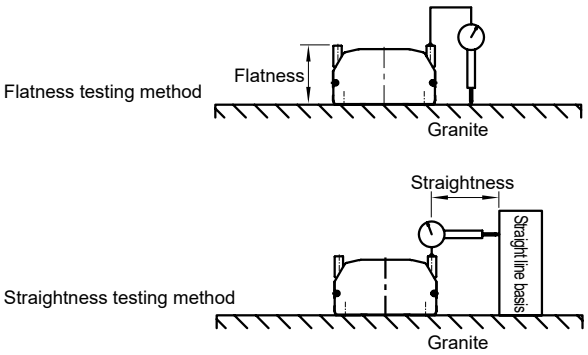
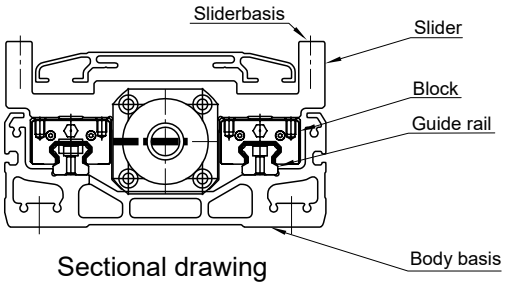
Flatness and straightness standard

Flatness standard=The parallelism of body basis and slider basis is less then 0.05mm/M
Straightness standard=The parallelism of slider basis and straight line basis is less then 0.05mm/M

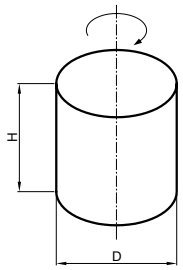




Sectional drawing

Equation of moment of inertia calculation

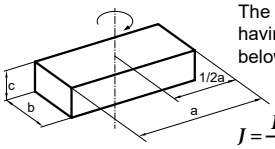
Usually the load is not simple form, and the calculation of the moment of inertia is not easy. As a method, load is replaced with several factors that resemble a simple form for which the moment of inertia can be calculated. The total of the moment of inertia for these factors is the obtained. The objects and equations often used for the calculation of the moment of inertia are shown below.



1.Moment of inertia for cylinder
The moment of inertia(J) for a cylinder having a rotation center such as shown below is given by

$$J=\frac{P\pi D^4h}{32\times980}=\frac{WD^2}{8g}\ (kgf\cdot cm\cdot sec^2)$$
$$=\frac{mD^2}{8}\ (Kgm^2)$$

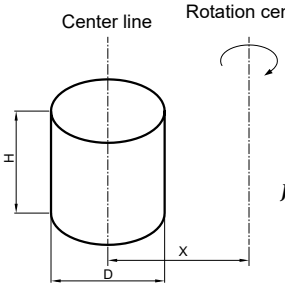
P = Density (kg/cm^3)
g = Gravitational acceleration (cm/sec^2)
W =Weight of cylinder (kgf)
m = Mass of cylinder (kg)



2.Moment of inertia for rectangular parallelepiped
The moment of inertia(J) for a cylinder having a rotation center such as shown below is given by

$$J=\frac{Pabc(a^2+b^2)}{12}=\frac{W(a^2+b^2)}{12g}\ (kgf\cdot cm\cdot sec^2)$$
$$=\frac{M(a^2+b^2)}{12}\ (Kgm^2)$$

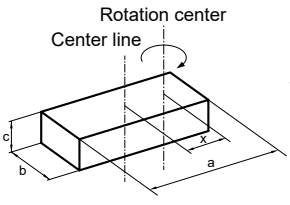
P = Density (kg/cm^3)
g = Gravitational acceleration (cm/sec^2)
W =Weight of cylinder (kgf)
m = Mass of cylinder (kg)



3.When the object's center line is offset from the rotation center
The moment of inertia(J) for a cylinder having a rotation center such as shown below is given by

$$J=\frac{P\pi D^4h}{32}+\frac{P\pi D^4h}{4}=\frac{WD^2}{8g}+\frac{WX^2}{G}\ (kgf\cdot cm\cdot sec^2)$$
$$=\frac{mD^2}{8}+mX^2(Kgm^2)$$

