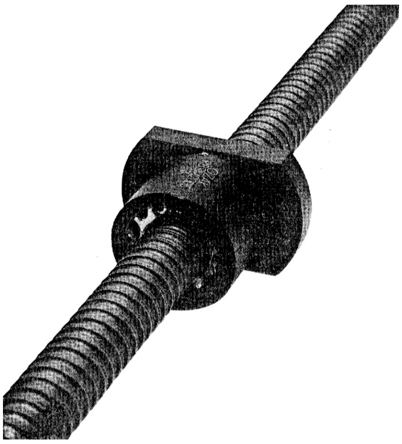
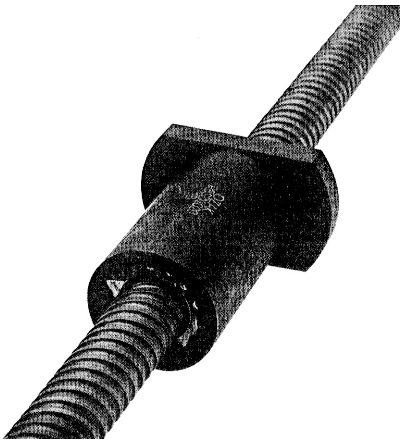
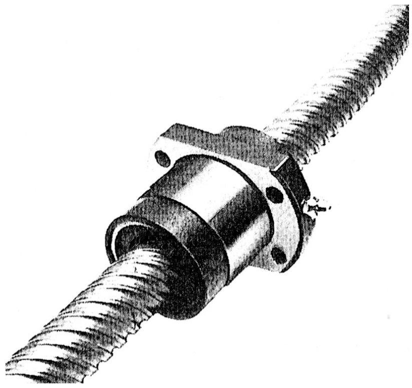
Series

Normal and Medium Lead (φ8～φ40) RBSMA Series	Large Lead l=d (φ10～φ40) RBSDA Series	Extra large Lead l=2d (φ16～φ32) RBSW Series
		
The method of ball return is adopted by return tube(RBSMA0802:guide plate) and nut flange is provided with both sides flat.	The lead is same as screw shaft diameter and the method of ball return is adopted by return tube. Nut flange is provided with both sides flat.	The lead is twice diameter of screw shaft and the method of ball return is adopted by end caps. Nut flange is provided with both sides flat. Ball screw nut incorporates with a triple start thread.

Combination Chart for Screw Shaft Dia and Lead

Dia. \ Lead	2	4	5	6	10	20	25	32	40	50	64
8	Ⓜ										
10		Ⓜ			Ⓓ						
12		Ⓜ			Ⓜ						
15			Ⓜ		Ⓜ						
16								Ⓦ			
20			Ⓜ		Ⓜ	Ⓓ			Ⓦ		
25			Ⓜ		Ⓜ		Ⓓ			Ⓦ	
28				Ⓜ							
32					Ⓜ			Ⓓ			Ⓦ
36					Ⓜ						
40					Ⓜ				Ⓓ		

Ⓜ : Normal, Medium Lead RBSMA Series
Ⓓ : Large Lead RBSDA Series
Ⓦ : Extra large Lead RBSW Series

Materials

Table 1 : Materials and Hardness

Item	Materials	Hardness
Nut	RBSM, DA Series SCM420 (JIS G4105) RBSW Series SCM415 (JIS G4105)	$H_RC58\sim62$
Screw Shaft	RBSM, DA Series S45C, S50C (JIS G4051) RBSW Series S45C (JIS G4051)	$H_RC56\sim62$
Steel Ball	SUJ-2 (JIS G4805)	H_RC60 and over

Lubrication

This series requires periodic lubrication to assure long term precision and high performance. The lubrication can be done easily by using the built-in oil ports around the nut flange's outside surface.

Table 2 : Recommended Lubricant

Oil	Turbine Oil ISO VG32～68
Grease	Lithium Soap Group Grease 2～3

Precision

Table 3 : Lead Precision

Accumulative Lead Error	±0.21/300mm

This precision shall be equal to that of the C10 Grade in JIS B1191 (for normal ball screw).

