MOTION & CONTROL™

NSK

NSK Standard Ball Screws
High Speed SS Series

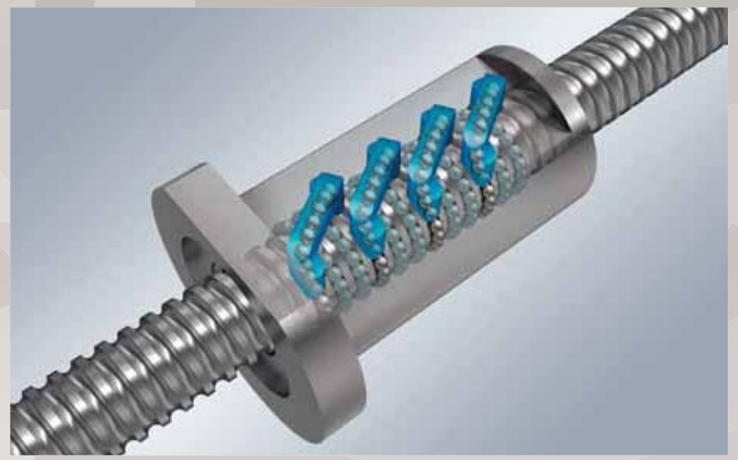
NSK's high speed and low noise ball screws provide high-level performance for drive systems of industrial machines such as those used in manufacturing. A standard stock series assures quick delivery.

Blank shaft end

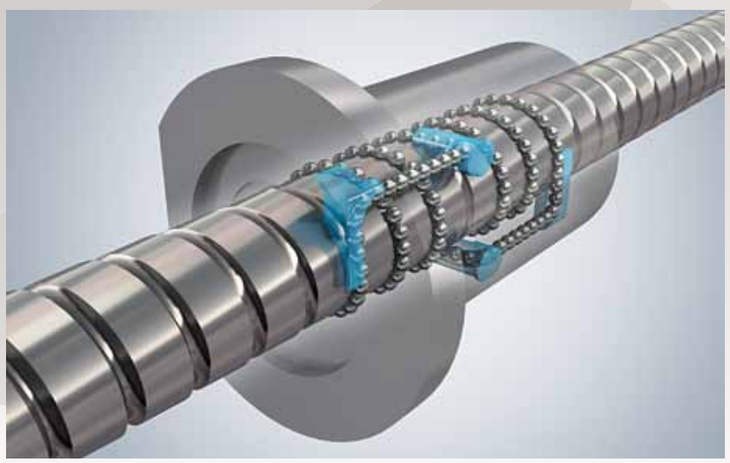
High Speed SS Series (HSS Type); Standard ball screws, high speed and low noise enable further performance improvements to be made.

The HMS and HMD series, originally developed for machine tools, are an addition to NSK's lineup of standard ball screws. They have a wide range of applications, from general machines to high performance machines such as those requiring high speed and precision.

NSK's original recirculation system realized high speed and low noise. An optimum recirculation system has been adopted based on the lead.



SRC recirculation system is suitable for fine screw leads.



The end deflector and middle deflector recirculation system are suitable for medium leads.

High speed

Permissible rotational speed is more than double d·n limit value: high speed of 160 000

Low noise and vibrations

Noise level has been reduced by 50%: a reduction of 6 dB
Vibration has been reduced drastically

Interchangeability

Installation dimensions are the same as those of a conventional SS series

Compact

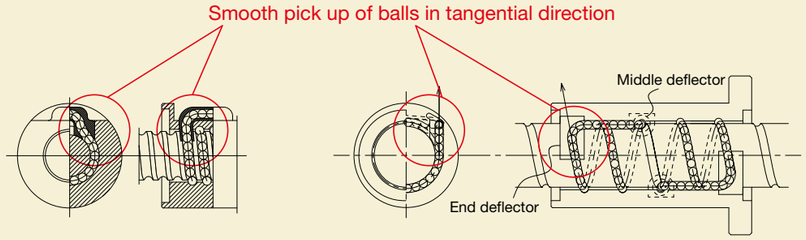
Compact design created using offset preload system

Convenience

Design flexibility has been improved by blank shaft end.
New support units are also provided for high speed operation.

High speed

The new recirculation system that utilizes NSK's high speed and low noise technology more than doubles the d·n value from 70 000 to 160 000.
To extend the range of the lead to 20mm, high speed operation of over 60m/min. is possible.



SRC recirculation system
Lead 5 to 12

End deflector and middle deflector recirculation system
Lead 16 and 20

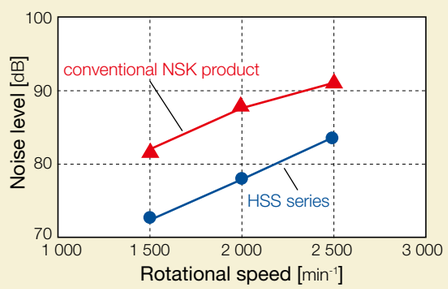
● Allowable feed speed of combinations of shaft diameter and lead.