P = Density (kg/cm^3)
g = Gravitational acceleration (cm/sec^2)
W =Weight of cylinder (kgf)
m = Mass of cylinder (kg)



$$J=\frac{Pabc(a^2+b^2)}{12}+\frac{PabcX^2}{G}$$
$$=\frac{W(a^2+b^2)}{12g}+\frac{WX^2}{G}\ (kgf\cdot cm\cdot sec^2)$$
$$=\frac{M(a^2+b^2)}{12}+mX^2(Kgm^2)$$

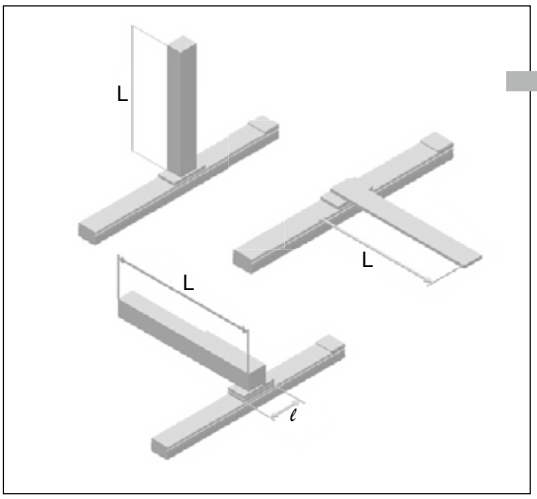
W =Weight of prism (kgf)
m = Mass of prism (kg)

Technical wording reference

SLIDER ELECTRIC ACTUATOR

Overhang load length

An overhang load length is specified for a slider-type actuator to indicate the length of overhang (offset) from the actuator. When the length of an object mounted to the slider actuator exceeds this length, it will generate vibration and increase the setting time. So, pay attention to the allowable overhang length as well as the allowable dynamic moment.



The allowable overhang load length is determined by the slider length.

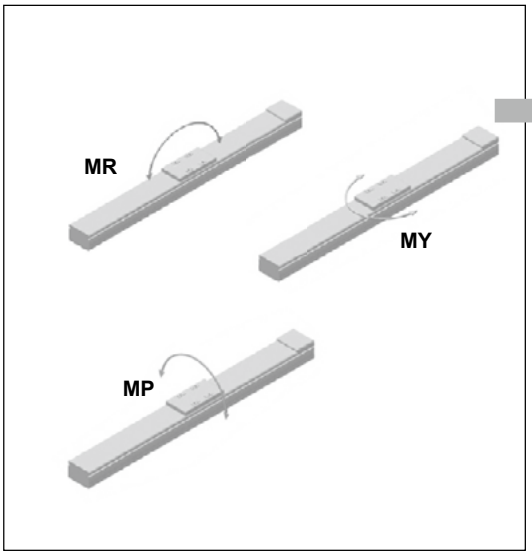
An overhang that exceeds the allowable overhang length will generate vibration and increase settling time.

L/ℓ =5 Within
* Between 3 to 4 for acamera equipped measuring machine.

- For example
L/ℓ =1.2 Mechanical machine
L/ℓ =3 Mechanical machine
L/ℓ =5 Robot

Allowable dynamic moment

The allowable dynamic moment is the maximum offset load exerted on the slider, calculated from the guide life. The direction in which force is exerted on the guide is categorized into 3 directions-MP(pitch), MY(yaw), MR(roll)-the tolerance for each of which are set for each actuator. Applying a moment exceeding the allowable value will reduce the service life of the actuator. Use an auxiliary guide when working within or in excess of these tolerances.



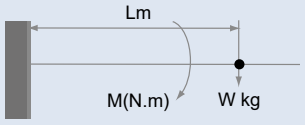
The allowable dynamic moment is calculated from the service life of the guide.

Over the moment would reduce the life of actuator.

*Moment is based on the following basis

M(N.m)=W(kg)×L(m)×9.8

W(kg)=Load
L(m)=Distance from work point to the center of gravity of payload.



Lead accuracy

PMI's precision ground ball screws are controlled in accordance with JIS B 1192.
The permissible values and each part of definitions are shown below.

