Miniature
Ball Screw

We invite you to explore and challenges
for the future of KIM

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KIM CO.,LTD.

THE GLOBAL LEADER OF MECHANICAL ENGINEERING SOLUTION

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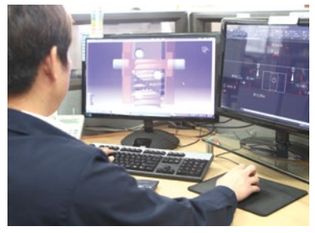

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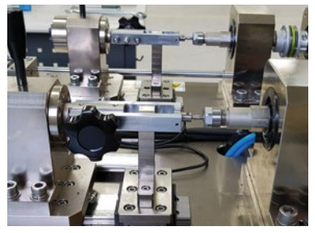

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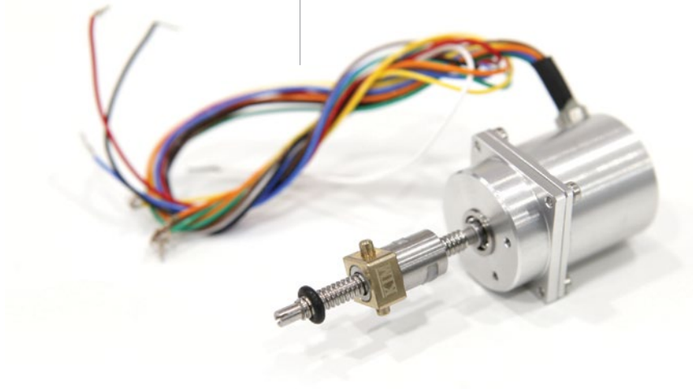


The Global Leader of **Mechanical Engineering Solution**

KIM Co., Ltd.

As a result of continuous investment in R&D on precision gears for decades, KIM Co. has grown to a specialist in driving device.

From designing, manufacturing to solution offer, KIM Co. can serve everything customers require with simple specification provided.

Applications


Defense Industry


Injection Molding

Medical


Aeronautics


Robotics


Machine Tools


Optics


Fields of High Technology

Product Overview

Ball screws convert the rotary motion into linear motion and consist of screw shaft, nut, cycle parts, and balls. Unlike sliding screw, ball screw can get a high transmission efficiency due to the rolling motion of the rotation and revolution.

Features

High Mechanical Efficiency

In ball screw, steel balls or stainless balls are assembled, and they have rolling contact between nut and screw. So ball screw has mechanic efficiency more than 90% and its torque is 1/3 smaller than general thread.

Axial Play

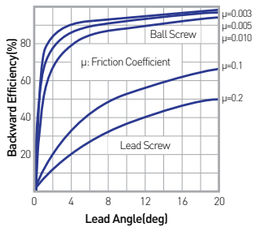
In case of general thread, to reduce axial play runout, the friction coefficient is increased and it will cause the rotation torque get higher. But the ball screw easily rotates without friction even though there is no axial play runout. And Double nut that applied to ball screw to reduce axial play runout increases hardness.

High Quality Assurance System

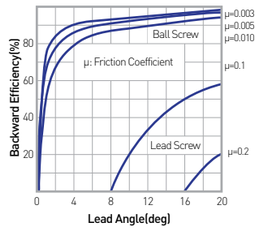
Machining, assembly, and inspection of KIM Co.'s ball screws are performed in thermostatic chamber where is maintained well with temperature and humidity and we have quality assurance system to guarantee our quality.

Long Life

KIM Co. ball screws are made with adequate materials and heat-treated parts and have rolling contact for low abrasion. For this reason, accuracy and long lift are assured.



Forward Efficiency



Backward Efficiency

Miniature Ball Screw

Ball screws translate rotational motion to linear motion with little friction. KIM Co. can deliver ball screws with C3-C9 precision that its diameter starts from 3mm.

Design Guidelines

Identification System

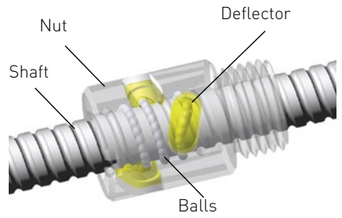
①	②	③	④	⑤	⑥		⑦	⑧
BS	08	01	R	K	S	–	C5	Z

① Ball Screw Symbol
② External Diameter of Ball Screw Axis (mm)
③ Lead (mm)
④ Direction of Rotation : R, L, B
⑤ Circulation System : K, P, E
⑥ Symbol of Double Nut : S, D
⑦ Accuracy Grade : C0 – C7
⑧ Axial Clearance : Z, T, S, N, L

Types of Ball Screw

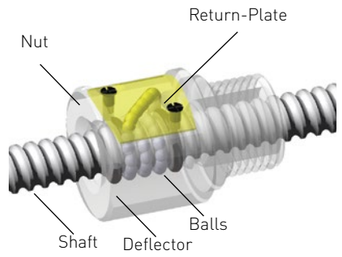
Internal-Deflector System (K)

The Internal-deflector system employs a lightweight miniature ball screw, which enables the nut diameter and length to be reduce to the smallest possible size. The balls bear the load while rolling along the screw groove between the shaft and the nut. The balls are continuously circulated, transferred to the adjacent groove in the screw via the Internal-deflector channel and then back to the loaded groove area.



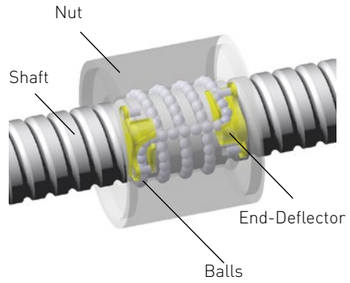
Return-Plate System (P)

The return-plate system uses coil-type deflectors incorporated inside the nut to pick up the steel balls and circulate them via the return-plate channel. This system has the advantage of allowing the use of a nut that is smaller in diameter than those employed in return-tube systems. In addition, the upward-angle installation of the return-plate ensures even smoother rotation.



End-Deflector System (E)

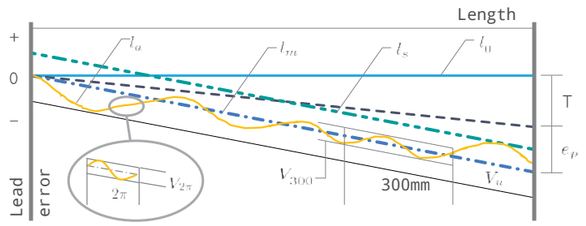
The balls are circulated from end-deflector incorporated inside the nut or outside the nut through the hole in the nut and the channels in the recirculating sections. Ball nut diameter can be smaller than return-plate system. This is suitable for the middle lead ball screws.



Lead Precision

Ball screw lead accuracy conforming to JIS B1192 is specified by the tolerance of actual mean travel error over the nut effective travel amount, or screw shaft effective length, travel variation and travel variation within arbitrary 1 revolution over the screw shaft effective length. Tolerance of each accuracy grades are shown in the Table 1,2.

Diagram 01



Nominal travel (l_0) : Amount of travel for a particular number of revolutions along nominal lead.

Target specified travel (T) : Target value for cumulative specified lead which has been increased or decreased in advance.

Specified travel (l_s) : Amount of travel for a particular number of revolutions along specified lead.

Actual travel (l_a) : Actual displacement of ball nut relative to the ball screw shaft, or vice versa, for a given number of revolutions.

Actual mean travel (l_m) : Straight line representing the trend of actual travel (l_m) and the nominal travel (l_0) or the specified travel (l_s), within the useful travel.

Actual mean travel deviation (e_p) : Difference between Actual mean travel (l_m) and Nominal travel (l_0) or Specified travel (l_s).

Travel variation (V_u) : The maximum width of the actual travel curve enclosed between two parallel lines along the actual mean travel line.

Travel variation (V_{300}) : The widest range of the actual travel for any 300mm within the useful travel or the effective screw thread length.

Travel variation ($V_{2\pi}$) : The widest range of the actual travel for one revolution (2π rad) within the useful travel or the effective screw thread length.

table 01 Target travel error ($\pm e_p$) and limit of travel variation (μm)

Effective Screw Length (mm)		Accuracy Grade (μm)							
		C0		C1		C3		C5	
Over	Up To	$\pm e_p$	V_u	$\pm e_p$	V_u	$\pm e_p$	V_u	$\pm e_p$	V_u
0	100	3	3	3.5	5	8	8	18	18
100	200	3.5	3	4.5	5	10	8	20	18
200	315	4	3.5	6	5	12	8	23	18
315	400	5	3.5	7	5	13	10	25	20
400	500	6	4	8	5	15	10	27	20
500	630	6	4	9	6	16	12	30	23
630	800	7	5	10	7	18	13	35	25
800	1,000	8	6	11	8	21	15	40	27

table 02 Limit of change of per 300mm and 1 round (V_{300}) ($V_{2\pi}$)

Accuracy Grade (μm)	C0		C1		C3		C5	
Item	V_{300}	$V_{2\pi}$	V_{300}	$V_{2\pi}$	V_{300}	$V_{2\pi}$	V_{300}	$V_{2\pi}$
Permissible Value	3.5	3	5	4	8	6	18	8

Ball Screw Run-Out and Location Tolerance

The connection precision of ball screw is produced based on the standard below.

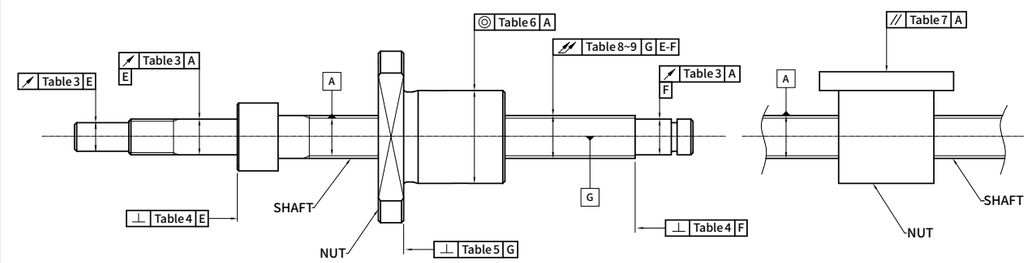


table 03 Radial run-out bearing seat related to the centerline of screw groove and radial run-out of journal diameter related to the bearing seat

Shaft Nominal Diameter (mm)		Permissible Deviation of Radial Run-Out (μm)					
Over	Up To	C0	C1	C3	C5	C7	C10
0	8	3	5	8	10	14	40
8	12	4	5	8	11	14	40
12	20	4	6	9	12	14	40

table 04 Axial run-out (perpendicularity) of shaft (bearing) face related to the centerline of the bearing seat

Shaft Nominal Diameter (mm)		Permissible Deviation of Radial Run-Out (Perpendicularity) (μm)					
Over	Up To	C0	C1	C3	C5	C7	C10
0	8	3	5	8	10	14	40
8	12	4	5	8	11	14	40
12	20	4	6	9	12	14	40

table 05 Axial run-out (perpendicularity) of ball nut location face related to the centerline of screw shaft

Shaft Nominal Diameter (mm)		Permissible Deviation of Radial Run-Out (Perpendicularity) (μm)					
Over	Up To	C0	C1	C3	C5	C7	C10
0	20	5	6	8	10	14	20
20	32	5	6	8	10	14	20
32	50	6	7	8	11	18	30

table 06 **Radial run-out of ball nut location diameter related to the centerline of screw shaft (Unit : μm)**

Shaft Nominal Diameter (mm)		Permissible Deviation of Radial Run-Out					
Over	Up To	C0	C1	C3	C5	C7	C10
-	20	5	6	9	12	20	40
20	32	6	7	10	12	20	40
32	50	7	8	12	15	30	60

table 07 **Parallelism of rectangular ball nut related to the centerline of screw shaft (Unit : μm)**

Mounting Length (mm)		Permissible Deviations of Parallelism					
Over	Up To	C0	C1	C3	C5	C7	C10
-	50	5	6	8	10	17	30
50	100	7	8	10	13	17	30

table 08 **Total run-out in radial direction of screw shaft related to the centerline of screw shaft (Unit : μm)**

Accuracy Grade		C0			C1			C3			C5			C7			C10		
Shaft Total Length	Over	-	8	12	-	8	12	-	8	12	-	8	12	-	8	12	-	8	12
	Up To	8	12	20	8	12	20	8	12	20	8	12	20	8	12	20	8	12	20
Over	Up To	Permissible Deviations of Total Run-Out In Radial Direction (Unit: μm)																	
-	125	15	15	15	20	20	15	25	25	20	35	35	35	60	55	55	100	95	90
125	200	25	20	20	30	25	20	35	35	25	50	40	40	75	65	60	140	120	110
200	315	35	25	20	40	30	25	50	40	30	65	55	45	100	80	70	210	160	130
315	400	-	35	25	45	40	30	60	50	40	75	65	55	-	100	80	-	210	160
400	500	-	45	35	-	50	40	-	65	50	-	80	60	-	120	95	-	270	200
500	630	-	50	40	-	60	45	-	70	55	-	90	75	-	150	110	-	350	250
630	800	-	-	50	-	-	60	-	-	70	-	-	90	-	-	140	-	460	320
800	1,000	-	-	65	-	-	75	-	-	95	-	-	120	-	-	170	-	-	420

Axial Play and Preload

Axial Play

Symbol and permissible value for axial play are shown in table 9.

table 09 **Symbol and permissible value for axial play**

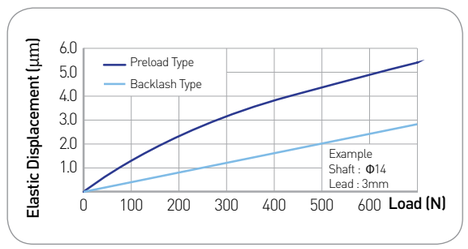
Symbol	Z	T	S	N	L
Axial Paly	0 (preloading)	0.005 max.	0.020 max.	0.050 max.	0.100 max.

Preload

Preload Effect

Preload is not only used for removing axial play, it also has the effect of reducing the amount of axial displacement due to axial load, and improving the rigidity in ball screw. Dia.2 shows the difference of the amount of elastic displacement (theoretical value) regarding ball screw with axial paly and ball screw with preload under the axial load.

Diagram 02 Elastic displacement curve comparison between backlash type and preload type



Proper Amount of Preload

Although the amount of preload should be determined by the required Rigidity and the permissible amount of backlash, when setting Preload, there are some concerning issues as follows.

- Increased Dynamic Drag Torque
- Heat Generation : lowering of positioning accuracy due to the temperature rise.
- Shortened Life

Therefore, it is advisable to establish the amount of preload at the lowest possible limits.

