

B-3-3.3 HMC Type for High-Speed Machine Tools

This product is being applied for a patent.

1. Features

- High-speed traveling
High helix leads of 16 mm to 36 mm are used. Furthermore, the ball recirculation return tube is reinforced to make a high-speed traveling of 40 to 120 m/min. possible.
- High rigidity, high load carrying capacity
Double start thread increases the number of effective turns of balls, and a smaller ball size increases the number of the balls. Together they contribute to have high rigidity and high load carrying capacity, despite the high helix lead.
- Compact nut
The size of nut diameter and length were reduced.

2. Specifications

(1) Ball recirculation system

The ball recirculation circuits and grooves are suited for high-speed operation. Structure of recirculation system is shown in Fig. 1.

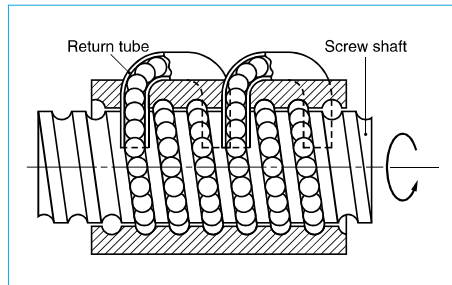


Fig. 1 Structure of return tube recirculation system

(2) Accuracy grades and axial play

Standard accuracy grades and axial play are shown in Table 1. Please consult NSK for other grade.

Accuracy grade	C3, C5
Axial play	0 mm (preloaded)

(3) Options

- Equipped with NSK K1 lubrication unit
Optional NSK K1 lubrication unit, molded from

resin and impregnated with lubrication oil, is available. Please consult NSK when using NSK K1.

- For twin-drive systems (See page B541.)
Upon request, the variations in lead accuracy and preload torque between two ball screws of a pair of the TW series are controlled for the further improvement of the reliability.
- Hollow shaft ball screw specifications (See page B542.)

The temperature rise and measures against thermal expansion of ball screw driving mechanism are the most challenging for high-speed machine tools. For the HMD type ball screws, we recommend to utilize the hollow for forced cooling system.

- For a vertical axis ball screw
For a vertical axis ball screw, which constantly supports the load of vertical axis system, a high load capacity ball screw is required. A high load capacity type with compact design is available for the nut models II and III in the dimension tables. For details, please consult NSK.

(4) Allowable d·n value and the criterion of maximum rotational speed

Allowable d·n value and the criterion of maximum rotational speed are shown below. Please consult NSK if the rotational speed exceeds the permissible range below.

Allowable d·n value: HZC, HDC; 100 000 or less
HZF, HDF; 135 000 or less

Criterion of maximum rotational speed: 3 750 min⁻¹

Note: Please also review the critical speed. See "Technical Description: Permissible Rotational Speed" (page B47) for details.

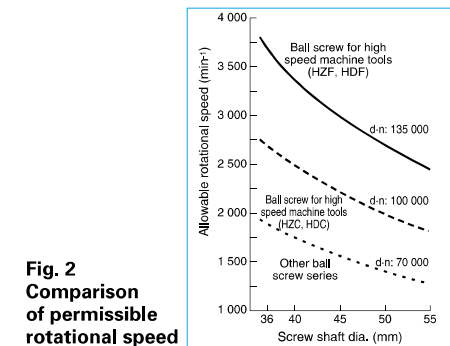


Fig. 2 Comparison of permissible rotational speed

(5) Other specifications

For other specifications not listed in the dimension tables such as high-speed, high-load capacity, and NSK K1 installed type, please consult NSK.

4. Product categories

HMC type has two different preload systems with several models (Table 2).

3. Design precautions

For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).

Table 2 HMC type product categories

Nut model	Shape	Flange shape	Preload system
HZC HZF		Flanged Circular I	Z-preload (medium preload)
HDC HDF		Flanged Circular I	D-preload (medium preload)

5. Structure of model number and reference number

The followings describe the structure of "Model number" and "Reference number for ball screw".

◇ Model number

HZF 36 16 - 5

Nut model: HZC, HZF, HDC, HDF Effective turns of balls

Screw shaft diameter (mm) Lead (mm)

◇ Reference number for ball screw

W 36 05 - * * Z X T - C5 Z 16

Product code Lead (mm)

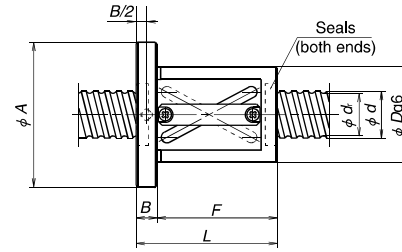
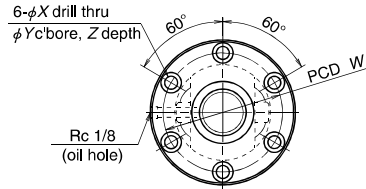
Screw shaft diameter (mm) Axial play code: Z (page B20)