Table 4 : Axial Clearance Unit:mm

Model No.		Axial Clearance
RBSMA－	0802	0.05 or less
	1004	
	1204	
	1210	0.10 or less
	1505, 10	
	2005	
	2010	0.15 or less
	2505	0.10 or less
	2510	0.20 or less
	2806	0.10 or less
	3210	0.20 or less
	3610	
	4010	
RBSDA－	1010	0.05 or less
	2020	0.10 or less
	2525	0.12 or less
	3232	0.15 or less
	4040	0.20 or less
RBSW－	1632	0.10 or less
	2040	
	2550	0.12 or less
	3264	0.15 or less

Table 5 : Screw Shaft's Radial Deviation Unit:mm

Total Length	Screw Shaft Dia.			
over or less	over ～12 or less	12～20	20～32	32～50
～500	0.27	0.20	0.16	0.13
500～800	0.46	0.32	0.23	0.17
800～1000		0.42	0.30	0.22
1000～1600		0.73	0.50	0.34
1600～2000		1.00	0.69	0.46
2000～2500			0.93	0.61
2500～3000			1.30	0.82
3000～4000				1.10

These deviation shall be equal to those of the C10 Grade in JIS B1191 (for normal ball screws).

Screw Shaft Types

The OZAK RBS Series screw shaft is composed of three different types — the standard BS series which is always available, the BSQ series which is tempered on both ends to make additional machining by the customer easier and the BNP series which is manufactured based on the customer's drawings and specs. Specify the required unit using the following numbering.

■ Standard Screw Shaft (BS series)

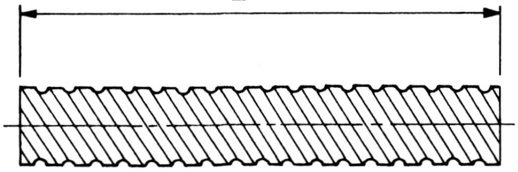


Fig.1

Table 6 : Standard Screw Shaft **Unit:mm**

Model No.	Screw Shaft Length											
	200	400	500	600	800	1000	1200	1500	2000	2500	3000	4000
0802	○	○										
1004		○		○								
1204,10		○			○							
1505,10				○			○					
2005,10				○			○		○			
2505,10						○			○	○		
2806						○			○	○		
3210						○			○		○	
3610						○			○		○	
4010									○		○	○
1010		○		○								
2020				○			○		○			
2525						○			○	○		
3232						○			○		○	
4040									○		○	○
1632			○			○						
2040			○			○		○	○	○		
2550			○			○		○	○	○		
3264			○			○		○	○	○		

■ Tempered Screw Shaft (BSQ series)

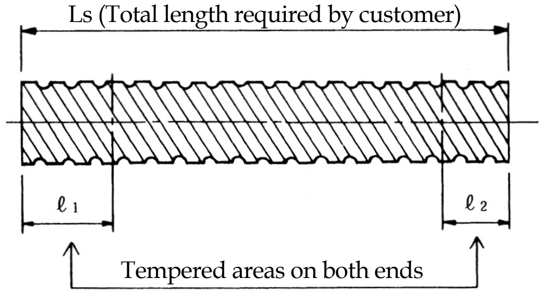


Fig.2
<Note> The heat treated area is Ls-(l_1+l_2+about 20mm)

<Note>

(1) The customer's requested unit length Ls, will be increased by 2mm at the time of shipment.

(2) Both the tempered length, l_1 and l_2, will be about 10mm longer than your requested length.

(3) The color of the tempered surface (l_1 and l_2) is black.

■ Custom-made Screw Shaft (BNP series)

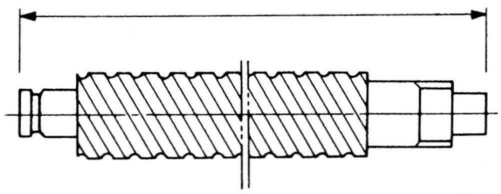


Fig.3
This series is manufactured based on your drawings.

<Numbering>

The OZAK RBS series includes both the nut and the screw shaft at the time of shipment. Specify the number based on the following example.

(Example);

Nut Number; Screw Shaft Number;

RBSW2040 - BS 1000 -

Screw Shaft Outside Diameter; Lead;

BSQ 1250 - 120-80

BNP 1460 - 155-95

Screw Shaft Type — Ls — -ℓ1 — -ℓ2

Nut Installation

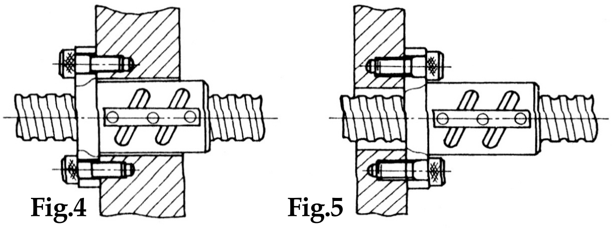
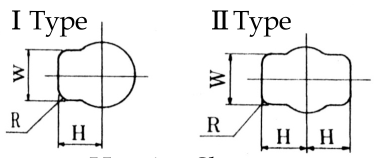


Fig.4 Fig.5



Housing Shape

For nut mounting of RBSM Series which method of ball return is by return tube, please design a relief in the housing as shown above to avoid interference with the tube projection.