Preload Methods

Generally, a method of double nut preload by inserting a spacer between two nuts is adopted. KIM Co. ball screw adopts [oversized ball preload] by inserting balls slightly bigger than space between screw shaft and nut. As a result, it can eliminate axial play even with a single nut and it is possible to maintain compact. Moreover, operating performance will never be deteriorated by using spacer balls (balls with slightly smaller diameter than those of the oversize balls) alternatively with oversize balls.

Diagram 03 Preload by oversized balls

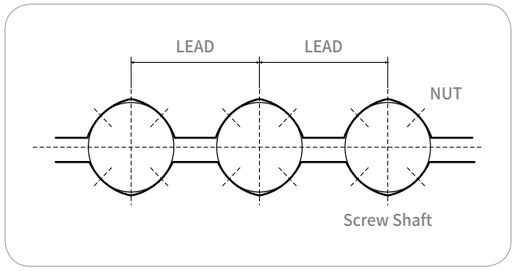
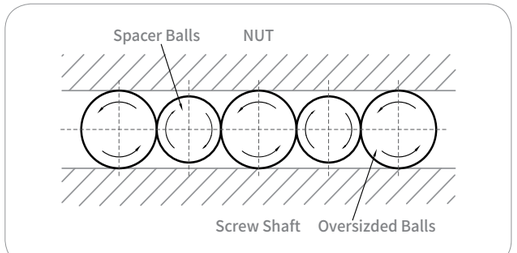


Diagram 04 Spacer balls



Design Calculation

Calculation of Permissible Axial Load

It is recommended that ball screw shafts be used almost exclusively under tension load conditions. However, in some applications, compression loads may exist, and under such conditions it must be determined that shaft buckling will not occur. Also, when the mounting span distance is short, there is a restriction on the permissible tension or compression load and the basic static load rating C_{0a} unrelated to mounting. Buckling load, permissible tension and permissible compression load can be calculated below.

$$\mathrm{P} = \mathrm{a} \times \frac{\mathrm{n}\pi^2\mathrm{E}\cdot\mathrm{I}}{\mathrm{L}^2}\ (N) \qquad \mathrm{I} = \frac{\pi}{64}\,d^4\ \ (mm^4)$$

a : Substitute safety factor = 0.5
E : Young's modulus
= 2.08 x 10^5 (N/mm^2)
d : Root diameter (mm)
L : Mounting span distance (mm)
n : Mounting factor
Supported - Supported, n = 1
Fixed - Supported, n = 2
Fixed - Fixed, n = 3
Fixed - Free, n = 1/4

Calculation of Permissible Revolution

For screw shaft rotation, the mounting method determines the established rotation limits. When this value is approached, resonance phenomenon can occur, and operation becomes impossible. There is also rotation limit which causes damages to recirculating parts. This limit is unrelated to mounting methods.

$$\mathrm{N} = \beta \times \frac{60\cdot\lambda^2}{2^\pi} \times \sqrt{\frac{E\cdot I\cdot g}{\gamma\cdot A\cdot L^4}}\ \ (RPM)$$

$$\mathrm{I} = \frac{\pi}{64}\,d^4\ \ (mm^4) \qquad \mathrm{A} = \frac{\pi}{4}\,d^2\ \ (mm^2)$$

β : Substitute safety factor = 0.8
E : Young's modulus
= 2.08 x10^5 (N/mm^2)
d : Root diameter (mm)
g : Gravity acceleration = 9.8 x 10^3 (mm/sec^2)
γ : Material specific gravity = 7.7 x 10^{-5} (N/mm^3)
L : Mounting span distance (mm)
λ : Factor for ball screw mounting method
Supported - Supported, λ = π
Fixed - Supported, λ = 3.927
Fixed - Fixed, λ = 4.730
Fixed - Free, λ = 1.875

Basic Dynamic Load Rating Ca and Basic Rating Life

The basic rating life of ball screws means the total number of revolutions which 90% of the ball screws can endure. Failure is indicated by flaking caused by rolling fatigue on the surface of grooves or balls.

These figures are valid when a group of the same type ball screws is operated individually under the same conditions. The basic dynamic load rating $\mathrm{C_a}$ is the axial load for which the basic rating life is 1,000,000 revolutions. These values are listed under $\mathrm{C_a}$ in the dimension tables. Ball screw's basic rating life $\mathrm{L_{10}}$ can be estimated using basic dynamic load rating $\mathrm{C_a}$ in the following formula.

$$L_{10} = \left(\frac{C_a}{f\cdot F_a}\right)^3 \times 10^6\ (\mathrm{rev})$$

Also, in place of the total number of revolutions, the basic rating life can be expressed in hours : L_{10h} or traveled distance : L_{10d}, and these can be calculated through the following formulas.

$$L_{10h} = \left(\frac{1}{60N}\right) \times L_{10}\,(\mathrm{hours})$$

$$L_{10d} = \left(\frac{\ell}{10^6}\right) \times L_{10}\,(\mathrm{km})$$

C_a : Basic dynamic load rating (N)
F_a : Axial load (N)
N : Revolution (rpm)
ℓ : Lead (mm)
f : Load factor
f = 1.0~1.2 : for almost no vibration, no shock condition
f = 1.2~1.5 : for slight vibration, shock condition
f = 1.5~3.0 : for severe vibration, shock condition

Generally, axial load on the most machine is not constant and it can be divided into several operating pattern. In this case, basic rating life can be calculated to figure up average axial load F_{am}, average revolution N_m in the following formula.

$$\mathrm{F}_{am} = \left(\frac{F_{a1}^{\,3}\cdot N_1\cdot t_1 + F_{a2}^{\,3}\cdot N_2\cdot t_2 + F_{a3}^{\,3}\cdot N_3\cdot t_3}{N_1\cdot t_1 + N_2\cdot t_2 + N_3\cdot t_3}\right)^{\frac{1}{3}}\ (N)$$

$$\mathrm{N}_{am} = \frac{N_1\cdot t_1 + N_2\cdot t_2 + N_3\cdot t_3}{t_1 + t_2 + t_3}\ (\mathrm{rpm})$$

table 10

Axial Load (N)	Revolution (rpm)	Working Time (%)
F_{a1}	N_1	t_1
F_{a2}	N_2	t_2
F_{a3}	N_3	t_3

Also, for axial loads which vary linearly, the average axial load F_{am} can be calculated approximately using the following formula.

$$\mathrm{F}_{am} = \left(\frac{F_{a\,min} + F_{a\,max}}{3}\right)\ (N)$$

$\mathrm{F}_{a\,min}$ = Minimum axial load (N)
$\mathrm{F}_{a\,max}$ = Maximum axial load (N)

Basic Static Load Rating C_{0a}

The basic static load rating C_{0a} is the axial static load at which the amount of permanent deformation (Ball + Raceway) occurring at the maximum stress contact point between the ball and raceway surfaces is 1/10,000 times the ball diameter. These values are listed under C_{0a} in the dimension tables. The basic static load rating C_{0a} values apply to investigation of stationary state or extremely low revolution load conditions (less than 10 rpm).

However, in most cases the amount of permanent deformation causes absolutely no problems under the general conditions. The maximum permissible load Fa max for the screw groove can be found by suing the following formula.

$$\mathrm{F}_{a\,max} = \left(\frac{C_{0a}}{f_s} \right) (N)$$

f_s : Static safety factor

f_S = 1~2 (for normal operation)

f_S = 2~3 (for vibration, shock)

Driving Torque

The feed screw system driving torque T is expressed according to the following formula.

$$T = T_1 + T_2 + T_3 + T_4 \ \ (N \cdot m)$$

T_1 : Acceleration torque $(N \cdot m)$

T_2 : Load torque $(N \cdot m)$

T_3 : Preload dynamic drag torque $(N \cdot m)$

T_4 : Additional torque $(N \cdot m)$

$T_1 \sim T_3$ can be calculated by the following formula.

$$T_1 = a \cdot I \ (N \cdot m)$$

$$a = \frac{2\pi N}{60 \cdot t} \ \ (rad/sec^2)$$

$$I = IW \cdot A^2 + I_S \cdot A^2 + I_A \cdot A^2 + I_B \ \ (kg \cdot \mathrm{m}^2)$$

$$\mathrm{I}_w = m_w \times \left(\frac{\ell}{2\pi} \right)^2 \qquad (kg \cdot \mathrm{m}^2)$$

$$\mathrm{I}_S = m_S \times \left(\frac{d^2}{8} \right) \qquad (kg \cdot \mathrm{m}^2)$$

$$m_S = \pi \times \left(\frac{d}{8} \right)^2 \times L \times \gamma \qquad (kg)$$

a : Angular acceleration (rad/sec^2)

I : Inertia moment $(kg \cdot \mathrm{m}^2)$

I_w : Inertia moment of moving object by Motor axial conversion $(kg \cdot \mathrm{m}^2)$

I_s : Inertia moment of Screw shaft $(kg \cdot \mathrm{m}^2)$

I_A : Inertia moment of gears on screw side $(kg \cdot \mathrm{m}^2)$

I_B : Inertia moment of gears on motor side $(kg \cdot \mathrm{m}^2)$

m_w : Mass of moving object (kg)

m_s : Mass of screw shaft (kg)

ℓ : Lead (m)

d : Screw shaft diameter (m)

L : Ball screw length (m)

γ : Specific gravity 7.85×10^3 $(kg \cdot \mathrm{m}^3)$

A : Reduction ratio

N : Motor speed (rpm)

t : Acceleration time (sec)

$$T_2 = \frac{P\ell \cdot A}{2\pi\eta} \times 10^{-3} = \frac{(F + \mu W)}{2\pi\eta} \cdot \ell \cdot A \times 10^{-3} \quad (N \cdot m)$$

P = Axial load (N)

F = Load (N)

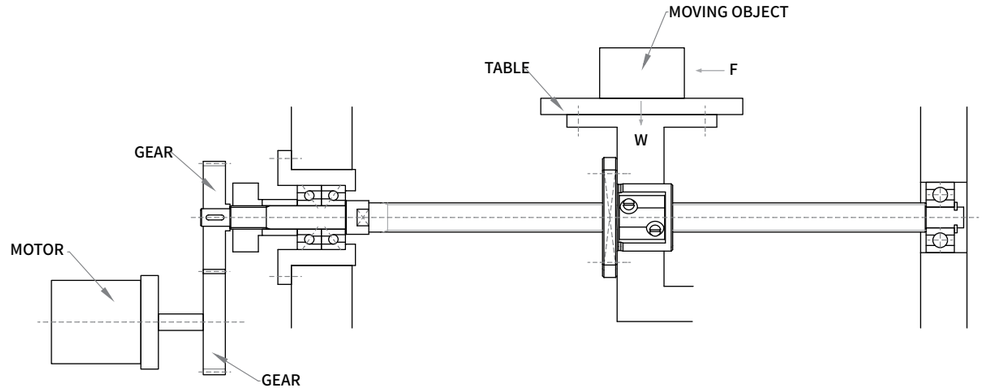
W = Weight of moving object (N)

ℓ = Lead (mm)

μ = Sliding surface friction coefficient

η = Efficient = 0.9

A = Reduction ratio



$$T_3 = 0.05 \times (\tan\beta)^{-0.5} \times \frac{F_a \cdot \ell}{2\pi} \times 10^{-3} \quad (N \cdot m)$$

P : Lead angle (deg)

F_a : Preload (N)

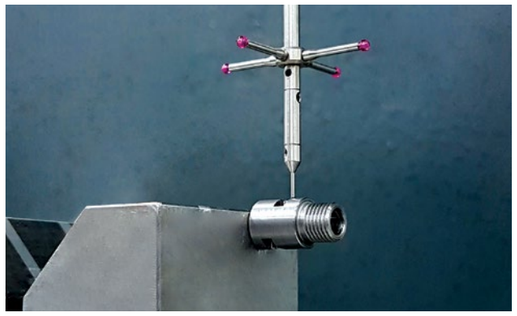
ℓ : Lead (mm)

Additional Torque T_4

Described as torque which occurs in addition to those listed above.
For example, support bearing friction torque, oil seal resistance torque, etc.

Guarantee of Reliability

Quality Management System



Cert'	AS9100D
No.	SEO6019691
Description	Design & Development and manufacture of gear box, electromechanical control systems, servo-actuators and components for aviation, defense and industries

KIM Co.'s quality management system is built up based on ISO 9001:2015 / AS 9100D. Considering clients' requirements, Inspection/test equipment are highly advanced and automated. This equipment ensures the reproducibility and reliability of inspection by preventing human error.

For the rigorous quality assurance, KIM Co. continues to perform quality assurance activities based on Military specifications (MIL-STD), AS9100, ISO9001. also, we are equipped with test & inspection equipment such as 3D CMM, gear tester, environmental chamber, and heat treatment hardness tester. In addition, we have been committed to improving the reliability of products through our performance test facilities.

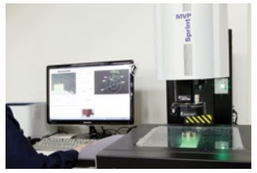
Gear / Screw Inspector

Klingelnberg (Switzland) PNC30
Spec : M (0.3~15) Dia (Φ5~300mm) Grade (DIN2)

Klingelnber (Switzland) PNC65
Spec : M (15) Dia (650) Grade (DIN2)

Tokyo Tech (Japan) TTI150H
Spec : M (0.3~10) Dia (Φ5~Φ160) Grade (DIN2)

Tokyo Tech (Japan) TTI450E
Spec : M (0.3~10) Dia (Φ5~Φ450) Grade (DIN2)



Non-Contact 3D Measuring Device
Measuring Ranges :
X = 250 mm, Y = 150 mm, Z = 150 mm

Mahr (Germany) 898D
Center Dis. (25~600mm) Grade (DIN2)

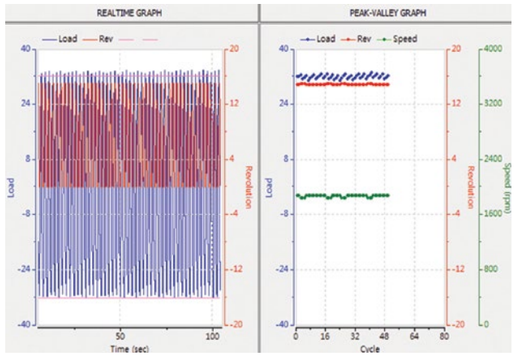
3-Axis CNC Coordinate Measuring Machine Hexagon (USA) Explorer 7105
Spec : 700×900×500

ZEISS 3D Measuring Device
Measuring Ranges : X=500 mm, Y=500 mm, Z=500 mm

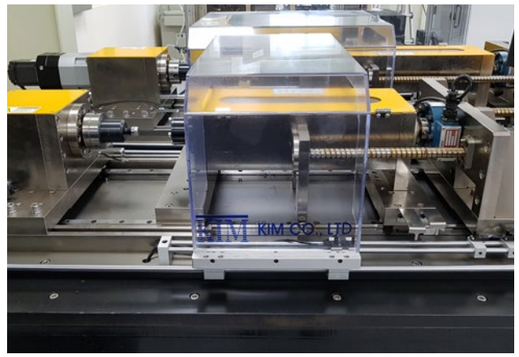
Assurance System

KIM Co.'s Ball screws are produced by the highest level of machines in the environment where the temperature is strictly managed. And we assure its quality based on the quality system that includes manufacture, assemble and test. KIM Co. tests the Ball Screws' durability, axial direction backlash and function system by using the machine below.

