



# Ball Screw for High-Speed Machine Tools

## HMC Series

NSK applies its highly regarded approach to the development of machine tools. The NSK Ball Screws feature a high speed of 100 m/min, high rigidity, stability against thermal expansion, and lower noise, opening a new era for machine tools.



NSK breaks through to an unprecedented high speed of 100 m/min. Even at such speeds, NSK Ball Screws maintain a high degree of accuracy, with the lower noise and compact design identified with NSK.

NSK is proud to introduce the HMC Series ball screws for machine tools, featuring higher speed operation.

Higher speeds are required not only by today's machine tools industry, but also from the machine industry as a whole. NSK addresses these demands with a higher speed of 100 m/min. Sufficient measures are taken for improved durability, achieving a threefold improvement in rigidity and doubling load capacity. To guard against thermal expansion, a hollow shaft type is available which supports forced cooling for the shaft center. Use of this type provides even greater equalized accuracy and reduced warm-up time, helping to reduce costs. Vibration and noise control features reflect consideration of ergonomic and environmental concerns.

We believe the HMC Series will play a major role in advancing the machine industry into a new era.



# Ball Screw for High-Speed Machine Tools: HMC Series

## 1. Features

### ● High speed

Capable of operating at high speeds of 100 m/min. Applies high lead of 16–32 mm, which means the ball recirculating components are reinforced.

Ideal for making machining centers even faster.

### ● High rigidity and high load capacity

Triple rigidity and double load capacity are achieved even with high helix lead by increasing the effective number of turns by multi-start thread (double/triple) and optimized ball-groove profile (compared with standard NSK products). Optional is a high local capacity type that is dedicated to the vertical axis, to which the main load is applied in uni-directional manner.

### ● Prevention of thermal expansion

Hollow shaft screw is optional to support forced cooling for the shaft center, contributing to equalized positioning accuracy and reduced warm-up time.

### ● Low vibration & noise

Achieves vibration and noise reduction through NSK's accumulated expertise.

### ● Compact design

Preloaded single nut with shorter length for compact design (compared with standard NSK products).



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## 2. Accuracy

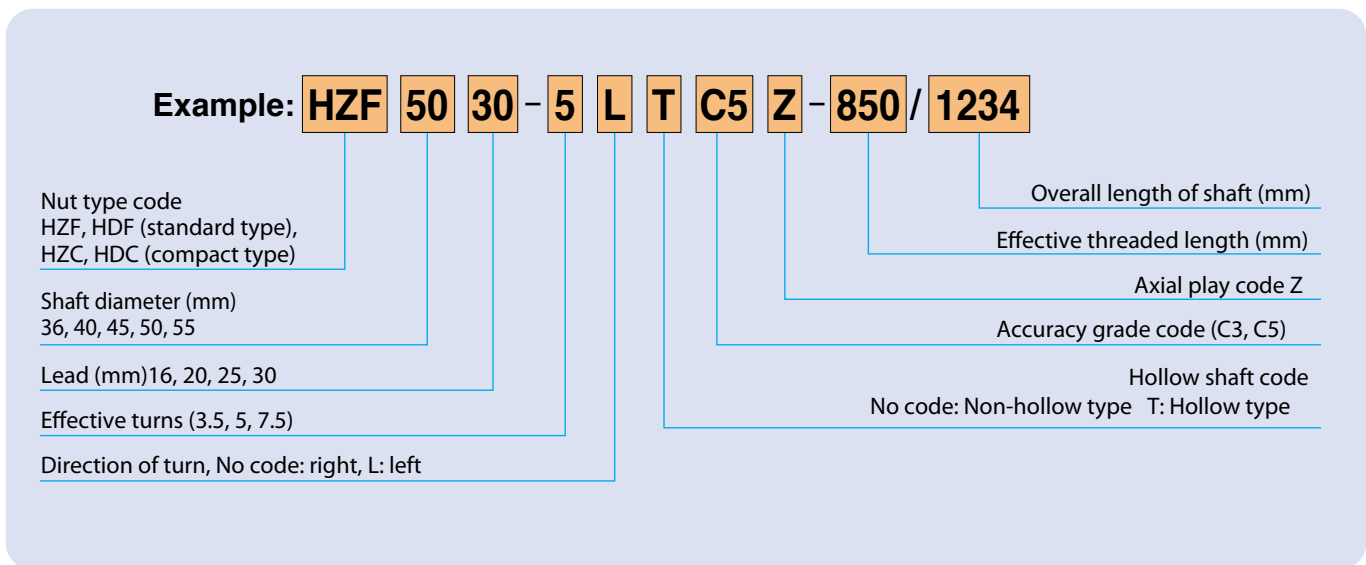
Accuracy of JIS R1192 (1997) C3 and C5 grades are available.