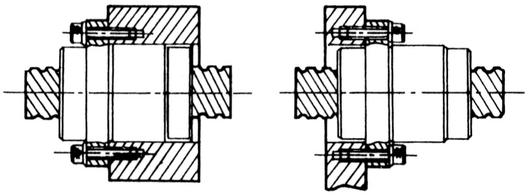


Fig.6 RBSD, RBSW Series Mounting Method

Fitting

The clearance between nut and housing, generally designed the suitable clearance for centering, in the case of precision mounting we recommend the clearance between the nut's outside dia. and housing is H7.

Nut Disassembly-and-Assembly

RBS Series is shipped the nut and screw shaft separately, so please mount the nut and shaft as next assembly procedure.

Assembly procedure

① Shaft-End Design

When transferring a ball screw nut onto a shaft from a mandrel, the balls may drop out or other trouble may occur if the shaft is not designed properly. Ideally, the tubular mandrel should fit over the shaft end, as shown in Fig.7, so it is directly against the screw-shaft threads. This allows the nut to be easily screwed onto the shaft. If a stepped shaft design such as the one in Fig.8 is necessary, make a suitable sleeve or wind tape around the shaft until its diameter is the same as that of the mandrel. If there is groove or keyway, fill it with some suitable material beforehand.

② Placement of Mandrel

Check the orientation of the nut on the shaft and remove the snap ring on the end next to the shaft. Then slide the mandrel fully onto the shaft with their centers aligned.

③ Nut transfer to the shaft

Push the nut slowly until it reaches the shaft threads. Then, hold the mandrel firmly against the shaft and begin turning the nut lightly in the appropriate direction. Do not remove the mandrel until the nut has been screwed entirely onto the shaft and the end of the threads are visible.

Fig.7

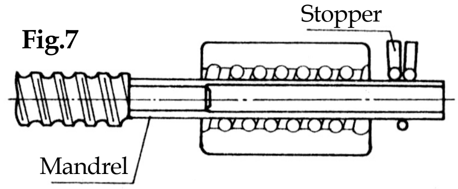
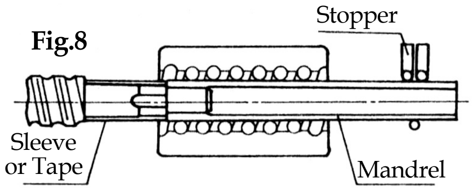


Fig.8



The OZAK RBSW series is shipped with both the nut and screw shaft already assembled. Use the following remover when the nut must be removed from the screw shaft for machining of the end of the shaft. Use the same tool for the nut's assembly. If the remover is not used, the steel balls may fall out of the nut.

Fig.9

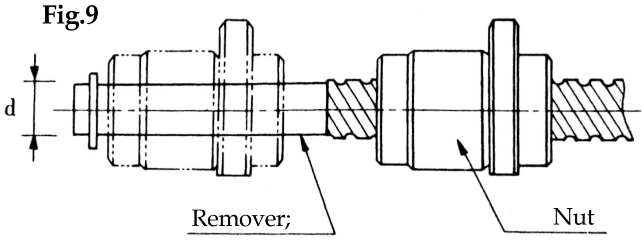


Table 7 : Remover's Outside Diameter **Unit:mm**

Type	d
RBSW1632	13.4
RBSW2040	17.6
RBSW2550	22.2
RBSW3264	28.8

Rated Life

The rated life of the ball screw is defined as the total number of revolutions before flaking or peeling appear on the screw shaft, due to rolling contact fatigue from the rolling type of contact imparted by the steel ball's surface. The unit's rated life can be found by using the basic dynamic load rating(C).

■ Basic Dynamic Load Rating (C)

The basic dynamic load rating is the load in an axial direction that 90% of group of ball screws can withstand after 10^6 rotations without showing any signs of flaking.

■ Basic Static Load Rating (C_0)

The basic static load rating means the load in an axial direction when the sum of the permanent deformations, which appear on the maximum stressed contact surface between the steel balls and screw shaft or nut's rolling contact grooves, amounts to ten thousandths of the steel ball's diameter.