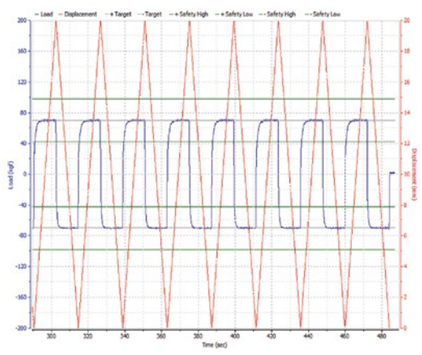
Function Test Machine



Function Test Data

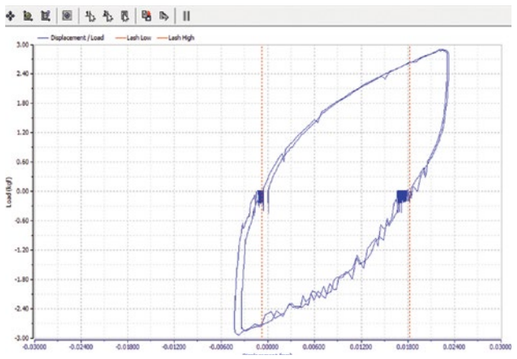


Endurance Test Machine



Endurance Test Data

Backlash Test Machine



Backlash Test Data

Product Information

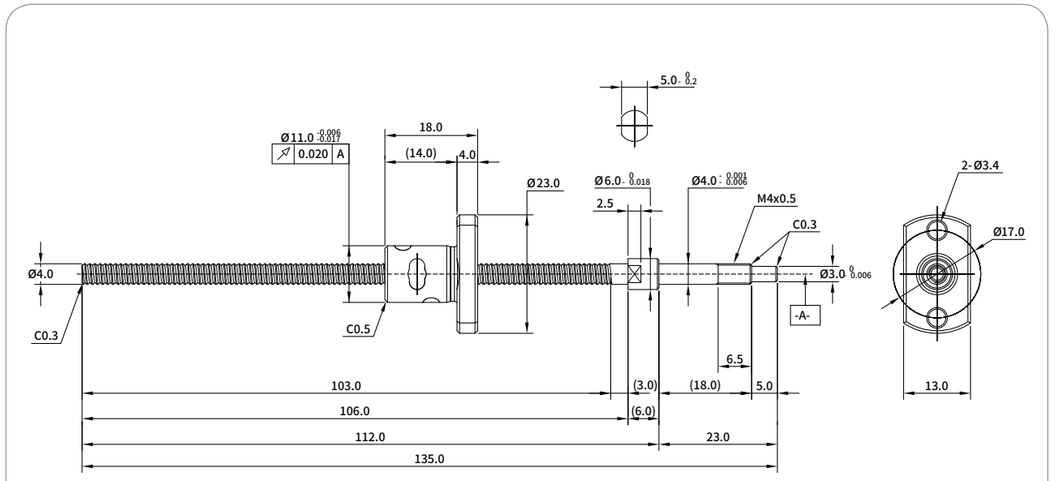
Applicable Circulation System of Each Model

KIM Co. delivers the 3 types of Ball Screw. The shown models below is the standard and you can change the specifications such as external-diameter, lead and so on.

Applicable Circulation System of Each Model	K Type	P Type	E Type
BS0401	●		
BS0501	●		
BS0601	●		
BS0602		●	
BS07.401.5		●	
BS0801	●		
BS0802	●	●	
BS1001	●		
BS1002	●	●	
BS1003		●	
BS1202		●	
BS1203	●	●	
BS1402	●		
BS1404	●		●
BS1602	●		
BS2005	●		●

Standardized Ball Screw

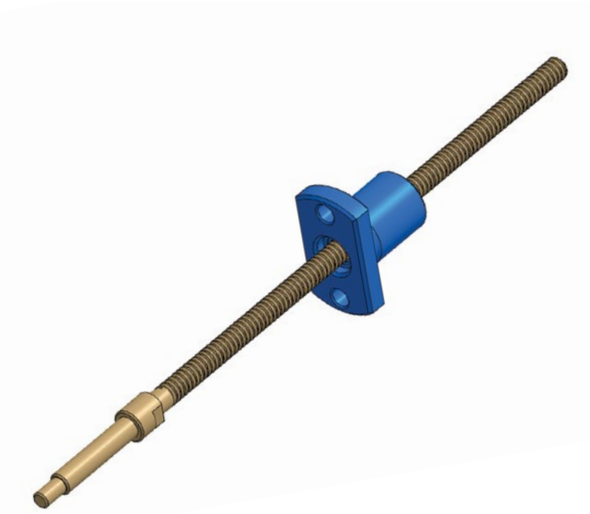
BS0401RKS-C5T



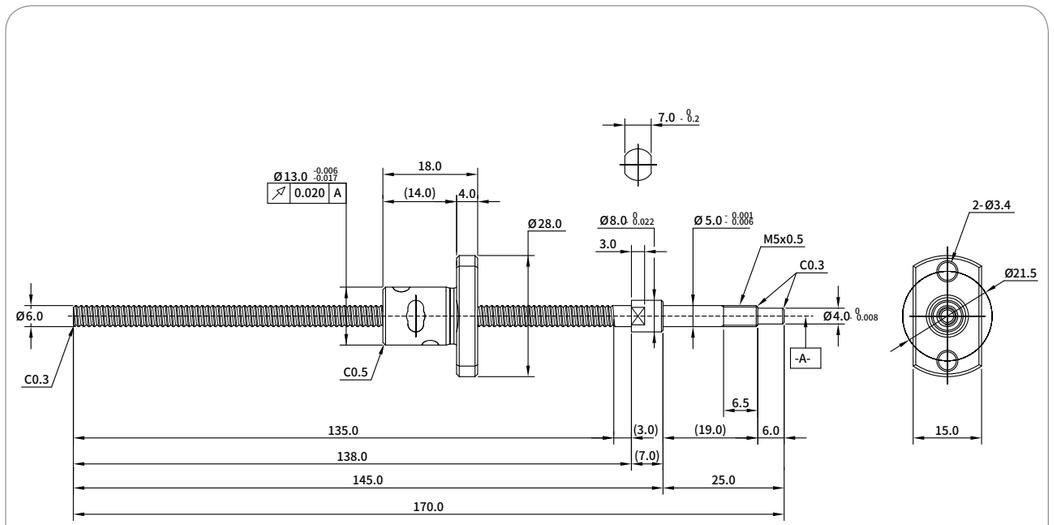
Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
86	C5	±0.020	0.018	570	790	~0.005

Specification of Ball Screw

Diameter (mm)	4
Lead (mm)	1
Grade	C5T
Diameter of Ball (mm)	0.8
Number of Loaded Turn	1 × 4
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type



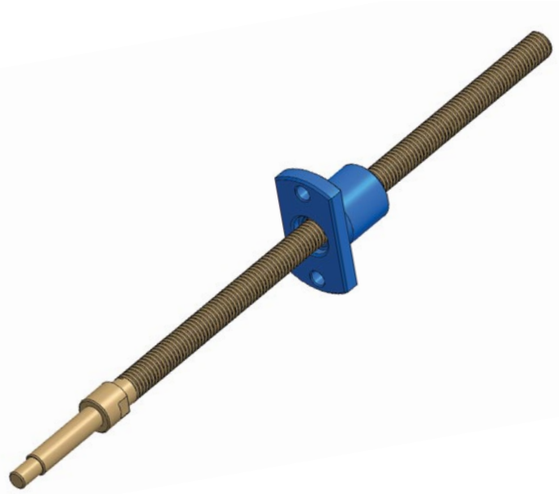
BS0601RKS-C5T



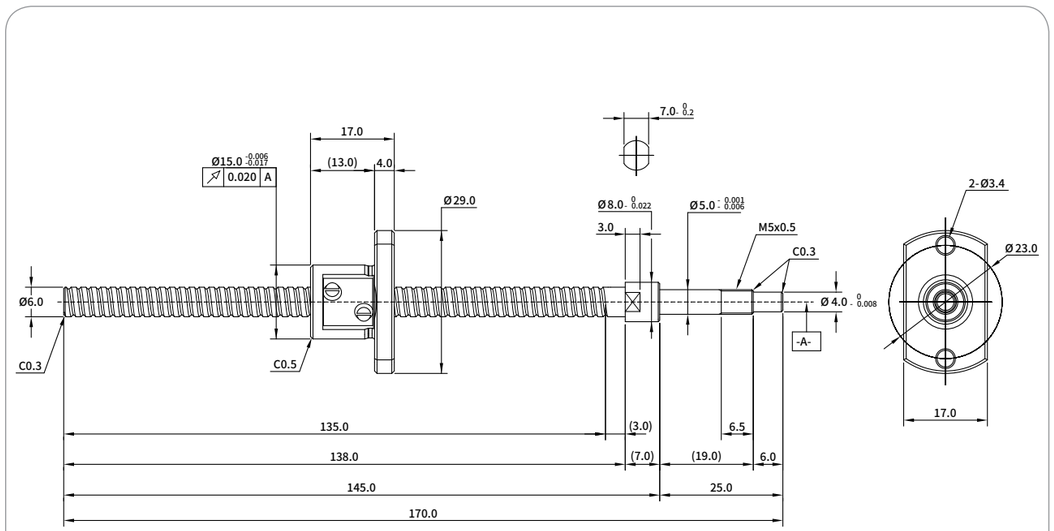
Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
117	C5	±0.020	0.018	670	1,210	~0.005

Specification of Ball Screw

Diameter (mm)	6
Lead (mm)	1
Grade	C5T
Diameter of Ball (mm)	0.8
Number of Loaded Turn	1 × 4
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type



BS0602RPS-C5T

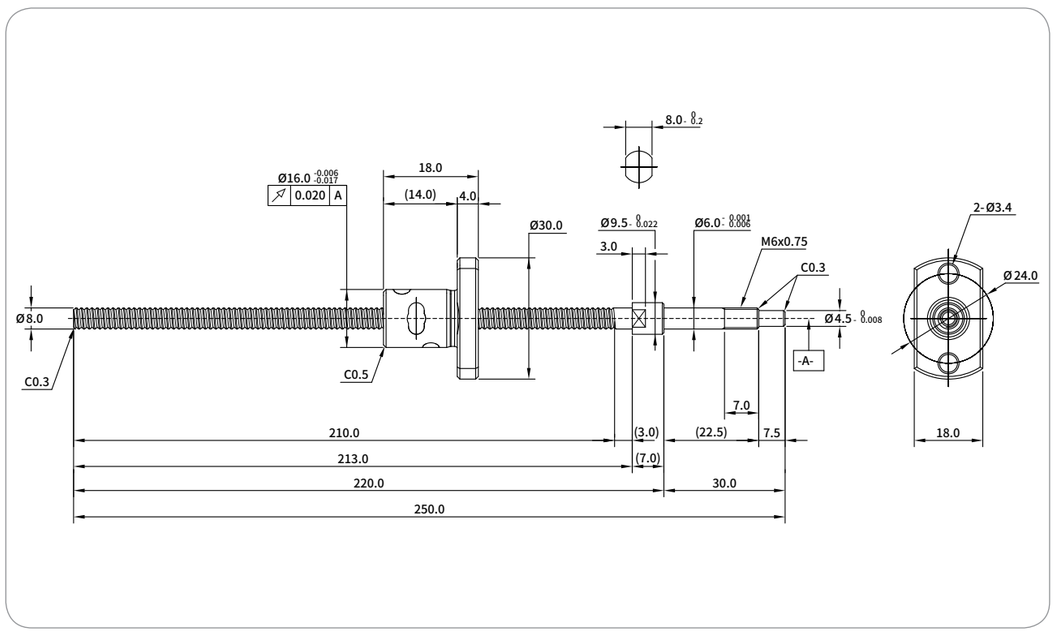


Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
118	C5	±0.020	0.018	755	1,210	~0.005

Specification of Ball Screw

Diameter (mm)	6
Lead (mm)	2
Grade	C5T
Diameter of Ball (mm)	1.0
Number of Loaded Turn	2.7 × 1
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Return-Plate Type

BS0801RKS-C5T

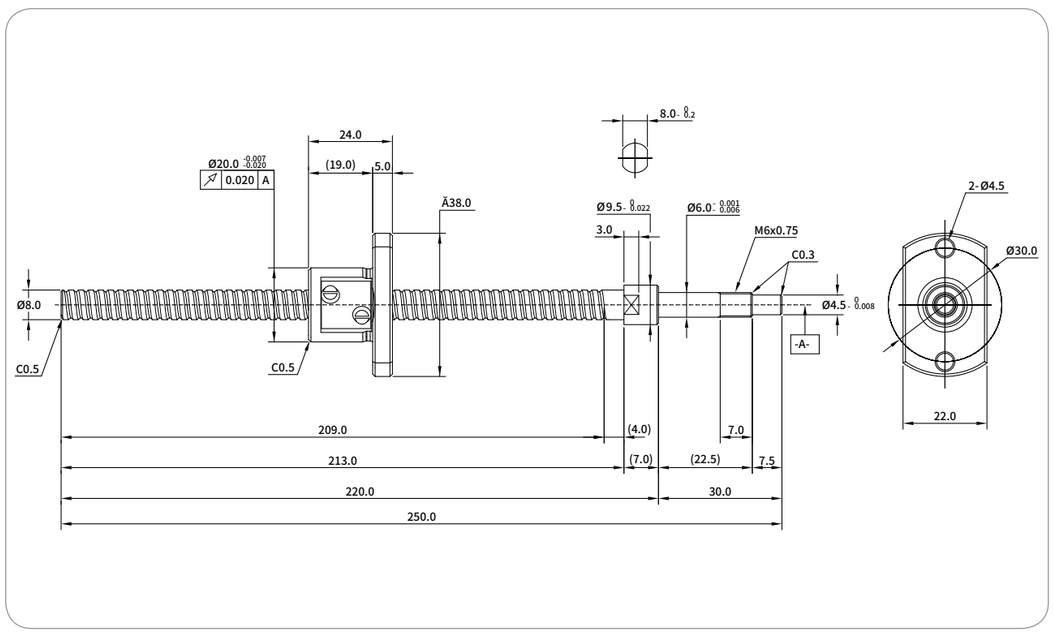


Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
192	C5	±0.023	0.018	770	1,600	~0.005

