MOTION & CONTROL TECHNOLOGY

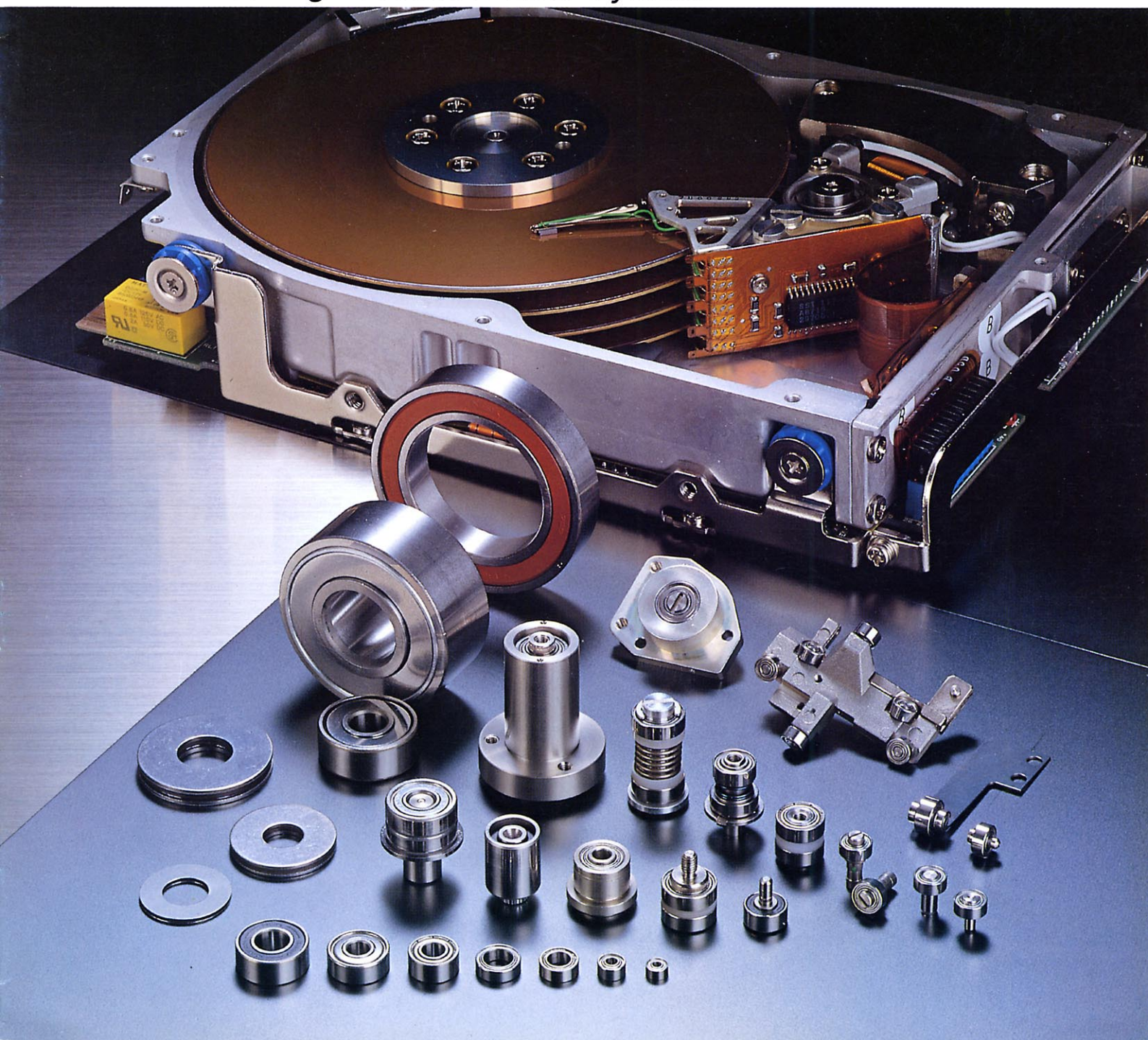
NSK

NIPPON SEIKO

High Precision Ball Bearings for Computer Disk Drives

Bearings for Disk Spindles
Bearings and Bearing Units for Actuators

NSK Ball Bearings and Units Facilitate Development of Advanced High Precision HDD Systems



NSK Ball Bearing for Computer Disk Drives Satisfy The M ost Stringent Requirements
Ball Bearings with High Precision and Reliability Assure Maximum Performance from Small to Large Magnetic Computer Disk Drives

The performance of magnetic disk drives is progressing steadily, so they are constantly becoming more compact but with higher track density. This progress is possible only with the most advanced Motion and Control Technology — which is our motto at NSK.

