

TSK Precision Ball Screws

Specifications of Ball Screws

Structure

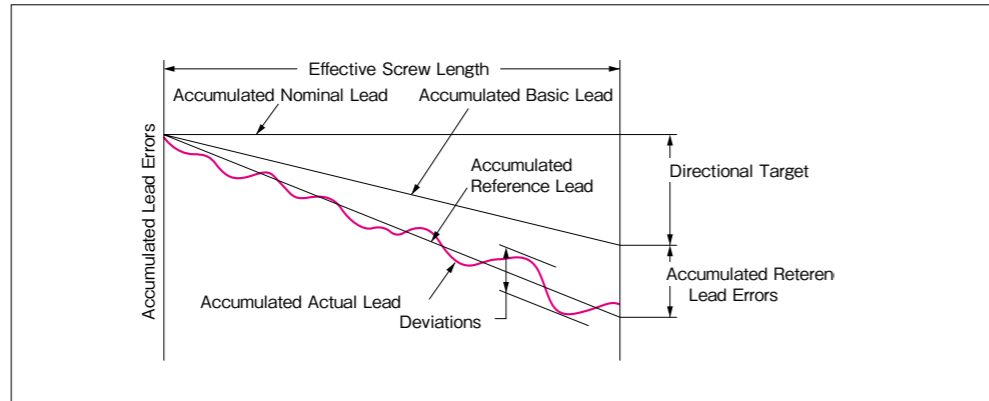
〈Screw Groove〉

The screw groove of the TSK ball screws is of a Gothic arc structure comprising two circular arcs to prevent any slip and it is possible to make zero clearance. The preload may also be possible.

Accuracy

Lead tolerance of ball screws is defined for the effective movement of a nut or the error and deviation of the accumulated reference lead against the effective length of the screw shaft or the deviation against any effective length 300mm of the screw shaft and against any one rotation.

(Designated by JIS B1192-1987)



[Basic Lead]

It is general the same as the accumulated nominal lead but the basic lead is sometimes set by giving plus or minus factors to the normal lead according to the preload, temperature conditions and external load.

[Accumulated Reference Lead]

It is the straight line representing a tendency of the accumulated actual lead. It is calculated from the curve of the accumulated actual lead via the minimal square method of similar ways.

[Deviations]

It is a maximal width on the line drawn parallel from the dots on the accumulated actual lead curve to the accumulated reference lead line.

- The Definition is given for the following three deviations.
- (a) Against the effective whole length of the screw shaft.
 - (b) Against any effective length 300mm of the screw shaft.
 - (c) Against any one rotation.

Accumulated Representative Lead Errors and Deviations : Tolerance

Unit : μm

Precision Symbol	JIS C0		JIS C1		JIS C3		JIS C5	
	A. R Lead Error	Deviations	A. R Lead Error	Deviations	A. R Lead Error	Deviations	A. R Lead Error	Deviations
Eff. Screw L.								
~315mm	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
800~1000	8	6	11	8	21	15	40	27
1000~1250	9	6	13	9	24	16	46	30
1250~1600	11	7	15	10	29	18	54	35
1600~2000			18	11	35	21	65	40
2000~2500			22	13	41	24	77	46
2500~3150			26	15	50	29	93	54

C 7 \pm 50/300mm
C10 \pm 210/300mm

Eff. Screw L : Effective Screw Length / A. R. Lead Er. : Accumulated Reference Lead Error

Deviations : Tolerance

Unit : μm

Precision Symbol	JIS C0		JIS C1		JIS C3		JIS C5	
	Deviations		Deviations		Deviations		Deviations	
Factor	300	1Revolution	300	1Revolution	300	1Revolution	300	1Revolution
Tolerance	3.5	3	5	4	8	6	18	8

Note: The values of the deviations listed in this chart are based upon a randomly selected 300mm length of a ball screw or upon a single lead rotation.

Axial Play

As the precision ground ball screw is generally used with some preload put on it, the axial play of nut becomes "zero". In case you want to avoid the inner friction torque caused by the preload, you had better give the nut a certain axial play.

The axial play for each precision class is shown in the following table.

Depending upon the length of screw shaft, the preloaded state will occur partially.