Specification of Ball Screw

Diameter (mm)	8
Lead (mm)	1
Grade	C5T
Diameter of Ball (mm)	0.8
Number of Loaded Turn	1 × 4
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type

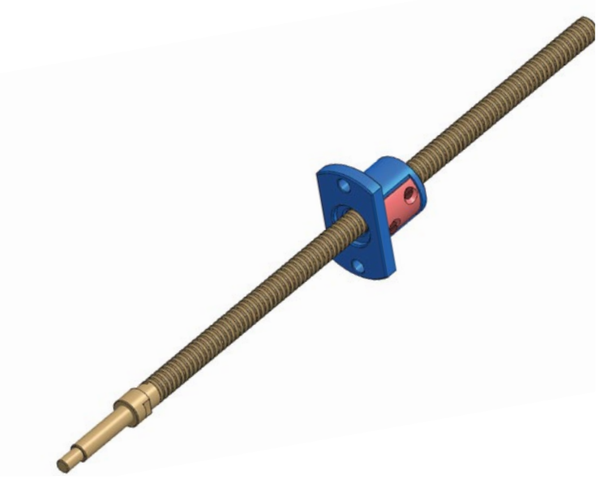
BS0802RPS-C5T



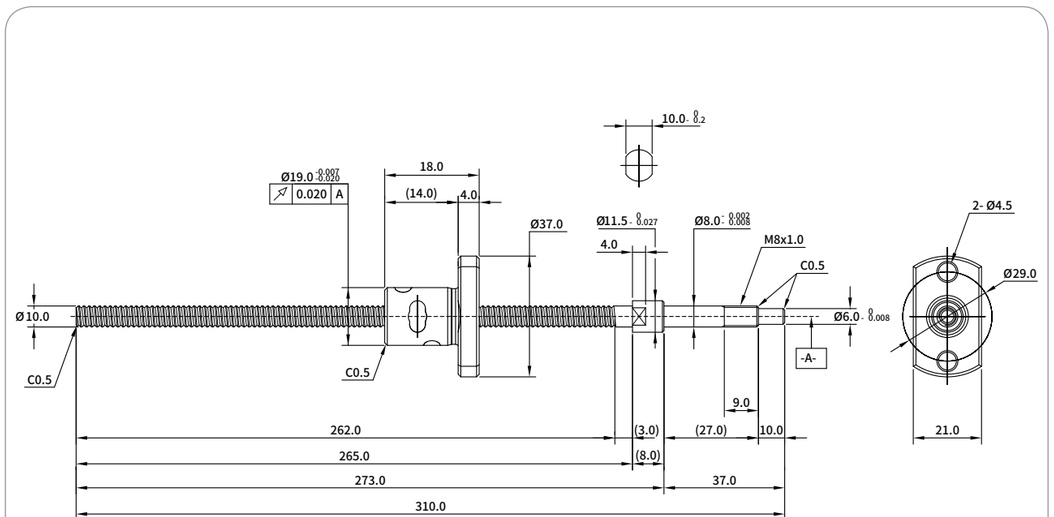
Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
185	C5	±0.023	0.018	2,300	4,000	~0.005

Specification of Ball Screw

Diameter (mm)	8
Lead (mm)	2
Grade	C5T
Diameter of Ball (mm)	1.5875
Number of Loaded Turn	3.7 X 1
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Return-Plate Type



BS1001RKS-C5T

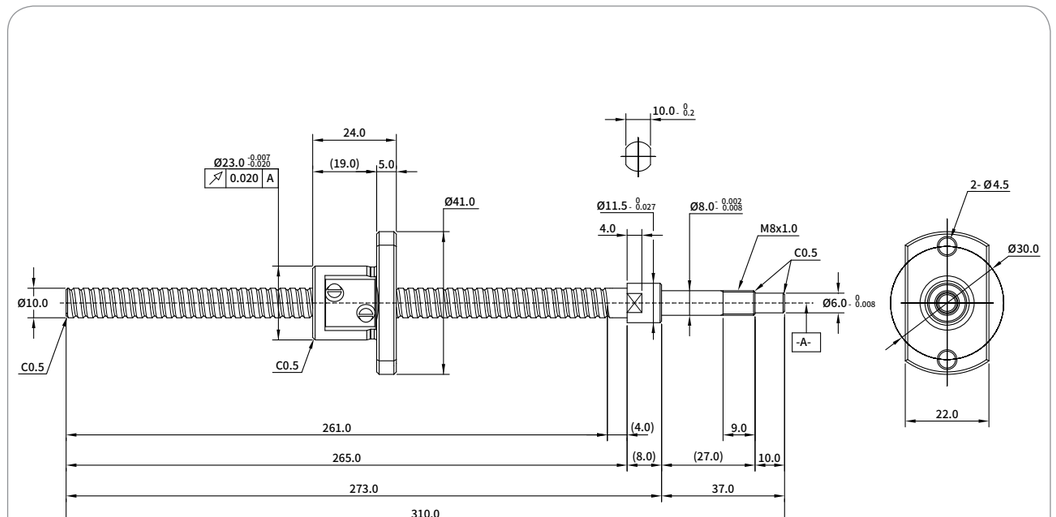


Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
244	C5	±0.023	0.018	850	2,100	~0.005

Specification of Ball Screw

Diameter (mm)	10
Lead (mm)	1
Grade	C5T
Diameter of Ball (mm)	0.8
Number of Loaded Turn	1 × 4
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type

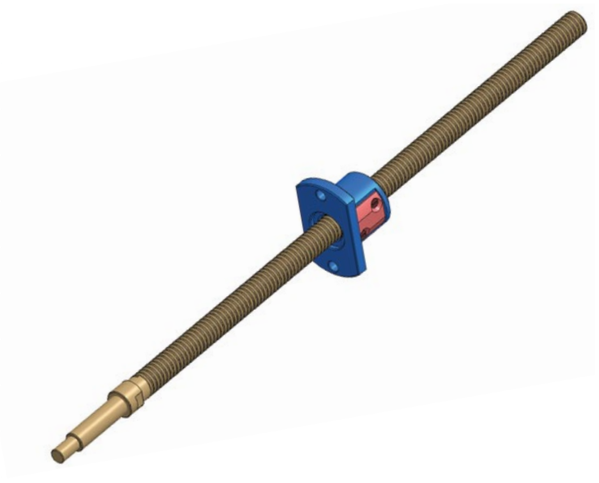
BS1002RPS-C5T



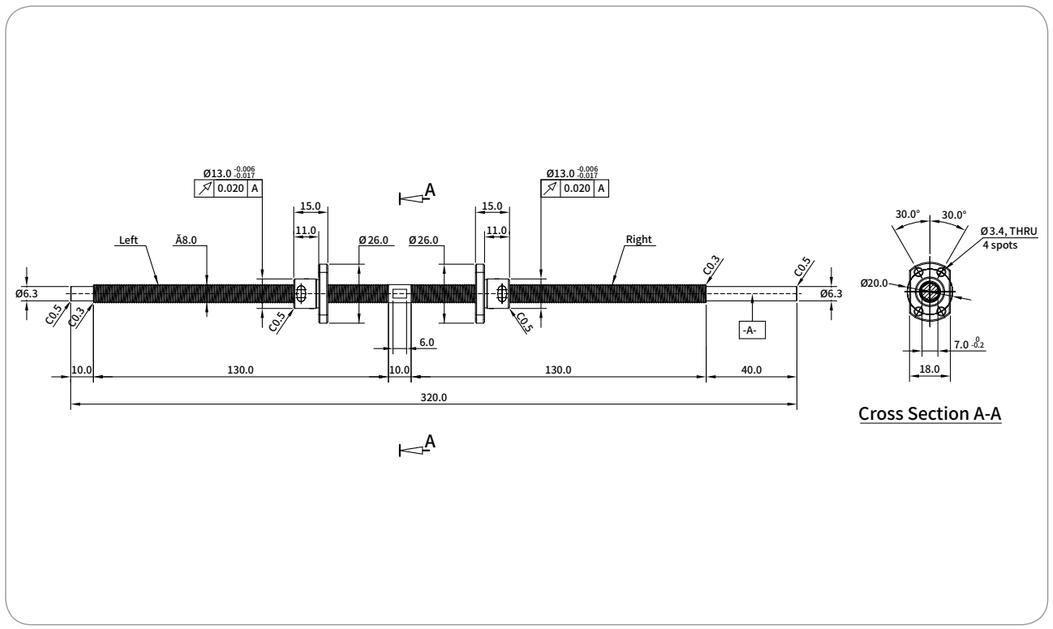
Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
237	C5	±0.023	0.018	2,710	5,310	~0.005

Specification of Ball Screw

Diameter (mm)	10
Lead (mm)	2
Grade	C5T
Diameter of Ball (mm)	1.5875
Number of Loaded Turn	3.7 × 4
Direction	Right
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Return-Plate Type



BS0801BKD-C5T

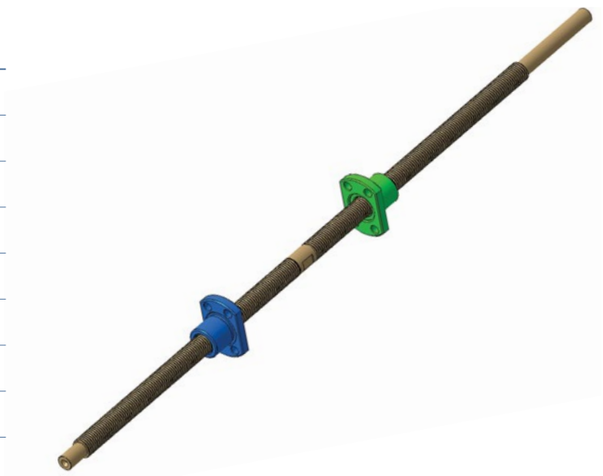


Cross Section A-A

Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
115	C5	±0.020	0.018	660	1,200	~0.005

Specification of Ball Screw

Diameter (mm)	8
Lead (mm)	1
Grade	C5T
Diameter of Ball (mm)	0.8
Number of Loaded Turn	1 × 3
Direction	Right and Left
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type



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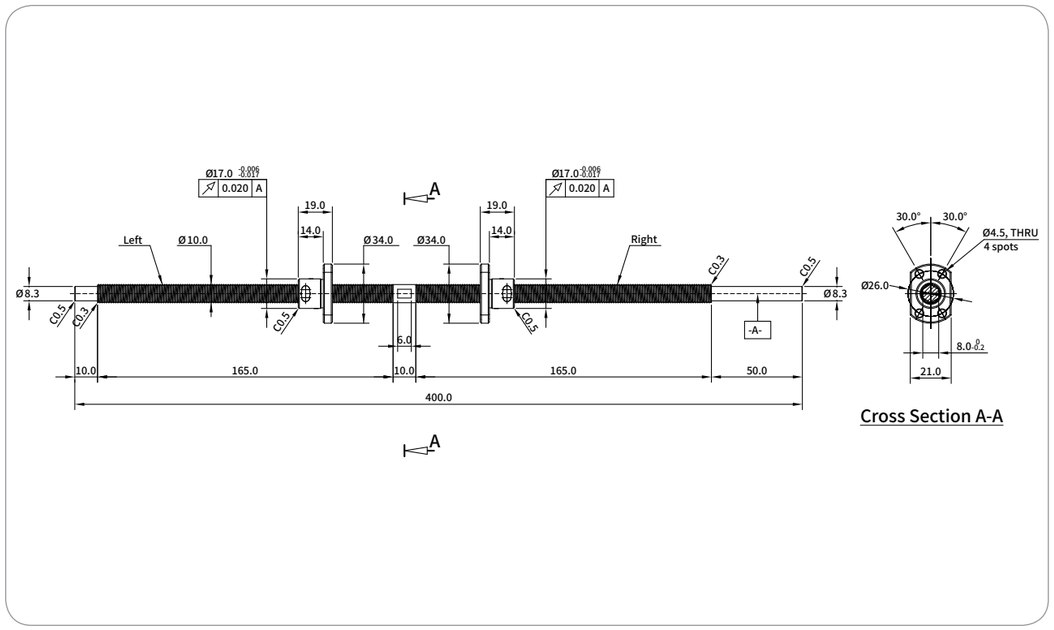


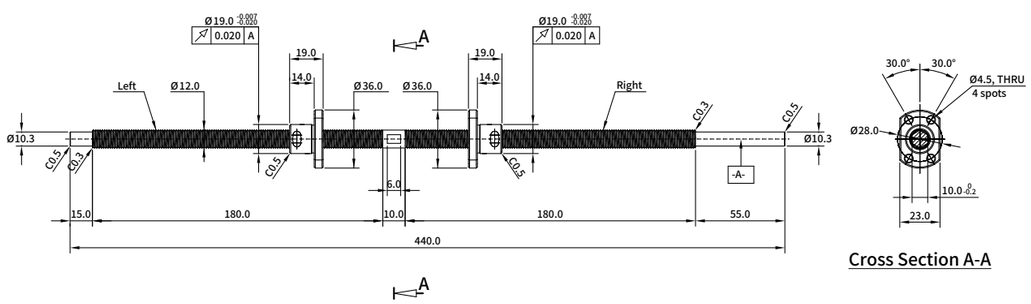
Cross Section A-A

Stroke (max.)	Grade	Lead Grade		Basic load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
145	C5	±0.020	0.018	1,200	2,600	~0.005

Specification of Ball Screw

Diameter (mm)	10
Lead (mm)	2
Grade	C5T
Diameter of Ball (mm)	1.5875
Number of Loaded Turn	1 × 3
Direction	Right and Left
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type

BS1202BKD-C5T

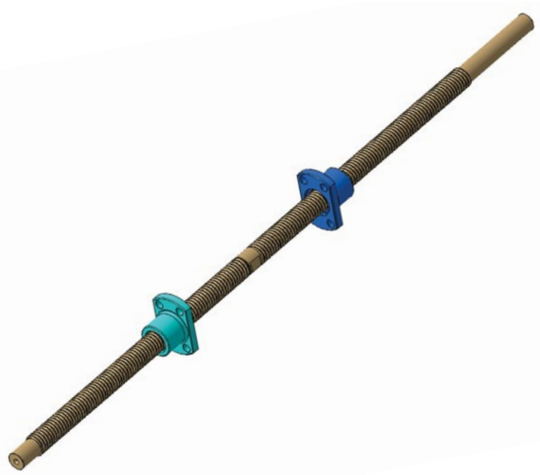


Cross Section A-A

Stroke (max.)	Grade	Lead Grade		Basic Load (N)		Backlash
		Actual Mean Travel Deviation e_p	Travel Variation V_u	Dynamic Load C_a	Static Load C_{0a}	
160	C5	±0.020	0.018	1,500	3,500	~0.005

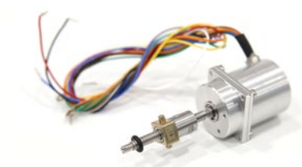
Specification of Ball Screw

Diameter (mm)	12
Lead (mm)	2
Grade	C5T
Diameter of Ball (mm)	1.5875
Number of Loaded Turn	1 × 3
Direction	Right and Left
Number of Thread	1
Hardness	HRC58~62 (Tread Area)
Circulation	Internal-Deflector Type



Examples of Customized Ball Screw

The great flexibility of KIM Co.'s Ball Screw means we can make various types of products that customer requested as shown in the examples below.



