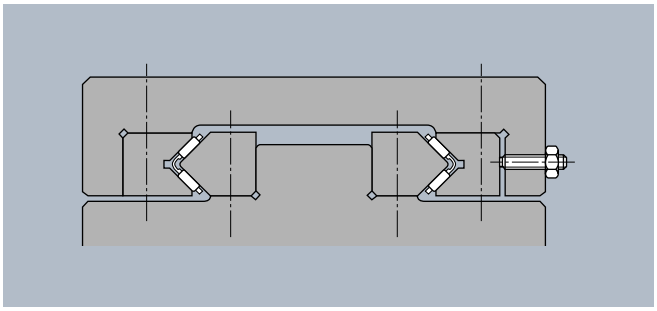


Fig. 4 When overhung load acts on

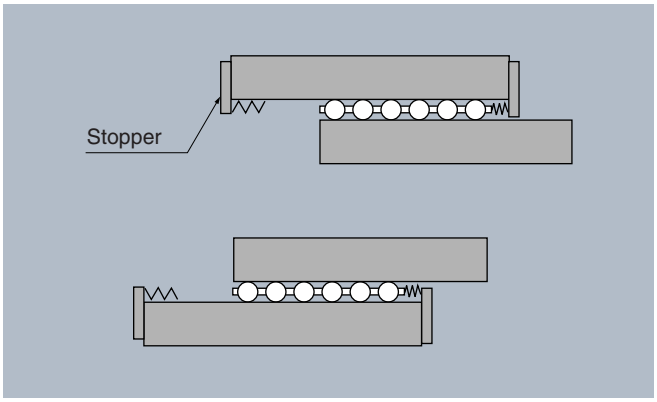
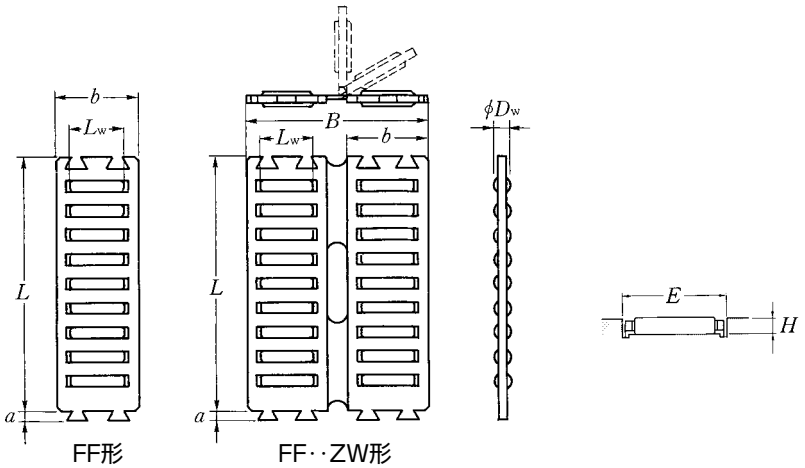


Fig. 5

Type FF
Type FF··ZW

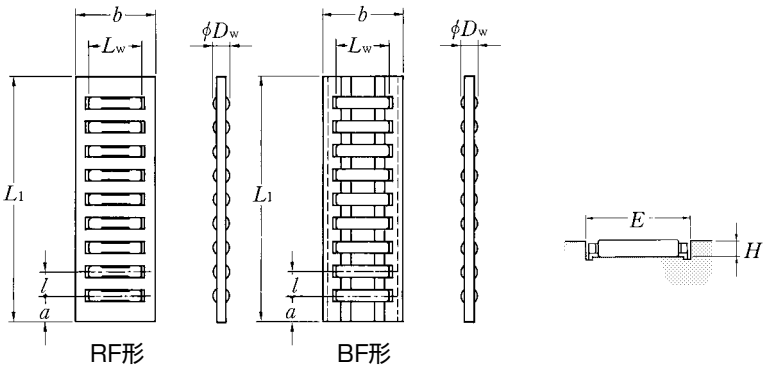


D_w 2～3.5mm

Boundary dimensions mm						Basic load ratings N dynamic	static	kgf dynamic	static	Bearing numbers	Number of rolls	Abutment dimensions mm		Mass kg
D_w[1)]	b	B	L	L_w	a	C_r	C_{or}	C_r	C_{or}			E	H	(approx.)
2	10	—	32	6.8	2	8 500	19 700	865	2 010	**FF2010**	7	$10.3^{+0.1}_{0}$	$1.7^{0}_{-0.2}$	0.0020
2	10	25	32	6.8	2	15 500	39 500	1 580	4 000	**FF2025ZW**	14	$25.3^{+0.1}_{0}$	$1.7^{0}_{-0.2}$	0.0043
2.5	15	—	45	9.8	2.4	17 100	41 400	1 740	4 200	**FF2515**	8	$15.3^{+0.1}_{0}$	$2.2^{0}_{-0.2}$	0.0038
2.5	15	35	45	9.8	2.4	29 300	82 500	2 980	8 450	**FF2535ZW**	16	$35.3^{+0.1}_{0}$	$2.2^{0}_{-0.2}$	0.0082
3	20	—	60	13.8	3	31 000	79 500	3 150	8 100	**FF3020**	9	$20.4^{+0.1}_{0}$	$2.7^{0}_{-0.2}$	0.0089
3	20	45	60	13.8	3	53 500	145 000	5 450	14 800	**FF3045ZW**	18	$45.4^{+0.1}_{0}$	$2.7^{0}_{-0.2}$	0.019
3.5	25	—	75	17.8	3.2	50 000	132 000	5 100	13 500	**FF3525**	10	$25.4^{+0.1}_{0}$	$3.2^{0}_{-0.2}$	0.017
3.5	25	55	75	17.8	3.2	86 000	265 000	8 800	27 000	**FF3555ZW**	20	$55.4^{+0.1}_{0}$	$3.2^{0}_{-0.2}$	0.035