## 3. Allowable revolutions

Allowable dm-N value is set to 130000. Maximum feed rate is indicated in the dimensions tables on pages 5 and 6. Numbers in parentheses represent speeds for the compact type. (For the compact type, allowable d-N value is 100000.) Confirm critical speed for ball screws exceeding 1000 mm in screw length. (For details, see "Precision Machine Components" catalogue CAT.No.3151e: P-A21.)

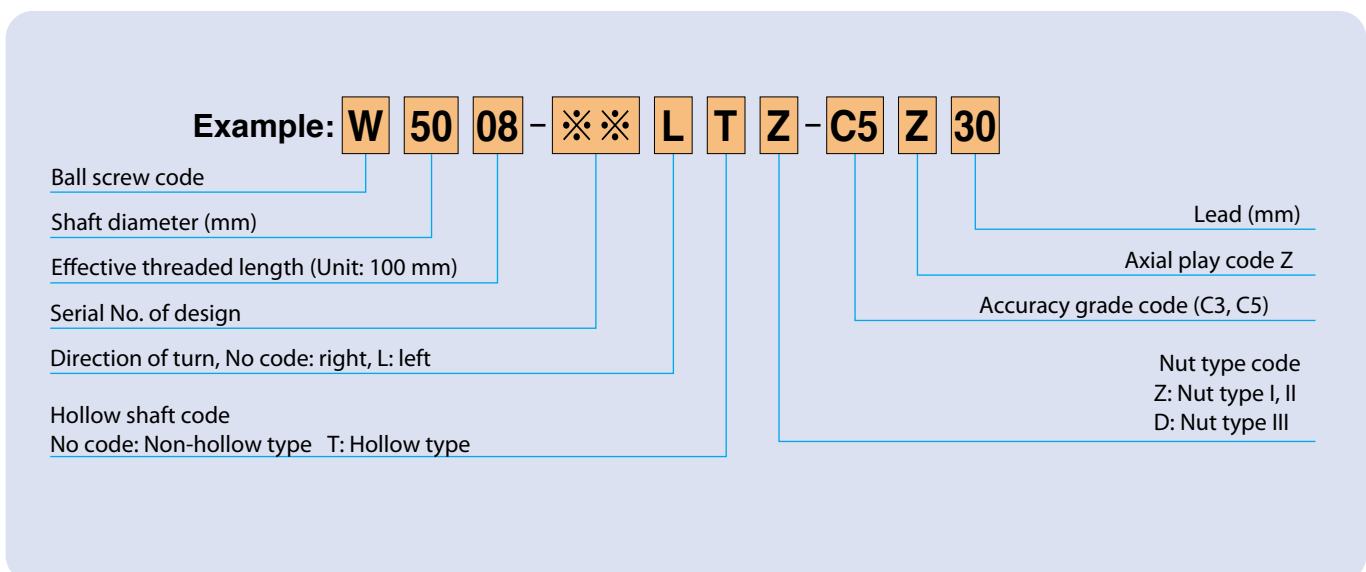
## 4. Specification number

Specification numbers are used for inquiry from customers to NSK until reference numbers are finalized. Please indicate shaft end configuration in a drawing.



## 5. Reference number

Parts are identified by reference numbers in drawings, price quotation, order acknowledgement, invoice, product, and packing. Please refer to these reference numbers when placing orders.