Effective threaded length (in the unit of 100 mm) Accuracy grade: C3, C5 (page B37 to B42)

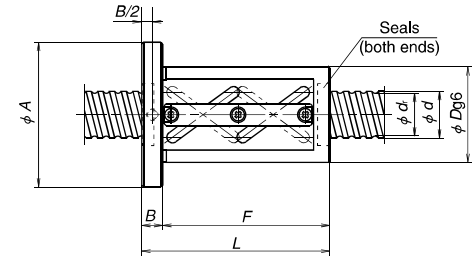
Design serial number Hollow shaft ball screw

Preload code : Z, Z-preload; D, D-preload (page B5) Appearance/specification code

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Nut model I (offset preload)



Nut model II (offset preload)

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Effective turns of balls	Nut model	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)	
						Dynamic <i>C_s</i>	Static <i>C_{sa}</i>	5% <i>C_s</i>	10% <i>C_s</i>
HZF3616-5 HZC3616-5	36	16	31.5	5	II	40 200	102 000	1 130	1 420
HZF3620-3.5 HZC3620-3.5		20	30.4	3.5	I	44 000	98 500	830	1 050
HZF4016-5 HZC4016-5	40	16	35.5	5	II	41 200	112 000	1 230	1 550
HZF4020-3.5 HZC4020-3.5		20	34.4	3.5	I	46 100	107 000	900	1 130
HZF4020-5 HZC4020-5				5	II	62 600	153 000	1 260	1 590
HZF4516-5 HZF4516-7.5		45	16	40.5	5	II	43 800	127 000	1 340
HZF4520-3.5 HZC4520-3.5	20		39.4	3.5	I	47 600	120 000	990	1 240
HZF4520-5 HZC4520-5				5	II	64 700	170 000	1 380	1 740
HZF4525-3.5 HZC4525-3.5	25		39.1	3.5	I	56 800	137 000	1 010	1 280
HZF5020-3.5 HZC5020-3.5	50		20	44.4	3.5	I	50 400	133 000	1 080
HZF5020-5 HZC5020-5		5			II	68 500	191 000	1 520	1 910
HZF5025-3.5 HZC5025-3.5		25	44.1	3.5	I	58 900	152 000	1 100	1 390
HZF5025-5 HZC5025-5				5	II	80 100	216 000	1 540	1 940
HZF5030-3.5 HZC5030-3.5		30	44.1	3.5	I	58 900	152 000	1 100	1 390
HZF5520-3.5 HZF5520-5		55	20	49.4	3.5	I	51 600	145 000	1 150
HZF5525-3.5 HZF5525-5	5				II	70 200	208 000	1 630	2 050
HZF5525-3.5 HZF5525-5	25		49.1	3.5	I	62 600	165 000	1 190	1 560
HZF5530-3.5				5	II	85 000	238 000	1 680	2 120
HZF5530-3.5	30		49.1	3.5	I	62 600	165 000	1 190	1 560

Notes: 1. Ball screws of 32 or 36 mm lead have triple start threads. Others have double start threads.

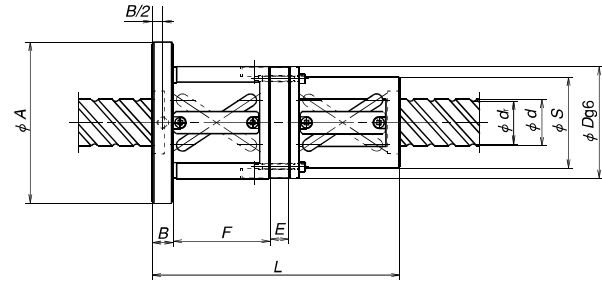
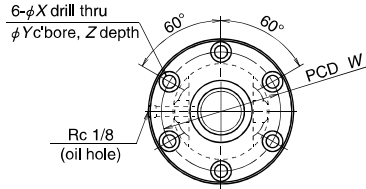
2. Rigidity listed under the column 5%Ca is the value when a 5% of basic dynamic load rating is applied as the preload.

Similarly, those listed under the column 10%Ca means a 10% of basic dynamic load rating is applied.