Note 1) The dimensional tolerance for needle roller diameter D_w is 0 to -2 μm.

Type BF
Type RF



D_w 3～7mm

Boundary dimensions mm						Basic load ratings[3] N dynamic		kgf dynamic		Bearing numbers	Abutment dimensions mm		Mass[4] kg
D_w[1]	b	L_1[2]	L_w	l	a	C_r	C_{or}	C_r	C_{or}		E	H	(approx.)
3	20	705	13.8	6	4.5	34 000	88 500	3 450	9 000	**RF3020/705**	$20.4^{+0.1}_{0}$	$2.7^{0}_{-0.2}$	0.015
3	20	1 000	15.8	6	5	38 000	102 000	3 850	10 400	**BF3020/1000**	$20.4^{+0.1}_{0}$	$2.7^{0}_{-0.2}$	0.037
5	23	1 000	19.8	8	8	87 000	211 000	8 850	21 500	**BF5023/1000**	$23.4^{+0.1}_{0}$	$4.7^{0}_{-0.2}$	0.054
5	32	1 000	27.8	8	8	114 000	299 000	11 600	30 500	**BF5032/1000**	$32.4^{+0.1}_{0}$	$4.7^{0}_{-0.2}$	0.073
7	28	1 000	24	11	10.5	155 000	355 000	15 800	36 000	**BF7028/1000**	$28.5^{+0.1}_{0}$	$6.7^{0}_{-0.2}$	0.091
7	35	1 000	30	11	10.5	185 000	445 000	18 900	45 500	**BF7035/1000**	$35.5^{+0.1}_{0}$	$6.7^{0}_{-0.2}$	0.110

Note 1) The dimensional tolerance for needle roller diameter D_w is 0 to -2 μm.
2) The standard length L_1 of the cage shall be 1000 mm for Type BF and 705 mm for Type RF.
Where special cage length is required, the nominal bearing number is followed by the numerical length value as exemplified below.
Ex. Where L_1 = 500 mm is required for **BF3020**, **BF302/500**
3) The listed basic load ratings are subject to use of 10 flat rollers. Calculate the basic load ratings for any optional cage length L_1 by the following formula.
$C = f_1^{7/9} \cdot C_r$
$C_0 = f_1 \cdot C_{0r}$
Herein, f_1=0.1 ($L_1 + l - 2a$) / l
4) The listed weights are subject to L_1 = 100 mm.

Remarks: For **Type BF**
1. On occasion, the length of an ordered unit could be shorter by l dimension shown in each Dimensions Table because the roller and cage assy is cut at the minimum unit of each pocket so as to match the required length.
2. Where this bearing unit is used frequently at various lengths, it is more economical to cut the standard bearing of 1000 mm length to each desired length at your side.

Linear Roller Bearings

This roller bearing with cylindrical rollers having the function capable of circulating within the raceway block ensures smooth infinite linear motion on a flat surface. The cylindrical rollers are retained and guided by the cage and the ribs of the raceway block.

The cage is of such a construction as not allow adjacent rollers to contact with one another. Hence, the friction coefficient is low.

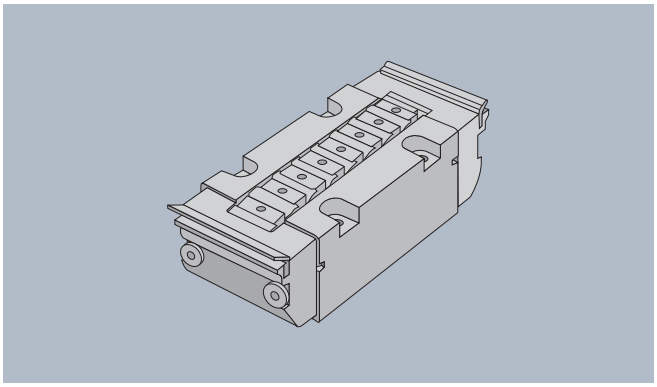


Fig. 1

Bearing accuracy

All the linear roller bearings are manufactured within the dimensional tolerance range of 0 to -2.5 μm for bearing height (H). And these bearings are delivered classified into 5-stepped tolerance classes. (See **Table 1**)

Table 1 Classification of bearing height H by accuracy class

Unit : μm

Class code	Tolerance for height (H)
1H	0～－ 5
2H	－ 5～－10
3H	－10～－15
4H	－15～－20
5H	－20～－25

Requirements and tolerances for raceway surface and mounting surface

Table 2 shows the requirements and tolerances for the raceway surface, on which linear roller bearing rolls, and the bearing mounting surface. Where adhesion of a hard foreign matter to the raceway surface is forecast, the raceway surface must be protected with a proper protective cover.