High precision angular and linear motions are vitally important for advanced systems, and NSK is the leader in the design, development and quality of bearings and integrated units.

Disk drive bearings must have extraordinarily high running accuracy (low repetitive and non-repetitive runout) and low noise and vibration.

Actuator bearings must have low torque and low torque variation and NSK's products are carefully produced to satisfy these requirements. NSK supplies a wide range of integrated bearing units and assemblies that offer high precision and easy mounting. Besides standard off-the-shelf products, custom-made units are also available. Contact NSK for details.

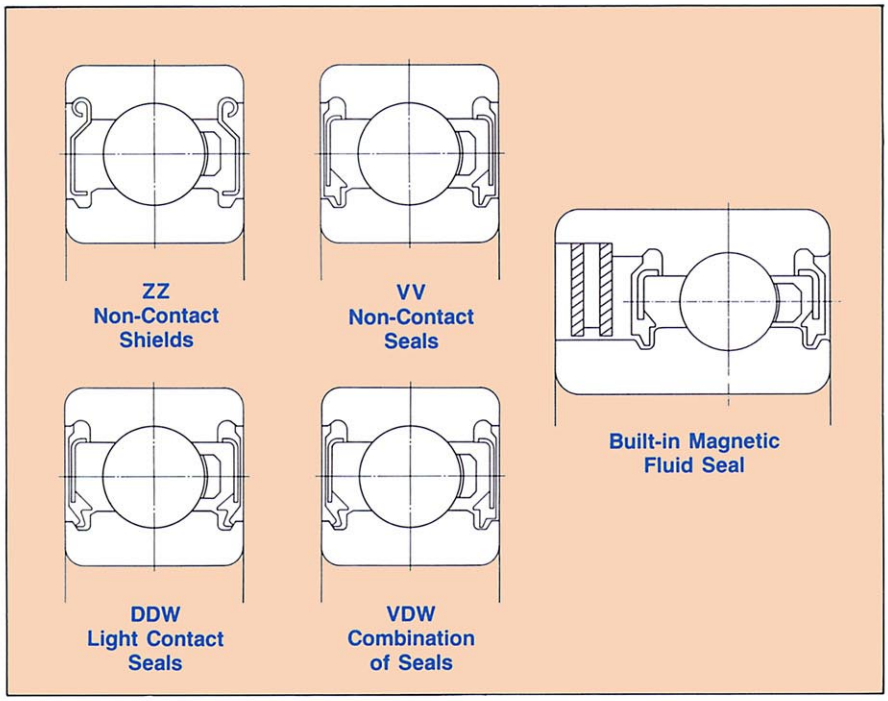
Features of Ball Bearings for Disk Spindles

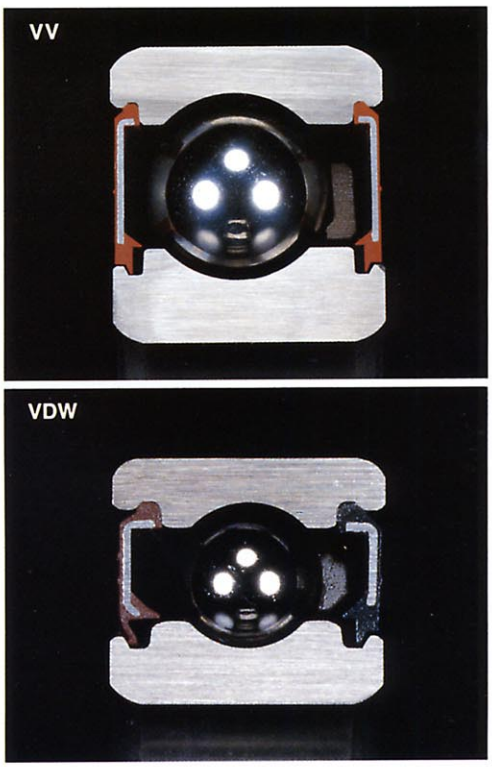
The requirements for spindle bearings for HDD applications are extremely severe, particularly for advanced systems now under development; however, NSK assures full compliance.