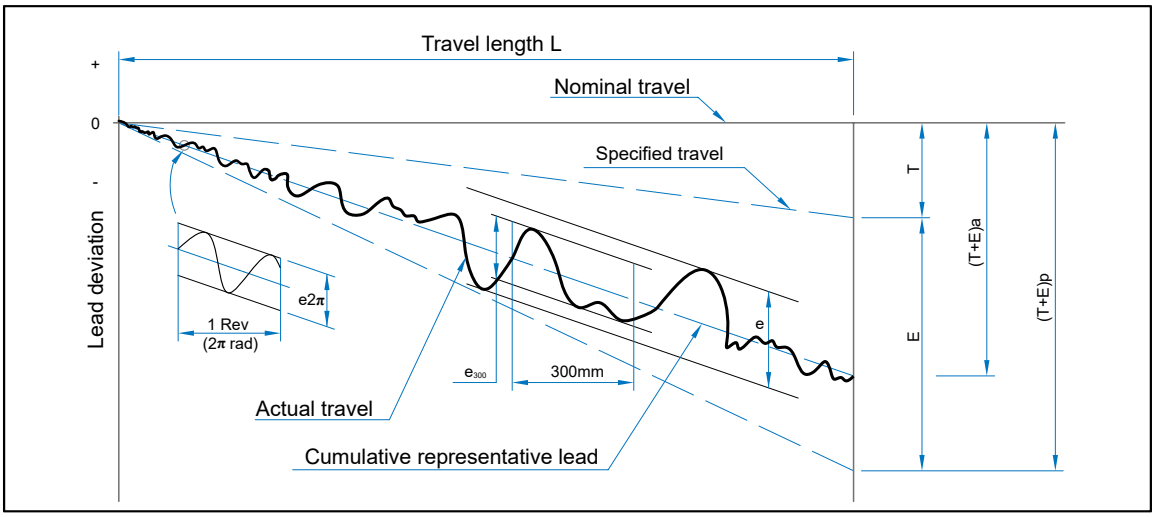


Fig.1 Technical terms concerning the lead

■ Table 1 Terms

T+E	Cumulative representative lead	Cumulative representative lead. A straight line representing the tendency of the cumulative actual lead. This is obtained by least square method and measured by laser system.
P		Permissible value.
a		Actual value.
T	Specified travel specify the target value	Specified travel. This value is determined by customer and maker as it depends on different application requirements.
E	Cumulative representative lead error	Accumulated reference lead deviation. This is allowable deviation of specified travel. It is decided by both of the accuracy grade and effective thread length.
e	Change	Total relative lead variation maximum width of variation over the travel length.
e_{300}		Lead deviation in random 300 mm.
$e_{2\pi}$		Lead deviation in random 1 revolution 2π rad.

■ Table 2 Accumulated reference lead deviation (±E) and total relative variation (e)

Effective thread length(mm) Grade	C0		C1		C2		C3		C4		C5		C6	C7	C8
Over up to	E	e	E	e	E	e	E	e	E	e	E	e	±0.025	±0.050	±0.120
315	4	3.5	6	5	5	7	12	8	12	12	23	18	/	/	/
315 400	5	3.5	7	5	7	7	13	10	14	12	25	20	300mm	300mm	300mm
400 500	6	4	8	5	8	7	15	10	16	12	27	20			
500 630	6	4	9	6	9	7	16	12	18	14	30	23			
630 800	7	5	10	7	10	7	18	13	20	14	35	25			
800 1000	8	6	11	8	11	8	21	15	22	16	40	27			
1000 1250	9	6	13	9	13	9	24	16	25	18	46	30			
1250 1600	11	7	15	10	15	10	29	18	29	20	54	35			
1600 2000			18	11	18	11	35	21	35	22	65	40			
2000 2500			22	12	21	13	41	24	41	25	77	46			
2500 3150			26	15	25	15	50	29	50	29	93	54			
3150 4000			32	18	30	18	62	35	62	35	115	65			
4000 5000					36	21	76	41	76	41	140	77			
5000 6300							85	50	85	50	170	96			
6300 8000							106	62	106	62	213	115			
8000									132	75	265	140			

■ Table 3 Accuracy grade

Variation in random 300mm (e_{300}) and wobble ($e_{2\pi}$)

α_{522}

Grade	C0	C1	C2	C3	C4	C5	C6	C7	C10
JIS	3.5	5		8		18		50	210
PMI	3.5	5	7	8	12	18	25	50	210

$\alpha_{4\pi}$

Grade	C0	C1	C2	C3	C4	C5
JIS	3	4		6		8
PMI	3	4	4	6	8	8