## 6. Optional specifications

### 6-1. Hollow shaft type

For high-speed machine tools, the ball screw driving mechanism should be provided with measures against heat generation and thermal expansion. For the HMC Series, we recommend forced cooling be used for the shaft center (see Figure 1); hollow shaft type is available.

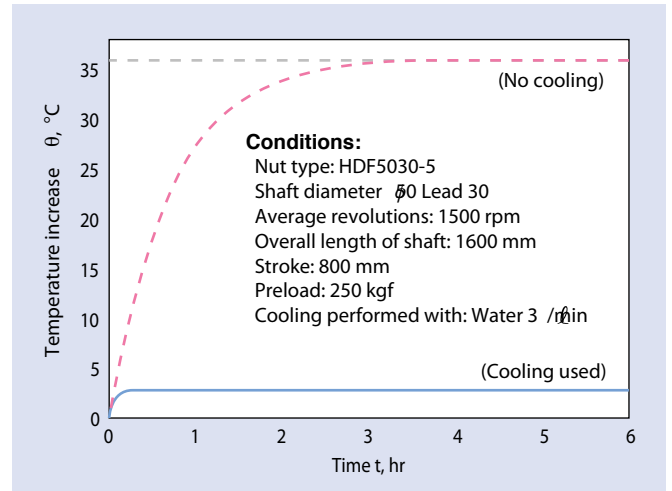
**Table 1 Inner diameter of hollow shaft**

Unit: mm

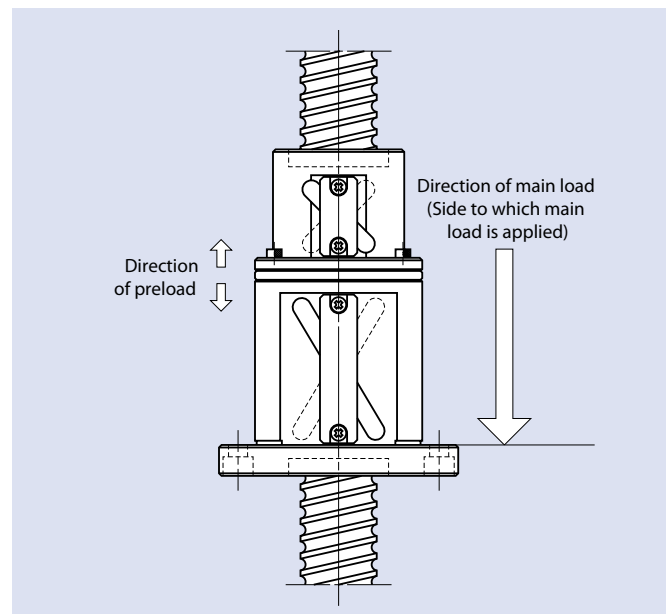
Maximum diameter of shaft	Inner diameter of hollow shaft
~ $\phi 40$	$\phi 12$
~ $\phi 55$	$\phi 15$

### 6-2. Vertical axis type

For the vertical axis ball screw, to which head load is constantly applied, a high load capacity ball screw is required. A high load capacity type with compact design, as shown in Figure 2, is available featuring an increased number of effective turns only in the direction of the main load. This type is available as an option for nut types II and III. For details, please consult NSK.



**Figure 1 The effect of forced cooling done by hollow shaft type ball screw**



**Figure 2 Example of vertical axis specification**

## 7. Endurance test data (reference)

In the process of developing the HMC Series, NSK performed endurance tests using a high-speed, high acceleration/deceleration table. We confirmed endurance by continuous operation over a long period of time, several times the theoretical life expectancy.