Requirements for HDD Systems	Features of NSK Disk Spindle Bearings
1. High Track Density	**Improvement of Non-Repetitive Run-Out** ● Maintain stable high accuracy by controlling profile deviation of raceways and balls.
2. Direct Drive by Compact DC Brushless Motors	**Low Torque and Temperature Rise** ● Optimum grease and packed quantity. ● Excellent non-contact seals and shields (VV•ZZ).
3. Minimum Reading/Writing Head Clearance	**Prevention of Grease Dispersion** ● Optimum grease and packed quantity. ● Light contact seals (DW). ● Magnetic fluid seals.
4. Low Noise	**Reduction of Bearing Noise** ● Optimum grease. ● Filtered grease. ● High accuracy finishing of internal surfaces.
5. High Reliability	**Long Life** ● Plastic cages.

Note: Regarding integrated shaft bearings, refer to NSK "Precision Bearings with Integrated Shafts" (Pr. No. A387).

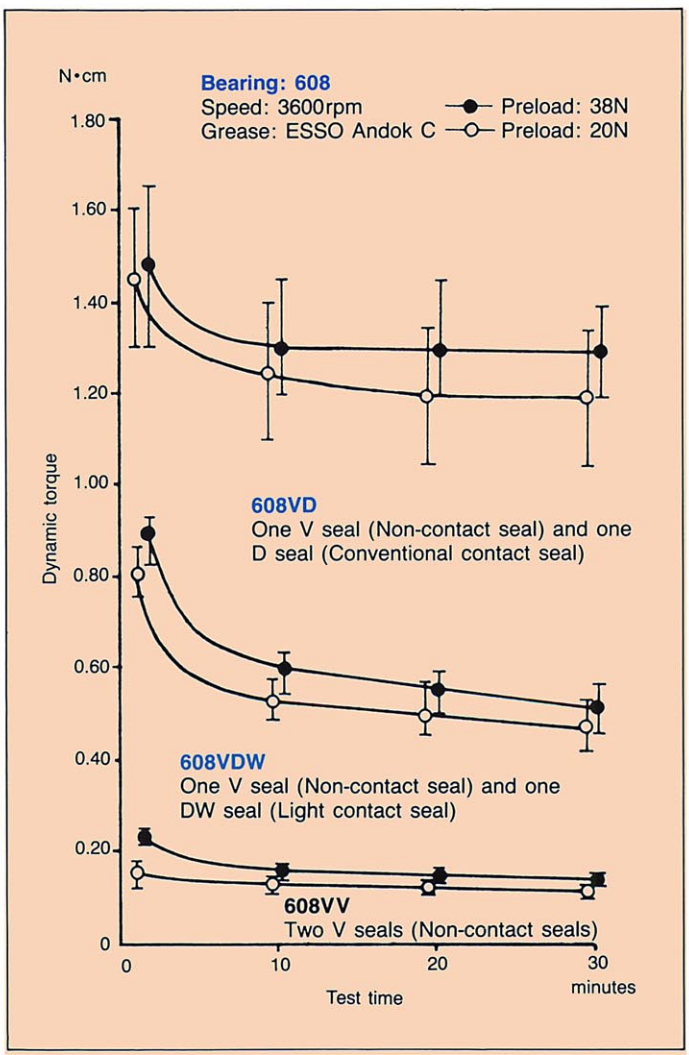
Seal and Shield Types

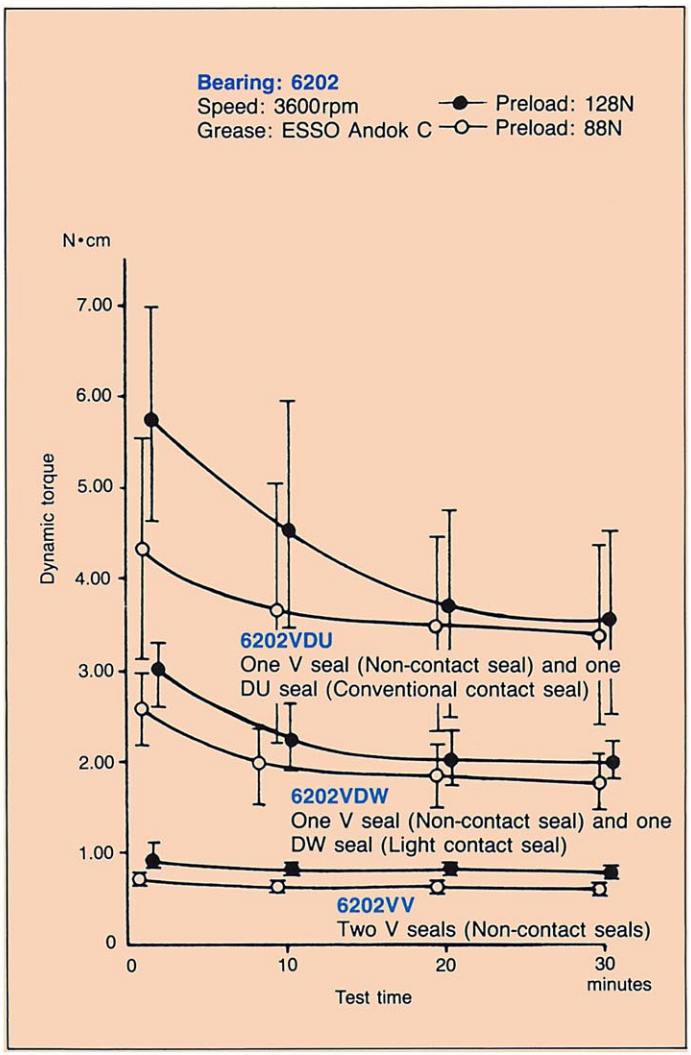




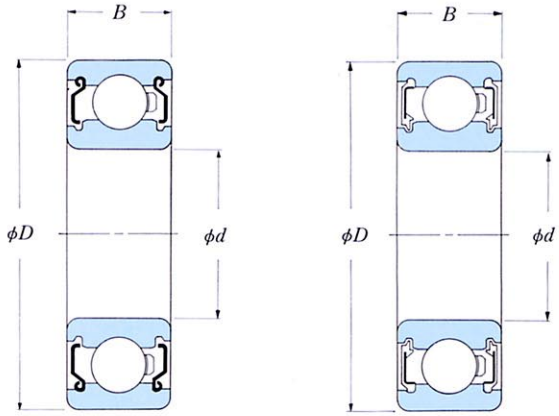
Seal Types and Running Torque

Running torque can be greatly reduced by light-contact seals compared with conventional contact seals.