Dia	Lead	Backlash	Grade
Ø 4	1 mm	~0.03 mm	C5

Dia	Lead	Backlash	Grade
Ø5	1 mm	~0.03 mm	C5

Dia	Lead	Backlash	Grade
Ø 6	2 mm	~0.01 mm	C5

Dia	Lead	Backlash	Grade
Ø 6	1 mm	~0.005 mm	C5

Dia	Lead	Backlash	Grade
Ø 7.4	1.5 mm	~0.005 mm	C5

Dia	Lead	Backlash	Grade
Ø 10	2 mm	~0.01 mm	C5

Dia	Lead	Backlash	Grade
Ø 10	3 mm	~0.005 mm	C5

Dia	Lead	Backlash	Grade
Ø10	3 mm	~0.05 mm	C7

Service Range

KIM's Enjoyable Challenge for Moving the World

We design innovative and challenging research and development for precision driving technology.

KIM Co. delivers from Designing to Maintaining. We focused on the highest quality and technological improvements through the joint research, mutual growth with national and international defense companies and precision driving system companies based on a global network. Our objective is to help customers improve productivity and get solutions.

KIM CO.,LTD.
THE GLOBAL LEADER OF MECHANICAL ENGINEERING SOLUTION

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Gyeongsangnam-do, Republic of KOREA
Tel +82-55-251-0261 **Fax** +82-55-251-2520
Website www.kimm.co.kr **E-mail** gear@kimm.co.kr

Ball Screw Application Configuration Worksheet

Company Name

Contact

Load & Life Requirements

Extension Max Load		lbf, kN
Extension Mean Load		lbf, kN
Retraction Max Load		lbf, kN
Retraction Mean Load		lbf, kN
Static Load Max		lbf, kN
Cycle Rate		cycles per min, hour, day
Operating Hours per Day		
Operating Days per Week		
Life Requirement		Total #cycles, #days, #years

Stroke & Speed Requirements

Maximum Stroke		inches, mm
Maximum Speed		inches, mm per second
Minimum Speed		inches, mm per second
Accuracy Grade		inches, mm

(Standard Accuracy Grade is C5T for KIM Co.'s Ball Screw)

Stroke & Speed Requirements

Application?	
Special Nut Features?	
Include Motors?	
Others?	

Please fill in and E-mail (gear@kimm.co.kr) to be contacted by a KIM Co. sales engineer.

Scan QR code
with your smartphone

www.kimm.co.kr

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Gyeongsangnam-do, Republic of KOREA

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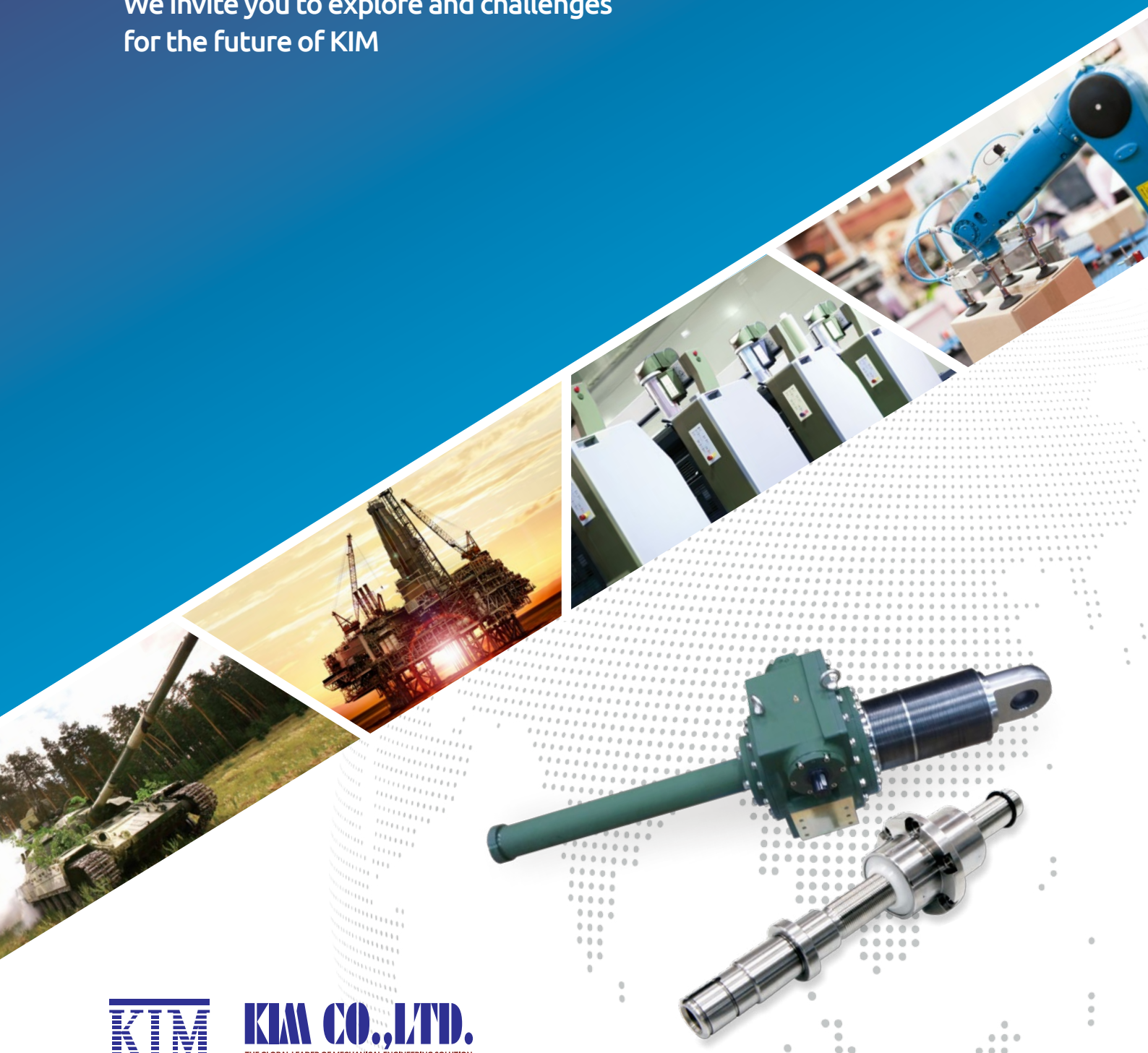
Miniature Ball Screw © KIM Co., Ltd. June 2018 **Vol.01**

Planetary
Roller Screw

We invite you to explore and challenges
for the future of KIM



KIM

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KIM Co., Ltd.

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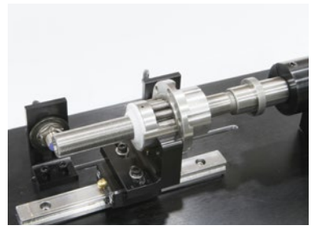
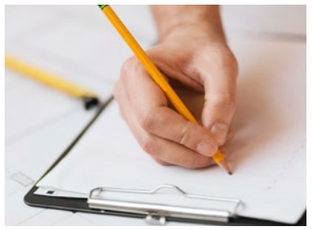


Service
Range

25



Application
Configuartion
Worksheet

The Global Leader of Mechanical Engineering Solution

KIM Co., Ltd.

As a result of continuous investment in R&D on precision gears for decades, KIM Co. has grown to a specialist in driving device.

From designing, manufacturing to solution offer, KIM Co. can serve everything customers require with simple specification provided.

Applications


Defense Industry


Telescopes


Robotics


Servo Presses

Medical


Aeronautics


Chemical Industry


Fields of High Technology

Product Overview

Planetary roller screw converts rotary motion to linear movement. Planetary roller screw system consists of a main screw and several number of planetary rollers and a internal thread.

Features

A planetary roller screw is a mechanism for converting rotary torque into linear motion and capable of carrying heavy loads.

KIM Co.'s planetary roller screws provide high speeds, high stiffness and shock load resistance. This makes many attractive choice instead of hydraulic or pneumatic motion.

High Load Rating, Long Life

Roller screw pitch is very small, heavy load is possible and life is long. Because the contact area between shaft and nut is a very large without a lead.

Shock Resistance

The shock resistance is very high because it has a large contact area between shaft and nut.

Smooth Rotation

Roller screw has not a ball tube for return such as a ball screw, so rotation is very smooth, jam is very few.

High Speed, High Acceleration

None cyclic planetary roller screw is a multi screw. It has a large lead, high-speed transfer is possible. Since the rotation is more stable, it can be high acceleration and it is very suitable for frequent round movement and stop transfer.

Environmental Resistance

None cyclic planetary roller screw is capable of correct operation even in adverse conditions (dust contamination or lack of lubrication, etc.) than the ball screw so that the rollers always in contact with the rotating shaft.

Planetary Roller Screw

Roller screws convert rotational motion to linear motion, or vice versa. KIM Co. can deliver roller screws with G3-G9 precision that its diameter starts from 3mm to 1,000mm.

The Difference between Planetary Roller Screw and Ball Screw

Planetary roller screw system is similar to ball screw, but the difference is load transfer elements are threaded rollers. The main advantage of planetary roller screw is a high number of contact to support the load. The high number of contact points enables to support very heavy loads, and gives many strong points compared to other devices on table 1.

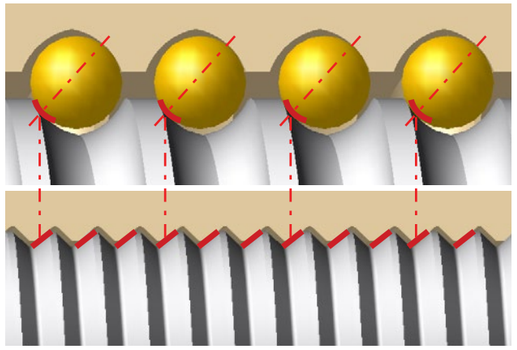


table 01 **The strong point of planetary roller screw compared to other devices**

No.	Items	Planetary Roller Screw	Ball Screw	Acme Screw	Hydraulic Cylinders	Pneumatic Cylinders
1	Load Capacity	Very High	High	High	Very High	High
2	Life Span	Very Long (10 × Ball Screw)	Moderate	Very Low	Long with Good Maintenance	Long with Good Maintenance
3	Speed	Very High (5,000 Rpm)	Moderate (2,000 Rpm)	Low	Moderate	Very High
4	Acceleration	Very High	Moderate	Low	Moderate	Very High
5	Positioning Control	Very Easy	Very Easy	Moderate	Difficult	Very Difficult
6	Rigidity & Strength	Very High	Moderate	Moderate	Very High	Very Low
7	Shock Loads	Very High	Moderate	Very High	Very High	Very Low
8	Space Requirement	Minimum	Moderate	Moderate	High	High
9	Friction	Low	Low	High	High	Moderate
10	Efficiency	> 90%	> 90%	< 40%	< 50%	< 50%
11	Lead & Pitch	Wide Range (Min 0.25)	Limited	Wide Range	Limited	Limited
12	Installation	Easy	Easy	Moderate	Difficult	Very Difficult
13	Maintenance	Very Row Cost	Moderate	High Cost	Very High	High
14	Environment	Good	Good	Good	Oil Leaks & Disposal	High Noise Levels

Design Guidelines

Identification System

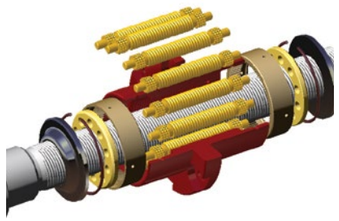
①	②	③	④	⑤	⑥		⑦	⑧
SG	20	03	CL	SN	R	–	1	G5

① Roller Screw Type : SG, RG, IG
② Normal Screw Diameter (mm)
③ Screw Lead (mm)
④ Connecting Type : CL, FF, RF
⑤ Nut Type : SN, PN, DN
⑥ Lead Direction : R, L, B
⑦ Seal : 1. With Seal, 2. Without Seal
⑧ Thread Accuracy : G1, G3, G5, G9

Types of Planetary Roller Screw

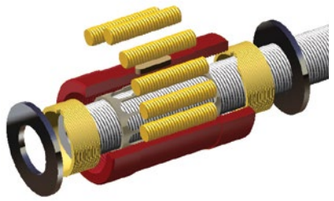
Satellite Type : SG

The main elements of SG are main screw, planetary roller screw, nut. The gear teeth in planetary roller screws engage in internal gears fixed nut. This guides the rollers parallel to the axis to ensure perfect function between each parts.
SG type operate without recirculation and give high reliability and speed capability, but low noise. SG type is useful to apply for big lead and heavy duty load.



Recycling Type : RG

The main elements of RG are fine threaded main screw, nut, and grooved roller screw. The rollers move to axially within the nut and return to started position. RG type is suitable for fine pitch and compact space. The small lead and angle can provide a low back driving torque or self locking function according to requirement.



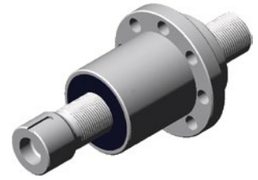
Inverted Type : IG

The principle is same to SG type, but nut system is reversed. The gear teeth in planetary roller screw engage in main screw gear teeth. The nut is thread along it's entire length and is much longer than SG type. IG type operate without recircuation and give design flexibility. Guiding and sealing functions easily integrated on nut or shaft. Non rotating and translating component acting directly as the push tube.

