

B-3-3.1 HMD Type for High-Speed Machine Tools

This product is being applied for a patent. The newly developed ball recirculation components, the end-deflector and middle-deflector, have greatly contributed for the substantial improvements in the maximum rotational speed and noise level compared to the HMC type.

1. Features

- High speed
The permissible rotational speed (d·n value) has greatly increased to 160 000 compared with 135 000 of the HMC type.
- Low noise
Noise reduced by 5 dB or more compared with the HMC type ball screws for high-speed machine tools.
- Nut mounting dimensions
The ball nut diameters are the same as those of the HMC type.

2. Specifications

(1) Recirculation system

Fig.1 shows the structure of the middle-deflector recirculation system of the HMD type.

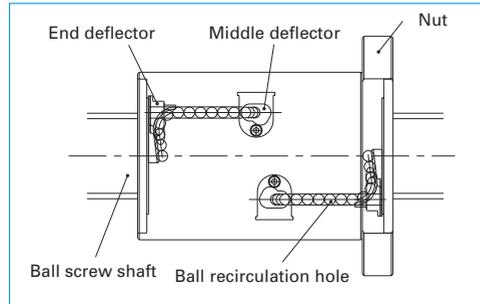


Fig. 1 Structure of middle-deflector recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

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

(3) 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: 160 000 or less
 Criterion of maximum rotational speed : 4 000 min⁻¹

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

(4) Options

- For twin-drive systems (See page B539.)
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 (See page B540.)
- Nut cooling ball screw (See page B545.)

The temperature rise and measures against thermal expansion of ball screw driving mechanism are the most challenging for high-speed machine tools. We recommend using core forced cooling or nut cooling for the HMD type.

(5) Seal

Compact, thin plastic seal is available. Nut outside diameter is compact compare with the return tube recirculation system.

3. Design precautions

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

4. Product categories

The HMD type has a model as follows.

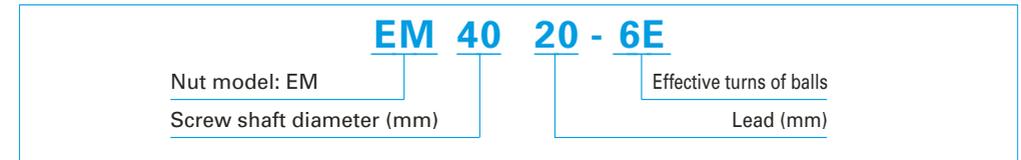
Table 2 HMD type product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
EM		Flanged Circular II	Circular	Z-Preload (medium preload)

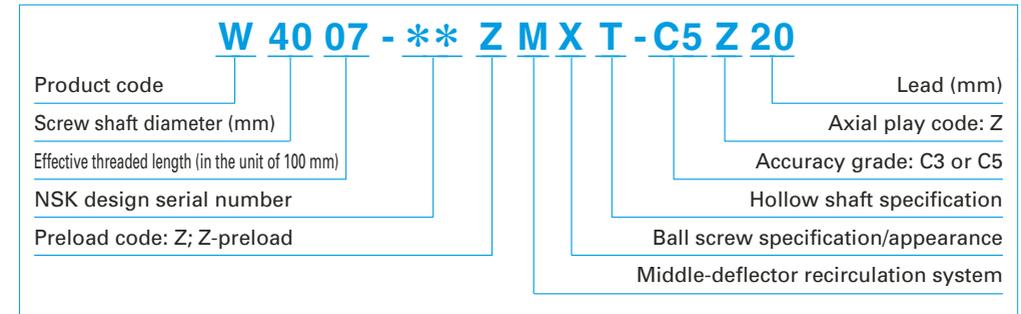
5. Structure of model number and reference number

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

◇Model number



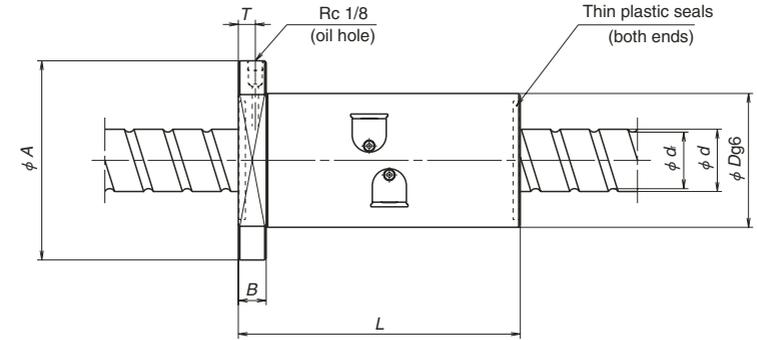
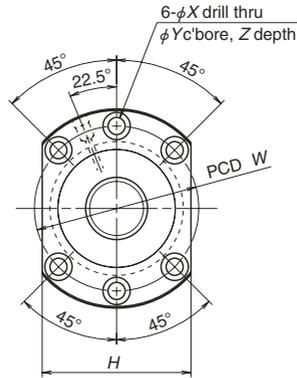
◇Reference number for ball screw



6. Handling Precautions

Maximum operating temperature: 80°C

If using NSK K1, operating temperature should not exceed 50°C. Refer to "Designing Precautions" (page B83).



