Lead Screw

Lead Screws - Overview

Feed Screw Comparison

Type	Slide Screws	Lead Screw	Rolled Ball Screw	Precision Ball Screw
Shape				
Feature	Simple feed and adjust mechanisms, etc. Made of stainless steel shaft and plastic nut. No-grease operation is possible.	Optimal for the case where thrust loads and high loadings exist.	Can be applied at reasonable costs when precision ball screw accuracies are not required.	Optimal for the case where high positioning and velocity accuracy are required.
Example	Stoppers In/Out and Transfer Pitch Changeover	Transfer Pitch Changeover Jacks, Feed Screw for Lathes	Transfer Line	Measurement Instruments
Allowable Rotational Speed	Low Speed	Medium Speed	High Speed	High Speed
Accuracy	**	**	****	*****
Allowable Axial Load ( ) is for reference.	△ (max540N)	◎ (max30000N)	○ (max9960N)	○ (max9960N)

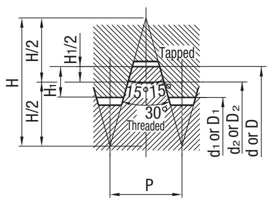
Lineup: Lead Screws

Lead Screw Type	Shape	Right-Hand Screw	Left-Hand Screw	Fine Pitch R Screw	R / L Screw	Prec. R / L Screw	Page
Both Ends Stepped		○	○	○	○	○	P.691
One End Stepped, One End Double Stepped		○	○	-	○	○	P.693
One End Stepped / One End Double Stepped		○	-	-	-	-	P.695
Both Ends Double Stepped		○	○	-	-	-	P.697
Straight		○	○	-	○	-	P.698

Lead Screw Accuracy Standards

Item	Content
Allowable Dimension and Tolerance	JISB0217 0218
Screw Accuracy	7e Grade
Nut Accuracy	7H Grade
Single Pitch Error	±0.02
Accumulated Pitch Error	±0.15/300mm
Shaft Maximum Runout	See table below
Length Tolerance	JIS B 0405 (Medium Class)

Lead Screw Thread Geometry Standards (JIS Tr)



$H=1.866P$ $H_1=0.5P$ $d_2=d-0.5P$
$d_1=d-P$ $D=d$ $D_2=d_2$ $D_1=d_1$

Thread d: O.D. d_1: Root Dia. d_2: Effective Dia.
Tapped D: Root Dia. D1: I.D. d2: Effective Dia.
P: Pitch H_1: Engage Height

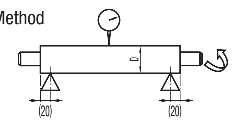
Pitch 3 of D Dimension 16, Pitch 5 of D Dimension 25 and Pitch 6 of D Dimension 40 conform to Tr Standard.

Lead Screw Specifications

Unit: mm

Shaft Dia.	Pitch	Screw Shaft Effective Dia.	Screw Shaft Minor Dia. (MIN.)	Screw Shaft Lead Angle	Screw Shaft Runout (Max.) Shaft Overall Length ~125	126~200	201~315	315~400	401~500	501~630	631~800	801~1000	1001~1250	1251~1600	1601~2000
8	1.5	7.25	(5.9)	3°46'	0.1	0.14	0.21	0.27	0.35	-	-	-	-	-	-
10	2	9	(7.2)	4°03'	0.09	0.12	0.16	0.21	0.27	0.35	0.46	0.58			
12	2	11	(9.2)	3°19'											
14	3	12.5	(10.1)	4°22'	0.09	0.11	0.13	0.16	0.2	0.25	0.32	0.42	-	-	-
16	2	15	(13.18)	2°25'									0.55	0.73	1
	3	14.5	(12.1)	3°46'											
18	4	16	(13.1)	4°33'	-										
20	2	19	(17.18)	1°55'											
	4	18	(15.1)	4°03'											
22	5	19.5	(16.1)	4°40'	-	0.09	0.11	0.13	0.16	0.19	0.23	0.3	0.38	0.5	0.69
25	5	22.5	(19)	4°03'											
28	5	25.5	(22)	3°34'											
32	6	29	(24.5)	3°46'											
36	6	33	(28.5)	3°19'	-	0.11	0.11	0.11	0.13	0.15	0.17	0.22	0.27	0.34	0.46
40	6	37	(32.5)	2°57'											
50	8	46	(40.4)	3°10'											

· Runout Measurement Method



Lead Screw

Lead Screw Specifications / Technical Calculations

Nuts for Lead Screw Specifications

Shaft Dia.	Pitch	MTS_ _ / Standard	MTSP_ _ / Compact	MTSJR / Pilot	MTSQR / Slotted Holes	MTRFR / RoHS Compliant	MTBLR / Anti-Backlash	MTSM_ _ / Lubrication-Free	MTSR_ _ / High Strength Plastic	MTSF_ _ / Plastic
										