Shaft diameter [mm] \ Lead [mm]	5	10	12	16	20
32	25m/min	50m/min			
40		40m/min	48m/min	64m/min	80m/min
45		35m/min			
50		32m/min	38m/min		

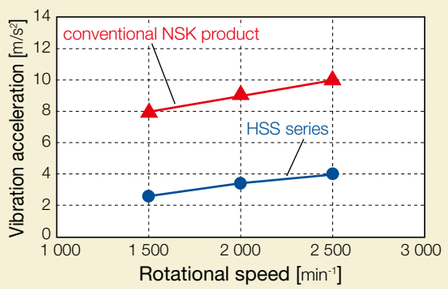
*Allowable speed needs to be calculated. See the permissible rotational speed in the dimensions table.

Low noise and vibrations

Compared to our conventional products, the average noise level has been reduced by more than 6 dB, reducing the number of colliding balls and recirculation parts thanks to high speed, low noise technology.
The vibration level of the nut has also been reduced drastically.



Noise level measurement result
(Shaft dia. 40, lead 16mm)



Vibration level measurement result
(Shaft dia. 40, lead 16mm)

Interchangeability

Installation dimensions are the same as those of a conventional SS series

Compact

By improving the nut manufacturing technology, highly precise screw manufacturing is possible with the long nut.
Achieved high-level stiffness and high load capacity equivalent to that of double nut preload by changing the double nut preload to the offset preload of a single nut, and compact sized nut.

●Seal

Adopted thin seals axially and shorten nut length

Convenience

●Optional configurations are possible for ball screw length as well as for the shaft end design

The blank shaft ends can be customized according to customers' requests. See page 11 in NSK's recommended design when drawing up plans for a shaft end. The support units are available on pages 12-14 in the case of NSK's recommended design.

●New support unit: For high speeds and heavy loads

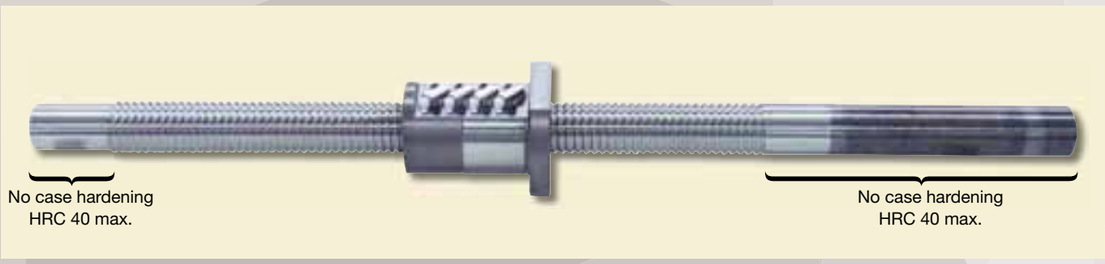
The support unit is applied for the thrust angular contact ball bearing, TAC series, with high precision and rigidity. NSK design is available attached to the support unit, which easily constitutes a system.

●Oil supply

2 oil holes, M6×1.0, are provided in the nut flange periphery and the end of the nut flange.
A plug is standardly screwed into the periphery of the nut flange.

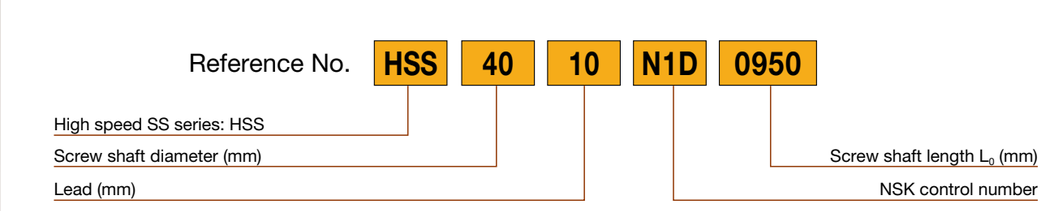
Ball screw specification

Accuracy grade	C5 of JIS B 1192 (1997)
Axial play Preload system	Axial play: 0 Offset preload (Z preload)
Thread direction	Right hand
Shaft end	Both shaft ends blank (No case hardening: HRC 40 max.)



Reference No.

The reference number is an identification number or symbol used for each model.
Specify the reference number when ordering, and thereafter, specify the shape of the end of the shaft indicated by NSK.