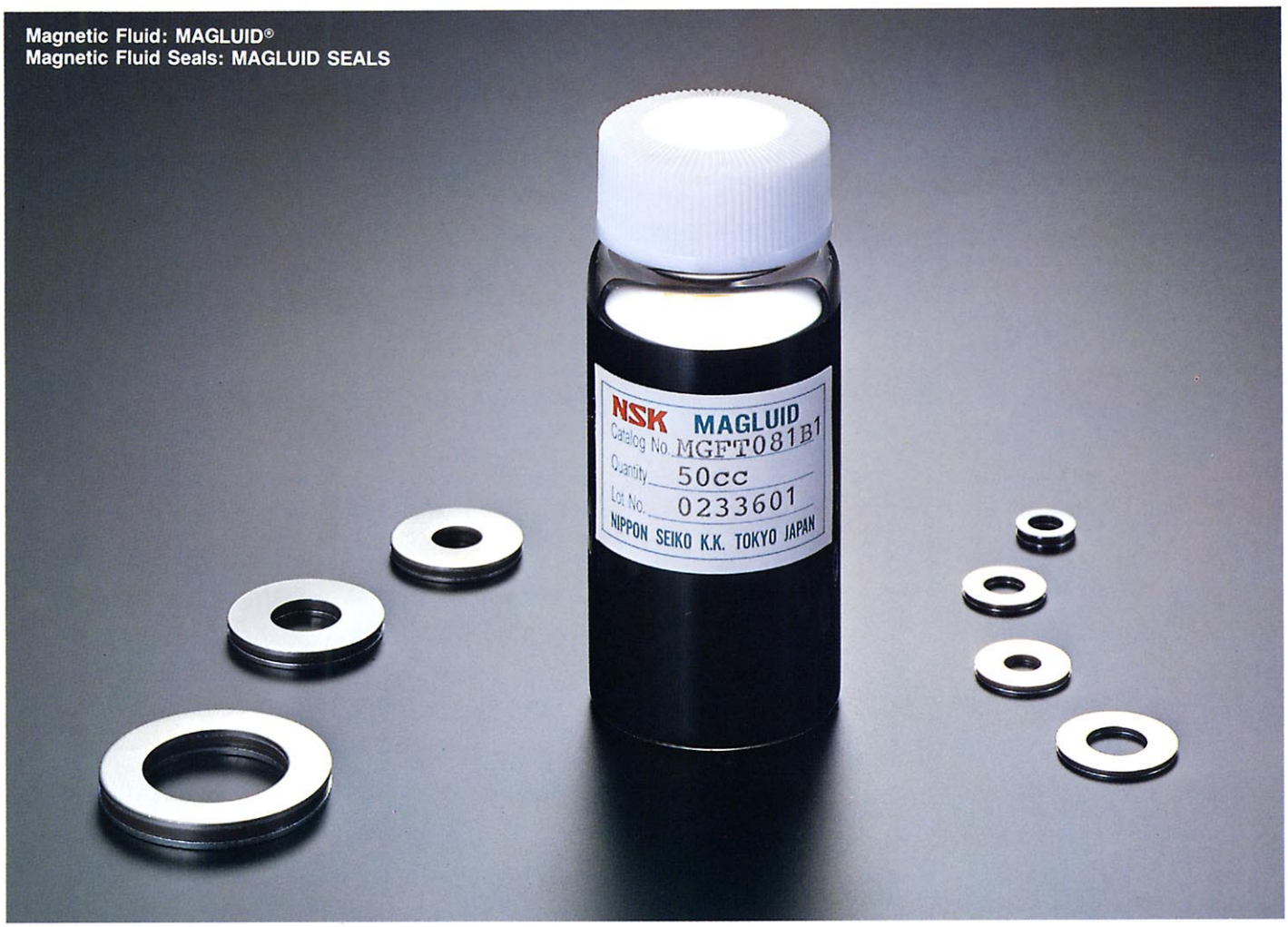
Ball Bearings for Disk Spindles



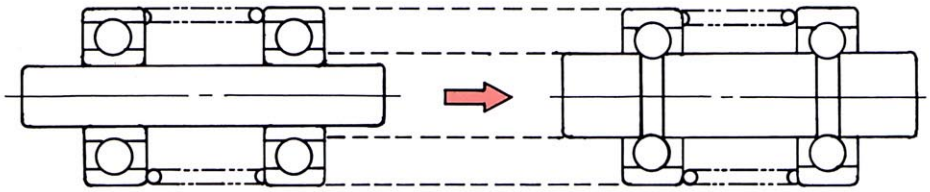
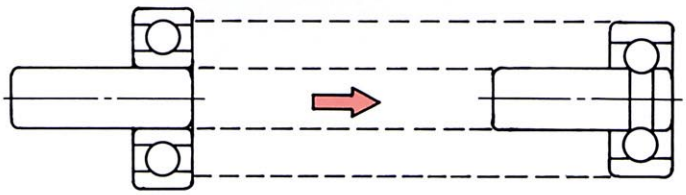
Applications	Bearing Nos.	Boundary Dimension (mm)			Basic Load Ratings (N)		Basic Load Ratings (kgf)	
		d	D	B	C_r	C_{0r}	C_r	C_{0r}
Disk Spindles	MR63ZZ	3	6	2.5	208	74	21	7.5
	683ZZ	3	7	3	310	111	32	11
	693ZZ	3	8	4	560	179	57	18
	MR84ZZ	4	8	3	395	139	40	14
	684ZZ	4	9	4	640	225	65	23
	MR115ZZ	5	11	4	715	281	73	29
	695ZZ	5	13	4	1080	430	110	44
	625ZZ	5	16	5	1730	670	177	68
	686ZZ	6	13	5	1080	440	110	45
	696ZZ	6	15	5	1730	670	177	68
	607ZZ	7	19	6	2340	885	238	90
	698ZZ	8	19	6	2240	910	228	93
	608ZZ	8	22	7	3300	1370	335	140
	629ZZ	9	26	8	4550	1970	465	201
	6000ZZ	10	26	8	4550	1970	465	201
	6200VV	10	30	9	5100	2390	520	244
	6001VV	12	28	8	5100	2370	520	241
	6201VV	12	32	10	6800	3050	695	310
	6002VV	15	32	9	5600	2830	570	289
	6202VV	15	35	11	7650	3750	780	380
	6003VV	17	35	10	6000	3250	610	330
	6203VV	17	40	12	9550	4800	975	490
	6004VV	20	42	12	9400	5000	955	510
	6204VV	20	47	14	12800	6600	1300	670
	6005VV	25	47	12	10100	5850	1030	595
	6205VV	25	52	15	14000	7850	1430	800
	6006VV	30	55	13	13200	8300	1350	845
	6206VV	30	62	16	19500	11300	1980	1150
	6207VV	35	72	17	25700	15300	2620	1560
	6307VV	35	80	21	33500	19200	3400	1960