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
				Dynamic <i>C_d</i>	Static <i>C_s</i>	
EM4016-4E	40	16	34.1	57 100	130 000	1 020
EM4020-6E		20	34.4	66 900	165 000	1 340
EM4025-6E		25	34.1	79 100	191 000	1 370
EM4030-6E		30	34.1	79 100	191 000	1 350
EM4516-4E	45	16	39.1	59 600	145 000	1 060
EM4520-6E		20	39.4	69 100	186 000	1 470
EM4525-6E		25	39.1	82 500	213 000	1 510
EM5016-4E	50	16	44.1	61 800	160 000	1 150
EM5020-6E		20	44.4	73 200	206 000	1 600
EM5025-6E		25	44.1	85 600	235 000	1 620
EM5030-6E		30	44.1	85 600	235 000	1 630
EM6316-4E	63	16	55.2	111 000	339 000	1 600

Notes: 1. The right turn screw is the standard. Please consult NSK for left turn screws.
2. Rigidity listed under the column K is the value when a 5% of basic dynamic load rating is applied as the preload.

Ball nut dimensions										Unit: mm	
Nut length <i>L</i>	Nut dia. <i>D</i>	Flange dia. <i>A</i>	Flange width <i>B</i>	Flange size <i>H</i>	Bolt hole size			Bolt hole PCD <i>W</i>	Oil hole position <i>T</i>	Max. feeding speed (m/min)	
					<i>X</i>	<i>Y</i>	<i>Z</i>				
160	86	128	18	96	11	17.5	11	106	11	64	
150										80	
182										100	
213										120	
160	92	134	18	102	11	17.5	11	112	11	56	
150										70	
182										88	
160	98	140	18	107	11	17.5	11	118	11	51	
150										64	
182										80	
213										96	
170	122	180	28	138	18	26	17.5	150	14	40	

B-3-3.2 HMS Type for High-Speed Machine Tools

1. Features

- High speed
The permissible rotational speed (d·n value) has greatly increased to 160 000 compared with 100 000 for tube type screws.
- Low noise
By adopting SRC recirculation system, noise reduced by 5 dB or more compared with tube type screws.
- Nut mounting dimensions
The ball nut diameters are the same as those of tube type screws.

2. Specifications

(1) Recirculation system

Fig.1 shows the structure of the SRC recirculation system of the HMS type.

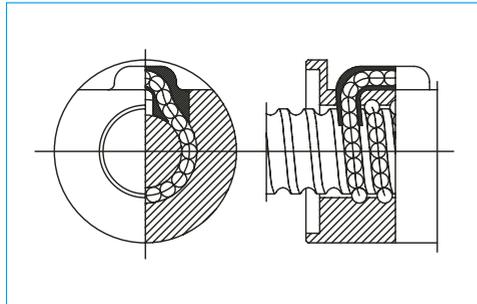


Fig. 1 Structure of SRC recirculation system

(2) Accuracy grade and axial play

The available standard accuracy grade and axial play are as follows. Please consult NSK for other grades.

Table 1 Accuracy grade and axial play

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

(3) 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: 160 000 or less
 Criterion of maximum rotational speed : 5 000 min⁻¹

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

(4) Options

- For twin-drive systems (See page B539.)
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 (See page B540.)
- Nut cooling ball screw (See page B545.)

The temperature rise and measures against thermal expansion of ball screw driving mechanism are the most challenging for high-speed machine tools. We recommend using core forced cooling or nut cooling for the HMS type.

3. Design precautions

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

4. Product categories

The HMS type has a model as follows.