Precautions

◆ Design

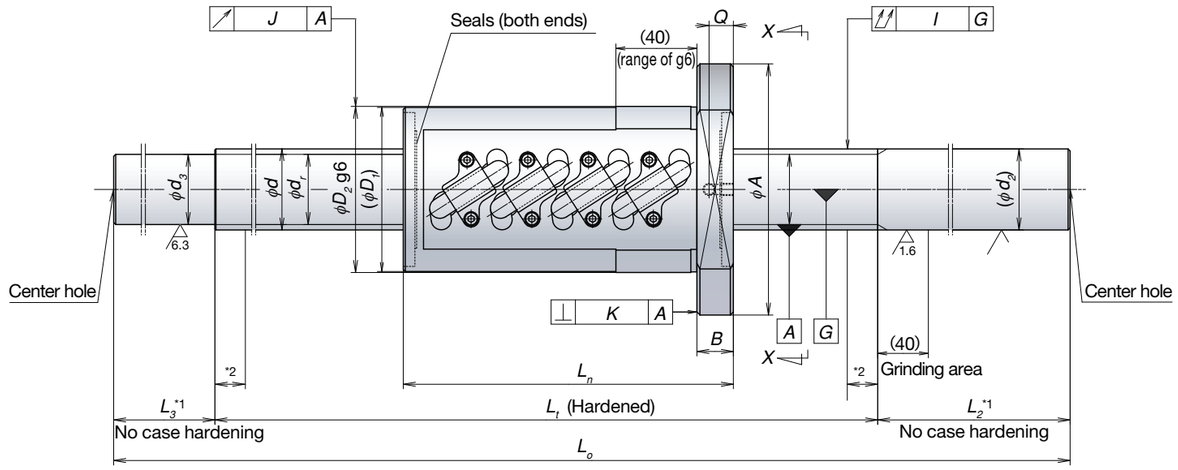
1. One end of the screw shaft is cut through.
2. If a ball screw of which the left shaft end (opposite the driving side) is the shape I. and if it is supported with the "fixed-fixed" supporting method, you should be aware that the operating life of support bearings may shorten due to thermal expansion of the screw shaft, depending on usage conditions. In this case, you should consider a structure that can accommodate thermal expansion of the screw shaft if necessary. Please consult with NSK for a detailed examination.
3. For general precautions concerning ball screws, please check NSK Catalog No.E3162 "Precision Machine Components".

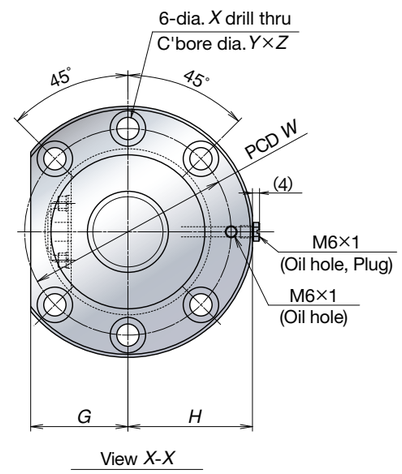
◆ Usage

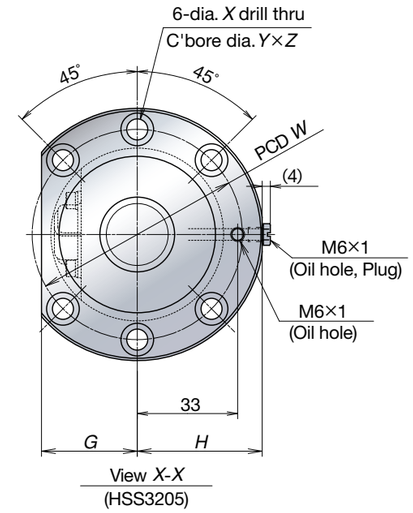
1. Instructions for shaft end processing

   The high speed SS series has a straight cut shaft end. Therefore, during actual use, the end of the shaft must be machined according to the customer's specifications. NSK recommends designated suppliers that offer quality assurances and precision guarantees. If any other supplier carries out processing, NSK will not provide a precision guarantee.
2. Service temperature environment of 60°C or less (at the nut outer temperature)
3. Only a rust preventive agent is applied at the time of delivery. Please apply lubricant, oil or grease before using.
4. The seals are installed on the end of the nut with the ball screw shaft. However, the ball screws should be provided with a dust cover to prevent debris such as dust and metal powder from entering.
5. If the nut accidentally comes off the screw shaft, please contact NSK.

