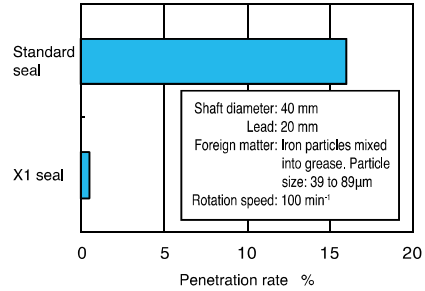


**B-3-3.6.2 Ball Screw with X1 Seals for Contaminated Environments and Grease Retention**

**1. Features**

● **Highly dustproof**

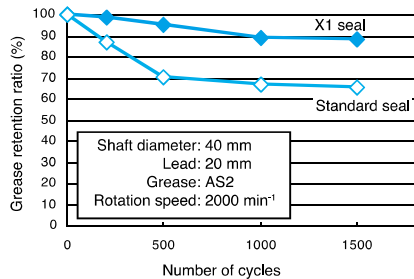
Particle penetration ratio reduced to less than 1/30 of existing standard seals, thus contributing to longer service life for machine tools.



**Fig. 1 Results of particle penetration rate test**

● **Superior grease retention**

Automatically adding grease makes it possible to reduce the amount used and keep it from spattering.



**Fig. 2 Results of grease leakage test**

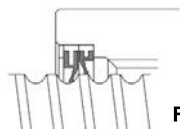
● **Contact seal with low torque**

Optimizing the seal shape reduces torque and enhances seal performance.

**2. Specifications**

**(1) Structure**

The ball screw with X1 seals has a double seal structure combining a dustproof seal and a grease-retaining seal.



**Fig. 3 Seal structure**

**(2) Scope of application in NSK Ball Screw series**  
This series is standard for the following two types.

Ball screws for high-speed machine tools	HMS type	Nut model: ZFRC
	HMD type	Nut model: EM

For specifications other than the above, please consult NSK. Table 1 shows the minimum nut outer diameter on which X1 seals can be mounted.

**Table 1 The minimum nut outer diameter on which X1 seals can be mounted**

Shaft diameter: 40 mm	70 mm
Shaft diameter: 45 mm	75 mm
Shaft diameter: 50 mm	82 mm

**(3) Accuracy grade / axial play**

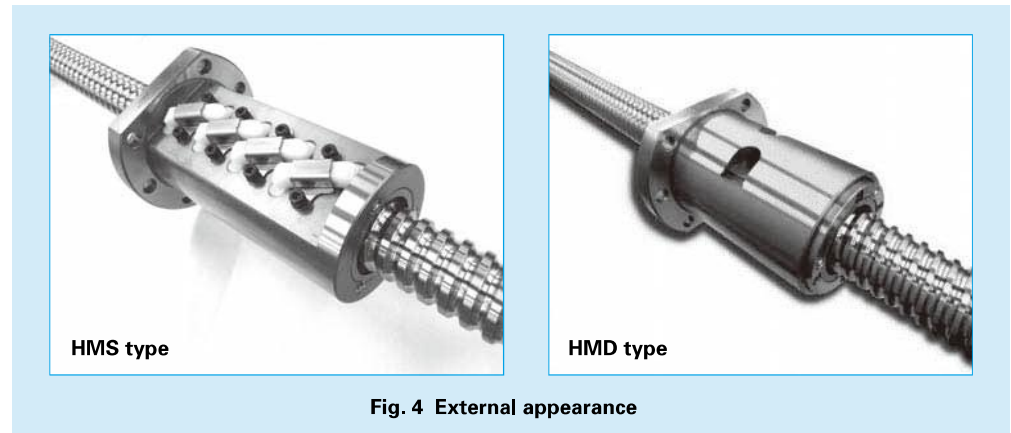
Table 2 shows standard tolerance classes and axial clearances. Please consult NSK for tolerance classes other than those in the table.

**Table 2 Accuracy grade and axial play**

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

**(4) Design-related precautions**

When designing the screw shaft end, assume that the end of the screw shaft is cut. The temperature will increase somewhat when torque is applied if an X1 seal is attached. Please consult NSK if it is to be used under strict operating conditions. Maximum overall shaft length is 2900 mm. For general precautions regarding ball screws, refer to "Design Precautions" (page B83) and "Handling Precautions" (page B103).



**Fig. 4 External appearance**

**3. Example of reference number**

A structure of "Reference number for ball screw" is as follows.

Note: "X1" is added at the end of "nut model code" and "Specifications number".