The calculated basic static load rating indicates whether the permanent deformation caused by an axial load during the unit's halt, causes an adverse effect on the smooth rotation and circulating motion of the unit. Choose a proper ball screw with the basic static load rating which is determined by the maximum axial load F_{max} in the following equation, when the unit is operated at a low revolving speed (10rpm or less).

$$F_{max} = C_0 \ / \ S \qquad \cdots\cdots\cdots\cdots \quad (1)$$

where S: Safety Factor

Table 8 : Safety Factor Selection

Service Conditions	S
Normal Operating Conditions	1～2
Impulse or Vibration-prone Conditions	2～3

■ Rated Life Calculation

The rated life is generally shown as the total number of ball screw rotations. Also this life can be shown in hours or as the unit's travel distance. Use the following formulas for the ball screw's rated life calculation.

$$L_n = \left(\frac{C}{F \cdot f_s} \right)^3 \cdot 10^6 \qquad \cdots\cdots\cdots\cdots \quad (2)$$

$$L_{hr} = \frac{L_n}{60 \cdot N} \qquad \cdots\cdots\cdots\cdots \quad (3)$$

$$L_{km} = \frac{L_n \cdot l}{10^6} \qquad \cdots\cdots\cdots\cdots \quad (4)$$

where

L_n : Rated life in total number of revolutions (rev)

L_{hr} : Rated life in hours (hr)

L_{km} : Rated life in travel distance (km)

C : Basic dynamic load rating (N)

F : Acting load in the axial direction (N)

N : Working rotation frequency (rpm)

l : Lead (mm)

f_s : Impulse and vibration factor

Table 9 : Impulse and Vibration Factors

Service Conditions	S
No impact and no vibration	1～1.5
Slight impact or vibration	1.5～2.0
Heavy impact or vibration	2.0～4.0

Allowable Rotation Frequency

The allowable rotation frequency of the RBS series is restricted to 80% or less of the critical speed to prevent the unit from resonating. Select a proper ball screw based on Fig.10 which is classified by the screw shaft end's mounting conditions as shown in the following pages.