Dimension: Lead 5, 10, and 12 Shaft screw dia.32, 40, 45 and 50





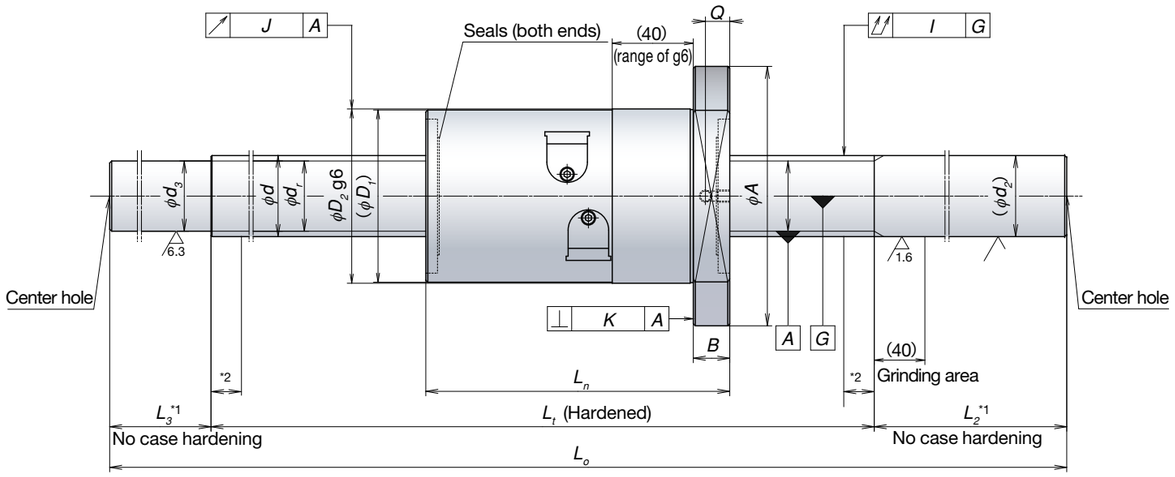


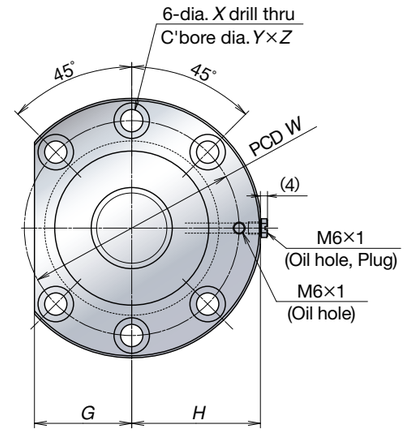
Unit: mm

Reference No.	Screw shaft dia. d	Lead ℓ	Root dia. d_r	Effective balls turns × Circuits	Basic load rating [N] Dynamic Ca	Basic load rating [N] Static Coa	Preload [N]	Dynamic friction torque, median [N·cm]	Nut rigidity [N/μm]	Ball nut dimensions: Diameter D_1	Diameter D_2	Flange A	Flange G	Flange H	Flange B	Overall length L_n	Bolt hole W	Bolt hole X	Bolt hole Y	Bolt hole Z	Oil hole Q	Screw shaft dimension: Threaded length L_t	Shaft end, right d_2	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy: Travel compensation T	Deviation e_p	Variation V_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass [kg]	Permissible rotational speed [min^{-1}] Installation: Fixed-Free support	Permissible rotational speed [min^{-1}] Installation: Fixed-Fixed support	Internal spatial volume of nut [cm^3]
HSS3205N1D0650	32	5	29.2	2.5×2	18 500	56 100	920	17.0	840	57	58	85	32	42	13	89	71	6.6	11	6.5	8	400	32	200	29.2	50	650	-0.010	0.025	0.020	0.055	0.019	0.013	5.2	5 000	5 000	10
HSS3205N1D0950																						600		250		100	950	-0.014	0.030	0.023	0.065			7.0	5 000	5 000	
HSS3205N1D1250																						900		250		100	1 250	-0.022	0.040	0.027	0.080			8.7	5 000	5 000	
HSS3205N1D1550																						1 150		300		100	1 550	-0.028	0.046	0.030	0.100			10.5	3 500	4 700	
HSS3205N1D1850																						1 450		300		100	1 850	-0.035	0.054	0.035	0.130			12.2	2 200	2 900	
HSS3210N1D0850		10	26.4	2.5×2	46 300	108 000	2 310	59.5	920	73	74	108	41	53.5	15	160	90	9	14	8.5	10	500	32	250	26.4	100	850	-0.012	0.027	0.020	0.065	0.019	0.013	8.9	5 000	5 000	43
HSS3210N1D1050																						700		250		100	1 050	-0.017	0.035	0.025	0.080			10.0	5 000	5 000	
HSS3210N1D1450																						1 050		300		100	1 450	-0.025	0.046	0.030	0.100			12.2	4 100	5 000	
HSS3210N1D1850																						1 450		300		100	1 850	-0.035	0.054	0.035	0.130			14.3	2 100	2 800	
HSS3210N1D2250																						1 850		300		100	2 250	-0.045	0.065	0.040	0.170			16.5	1 200	1 700	
HSS4010N1D0950	40	10	34.4	2.5×2	52 000	137 000	2 600	74.5	1 090	81	82	124	47	61.5	18	163	102	11	17.5	11	12	600	40	250	34.4	100	950	-0.014	0.030	0.023	0.050	0.025	0.015	13.5	4 000	4 000	52
HSS4010N1D1450																						1 050		300		100	1 450	-0.025	0.046	0.030	0.070			17.9	4 000	4 000	