Types of Connecting

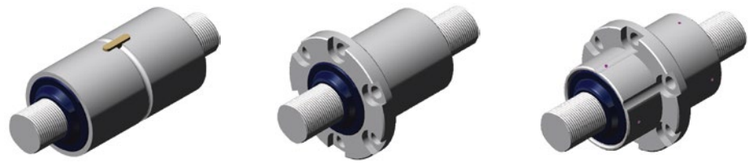
Cylindrical with Key : CL

Flat-Sided Flange : FF

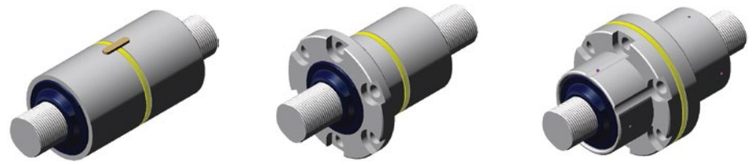


Round Flange : RF

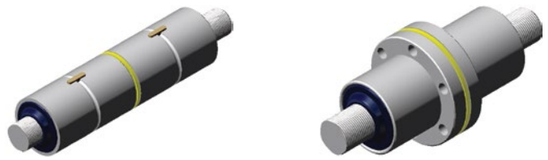
Single Nut
Nut is one piece with standard axial backlah



Split Nut
Nut is two pieces preloaded and without backlash



Double Nut
Two single nuts, preloaded and without backlash



Design Guidelines

Accuracy Tolerance according to Quality Grade

Lead Error

KIM Co.'s planetary roller screws are produced in quality classes according to ISO 1, 3 and 5 standard. Positioning control purposes are supplied in tolerance asses of G1, G3, G5 and transport purposes in G9. Industry standard is G5 tolerance unless otherwise specified.

table 02 Accuracy grade

Accuracy Grade	V300p
G1	6μm / 300mm
G3	12μm / 300mm
G5	23μm / 300mm
G9	200μm / 300mm

Here,

V300p = Maximum permitted travel variation over 300mm
V300a = Measured travel variation over 300mm

Accuracy tolerance base on DIN69051

Diagram 01 Definition of lead error measurement

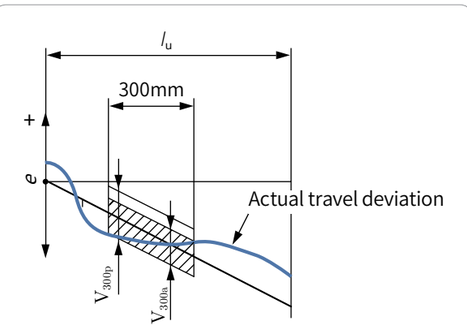


table 03 Accuracy tolerance

Lu(mm)		Ep(μm)		
From	to	G1	G3	G5
	315	6	12	23
315	400	7	13	25
400	500	8	15	27
500	630	9	16	30
630	800	10	18	35
800	1,000	11	21	40
1,000	1,250	13	24	46
1,250	1,600	15	29	54

Here,
Lu : Effective travel(mm)
Ep : Difference between required lead and nominal lead(μm)

Accuracy Tolerance according to Quality Grade

Outside Tolerance of roller screw correspond in standard of ISO3408-3

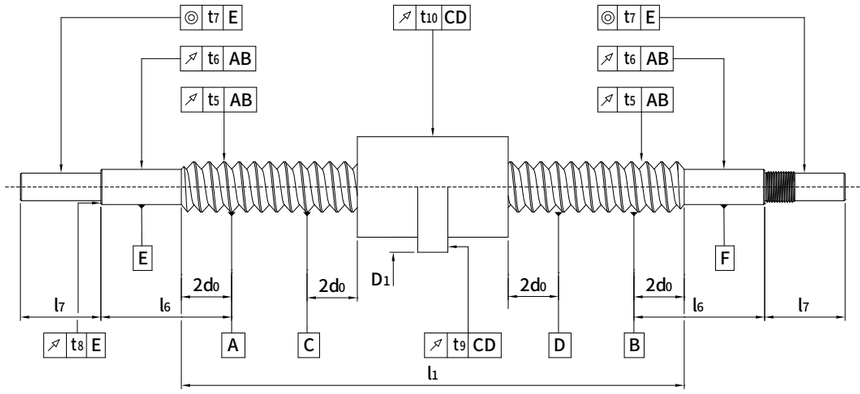


table 04 Outside tolerance of class G1

Nominal Diameter d0(mm)	Threaded Length l1(mm)	Within Threaded Length t5 (μm)	Over Threaded Length		t6 (μm)	t6 Min. (μm)	t7 (μm)	t7 Min. (μm)	t8 (μm)	t9 (μm)	t10 (μm)
			l1/d0	t5 (μm)							
6 ~ 12	320	20	≤ 40	40	0.12 × L6	10	0.06 × L7	5	3		
12 ~ 20	640	20	≤ 60	60	0.12 × L6	10	0.06 × L7	6	3	10	10
20 ~ 25	640	20	≤ 60	60	0.10 × L6	12	0.05 × L7	8	3	10	10
25 ~ 32	1,260	20	≤ 80	60	0.10 × L6	12	0.05 × L7	8	3	10	10
32 ~ 50	1,260	20	≤ 80	100	0.10 × L6	12	0.05 × L7	8	3	12	12
50 ~ 63	2,520	20	≤ 100	100	0.08 × L6	16	0.05 × L7	8	3	12	12
63 ~ 100	2,520	20	≤ 100	160	0.08 × L6	16	0.04 × L7	8	4	16	16
100 ~ 125	5,000	20			0.08 × L6	16	0.04 × L7	8	4	16	16
125 ~ 200	5,000	20								20	20
200 ~ 250										20	20
250 ~ 500											

Design Guidelines

table 05 **Outside tolerance of class G3**

Nominal Diameter d0(㎜)	Threaded Length l1(㎜)	Within Threaded Length t5 (㎛)	Over Threaded Length		t6 (㎛)	t6 min. (㎛)	t7 (㎛)	t7 min. (㎛)	t8 (㎛)	t9 (㎛)	t10 (㎛)
			l1/d0	t5 (㎛)							
6 ~ 12	320	25	≤ 40	50	0.15 × L6	12	0.08 × L7	6	4		
12 ~ 20	640	25	≤ 60	75	0.15 × L6	12	0.08 × L7	6	4	12	12
20 ~ 25	640	25	≤ 60	75	0.15 × L6	16	0.06 × L7	8	4	12	12
25 ~ 32	1,260	25	≤ 80	125	0.15 × L6	16	0.06 × L7	8	4	12	12
32 ~ 50	1,260	25	≤ 80	125	0.13 × L6	16	0.06 × L7	8	4	16	16
50 ~ 63	2,520	25	≤ 100	200	0.10 × L6	16	0.05 × L7	10	4	16	16
63 ~ 100	2,520	25	≤ 100	200	0.10 × L6	20	0.05 × L7	10	5	20	20
100 ~ 125	5,000	25			0.08 × L6	20	0.05 × L7	10	5	20	20
125 ~ 200	5,000	25			0.08 × L6	25	0.04 × L7	12	6	25	25
200 ~ 250										25	25
250 ~ 500										32	32

table 06 **Outside tolerance of class G5**

Nominal Diameter d0(㎜)	Threaded Length l1(㎜)	Within Threaded Length t5 (㎛)	Over Threaded Length		t6 (㎛)	t6 min. (㎛)	t7 (㎛)	t7 min. (㎛)	t8 (㎛)	t9 (㎛)	t10 (㎛)
			l1/d0	t5 (㎛)							
6 ~ 12	320	32	≤ 40	64	0.25 × L6	20	0.10 × L7	8	5		
12 ~ 20	640	32	≤ 60	96	0.25 × L6	20	0.10 × L7	8	5	16	16
20 ~ 25	640	32	≤ 60	96	0.20 × L6	25	0.08 × L7	10	5	16	16
25 ~ 32	1,260	32	≤ 80	160	0.20 × L6	25	0.08 × L7	10	5	16	16
32 ~ 50	1,260	32	≤ 80	160	0.20 × L6	25	0.08 × L7	10	5	20	20
50 ~ 63	2,520	32	≤ 100	256	0.16 × L6	32	0.06 × L7	12	5	20	20
63 ~ 100	2,520	32	≤ 100	256	0.16 × L6	32	0.06 × L7	12	6	25	25
100 ~ 125	5,000	32			0.16 × L6	32	0.06 × L7	12	6	25	25
125 ~ 200	5,000	32			0.13 × L6	40	0.05 × L7	16	8	32	32
200 ~ 250										32	32
250 ~ 500										40	40

Lubrication

Generally, oil and grease lubricant are used for planetary roller screws. Proper lubrication is very important for good function of a planetary roller screw. Lubrication service must be proceeded according to service manual.

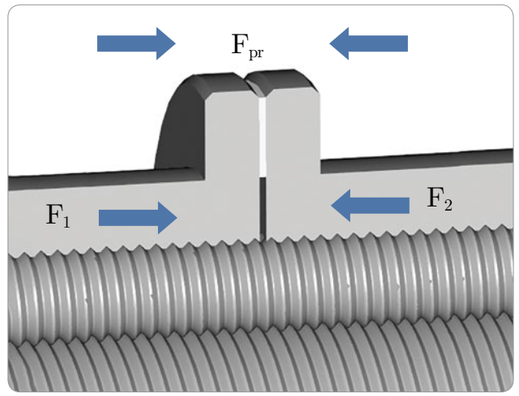
Oil Lubrication

A recirculating lubrication system is ideal due to its good ability proper filtering system and temperature control, oil flowrate control are very important to continue long life. The suitable lubricating oil is a mineral base with EP additives to enhance resistance to aging and corrosion protection in compliance with DIN 51517 part 2. Operating speed, ambient temperature and operating temperature are all factors in determining the required viscosity of the lubricant. The required volume depends on the screw diameter, the number of supporting rollers and the amount of heat to be dissipated. The operating temperature of standard steel under normal operating condition is -20°C ~ +110°C. Above +110°C or below -20°C, please consult KIM Co. technical part for advice.

Grease Lubrication

Grease is the most common lubricating system for planetary roller screws. The viscosity of grease is rated with ISO VG levels just as oils and grease type is according to DIN 51825 part 3. Regressing interval depend on the screw arrangement, size and operating conditions. The operating temperature range is -50°C ~ 120°C under normal operating condition. Over above specification, please consult KIM Co. technical part for advice.

Axial Play and Preloading



The axial play of standard roller screws are 0.02~0.03mm. But maximum axial play is depending on model size.

Roller screws can be manufactured without axial play by preloaded nuts to eliminate thread backlash and increase rigidity. Best preloading force can be calculated to achieve the highest rate of efficiency and the longest lifetime.

If the customer needs no axial play, all detail data can be informed to operate best condition.

Calculation Example

Model Selecting

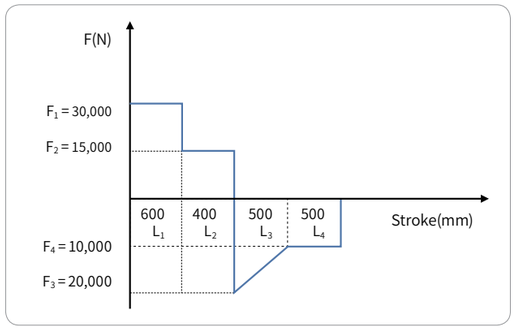
① Specification of roller screw

- d0 : Nominal diameter = 30 (mm)
  d1 = 30.63 (mm)
  d2 = 29.01 (mm)
- PL: Lead = 10 (mm)

② Operating speed

- S : Stroke = 1,000 (mm)
- T : Time per stroke = 30 (sec)
- N : Speed = $\frac{60 \cdot S}{P_L \cdot T} = \frac{60 \times 1{,}000}{10 \times 30} = 200\ (\mathrm{RPM})$
- Load cycle

Diagram 02 Load cycle



- Operating time
  1 cycle/60(sec) = 60 cycle/hr.
  4 hr/day, 100 days/year, 5 years
  L10, min = 60×4×100×5
  = 120,000 cycles

③ Calculation of dynamic load

- Equivalent mean load : Fm

table 07 **Mean load**

Load (N)	Stroke Length (mm)
F1 = 30,000	L1 = 600
F2 = 15,000	L2 = 400
F3 = 20,000	L3 = 500
F4 = 10,000	L4 = 500

$$F3m = \frac{2F_3 + F_4}{3}$$

$$= 16{,}667\ (\mathrm{N})$$

$$Fm = \sqrt[3]{\frac{\Sigma Fi^3 \times Li}{\Sigma Li}}$$

$$= 21{,}675\ (\mathrm{N})$$

$$L10 = L10,\ \min \times \frac{\sum Li}{P_L}$$

$$= 120{,}000 \times \frac{600+400+500+500}{10}$$

$$= 24 \times 10^6\ \text{revolutions}$$

Requirement of minimum dynamic load

$$Ca,\ req = Fm(L_{10})^{1/3}$$

$$= 21{,}675(24)^{1/3}$$

$$= 62{,}522\ (\mathrm{N})$$

$$= 62.5\ (\mathrm{KN})$$

Checking on table, select model

SG30×10
Ca = 89.9 (KN) > Ca, req = 62.5 (KN)

This model is satisfied with the requirement of minimum dynamic load capacity.