Ball Bearings for Disk Spindles

Magnetic Fluid: MAGLUID®
Magnetic Fluid Seals: MAGLUID SEALS

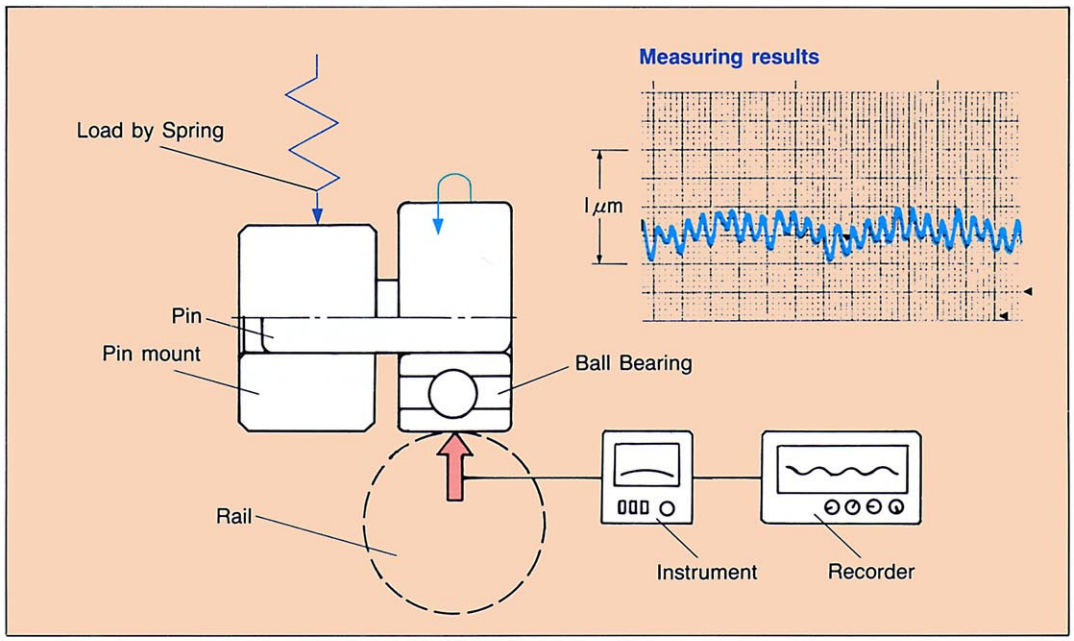


Features of Ball Bearings and Ball Bearing Units for

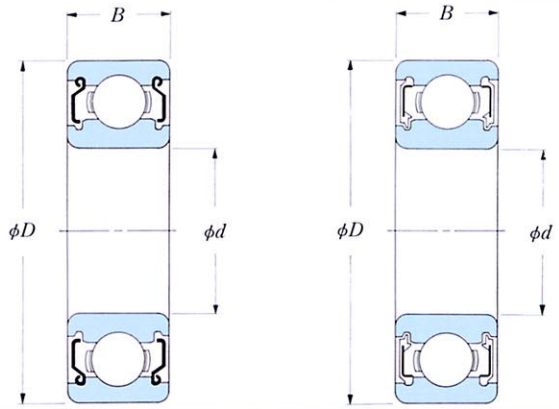
Requirements for HDD Equipment	Features of NSK Ball Bearings and Ball Bearing Units
1. High-Speed and High Accuracy Positioning of Magnetic Heads	**Low Torque, Low Torque Variation and High Running Accuracy** ● High precision bearings with high grade balls. Optimum grease brand and quantity and proper grease packing method assure low torque and low torque variation. ● High running accuracy assured by measurement of outer-ring radial thickness variation (refer to next page). Minimum positioning error of magnetic head. (For linear actuators)
2. High Rigidity and Reduced Size	**Integration of Inner Rings and Shaft** ● Elimination of inner rings allows a larger shaft with greater rigidity. Ball Bearings for Rotary Actuators  ● For a given shaft size, the bearing outer diameter can be smaller. Ball Bearing for Linear Actuator 
3. Easy Bearing Mounting	**Unit** ● Rotary Actuators: Bearing units are supplied with a sleeve and the proper preload between the bearings. This enables easy mounting on the arm and actuator base. ● Linear Actuators: The bearings are controlled so the proper radial clearance is achieved after a pin is inserted in them. This makes mounting on carriages simple.
4. Prevention of Grease Dissipation	**Magnetic Fluid Seals** ● Grease dissipation from bearings is prevented by magnetic fluid seals.

Actuators