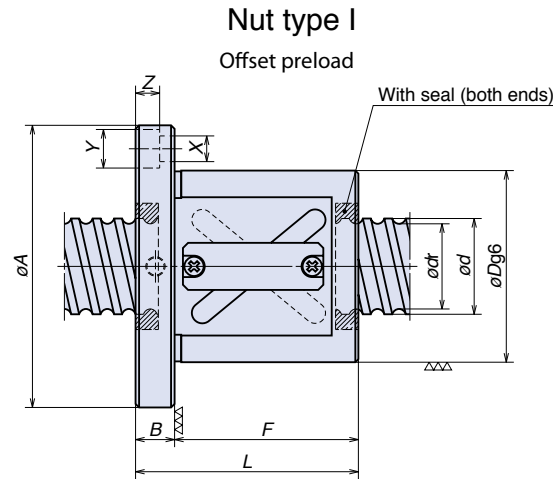
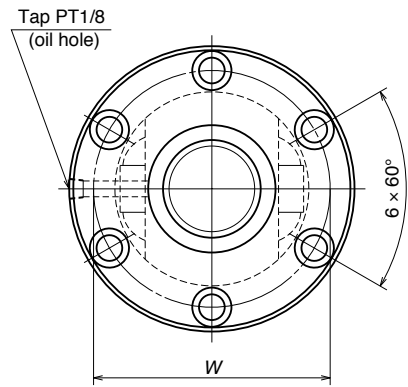
**Table 2 Test conditions of high-speed, high acceleration/ deceleration table**

Items	Specification
Ball screw	HMC Series for high-speed machine tools
Guiding component	Linear Guide (LA Series #45)
Weight of moving members	2000 kgf (19600N)
Acceleration	1.3G
Maximum speed	60 m/min (2000 rpm)
Operating pattern	Step feed, 100 mm per step
Stroke	600 mm



# Ball Screw for High-Speed Machine Tools: HMC Series

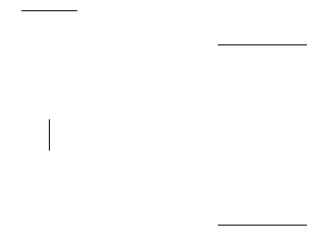
## Outline drawing of ball screw



Nut type II  
Offset preload



Nut type III  
Double nut spacer preload  
(The figure illustrates double-start thread nut.)