Ball nut dimensions

Nut entire length <i>L</i>	Nut dia. <i>D</i>	Flange dia. <i>A</i>	Flange width <i>B</i>	Nut length <i>F</i>	Bolt hole demensions			Bolt hole PCD <i>W</i>	Max. feeding speed (m/min)
					<i>X</i>	<i>Y</i>	<i>Z</i>		
134	78	120	18	116	11	17.5	11	98	60
121	94	136	18	103	11	17.5	11	91	44
134	79	121	18	116	11	17.5	11	114	75
121	96	138	18	103	11	17.5	11	98	56
134	76	118	18	116	11	17.5	11	99	54
121	96	138	18	103	11	17.5	11	96	40
161	96	138	18	143	11	17.5	11	116	67
134	82	124	18	116	11	17.5	11	102	50
187	82	128	22	165	14	20	13	116	67
122	98	140	18	104	11	17.5	11	102	50
162	98	140	18	144	11	17.5	11	108	44
141	98	130	18	144	11	17.5	11	118	60
141	101	143	18	123	11	17.5	11	108	44
141	92	134	18	123	11	17.5	11	121	75
122	101	143	18	104	11	17.5	11	112	56
162	95	137	18	144	11	17.5	11	121	54
141	103	145	18	123	11	17.5	11	115	40
191	103	145	18	173	11	17.5	11	123	54
159	98	140	18	173	11	17.5	11	115	40
141	103	145	18	141	11	17.5	11	123	67
159	103	145	18	141	11	17.5	11	118	50
122	103	145	18	104	11	17.5	11	123	67
162	103	145	18	144	11	17.5	11	118	50
141	105	147	18	123	11	17.5	11	123	67
191	105	147	18	173	11	17.5	11	118	50
159	105	147	18	141	11	17.5	11	123	81
159	105	147	18	141	11	17.5	11	118	60
122	103	145	18	104	11	17.5	11	123	49
162	103	145	18	144	11	17.5	11	123	49
141	105	147	18	123	11	17.5	11	125	61
191	105	147	18	173	11	17.5	11	125	61
159	105	147	18	141	11	17.5	11	125	73

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Nut model III (double nut spacer, preload)
(the figure indicates use of double start threads)

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Effective turns of balls	Nut model	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)	
						Dynamic <i>C_d</i>	Static <i>C_{st}</i>	5% <i>C_d</i>	10% <i>C_d</i>
HDF3620-5 HDC3620-5	36	20	30.4	5	III	59 800	138 000	1 160	1 460
HDF4025-5 HDC4025-5	40	25	34.1	5	III	74 000	175 000	1 320	1 660
HDF4030-5 HDC4030-5		30	34.1	5	III	74 000	175 000	1 320	1 660
HDF4032-7.5 HDC4032-7.5		32	34.4	7.5	III	88 700	230 000	1 920	2 420
HDF4036-4.5		36	34.4	4.5	III	57 200	138 000	1 170	1 480
HDF4525-5 HDC4525-5		25	39.1	5	III	77 200	197 000	1 430	1 800
HDF4530-5 HDC4530-5	45	30	39.1	5	III	77 200	197 000	1 430	1 800
HDF4532-7.5 HDC4532-7.5		32	39.4	7.5	III	91 700	256 000	2 090	2 630
HDF4536-4.5		36	39.4	4.5	III	59 100	155 000	1 280	1 620
HDF5030-5 HDC5030-5	50	30	44.1	5	III	80 100	216 000	1 540	1 940
HDF5032-7.5 HDC5032-7.5		32	44.4	7.5	III	97 100	286 000	2 270	2 860
HDF5530-5 HDF5532-7.5	55	30	49.1	5	III	85 000	238 000	1 680	2 120
		32	49.4	7.5	III	99 500	313 000	2 420	3 050

- Notes: 1. Ball screws of 32 or 36 mm lead have triple start threads. Others have double start threads.
2. Rigidity listed under the column 5%Ca is the value when a 5% of basic dynamic load rating is applied as the preload. Similarly, those listed under the column 10%Ca means a 10% of basic dynamic load rating is applied.

Nut entire length <i>L</i>	Ball nut dimensions										Max. feeding speed (m/min)
	Nut dia.		Flange dia. <i>A</i>	Flange width <i>B</i>	Nut length <i>F</i>	Spacer dimensions <i>E</i>	Bolt hole size			Bolt hole PCD <i>W</i>	
	<i>D</i>	<i>S</i>					<i>X</i>	<i>Y</i>	<i>Z</i>		
191	94	76	136	18	77	5	11	17.5	11	114	75
	78	60	120								56
228.5	98	80	140	18	91	13.5	11	17.5	11	118	84
	86	68	128								63
248	98	80	140	18	104	8	11	17.5	11	118	101
	86	68	128								75
265	96	78	142	22	109	11	14	20	13	118	108
	82	64	128								80
200	96	78	138	18	83	4	11	17.5	11	116	120
	101	83	143								75
228.5	92	74	134	18	91	13.5	11	17.5	11	121	56
	101	83	143								90
248	92	74	134	18	104	8	11	17.5	11	121	67
	98	80	144								96
266	88	70	134	22	109	11	14	20	13	120	71
	98	80	140								108
200	103	85	145	18	104	8	11	17.5	11	123	81
	98	80	140								60
266	101	83	147	22	109	11	14	20	13	123	86
	95	77	141								64
249	105	87	147	18	104	8	11	17.5	11	125	73
	266	103	85								149