The reference surface for mounting is the back face and opposite face to **NTN** mark.

Table 2 Requirements for raceway surface and mounting surface

Characteristics	Allowable value or tolerance range
Raceway surface roughness (max)	0.2a
Raceway surface hardness	HRC58～64
Effective hardened layer depth of raceway surface (min)	as described in applicable Dimensions Table
Parallelism of mounting surface	
Δx (See **Fig. 2**)	0.05 mm per 100 mm
Δy (See **Fig. 3**)	0.01 mm per 100 mm

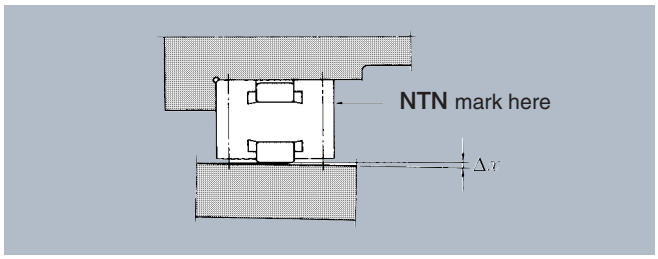


Fig. 2

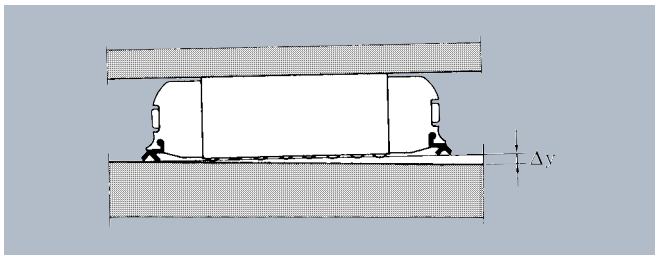


Fig. 3

How to mount

Fix linear roller bearing using the tapped holes which are provided on the mounting reference surface. (See **Fig. 4**)

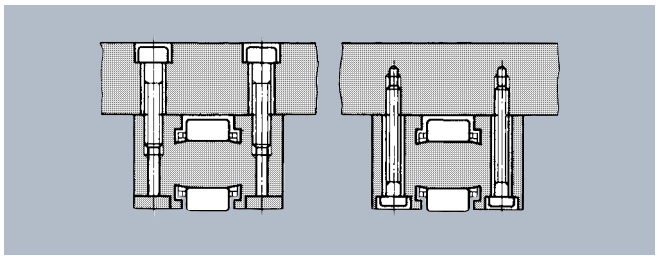
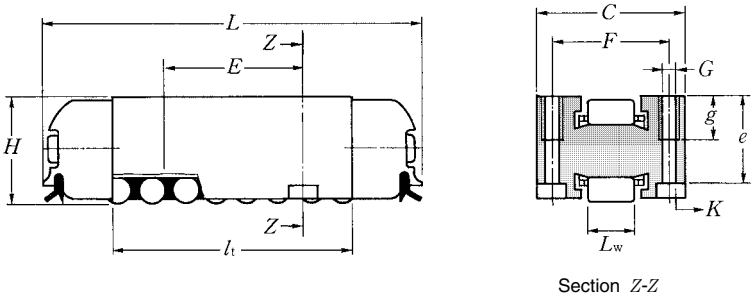


Fig. 4

Type RLM



Section Z-Z

H 16～38mm

Boundary dimensions mm											Bearing numbers	Basic load ratings N dynamic	Basic load ratings N static	Basic load ratings kgf dynamic	Basic load ratings kgf static	Required case depth on track (min.)	Mass kg
H	*C*	*L*	L_w	*E*	*F*	*G*	L_t	*e*	*g*	*K*		C_r	C_{or}	C_r	C_{or}	mm	(approx.)
16	25	62	8	17	19	M4	35.5	12.5	6	ϕ3.2	**RLM16× 62**	15 400	34 000	1 570	3 450	0.3	0.11
19	27	69	10	25.5	20.6	M4	43.4	15.5	6	ϕ3.2	**RLM19× 69**	26 100	58 000	2 670	5 900	0.3	0.16
26	40	86	14	28	30	M6	52.4	21	10	ϕ4.5	**RLM26× 86**	50 000	106 000	5 100	10 800	0.4	0.41
26	40	102	14	44	30	M6	67.9	21	10	ϕ4.5	**RLM26×102**	62 500	142 000	6 400	14 500	0.4	0.53
26	40	126	14	68	30	M6	91.8	21	10	ϕ4.5	**RLM26×126**	80 000	195 000	8 150	19 900	0.4	0.70
38	52	134	20	51	41	M8	85.7	31	14	ϕ6.5	**RLM38×134**	124 000	270 000	12 700	27 500	0.5	1.3