◇Reference number for ball screw

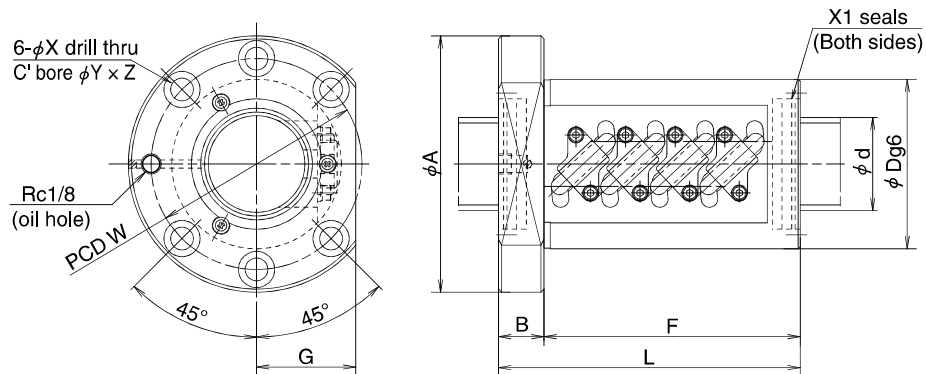
**W4010-\*\*-ZMX1-C5Z16**

X1 seal equipped type ball screw code

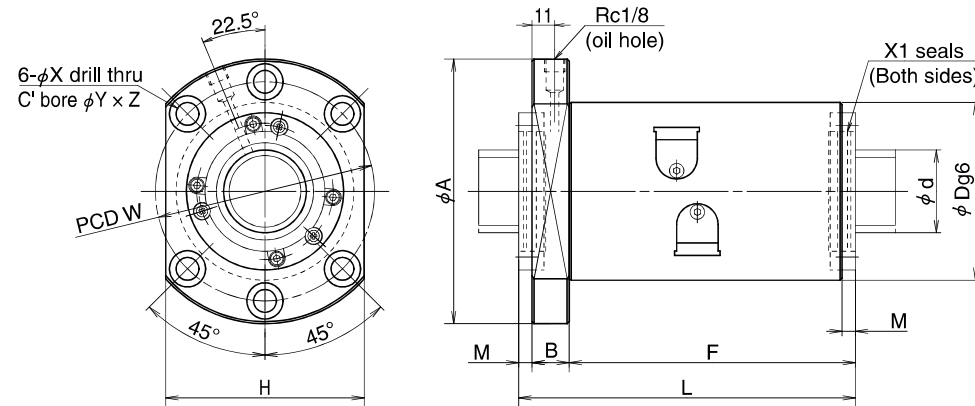
**4. Precautions for use**

Temperature range for use: Maximum temperature: 60°C (at outside diameter of ball nut)  
Chemicals that should not come to contact: Do not leave ball screw in organic solvent, white kerosene such as hexane, thinner which removes oil, and rust preventive oil which contains white kerosene.

The data shown in the catalog are the results of our tests, and no warranty is given to sealing performance on actual usage on machinery. Sealing performance is affected by usage environment and lubrication conditions. Dust covers and other measures to keep machinery free of dust are recommended.



HMS type (Nut model : ZFRC)



HMD type (Nut model: EM)

Applicable dimensions for HMS type

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Nut dimensions									
			Dynamic <i>C<sub>a</sub></i>	Static <i>C<sub>0a</sub></i>	<i>L</i>	<i>F</i>	<i>B</i>	<i>D</i>	<i>A</i>	<i>G</i>	Bolt holes			
											<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>
ZFRC4010-10	40	10	52 000	137 000	173	151	22	82	124	47	11	17.5	11	102
ZFRC4012-10		12	61 000	155 000	197	175		86	128	48				
ZFRC4508-10	45	8	37 300	118 000	146	124	22	82	124	47	11	17.5	11	102
ZFRC5010-10	50	10	57 700	175 000	174	151	23	93	135	51	11	17.5	11	113
ZFRC5012-10		12	77 600	214 000	200	177		100	146	55				

Note: 1.The right hand screw is the standard. For specifications on left hand screws, contact NSK.

Applicable dimensions for HMD type

Unit: mm

Model No.	Shaft dia. <i>d</i>	Lead <i>l</i>	Basic load rating (N)		Nut dimensions										
			Dynamic <i>C<sub>a</sub></i>	Static <i>C<sub>0a</sub></i>	<i>L</i>	<i>F</i>	<i>M</i>	<i>B</i>	<i>D</i>	<i>A</i>	<i>H</i>	Bolt holes			
												<i>X</i>	<i>Y</i>	<i>Z</i>	<i>W</i>
EM4016-4E	40	16	57 100	130 000	172	148	6	18	86	128	96	11	17.5	11	106
EM4020-6E		20	66 900	165 000	164	139	7								
EM4516-4E	45	16	59 600	145 000	173	148.5	6.5	18	92	134	102	11	17.5	11	112
EM4520-6E		20	69 100	186 000	164	139	7								
EM5016-4E	50	16	61 800	160 000	173	148.5	6.5	18	98	140	107	11	17.5	11	118
EM5020-6E		20	73 200	206 000	164	139	7								

Note: 1.The right hand screw is the standard. For specifications on left hand screws, contact NSK.

X1 seals