Critical Speed

The critical speed of screw shaft is calculated as followings.

$$n_{cr} = \frac{f_1 \cdot d_0 \cdot 10^7}{L^2}$$

$$= \frac{16.7 \times 30 \times 10^7}{1{,}050^2} = 4{,}544\ (\mathrm{RPM})$$

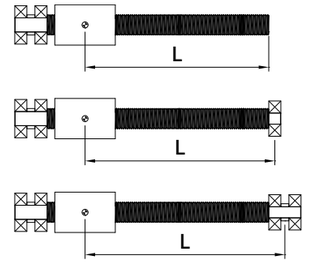
Here, n_{cr} : Critical speed of screw shaft (RPM)
f1 : End support stiffness factor
d0 : Screw nominal diameter (mm)

End support stiffness factor f1

Fixed - free
f1 = 3.5

Fixed – supported
f1 = 16.7

Fixed – fixed
f1 = 24.2



Efficiency

The efficiency is dependent on its operating parameters. The efficiency calculation is as followings.

$$\eta = \frac{1}{1 + \frac{\pi \cdot d_0}{P_L} \cdot \mu}$$

$$= \frac{1}{1 + \frac{\pi \cdot d_0}{P_L} \times 0.012} = 0.898$$

$$\eta' = 2 - \frac{1}{\eta}$$

$$= 2 - \frac{1}{0.898} = 0.886$$

$$\eta p = \eta \cdot 0.9$$

$$= 0.898 \times 0.9 = 0.81$$

Here, η : Theoretical direct efficiency
η' : Theoretical indirect efficiency
ηp : Practical efficiency
PL : Lead of main screw (mm)
d0 : Pitch diameter of main screw (mm)
μ : Coefficient of friction

Driving Torque

The required motor torque can be calculated as followings.

$$T = \frac{F_{max} \cdot P_L}{2{,}000 \cdot \pi \cdot \eta_p}$$

$$= \frac{30{,}000 \times 10}{2{,}000 \times \pi \times 0.81} = 58.9\ (\mathrm{Nm})$$

Braking Torque

The braking torque to retrain axial load is calculated as followings.

$$Tb = \frac{F_{max} \cdot P_L \cdot \eta'}{2{,}000 \cdot \pi}$$

$$= \frac{30{,}000 \times 10 \times 0.886}{2{,}000 \times \pi} = 42.3\ (\mathrm{Nm})$$

Design Guidelines

Motor Power

The motor power is calculated by application load Fmax = 30,000 N and the rotation speed n = 200 RPM.

$$P = \frac{F_{max} \cdot n \cdot P_L}{60{,}000 \cdot \eta_p} = \frac{30{,}000 \times 200 \times 10}{60{,}000 \times 0.81} = 1{,}235\ (W)$$

Buckling Strength

In case of compressive loading conditions, the buckling capacity of the screw must be evaluated.
The buckling strength of the screw can be calculated as followings.

$$Fc = \frac{34 \cdot f_3 \cdot d_2^4 \cdot 10^3}{L^2}$$

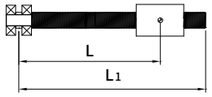
$$= \frac{34 \times 2.0 \times 29.01^4 \times 10^3}{1{,}050^2}$$

$$= 43{,}684\ (N) > F1 = 30{,}000(N) \rightarrow OK$$

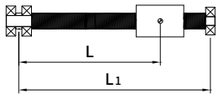
Here, Fc : Buckling strength (N)
f3 : Shaft stiffness factor
d2 : Screw shaft root diameter (mm)
L : Free length
(Distance between support bearing)

Shaft stiffness factor f3

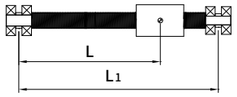
Fixed - free
f3 = 0.25



Fixed – supported
f3 = 2.0



Fixed – fixed
f3 = 4.0



Supported – supported
f3 = 1.0

Static Axial Stiffness of Assembly

The axial stiffness of assembly has many parameters to calculate. For example: shaft stiffness, nut stiffness, bearing and housing stiffness, etc. (Please contact with us for more information). Static axial stiffness of assembly can be calculated as followings.

$$Rt = \left(\frac{1}{R_s} + \frac{1}{R_n} + \frac{1}{R_p} + \frac{1}{R_h} \right)^{-1}$$

Here,
Rt : Stiffness of a complete assembly (N/μm)
Rs : Shaft stiffness (N/μm)
Rn : Nut stiffness (N/μm)
Rp : Support bearing stiffness (N/μm)
Rh : Housing stiffness (N/μm)

- Shaft stiffness

① Fixed–free and fixed-supported type

$$Rs = 165\ \frac{d_2^2}{L}\ (N/\mu m)$$

② Fixed-fixed type

$$Rs = 165\ \frac{d_2^2 \cdot L_1}{L(L_1 - L)}\ (N/\mu m)$$

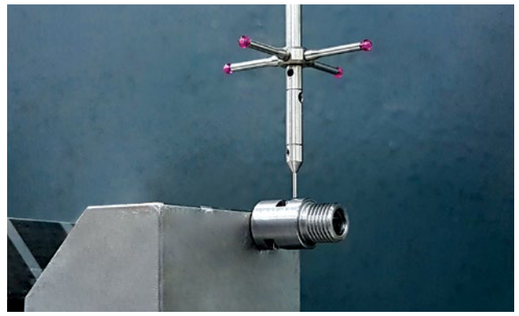
- Nut siffness

$$Rn = fn\ (Fax)^{1/3}\ (N/\mu m)$$

Here, fn : Nut stiffness (provided on request)
Fax : Applied load (N)

Guarantee of Reliability

Outside Tolerance of Roller Screw Correspond in Standard of ISO3408-3



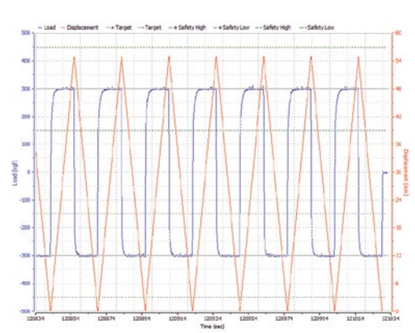
Cert'	AS9100D
No.	SEO6019691
Description	Design & Development and manufacture of gear box, electromechanical control systems, servo-actuators and components for aviation, defense and industries

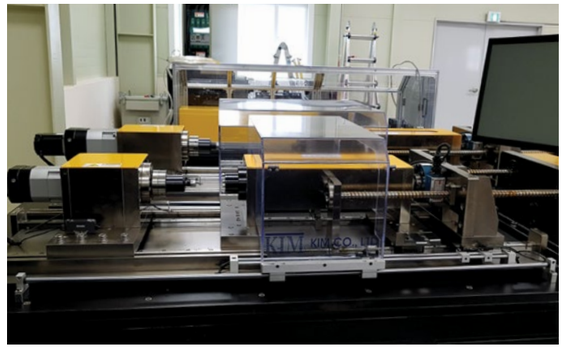
KIM Co.'s quality management system is built up based on ISO 9001:2015 / AS 9100D. Considering clients' requirements, Inspection/ test equipment are highly advanced and automated. This equipment ensures the reproducibility and reliability of inspection by preventing human error.

Load Test

Actual driving torque can be calculated and checked by load test system. We confirm the requirements of the planetary roller screw by performing left/right operating test under the designed maximum load of the planetary roller screw.
This system guarantees reliability of roller screws.

Load test system

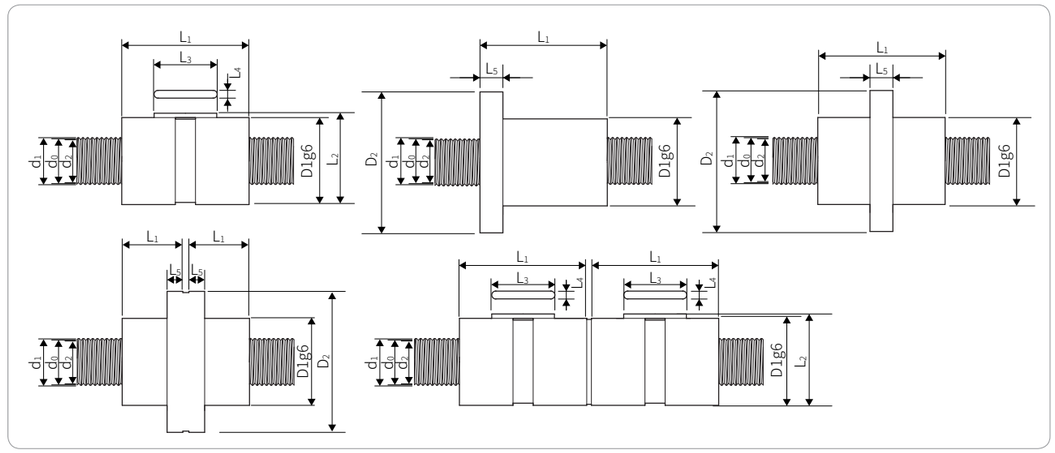




Additionally, we can test noise level and operating temperature, life time etc. under full load conditions.

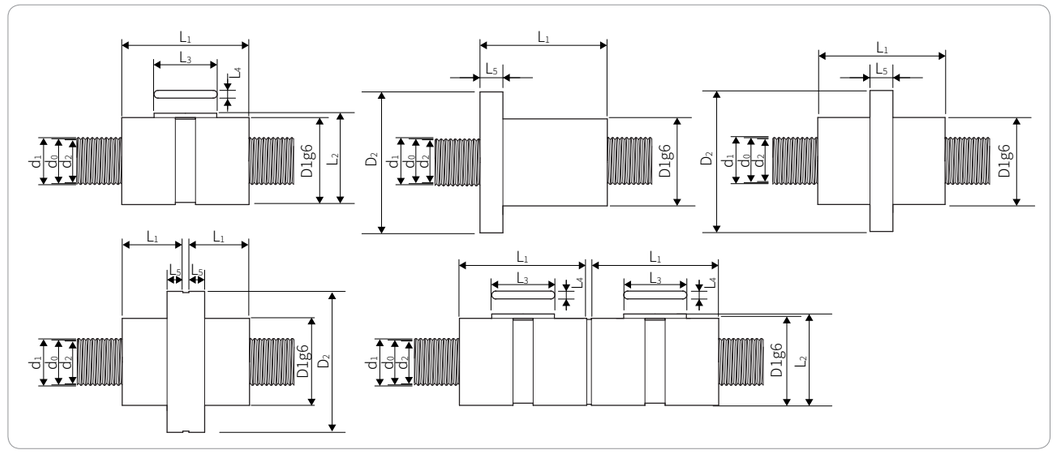
Product Overview

SG Type (Ø3.5 ~ Ø12 mm)



Screw Size		d0	d1	d2	Efficiency	Single Nut, with Backlash and Double Nut		Split Nut, Preloaded, Without Backlash		D_1	D_2	Without Wipers	With Wipers	L_2	L_3	L_4	L_5
Screw Diameter (mm)	Lead (mm)					Dynamic Load C (KN)	Static Load C_0 (KN)	Dynamic Load C (KN)	Static Load C_0 (KN)			L_1	L_1				
3.5	1	3.5	3.62	3.35	0.86	8.4	6.6	5.3	3.2	15	35	31	41	16	10	2	13
5	1	4.5	4.62	4.35	0.85	10.4	7.9	6.6	3.9	19	39	31	41	20.3	10	3	13
5	2	4.5	4.71	4.17	0.88	7.3	7.9	4.5	3.9	19	39	31	41	20.3	10	3	13
7	1	7	7.09	6.89	0.84	11.8	11	7.5	5.6	19	41	31	41	20.3	10	3	13
7	2	7	7.16	6.76	0.88	9.4	11.5	6	5.8	19	41	31	41	20.3	10	3	13
7	3	7	7.23	6.62	0.89	7.7	11.2	4.8	5.7	19	41	31	41	20.3	10	3	13
8	1	8	8.09	7.89	0.83	11.6	10.8	7.3	5.5	21	41	31	41	22.3	10	3	13
8	2	8	8.17	7.76	0.87	9.3	11.5	5.9	5.8	21	41	31	41	22.3	10	3	13
8	3	8	8.24	7.63	0.89	7.6	11.1	4.7	5.6	21	41	31	41	22.3	10	3	13
8	4	8	8.3	7.49	0.89	6.8	11.2	4.2	5.7	21	41	31	41	22.3	10	3	13
8	5	8	8.35	7.33	0.89	5.9	10.8	3.7	5.4	21	41	31	41	22.3	10	3	13
10	1	10	10.09	9.89	0.8	18.9	17.8	11.9	8.9	26	48	31	41	27.3	10	3	13
10	2	10.5	10.64	10.31	0.86	13.2	18.3	8.4	9.2	24	46	31	41	25.3	10	3	13
10	3	10.5	10.7	10.21	0.88	11.4	18.1	7.2	9.1	24	46	31	41	25.3	10	3	13
10	4	10.5	70.75	10.1	0.89	10.6	18.4	6.7	9.2	24	46	31	41	25.3	10	3	13
10	5	10.5	70.79	9.98	0.89	9.7	18.1	6.1	9.1	24	46	31	41	25.3	10	3	13
12	1	12	12.09	11.89	0.79	19.2	17.4	12.1	8.7	30	50	31	41	31.3	10	3	13
12	2	12	12.14	11.81	0.85	12.9	18.2	8.2	9.1	26	46	31	41	27.3	10	3	13
12	3	12	12.22	11.74	0.87	11.3	18.3	7.2	9.2	26	46	31	41	27.3	10	3	13
12	4	12	12.25	11.65	0.89	10.1	18	6.4	9	26	46	31	41	27.3	10	3	13
12	5	12	12.32	11.56	0.89	10.6	18.3	6.7	9.2	26	46	31	41	27.3	10	3	13

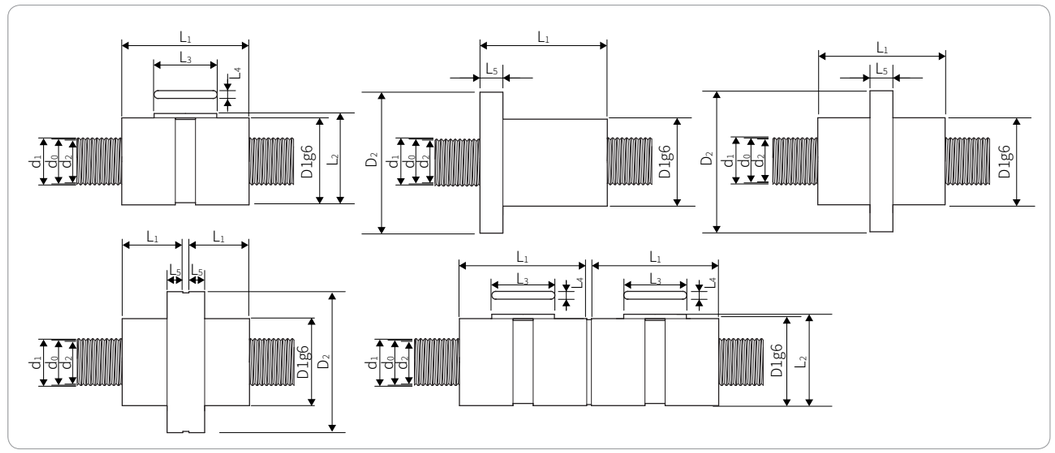
SG Type (Ø15 ~ Ø44 mm)