		P.685	P.685	P.685	P.685	P.686	P.686	P.687	P.688	P.688
		Allowable Dynamic Thrust (N)								
8	1.5	1470	-	-	-	-	-	-	-	-
10	2	2550	2020	-	-	2550	2600	2550	278	255
12	2	3920	3140	-	-	3920	3390	3920	428	392
14	3	4900	3920	4900	4900	4900	-	4900	536	490
16	2	-	-	6670	6670	6670	-	-	-	-
	3	6670	5340	-	-	6670	6290	6670	686	628
18	4	8720	-	-	-	-	-	-	954	873
20	2	-	-	-	-	10100	-	-	-	-
	4	9810	7850	9810	9810	9810	9320	9810	1071	980
22	5	12360	9890	12360	12360	-	-	12360	-	-
25	5	14220	11380	14220	14220	14220	-	14220	-	1412
28	5	17950	14420	17950	17950	17950	-	17950	-	1765
32	6	21080	16940	21080	21080	21080	-	21080	-	2050
36	6	25780	-	-	-	-	-	25780	-	-
40	6	33830	-	-	-	-	-	33830	-	-
50	8	40310	-	-	-	-	-	-	-	-

Lead Screw Technical Calculations

Calculate Contact Pressure P and Sliding Velocity V based on conditions of use to check that no abnormal wear will occur.
Calculate cross point based on the calculated P and V values in PV Graph.
When the cross point is located inside the line ① or ② in PV Value Graph, it can be stated that no abnormal wear will occur.

Lead Screw Nut Selection Procedure

Determine conditions of use. - - - **Axial Load, Speed**

↓

Temporarily select the Lead Screw Nut part number. - - - Lead Screw Nut Material

↓

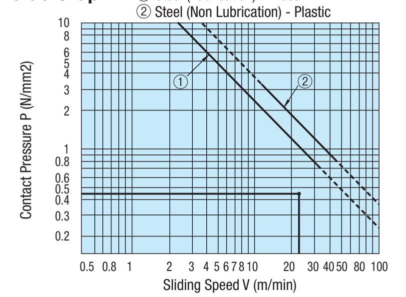
Calculate ① Contact Pressure P and ② Sliding Speed V. Confirm that the cross point is located inside the lines in PV Graph. (NG → return to temporarily select the Lead Screw Nut part number.)

NG

↓

Calculate ③ Screw Efficiency η and ④ Load Torque T. - - - For Selection of Motors, etc.

PV Value Graph ① Steel (Lubrication) - Brass ② Steel (Non Lubrication) - Plastic



①Contact Pressure P (N/mm²)

$$P=\frac{Fs}{Fo}\times\alpha$$

Fs: Axial Load (N)
Fo: Allowable Dynamic Thrust (N)→Nuts for Lead Screw Specifications
The thrust when the contact pressure acting on the screw shaft and nuts is 9.8 (N/mm²)
α: 9.8 (Brass), 0.98 (Resin)

②Sliding Speed V (m/min)

$$V=\frac{\pi\cdot d_2\cdot n}{\cos(d)}\times10^{-3}$$

d2: Screw Shaft Effective Dia. →Nuts for Lead Screw Specifications
d: Screw Shaft Lead Angle (Degree) →Nuts for Lead Screw Specifications
n: Screw Shaft Revolution Frequency per Minute (min^{-1})

③Screw Efficiency η

$$\eta=\frac{1-\mu\tan(d)}{1+\mu/\tan(d)}$$

µ: Dynamic Friction Coefficient
d: Screw Shaft Lead Angle (Degree)

Dynamic Friction Coefficient Reference Value

Thread Shaft	Nut	Dynamic Friction Coefficient µ
Steel (Lubrication)	Brass	0.21
Steel (Non Lubrication)	Polyacetal / PPS Resin with Sliding Property	0.13

④Load Torque T (N·cm)

$$T=\frac{FS\cdot R}{2\pi\cdot\eta}$$

Fs: Axial Load
η: Screw Efficiency
R: Lead (cm)

Calculation Example

In case of using MTSRW16 shaft, pitch 3 and MTSFR16 brass flanged nut when the axial load is 300(N) as rotational speed at 500min-1.

①Contact Pressure P (N/mm²)

$$P=\frac{Fs}{Fo}\times\alpha=\frac{300}{6670}\times9.8=0.44(N/mm^2)$$

②Sliding Speed V (m/min)

$$V=\frac{\pi\cdot d_2\cdot n}{\cos(d)}\times10^{-3}=\frac{\pi\times14.5\times500}{\cos(3°46')}\times10^{-3}=22.8(m/min)$$

When the PV Graph is viewed based on the calculated P and V values, the cross point V=22.8(m/min) when P=0.44(N/mm²) is located inside the line ①, thus it can be stated that no abnormal wear will occur.

Calculation Example

Required Torque when using screw shaft MTSRW16, pitch 3, nut MTSFR16 (flanged brass)

③Screw Efficiency η

$$\eta=\frac{1-\mu\tan(d)}{1+\mu/\tan(d)}=\frac{1-0.21\times\tan(3°46')}{1+0.21/\tan(3°46')}=0.24$$

Also, in a case of calculating for the Load Torque T (N·cm) when the axial load is 300N.

④Load Torque T (N·cm)

$$T=\frac{FS\cdot R}{2\pi\cdot\eta}=\frac{300\times0.3}{2\pi\times0.24}=59.7(N\cdot cm)$$