HSS4010N1D2100																						1 600		350		150	2 100	-0.039	0.054	0.035	0.110			23.5	2 200	3 000	
HSS4010N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			30.5	900	1 300	
HSS4012N1D1450		12	34.1	2.5×2	61 000	155 000	3 050	96.0	1 110	85	86	128	48	63.5	18	187	106	11	17.5	11	12	1 050	40	300	34.1	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	19.1	4 000	4 000	67
HSS4012N1D2100																						1 600		350		150	2 100	-0.039	0.054	0.035	0.110			24.8	2 200	3 000	
HSS4012N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			31.8	900	1 300	
HSS4510N1D1450	45	10	39.4	2.5×2	54 200	155 000	2 710	82.0	1 210	87	88	132	50	65.5	18	163	110	11	17.5	11	12	1 050	45	300	39.4	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	22.0	3 500	3 500	58
HSS4510N1D2100																						1 600		350		150	2 100	-0.039	0.054	0.035	0.110			29.2	2 500	3 400	
HSS4510N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			38.2	1 100	1 500	
HSS5010N1D1450	50	10	44.4	2.5×2	57 700	175 000	2 880	92.0	1 320	92	93	135	51	67	18	163	113	11	17.5	11	12	1 050	50	300	44.4	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	26.3	3 200	3 200	64
HSS5010N1D1850																						1 450		300		100	1 850	-0.035	0.054	0.035	0.090			31.9	3 200	3 200	
HSS5010N1D2350																						1 850		350		150	2 350	-0.045	0.065	0.040	0.110			38.8	2 100	2 900	
HSS5010N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			46.5	1 200	1 700	
HSS5012N1D1450		12	43.2	2.5×2	77 600	214 000	3 880	136.5	1 360	99	100	146	55	72.5	22	193	122	14	20	13	12	1 050	50	300	43.2	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	28.5	3 200	3 200	99
HSS5012N1D2100																						1 600		350		150	2 100	-0.039	0.054	0.035	0.110			37.3	2 800	3 200	
HSS5012N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			48.2	1 200	1 600	

Note:
- NSK support units are recommended. Refer to Page 12 to 14 for details.
- Only a rust preventive agent is applied at the time of delivery. Please apply lubricant, oil or grease before use.
- Nut rigidity: Values in the table are theoretical values obtained from the elastic deformation between ball grooves with preload and balls.
- Permissible rotational speed: Calculated values obtained from the critical speed between the threaded length and NSK's recommended shaft end design.
- *1: No case hardening: HRC 40 max.
- *2: Imperfect hardened areas for one lead exists on both ends of a screw. Exercise care when stroke setting