Screw Size		d0	d1	d2	Efficiency	Single Nut, with Backlash and Double Nut		Split Nut, Preloaded, Without Backlash		D_1	D_2	Without Wipers	With Wipers	L_2	L_3	L_4	L_5
Screw Diameter (mm)	Lead (mm)					Dynamic Load C (KN)	Static Load C_0 (KN)	Dynamic Load C (KN)	Static Load C_0 (KN)			L_1	L_1				
15	2	15	15.14	14.81	0.84	19.6	26.7	12.4	13.4	34	56	35	51	35.7	14	4	18
15	4	15	15.25	14.65	0.88	16.1	28	10.2	14	34	56	35	51	35.7	14	4	18
15	5	15	15.32	14.56	0.89	15.2	28.2	9.5	14.1	34	56	35	51	35.7	14	4	18
15	8	15	15.46	14.16	0.9	14.1	25.7	8.8	12.8	34	56	35	51	35.7	14	4	18
20	2	19.5	19.65	19.32	0.82	48.3	60.3	30.4	30.1	42	64	55	65	43.7	20	4	20
20	4	19.5	19.8	19.15	0.87	40.6	64.9	25.6	32.5	42	64	55	65	43.7	20	4	20
20	8	19.5	19.98	18.69	0.89	38.6	64.6	24.3	32.3	42	64	55	65	43.7	20	4	20
23	2	22.5	22.65	22.32	0.8	54.9	67.9	34.6	33.9	45	67	55	65	46.7	20	4	20
23	4	22.5	22.79	22.15	0.86	46.7	74.2	29.4	37.2	45	67	55	65	46.7	20	4	20
23	8	22.5	23	21.71	0.89	45	75.2	28.4	37.6	45	67	55	65	46.7	20	4	20
25	2	24	24.14	23.82	0.8	79.6	95.1	50.1	47.5	53	84	64	78	55.5	25	6	20
25	4	24	24.28	23.63	0.85	67.8	104.7	42.7	52.3	53	84	64	78	55.5	25	6	20
25	8	24	24.51	23.21	0.89	76.8	106.9	48.5	53.4	53	84	64	78	55.5	25	6	20
30	4	30	30.29	29.65	0.84	98.8	148.3	62.2	74.2	62	92	71	85	64.7	20	6	27
30	6	30	30.4	29.43	0.86	87.2	151.2	55	75.6	62	92	71	85	64.7	20	6	27
30	10	30	30.63	29.01	0.89	89.9	153.6	56.6	76.8	62	92	71	85	64.7	20	6	27
36	4	36	36.28	35.63	0.82	92.8	142.3	58.5	71.2	74	110	70	84	76.7	28	6	25
36	6	36	36.41	35.44	0.85	84.1	149.3	53	74.6	74	110	70	84	76.7	28	6	25
36	10	36	36.65	35.12	0.88	71.6	151.3	45.1	75.6	74	110	70	84	76.7	28	6	25
44	6	44	44.35	43.54	0.84	123.8	234.7	78	117.3	80	118	80	90	82.7	28	6	25
44	12	44	44.65	43.03	0.88	135.8	244.1	85.6	122.1	80	118	80	90	82.7	28	6	25
44	18	44	44.9	42.47	0.89	138.3	240.3	87.2	120.1	80	118	80	90	82.7	28	6	25

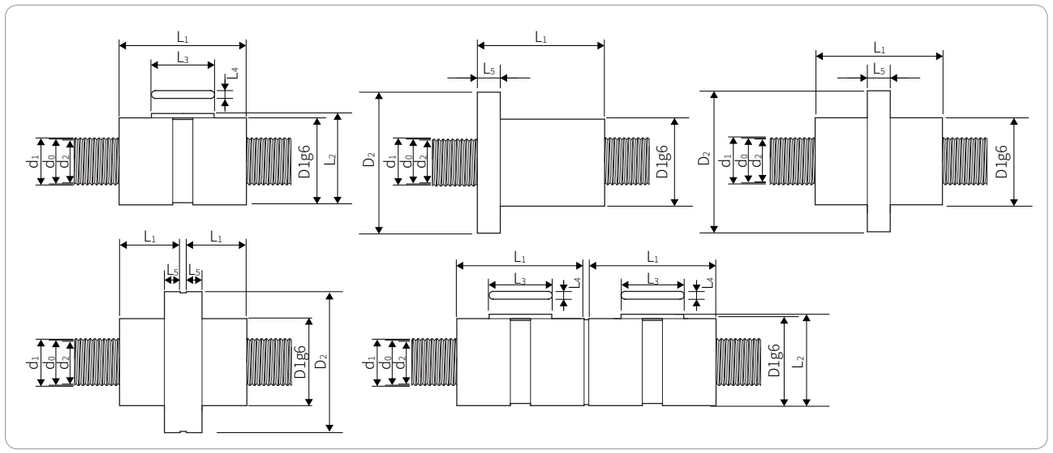
Product Overview

SG Type (∅48 ~ ∅150 mm)



Screw Size		d0	d1	d2	Efficiency	Single Nut, with Backlash and Double Nut		Split Nut, Preloaded, Without Backlash		D_1	D_2	Without Wipers	With Wipers	L_2	L_3	L_4	L_5
Screw Diameter (mm)	Lead (mm)					Dynamic Load C (KN)	Static Load C_0 (KN)	Dynamic Load C (KN)	Static Load C_0 (KN)			L_1	L_1				
48	10	48	48.67	47.05	0.87	210.7	418.9	132.8	209.5	100	150	115	127	103	45	8	37
48	20	48	49.21	45.97	0.89	226.6	480.5	142.8	240.3	100	150	115	127	103	45	8	37
48	30	48	49.62	44.75	0.89	174.3	413.6	109.7	206.8	100	150	115	127	103	45	8	37
60	15	60	60.99	58.55	0.87	502.3	1223.9	-	-	122	166	-	189	-	-	-	-
60	20	60	61.26	58.02	0.88	448.8	1202.9	-	-	122	166	-	189	-	-	-	-
60	30	60	61.74	56.87	0.89	370.9	1145.8	-	-	122	166	-	189	-	-	-	-
75	15	75	76.01	73.58	0.86	476.6	1279.9	-	-	150	210	175	191	153	63	10	45
75	20	75	76.31	73.07	0.88	499.7	1284	-	-	150	210	175	191	153	63	10	45
75	30	75	76.83	71.97	0.89	488.2	1780.6	-	-	150	210	-	233	-	-	-	-
80	10	80	80.61	79.27	0.84	388.6	951.5	-	-	138	180	130	158	141.7	50	10	35
80	20	80	81.09	78.39	0.88	415.4	964.1	-	-	138	180	130	158	141.7	50	10	35
80	30	80	81.53	77.48	0.89	431.2	964.1	-	-	138	180	130	158	141.7	50	10	35
100	15	99	100.94	97.61	0.84	988.2	3550.7	-	-	200	245	-	304	-	-	-	-
100	20	99	100.35	97.11	0.86	900.3	3562.7	-	-	200	245	-	304	-	-	-	-
100	30	100	101.6	97.55	0.88	822.1	1942.2	-	-	185	260	230	260	188	63	10	50
120	15	120	121	118.62	0.83	1177.9	4668.2	-	-	240	300	-	354	-	-	-	-
120	20	120	121.37	118.13	0.85	1076.4	4706.4	-	-	240	300	-	354	-	-	-	-
120	30	120	121.98	117.11	0.87	949.7	4749.6	-	-	240	300	-	354	-	-	-	-
135	15	135	136.06	133.62	0.82	1413.9	6123.5	-	-	280	345	-	393	-	-	-	-
135	20	135	136.38	133.14	0.84	1303.3	6237.2	-	-	280	345	-	393	-	-	-	-
135	30	135	137	132.14	0.86	1138.8	6246.3	-	-	280	345	-	393	-	-	-	-
150	15	150	151.06	148.63	0.81	1551.4	7357.9	-	-	320	385	-	437	-	-	-	-
150	20	150	151.39	148.15	0.83	1440.3	7555.8	-	-	320	385	-	437	-	-	-	-
150	30	150	152.02	147.1	0.86	1275.6	7677	-	-	320	385	-	437	-	-	-	-

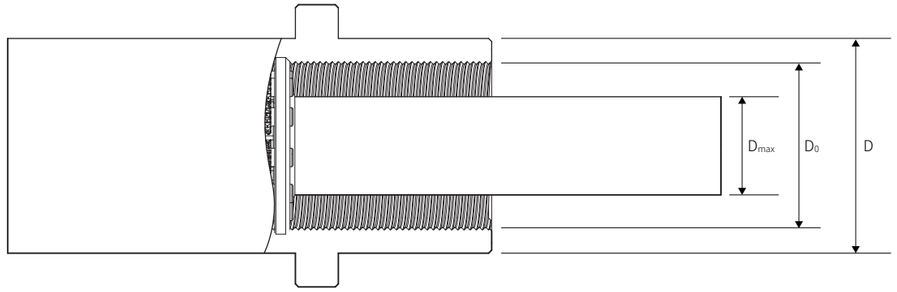
RG Type



Screw Size		d0	d1	d2	Efficiency	Single Nut, with Backlash and Double Nut		Split Nut, Preloaded, Without Backlash		D_1	D_2	Without Wipers	With Wipers	L_2	L_3	L_4	L_5
Screw Diameter (mm)	Lead (mm)					Dynamic Load C (KN)	Static Load C_0 (KN)	Dynamic Load C (KN)	Static Load C_0 (KN)			L_1	L_1				
8	1	7.63	8	7.19	0.84	8.1	12.2	5.2	6.1	20	43	31	41	20.8	12	2	13
10	1	9.63	10	9.19	0.82	9	14.5	5.7	7.3	22	43	31	41	22.8	12	2	13
10	2	9.63	10	9.19	0.87	9	14.5	5.7	7.3	22	43	31	41	22.8	12	2	13
12	1	11.63	12	11.19	0.8	10.2	17.6	6.4	8.8	24	46	31	41	25.3	10	3	13
12	2	11.63	12	11.19	0.86	10.2	17.5	6.4	8.8	24	46	31	41	25.3	10	3	13
16	1	16	16.37	15.56	0.77	11.2	21.2	7.1	10.6	29	53	31	41	31.2	14	4	13
16	2	16	16.37	15.56	0.84	11.2	21.2	7.1	10.6	29	53	31	41	31.2	14	4	13
20	1	19.63	20	19.19	0.74	17.7	36.4	11.2	18.2	34	56	37	47	35.7	14	4	18
20	2	19.63	20	19.19	0.82	17.7	36.4	11.2	18.2	34	56	37	47	35.7	14	4	18
25	1	25	25.37	24.56	0.7	30.9	71.1	19.5	35.5	42	67	44	54	43.7	14	4	18
25	2	25	25.37	24.56	0.8	30.9	71.1	19.5	35.5	42	67	44	54	43.7	14	4	18
32	1	32	32.37	31.56	0.65	65.8	122.5	41.4	61.3	53	83	55	67	55.2	20	5	20
32	2	32	32.37	31.56	0.77	65.8	122.5	41.4	61.2	53	83	55	67	55.2	20	5	20
40	1	39.63	40	39.19	0.61	84.5	182.9	53.2	91.4	70	104	66	80	72.7	28	6	26
40	2	39.63	40	39.19	0.74	84.5	182.9	53.2	91.4	70	104	66	80	72.7	28	6	26
50	1	49.63	50	49.19	0.56	163.4	329.4	103	164.6	82	124	80	94	84.7	28	6	28
50	2	49.63	50	49.19	0.7	163.4	329.4	102.9	164.6	82	124	80	94	84.7	28	6	28
50	3	49.45	50	48.79	0.76	144.1	334.4	90.8	167.2	82	124	80	94	84.7	28	6	28
50	4	49.26	50	48.38	0.8	133.7	337.2	84.2	168.7	82	124	80	94	84.7	28	6	28
63	2	62.26	63	61.38	0.66	200.8	493.5	126.5	246.7	105	148	110	124	108	40	8	32
63	4	62.26	63	61.38	0.77	200.8	493.4	126.5	246.6	105	148	110	124	108	40	8	32
80	4	78.52	80	76.76	0.74	364.5	842.7	-	-	138	195	175	189	141.7	50	10	35
100	5	98.15	100	95.95	0.74	490.5	1445.3	-	-	170	230	195	215	173.7	56	12	40
125	5	123.15	125	120.95	0.7	856	3102	-	-	220	260	262	282	223	100	12	40

Product Overview

IG Type



Screw Size		D_0	Efficiency	Dynamic Load C (KN)	Static Load C_0 (KN)	Min. Nut Outer Diameter D	Max. Push Tube Outer Diameter D_{max}	Max. Stroke S
Screw Diameter (㎜)	Lead (㎜)							
18	3	30	0.73	38.1	71.5	38	16	50
18	4	30	0.77	36.9	61.7	38	16	50
18	6	30	0.82	40.7	62.4	38	16	50
21	3	35	0.7	59	104	45	18	56
21	4	35	0.75	62.7	103	45	18	56
21	6	35	0.8	63.6	91.3	45	18	56
24	3	40	0.68	67.9	120.2	50	21	65
24	4	40	0.73	72.7	120.2	50	21	65
24	6	40	0.79	75.2	110.1	50	21	65
30	3	50	0.63	100.2	200	60	27	75
30	4	50	0.69	106.1	195.9	60	27	75
30	6	50	0.76	118.2	202	60	27	75
48	3	80	0.52	218.8	561.3	90	44	114
48	4	80	0.59	231.7	551.4	90	44	114
48	6	80	0.68	256.4	553.4	90	44	114

Examples of Customized Roller Screw

The great flexibility of KIM Co.'s Planetary Roller Screw means we can make various types of products that customer requested as shown in the examples below.

Dia	Lead	Length	Grade
Ø 12	0.5 mm	103 mm	G5

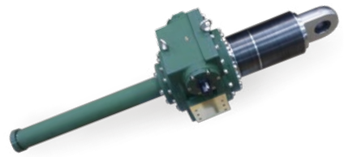
Dia	Lead	Length	Grade
Ø 15	5 mm	198 mm	G3

Dia	Lead	Length	Grade
Ø 22	5 mm	137 mm	G5

Dia	Lead	Length	Grade
Ø 25	2 mm	258 mm	G5

Dia	Lead	Length	Grade
Ø 51	5 mm	534.5 mm	G5

Dia	Lead	Length	Grade
Ø 60	20 mm	955 mm	G5



Dia	Lead	Length	Grade
Ø 64	24 mm	1152 mm	G5

Dia	Lead	Length	Grade
Ø 590	48 mm	1188 mm	G7

Service Range

KIM's Enjoyable Challenge for Moving the World

We design innovative and challenging research and development for precision driving technology.

KIM Co. delivers from Designing to Maintaining. We focused on the highest quality and technological improvements through the joint research, mutual growth with national and international defense companies and precision driving system companies based on a global network. Our objective is to help customers improve productivity and get solutions.

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Planetary Roller Screw Application Configuration Worksheet

Company Name

Contact

Load & Life Requirements

Extension Max Load _____ lbf, kN

Extension Mean Load _____ lbf, kN

Retraction Max Load _____ lbf, kN

Retraction Mean Load _____ lbf, kN

Static Load Max _____ lbf, kN

Cycle Rate _____ cycles per min, hour, day

Operating Hours per Day _____

Operating Days per Week _____

Life Requirement _____ Total #cycles, #days, #years

Stroke & Speed Requirements

Maximum Stroke _____ inches, mm

Maximum Speed _____ inches, mm per second

Minimum Speed _____ inches, mm per second

Accuracy Grade _____ inches, mm

(Standard Accuracy Grade is C5T for KIM Co.'s Roller Screw)

Stroke & Speed Requirements

Application? _____

Special Nut Features? _____

Include Motors? _____

Others? _____

Please fill in and E-mail (gear@kimm.co.kr) to be contacted by a KIM Co. sales engineer.

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