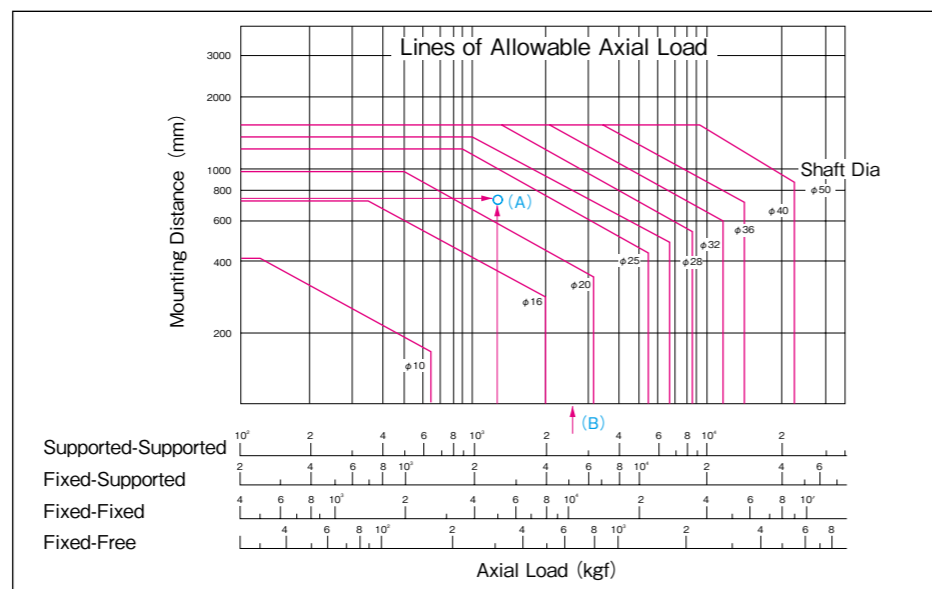
Limits for Axial Play by Grade

Unit : μm

Accuracy Grade	C0	C1	C3	C5
Axial Play	5	5	10	20

Allowable Axial Load

The figure below shows an allowable axial load when determining a minimal axis diameter against an axial load.

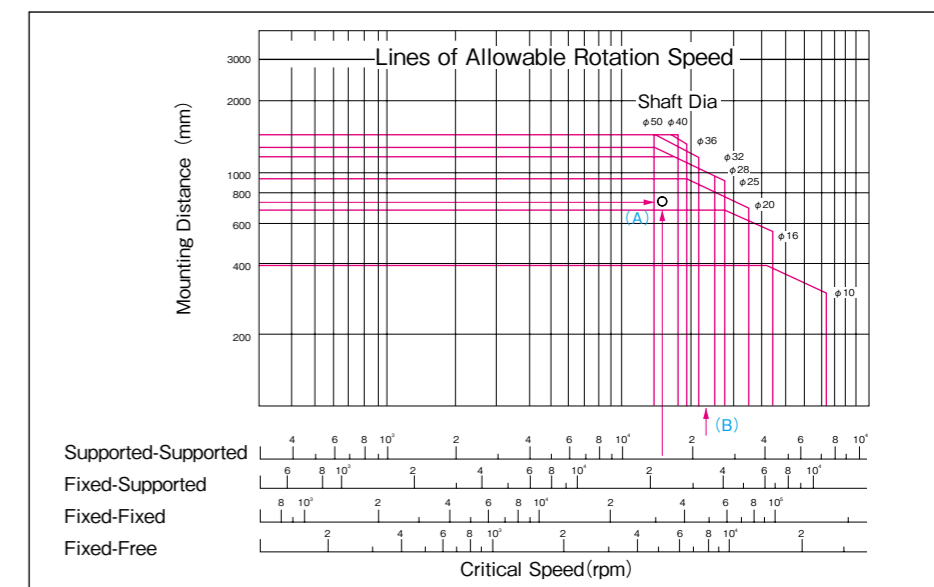


- ①Slant Line
It indicates an allowable buckling load.
- ②Line Perpendicular to the Axial Load
It is an allowable tensile compressive load of the ball screw. As it is not changed with the attaching methods, read it out from the supported-supported scale.
- ③Line Parallel to the Axial Load
It shows a screw shaft length to be made in a normal work routine against the axis diameter of the ball screw.
[Example] Attaching Distance—750mm
Maximal Compressive Load—2,500kgf
Attaching Method—Fixed-supported

(A) Spot the cross point of the line perpendicular from the 2,500kgf point on the fixed-supported scale and the attaching distance of 750mm. The point is situated between φ20 and φ25 on the line of the allowable buckling load. Thus, the minimal axis diameter without buckling is φ25mm.
(B) The 2,500kgf on the supported-supported scale is situated between φ16 and φ20. Thus, the minimal axis diameter for the allowable compressive load is φ20mm.
From (A) and (B), the axis diameter should be more than φ25mm.

Allowable Rotating Speed

The figure below shows an allowable rotating speed to set the optimal axis diameter for the rotating speed.



- ①Slant Line
It shows danger speed.
- ②Line Perpendicular to the Axial Load
It is a DN value as the limit of the rotation cycles of the ball screw. As it is not changed with the attaching method, read it out from the support-support scale.
- ③Line Parallel to the Rotation Cycles
It shows a screw axis length made in a normal work routine to the axis diameter of the ball screw.
[Note] DN Value—D : Outer Diameter of Ball Screw Shaft N : Maximal Rotation Cycles (rpm)
[Example] Attaching Distance—750mm
Maximam Compressive Load—2,300kgf
Attaching Method—Fix-support

(A) Spot the cross point of the line perpendicular from the 2,300rpm point on the fix-support scale and the attaching distance of 750mm. The point is situated between φ16 and φ20 on the line of danger speed. Thus, the minimal axis diameter without danger speed is φ20mm.
(B) The 2,300rpm point on the support-support scale is situated between φ28 and φ32. Thus, the maximal axis diameter to the DN value is φ28mm.
According to (A) and (B), the axis diameter to be determined lies on φ20—φ28mm.