Dimension: Lead16, 20 Shaft screw dia.40



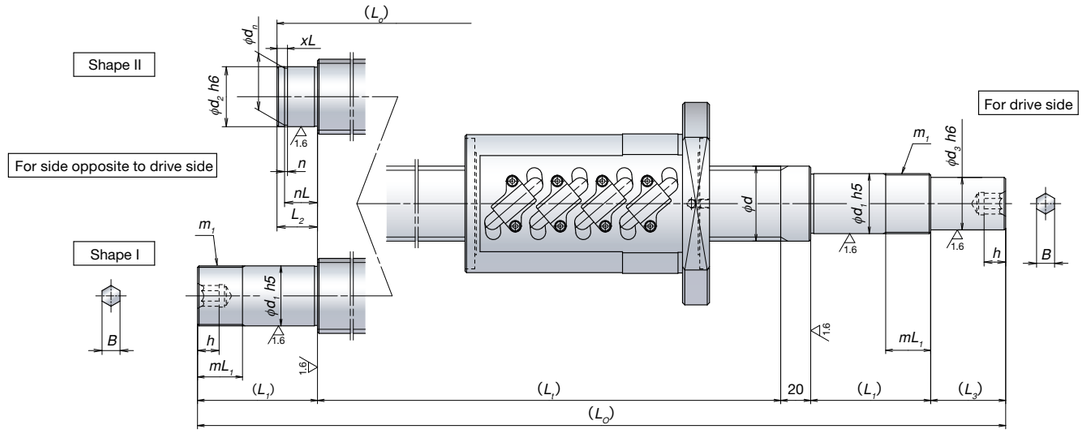


Unit: mm

Reference No.	Screw shaft dia. d	Lead ℓ	Root dia. d_r	Effective balls turns × Circuits	Basic load rating [N] Dynamic Ca	Basic load rating [N] Static Coa	Preload [N]	Dynamic friction torque, median [N·cm]	Nut rigidity [N/μm]	Ball nut dimensions: Diameter D_1	Diameter D_2	Flange A	Flange G	Flange H	Flange B	Overall length L_n	Bolt hole W	Bolt hole X	Bolt hole Y	Bolt hole Z	Oil hole Q	Screw shaft dimension: Threaded length L_t	Shaft end, right d_2	Shaft end, right L_2	Shaft end, left d_3	Shaft end, left L_3	Overall length L_o	Lead accuracy: Travel compensation T	Deviation e_p	Variation V_u	Run-out: Shaft straightness I	Nut O.D. eccentricity J	Flange perpendicularity K	Mass [kg]	Permissible rotational speed [min⁻¹] Installation: Fixed-Free support	Permissible rotational speed [min⁻¹] Installation: Fixed-Fixed support	Internal spatial volume of nut [cm³]
HSS4016N1D1450	40	16	34.1	3.7×1	57 100	130 000	2 850	104.0	970	85	86	128	48	63.5	18	160	106	11	17.5	11	11	1 050	40	300	34.1	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	19.2	4 000	4 000	40
HSS4016N1D2100																						1 600		350		150	2 100	-0.039	0.054	0.035	0.110			25.0	2 200	3 000	
HSS4016N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			32.2	900	1 300	
HSS4020N1D1450		20	34.1	3.7×1	57 100	130 000	2 850	116.5	960	85	86	128	48	63.5	18	192	106	11	17.5	11	11	1 050	40	300	34.1	100	1 450	-0.025	0.046	0.030	0.070	0.025	0.015	20.3	4 000	4 000	47
HSS4020N1D2100																						1 600		350		150	2 100	-0.039	0.054	0.035	0.110			26.2	2 200	3 000	
HSS4020N1D2900																						2 400		350		150	2 900	-0.058	0.077	0.046	0.140			33.5	900	1 300	

Note:
- NSK support units are recommended. Refer to Page 12 to 14 for details.
- Only a rust preventive agent is applied at the time of delivery. Please apply lubricant, oil or grease before use.
- Nut rigidity: Values in the table are theoretical values obtained from the elastic deformation between ball grooves with preload and balls.
- Permissible rotational speed: Calculated values obtained from the critical speed between the threaded length and NSK's recommended shaft end design.
- *1: No case hardening: HRC 40 max.
- *2: Imperfect hardened areas for one lead exists on both ends of a screw. Exercise care when stroke setting

Dimension: Recommendation for shaft end design



For drive side: Recommendation for shaft end design — Unit: mm

Screw shaft diameter	Bearing installation		Thread screw		Support unit	Parts installation		Shaft length			
	Diameter	Length	Screw size	Length		Diameter	Length	Screw length	Shaft overall length	Shaft end hexagon hole	
d	d_1	L_1	m_1	mL_1		d_3	L_3	L_t	L_o	*B*	*h*
32	25	89	M25×1.5	26	WBK25DF-31H	20	51	max 1 850	max 2 250	$8^{+0.2}_{0}$	10
		104			WBK25DFD-31H						
40	30	89	M30×1.5	26	WBK30DF-31H	25	61	max 2 400	max 2 900	$10^{+0.2}_{0}$	12
		104			WBK30DFD-31H						
45	35	92	M35×1.5	30	WBK35DF-31H	30	63	max 2 400	max 2 900	$12^{+0.3}_{0}$	14
		107			WBK35DFD-31H						
		122			WBK35DFF-31H						
50	40	92	M40×1.5	30	WBK40DF-31H	35	78	max 2 400	max 2 900	$14^{+0.3}_{0}$	18
		107			WBK40DFD-31H						
		122			WBK40DFF-31H						

For side opposite to drive side: Recommendation for shaft end design — Unit: mm

Screw shaft diameter	Shape	Bearing installation		Thread screw		Snap ring ditch			Support unit (Bearing model)
		Diameter	Length	Screw size	Length	Width	Ditch diameter	Ditch location	
d		d_2	L_2	m_2	mL_2	*n*	d_n	*nL* (*xL*)	
32	I	✻				-	-	-	✻
	II	25	20	-	-	$1.35^{+0.14}_{0}$	$23.9^{0}_{-0.21}$	16.35 (5)	(6205)
40	I	✻				-	-	-	✻
	II	30	22	-	-	$1.75^{+0.14}_{0}$	$28.6^{0}_{-0.21}$	17.75 (6)	(6206)
45	I	✻				-	-	-	✻
	II	35	23	-	-	$1.75^{+0.14}_{0}$	$33^{0}_{-0.25}$	18.75 (6)	(6207)
50	I	✻				-	-	-	✻
	II	40	25	-	-	$1.95^{+0.14}_{0}$	$38^{0}_{-0.25}$	19.95 (7)	(6208)