NSK's measuring method for outer-ring radial thickness variation is similar to actual running conditions of linear actuator bearings.



Ball Bearing and Ball Bearing Units for Actuators



Applications	Bearing Nos.	Boundary Dimension (mm)			Basic Load Ratings (N)		Basic Load Ratings (kgf)	
		d	D	B	C_r	C_{0r}	C_r	C_{0r}
Rotary Actuators	MR84ZZ	4	8	3	395	139	40	14
	684VV	4	9	4	640	225	65	23
	694ZZ	4	11	4	960	345	98	35
	MR85ZZ	5	8	2.5	278	130	28	13
	MR105ZZ	5	10	4	430	168	44	17
	695ZZ	5	13	4	1080	430	110	44
	MR106ZZ	6	10	3	495	218	51	22
	686VV	6	13	5	1080	440	110	45
	606VV	6	17	6	2260	835	231	85
	SR168ZZ	6.350	9.525	3.175	315	137	32	14
	SR1810ZZ	7.938	12.7	3.967	460	221	47	23
	MR128ZZ	8	12	3.5	545	275	55	28
	688ZZ	8	16	5	1260	590	128	60
	608ZZ	8	22	7	3300	1370	335	140
	6800VV	10	19	5	1720	840	175	86
	6000VV	10	26	8	4550	1970	465	201
	6801VV	12	21	5	1920	1040	195	106
	NBC1204hZZ	12.7	19.05	4.978	585	268	60	27
	6902VV	15	28	7	4350	2260	440	230
	6903VV	17	30	7	4600	2550	470	260
	6904VV	20	37	9	6400	3700	650	375
	6905VV	25	42	9	7050	4550	715	460
	6906VV	30	47	9	7250	5000	740	510
Linear Actuators	SR1ZZ	1.397	4.762	2.779	197	53	20	5.5
	681XhZZ	1.5	4	2	95	26	9.5	2.5
	SMR52ZZ	2	5	2.5	143	40	15	4
	692hZZ	2	6	3	280	79	29	8
	SR133ZZ	2.380	4.762	2.380	122	42	12	4.5
	SR1-5ZZ	2.380	7.938	3.571	470	139	48	14
	SMR63ZZ	3	6	2.5	177	59	18	6
	683hZZ	3	7	3	265	89	27	9
	693hZZ	3	8	4	475	143	48	15
	623hZZ	3	10	4	545	179	56	18
	SR144ZZ	3.175	6.350	2.779	241	76	25	8
	SR2-5ZZ	3.175	7.938	3.571	475	143	48	15
	SR2ZZ	3.175	9.525	3.967	535	175	55	18
	SMR74ZZ	4	7	2.5	216	85	22	8.5

Note: Bearings for linear actuators are made of stainless steel.