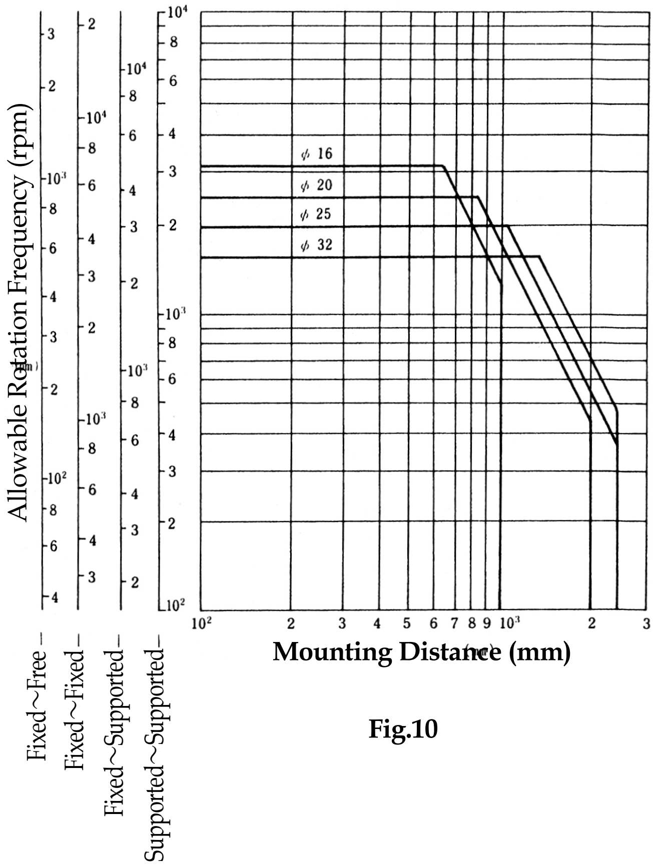


Fig.10

<How to Support the shaft ends>

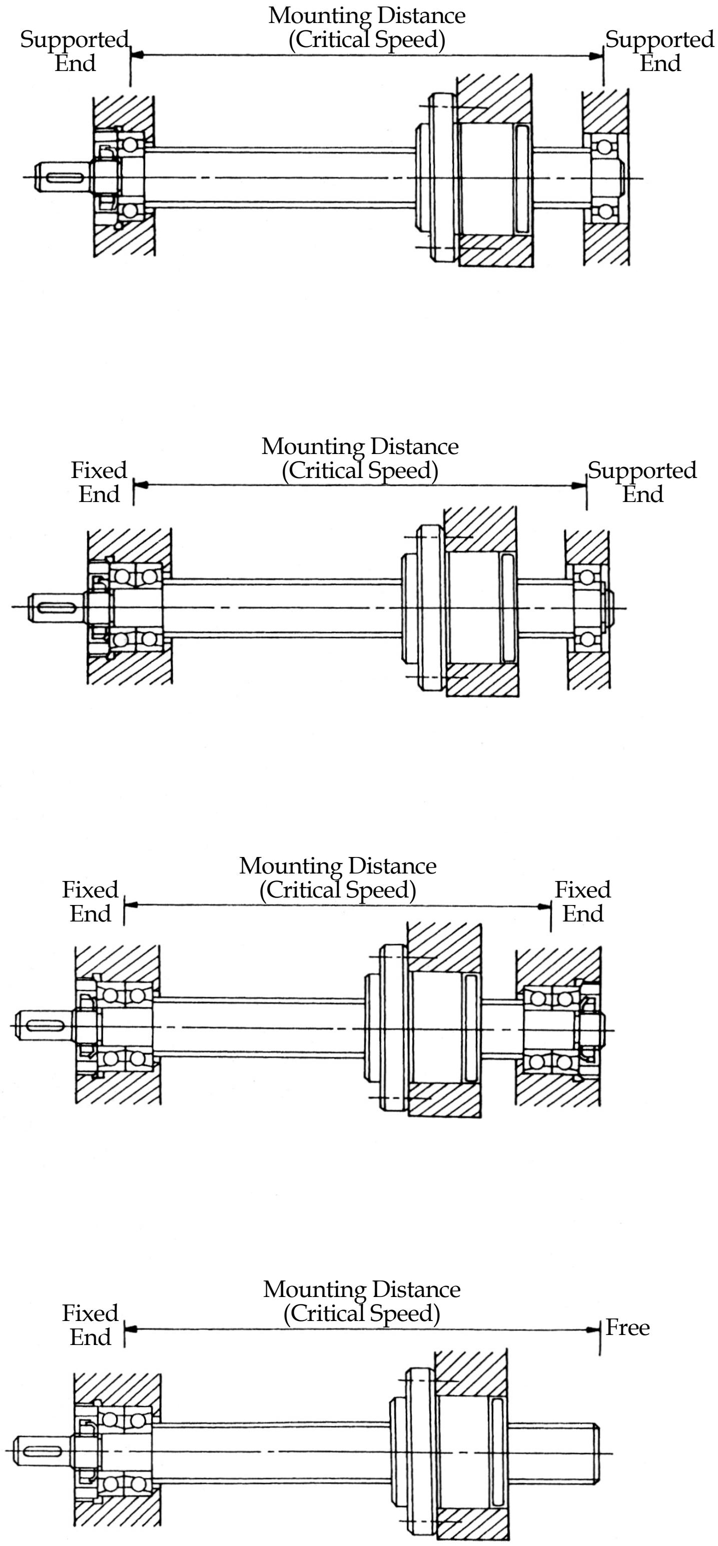


Fig.11

■ Allowable Rotation Frequency (N_c) and Critical Speed

$$N_c = \alpha \cdot \frac{60\lambda^2}{2\pi l^2}\sqrt{\frac{EIg}{\gamma A}} \quad \text{(rpm)} \quad \cdots\cdots\cdots\cdots\cdots \quad (5)$$

where

- α : Safety factor = 0.8
- E : Modulus of longitudinal elasticity (2.06×10^5N/mm^2)
- I : Screw shaft's minimum geometrical moment of inertia (mm^4)
- l : Mounting Distance (mm)
- A : Sectional area of screw shaft's root diameter (mm^2)
- g : Gravitational acceleration (9.8×10^3mm/sec^2)
- γ : Material's specific gravity (7.65×10^{-5}N/mm^3)
- λ : Coefficient determined by screw shaft's mounting condition

Supported~Supported $\lambda=\pi$, Fixed~Supported λ =3.927

Fixed~Fixed λ =4.73 , Fixed~Free λ =1.875

■ d_m and n Values

The d_m and n values restrict the allowable rotation frequency.

These values must satisfy the following equation.

$$d_m \cdot n \leqq 50000$$

where d_m : Ball screw shaft's pitch circle diameter (mm)

n : Rotation frequency (rpm)