## Dimensions

Model No.	Shaft diameter [mm] d	Lead [mm] l	Effective turns	Nut type	Root diameter [mm] d <sub>r</sub>	Basic load rating [N]		Rigidity [N/μm]		Nut dimension [mm] [The parenthesized number refers to compact type]											Maximum feed rate [m/min] [The parenthesized number refers to compact type]	
						Dynamic C <sub>a</sub>	Static C <sub>0a</sub>	5% C <sub>a</sub>	10% C <sub>a</sub>	D	A	S	B	F	L	E	W	X	Y	Z		
HZF 3616-5	36	16	5	II	31.7	40200	102000	1130	1420	78 (71)	120 (113)	—	18	116	134	—	98 (91)	11	17.5	11	57 (44)	
HZF3620-3.5	36	20	3.5	I	30.6	44000	98500	830	1050	94 (78)	136 (120)	—	18	103	121	—	114 (98)	11	17.5	11	70 (56)	
HDF 3620-5	36	20	5	III	30.6	59800	138000	1160	1460	94 (78)	136 (120)	76(60)	18	77	191	5	114 (98)	11	17.5	11	70 (56)	
HZF 4016-5	40	16	5	II	35.7	41200	112000	1230	1550	79 (76)	121 (118)	—	18	116	134	—	99 (96)	11	17.5	11	51 (40)	
HZF 4020-3.5	40	20	3.5	I	34.6	46100	107000	900	1130	96 (82)	138 (124)	—	18	103	121	—	116 (102)	11	17.5	11	63 (50)	
HZF 4020-5	40	20	5	II	34.6	62600	153000	1260	1590	96 (82)	138 (124)	—	18	143	161	—	116 (102)	11	17.5	11	63 (50)	
HDF 4025-5		25	5	III	34.3	74000	175000	1320	1660	98 (86)	140 (128)	80(68)	18	91	228.5	3.5	118 (106)	11	17.5	11	78 (63)	
HDF 4030-5	40	30	5	III	34.3	74000	175000	1320	1660	98 (86)	140 (128)	80(68)	18	104	248	8	118 (106)	11	17.5	11	94 (75)	
HDF 4032-7.5		32	7.5	III	34.6	88700	230000	1920	2420	96 (82)	142 (128)	78(64)	22	109	265	11	118 (104)	14	20	13	101 (80)	
HZF 4516-5		16	5	II	40.7	43800	127000	1340	1690	82	124	—	18	116	134	—	102	11	17.5	11	45	
HZF 4516-7.5	45	16	7.5	II	40.7	62100	191000	1960	2470	82	128	—	22	165	187	—	104	14	20	13	45	
HZF 4520-3.5	45	20	3.5	I	39.6	47600	120000	990	1240	98 (88)	140 (130)	—	18	104	122	—	118 (108)	11	17.5	11	57 (44)	
HZF 4520-5	45	20	5	II	39.6	64700	170000	1380	1740	98 (88)	140 (130)	—	18	144	162	—	118 (108)	11	17.5	11	57 (44)	
HZF 4525-3.5	45	25	3.5	I	39.3	56800	137000	1010	1280	101 (92)	143 (134)	—	18	123	141	—	121 (112)	11	17.5	11	70 (56)	
HDF 4525-5		25	5	III	39.3	77200	197000	1430	1800	101 (92)	143 (134)	83(74)	18	91	228.5	3.5	121 (112)	11	17.5	11	70 (56)	
HDF 4530-5	45	30	5	III	39.3	77200	197000	1430	1800	101 (92)	143 (134)	83(74)	18	104	248	8	121 (112)	11	17.5	11	84 (67)	
HDF 4532-7.5		32	7.5	III	39.6	91700	256000	2090	2630	98 (88)	144 (134)	80(70)	22	109	266	11	120 (110)	14	20	13	90 (71)	
HZF 5020-3.5	50	20	3.5	I	44.6	50400	133000	1080	1360	101 (95)	143 (137)	—	18	104	122	—	121 (115)	11	17.5	11	51 (40)	
HZF 5020-5	50	20	5	II	44.6	68500	191000	1520	1910	101 (95)	143 (137)	—	18	144	162	—	121 (115)	11	17.5	11	51 (40)	
HZF 5025-3.5	50	25	3.5	I	44.3	58900	152000	1100	1390	103 (98)	145 (140)	—	18	123	141	—	123 (118)	11	17.5	11	63 (50)	
HZF 5025-5	50	25	5	II	44.3	80100	216000	1540	1940	103 (98)	145 (140)	—	18	173	191	—	123 (118)	11	17.5	11	63 (50)	
HZF 5030-3.5	50	30	3.5	I	44.3	58900	152000	1100	1390	103 (98)	145 (140)	—	18	141	159	—	123 (118)	11	17.5	11	76 (60)	
HDF 5030-5		30	5	III	44.3	80100	216000	1540	1940	103 (98)	145 (140)	85(80)	18	104	249	8	123 (118)	11	17.5	11	76 (60)	
HDF 5032-7.5	50	32	7.5	III	44.6	97100	286000	2270	2860	101 (95)	147 (141)	83(77)	22	109	266	11	123 (117)	14	20	13	82 (64)	
HZF 5520-3.5	55	20	3.5	I	49.6	51600	145000	1150	1450	103	145	—	18	104	122	—	123	11	17.5	11	46	
HZF 5520-5	55	20	5	II	49.6	70200	208000	1630	2050	103	145	—	18	144	162	—	123	11	17.5	11	46	
HZF 5525-3.5	55	25	3.5	I	49.3	62600	165000	1190	1560	105	147	—	18	123	141	—	125	11	17.5	11	58	
HZF 5525-5	55	25	5	II	49.3	85000	238000	1680	2120	105	147	—	18	173	191	—	125	11	17.5	11	58	
HZF 5530-3.5	55	30	3.5	I	49.3	62600	165000	1190	1560	105	147	—	18	141	159	—	125	11	17.5	11	69	
HDF 5530-5		30	5	III	49.3	85000	238000	1680	2120	105	147	87	18	104	249	8	125	11	17.5	11	69	
HDF 5532-7.5	55	32	7.5	III	49.6	99500	313000	2420	3050	103	149	85	22	109	266	8	125	14	20	13	74	