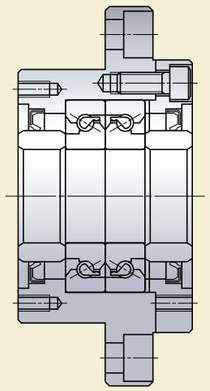
Note:
- The dimensions of the drawing can be flexibly set within limits.
- The support unit is available with a recommended design.
- ✻: The same as that of the drive side.

New support unit (For high speed and heavy load)

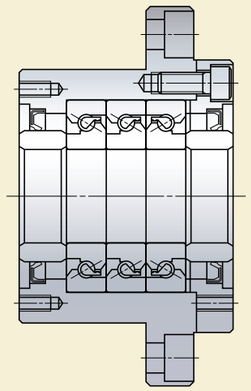
High speed and low heat generation

Heat generation has been reduced via adoption of a low preload type bearing. Along with speedup of the ball screw, permissible rotational speed have been improved.

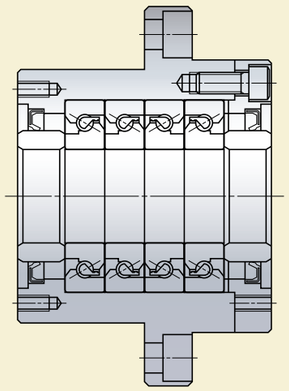
The new support units are assembled with the thrust angular contact ball bearings, TAC series, which are a high precision, high rigidity, high speed type with the most suitable function and structure. The bearing combination comes in three types as shown in the figure below



DF combination



DFD combination



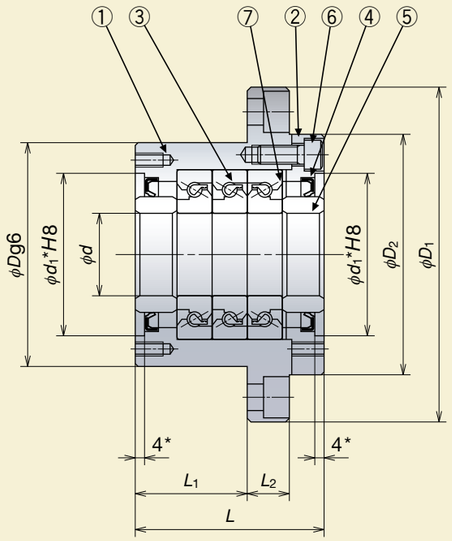
DFF combination

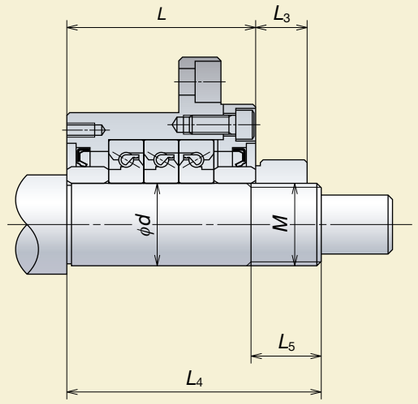
Support unit reference No.

Reference No. **WBK** **40** **DF** – **31** **H**

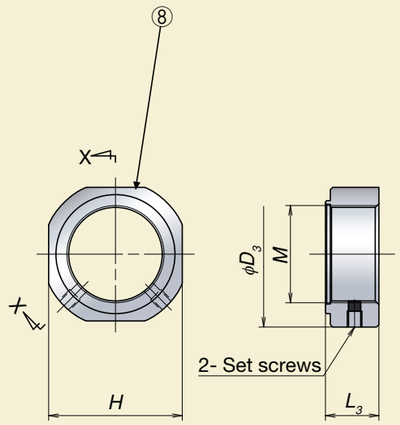
- WBK: Product code for support unit
- 40: Bearing bore diameter (mm)
- DF: Bearing combination
- 31: NSK control number
- H: High speed type