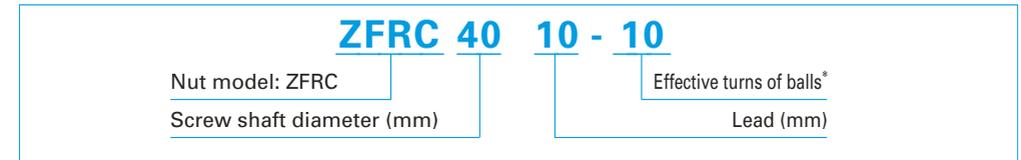
Table 2 HMS type product categories

Nut model	Shape	Flange shape	Nut shape	Preload system
ZFRC		Flanged Circular II	Circular	Z-Preload (medium preload)

5. Structure of model number and reference number

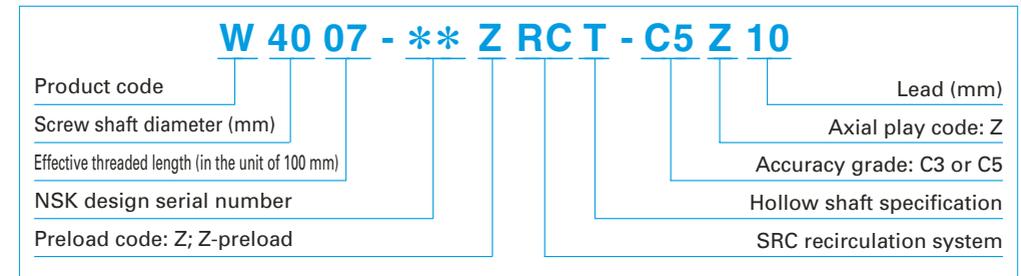
The followings describe the structure of "Model number" and "Reference number for ball screw".

◇Model number



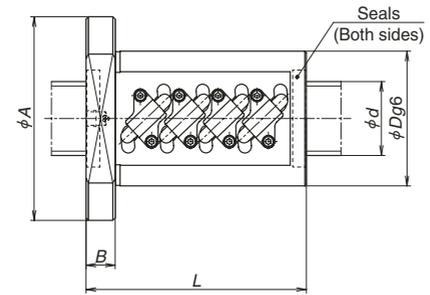
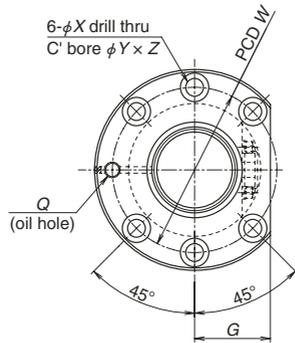
* In the case of Z-preload, the amount shown is twice the effective turn of balls.

◇Reference number for ball screw



6. Handling Precautions

Maximum operating temperature: 60°C
 If using NSK K1, operating temperature should not exceed 50°C. Refer to "Designing Precautions" (page B83).



Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Root dia. <i>d_r</i>	Effective turns Turns × rows	Basic load rating (N)		Axial rigidity <i>K</i> (N/μm)
					Dynamic <i>C_e</i>	Static <i>C_{0a}</i>	
ZFRC3205-10	32	5	29.2	2.5×2	18 500	56 100	840
ZFRC3210-10	32	10	26.4	2.5×2	46 300	108 000	920
ZFRC4010-10	40	10	34.4	2.5×2	52 000	137 000	1 090
ZFRC4012-10	40	12	34.1	2.5×2	61 000	155 000	1 110
ZFRC4508-10	45	8	40.5	2.5×2	37 300	118 000	1 160
ZFRC4510-10	45	10	39.4	2.5×2	54 200	155 000	1 210
ZFRC4512-10	45	12	39.1	2.5×2	64 200	177 000	1 230
ZFRC5010-10	50	10	44.4	2.5×2	57 700	175 000	1 320
ZFRC5012-10	50	12	43.2	2.5×2	77 600	214 000	1 360
ZFRC6312-14	63	12	56.2	3.5×2	115 000	386 000	2 250

Notes: 1. The right turn screw is the standard. Please consult NSK for left turn screws.
2. Rigidity listed under the column K is the value when a 5% of basic dynamic load rating is applied as the preload.

Unit: mm

Nut length <i>L</i>	Nut dia. <i>D</i>	Ball nut dimensions			Bolt hole size			Bolt hole PCD <i>W</i>	Oil hole position <i>Q</i>	Max. feeding speed (m/min)
		Flange dia. <i>A</i>	Flange width <i>B</i>	Groove size <i>G</i>	<i>X</i>	<i>Y</i>	<i>Z</i>			
89	58	85	12	32	6.6	11	6.5	71	M6×1	25
163	74	108	15	41	9	14	8.5	90	M6×1	50
166	82	124	18	47	11	17.5	11	102	Rc1/8	40
192	86	128	18	48	11	17.5	11	106	Rc1/8	48
136	82	124	18	47	11	17.5	11	102	Rc1/8	28
166	88	132	18	50	11	17.5	11	110	Rc1/8	35
192	90	132	18	50	11	17.5	11	110	Rc1/8	42
166	93	135	18	51	11	17.5	11	113	Rc1/8	32
198	100	146	22	55	14	20	13	122	Rc1/8	38
244	115	161	22	61	14	20	13	137	Rc1/8	30