Representative Ball Bearing Units for Actuators

Rotary Actuators

Fig. 1 Unified Inner Rings and Shaft (with Sleeve)

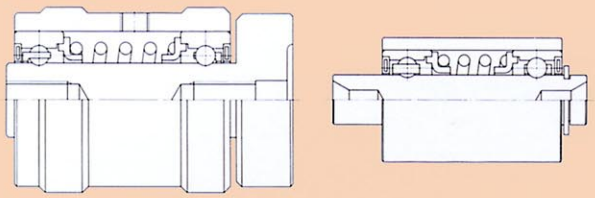


Fig. 2 Shaft Press Fitted (without Sleeve)

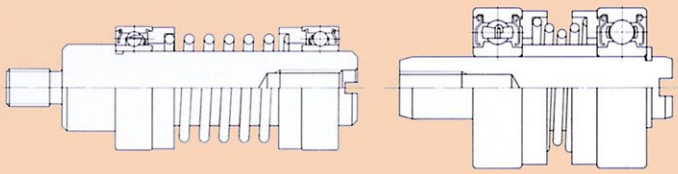


Fig. 3 Shaft Press Fitted (with Sleeve)

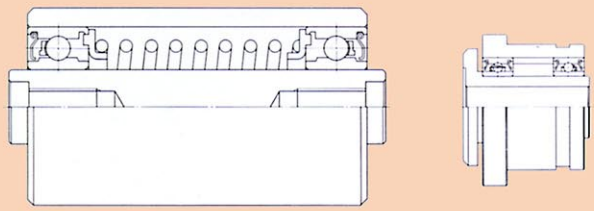


Fig. 4 Shaft Press Fitted (with Complex Sleeve)

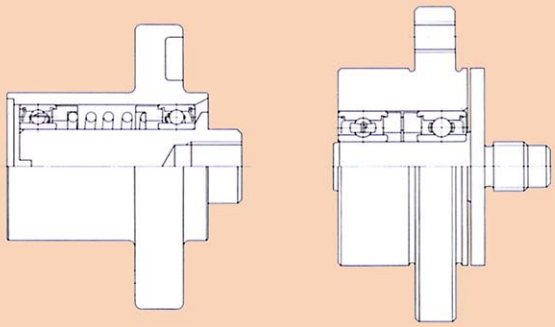
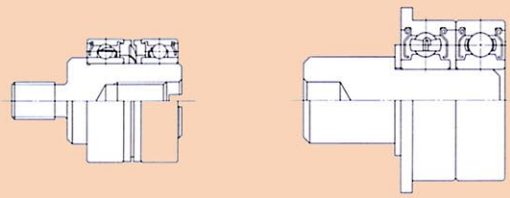


Fig. 5 Inner Rings Bonded on Shaft (Short Span)



Linear Actuators

Fig. 6 Unified Inner Rings and Shaft

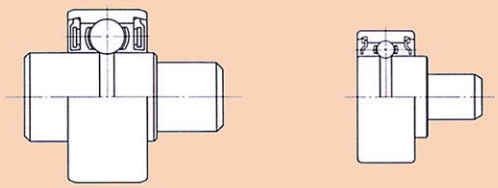


Fig. 7 With Magnetic Fluid Seal

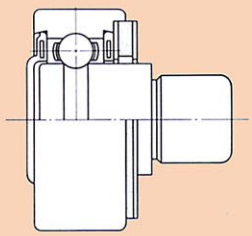


Fig. 8 Press Fitted Pin

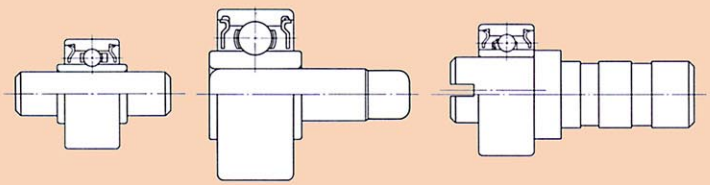
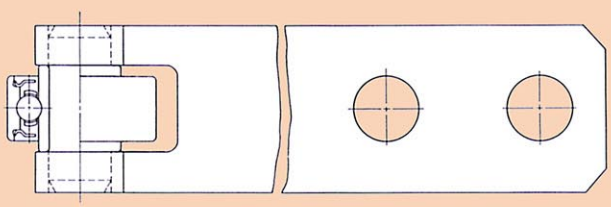


Fig. 9 Press Fitted Pin with Preload Spring



Note: Please contact NSK for details.