Dimension: Support unit



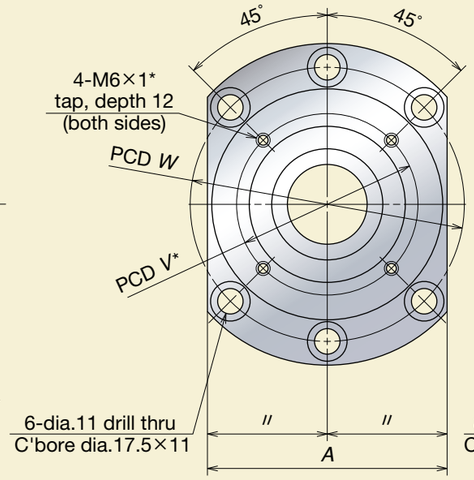


Dimensions of bearing seat

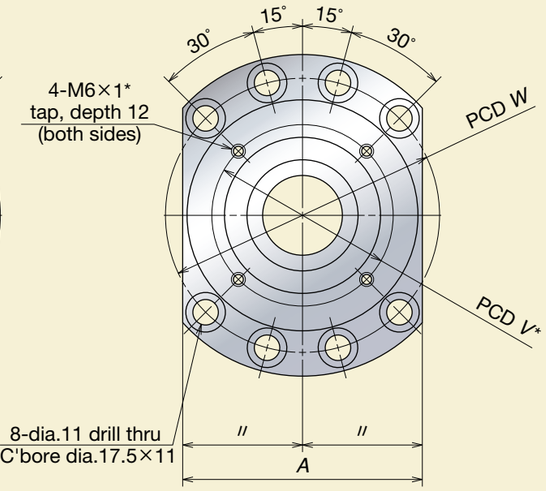


Section *X-X*

Lock nut



Bearing bore diameter $d \leqq 30$



Bearing bore diameter $d \geqq 35$

Unit: mm

Reference No.	Support unit											Basic dynamic load rating [N]	Permissible axial load	Preload	Axial rigidity	Maximum starting torque	Lock nut					Bearing seat for unit			Permissible rotational speed	Mass
																	Length				Installation torque					
	d	*D*	D_1	D_2	*L*	L_1	L_2	*A*	*W*	d_1*	*V**	*Ca* [N]	[N]	[N]	[N/μm]	[N·cm]	*M*	*H*	D_3	L_3	[N·cm]	*d*	L_4	L_5	[min^{-1}]	[kg]
WBK25DF-31H	25	85	130	90	66	33	18	100	110	57	70	29 900	40 500	2 280	850	21	M25×1.5	41	45	20	8 500	25	89	26	5 200	3.1
WBK25DFD-31H					81	48						48 500	81 500	3 100	1 250	28							104			3.4
WBK30DF-31H	30	85	130	90	66	33	18	100	110	57	70	30 500	43 000	2 400	890	23	M30×1.5	46	50	20	10 100	30	89	26	4 900	3.0
WBK30DFD-31H					81	48						50 000	86 000	3 260	1 310	30							104			3.3
WBK35DF-31H	35	95	142	102	66	33	18	106	121	69	80	32 500	50 000	2 750	1 030	27	M35×1.5	50	55	22	13 800	35	92	30	4 100	3.4
WBK35DFD-31H					81	48						53 000	100 000	3 740	1 500	34							107			4.3
WBK35DFF-31H					96	48						53 000	100 000	5 490	2 060	43							122			5.0
WBK40DF-31H	40	95	142	102	66	33	18	106	121	69	80	33 500	52 000	2 860	1 080	28	M40×1.5	55	60	22	15 500	40	92	30	4 100	3.6
WBK40DFD-31H					81	48						54 000	104 000	3 900	1 590	36							107			4.2
WBK40DFF-31H					96	48						54 000	104 000	5 730	2 150	46							122			4.7

Note:
- Rigidity: Values in the table are theoretical and obtained from the elastic deformation between ball groove and balls.
- Starting torque indicates torque due to the preload of the bearing. It does not include seal torque.
- h5 class of the fits tolerance is recommended.
- Pilot diameter and tapped screws marked with "*", are used for seal unit installation for NSK standard hollow shaft ball screws. They can also be used for the dust cover and damper installation.
- Grease is packed into bearings. It is not necessary to apply grease before use.
- Installation torque of a set screw 490[N·cm] (Reference value)
- The locknut has been designed to stay fastened, but it may come loose if a machine has strong vibrations. Apply construction adhesive as necessary.
- Allowable axial load is 0.7 times of the permissible axial load in the dimension table.

Parts list

Parts No.	Part Name	Quantity
①	Housing	1
②	Retaining Cover	1
③	High accuracy thrust angular contact ball bearing	One set
④	Dust seal	2
⑤	Collar	2
⑥	Preload bolt	6 or 8
⑦	Shim	One set
⑧	Lock nut	1

- NSK support units are precisely preloaded and adjusted. Do not disassemble components ①, ②, ③, ④, ⑥ or ⑦.
- Lock nut ⑧ has been exclusively prepared for ball screws. The end surface of the nut is positioned precisely perpendicular to the V thread. Secure the lock nut using a set screw.

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<As of June 2013>

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CAT. No. E3241a 2014 B-2 Printed in Japan