Fine Shaft

The CYRUS slide shaft is used with bearings such as a slide bush in order to obtain highly accurate linear motion. When used in combination with a slide bush, the shaft performs as the inner race of the bearing system. The quality and accuracy of the shaft directly affect the performance of the slide bush.

ADVANTAGES

1 · Advanced Machining Technology
2 · Excellent Wear Resistance
3 · Wide Selection of Shaft Types
4 · Special requirements
5 · Effective Depth of Hardened Layer

SUJ2 SHAFT-WCS

C	Si	Mn	P	S	Cr
0.95 ~ 1.10	0.15 ~ 0.35	Less than0.5	Less than 0.025	Less than 0.025	1.3~1.6

Outer diameter	Effective hardened layer depth
Over 6mm up to 12mm	0.8mm or more
Over 12mm up to 30mm	1.0mm or more
Over 30mm	2.0mm or more

1 · HRC60 ±2.
2 · Surface roughness less than：0.4Ra.
3 · Outer diameter tolerance：g6.
4 · Trartment-chromium plated.

SUS440C SHAFT

C	Si	Mn	P	S	Cr
0.95 ~ 1.2	Less than1.0	Less than1.0	Less than 0.04	Less than 0.03	1.3~1.6

TABLE OF TOLERANCE SIZE-g6

Diameter(mmφ)	Lever g6
6 ~ 10	-0.005 ~ -0.014
10 ~ 18	-0.006 ~ -0.017
18 ~ 30	-0.007 ~ -0.020
35 ~ 50	-0.009 ~ -0.025
50 ~ 80	-0.010 ~ -0.029

Fine Shaft

S45C SHAFT

Diameter(mmφ)					Remark
6	19	32	50.8	80	★ External Diameter Accuracy：h7、f8 ★ Surface Roughness：0.8～1.6S ★ Hard Chrom Thickness：20Micron±10% ★ Surface Hardness：HV800 以上 ★ Standard Lengths：3m～3.5m ★ Material：SAE1045，JIS(S45C), special specification and material are available. ★ And others, especially can be available ★ Max Diameter：1m
8	20	35	55	85	
10	22	35.5	56	90	
12	22.4	36	57.15	95	
13	25	38	60	100	
14	25.4	38.1	63	101.6	
15	28	40	63.5		
16	30	44.45	65		
17	31.5	45	70		
18	31.75	50	75		

Note：

1．Special specification and material are available.

2．High-Frequency treatment for chroming bar as option.

3．Grinding processing for inside and outside of the piston rods according to customer demand.

4．Offering lathe process available.

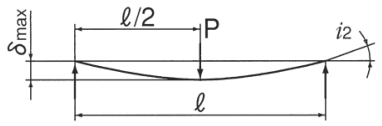
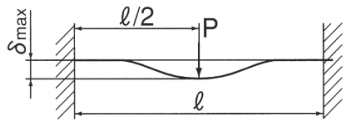
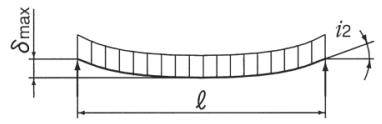
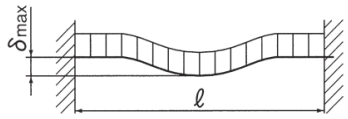
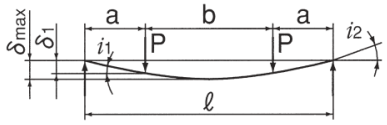
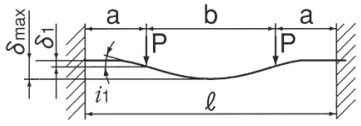
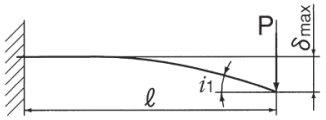
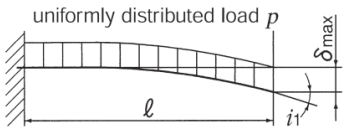
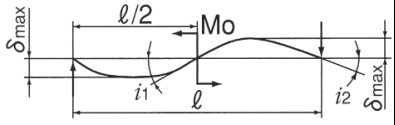
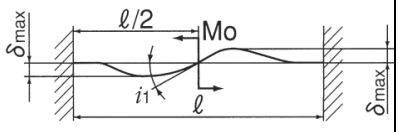
TABLE OF TOLERANCE SIZE -f8

Diameter(mmφ)	Lever f8
6～10	-0.013～-0.035
10～18	-0.016～-0.043
18～30	-0.020～-0.053
35～50	-0.025～-0.064
50～80	-0.030～-0.076
80～101.6	-0.036～-0.090

Fig. 34

Fine Shaft

CALCULATION OF DEFLECTION AND DEFLECTION ANGLE

Support method		Specification	Formula for deflection	Formula for angle
1	Support - Support		$\delta_{max}=\frac{P\ell^3}{48EI}P\ell^3C$	$i_1=0$ $i_2=\frac{P\ell^2}{16EI}=3P\ell^2C$
2	Fixed - Fixed		$\delta_{max}=\frac{P\ell^3}{192EI}=\frac{1}{4}P\ell^3C$	$i_1=0$ $i_2=0$
3	Support - Support		$\delta_{max}=\frac{5P\ell^4}{384EI}=\frac{5}{8}P\ell^4C$	$i_2=\frac{P\ell^3}{24EI}=2P\ell^3C$
4	Fixed - Fixed		$\delta_{max}=\frac{P\ell^4}{384EI}=\frac{1}{8}P\ell^4C$	$i_2=0$
5	Support - Support		$\delta_1=\frac{Pa^3}{6EI}\left(2+\frac{3b}{a}\right)=8Pa^3\left(2+\frac{3b}{a}\right)C$ $\delta_{max}=\frac{Pa^3}{24EI}\left(\frac{3\ell^2}{a^2}-4\right)=2Pa^3\left(\frac{3\ell^2}{a^2}-4\right)C$	$i_1=\frac{P_{ab}}{2EI}=24P_{ab}C$ $i_2=\frac{P_{a(a+b)}}{2EI}=24P_{a(a+b)}C$
6	Fixed - Fixed		$\delta_1=\frac{Pa^3}{6EI}\left(2-\frac{3a}{\ell}\right)=8Pa^3\left(2-\frac{3a}{\ell}\right)C$ $\delta_{max}=\frac{Pa^3}{24EI}\left(2+\frac{3b}{a}\right)=2Pa^3\left(2+\frac{3b}{a}\right)C$	$i_1=\frac{P_{a^2b}}{2EI\ell}=\frac{24P_{a^2b}C}{\ell}$ $i_2=0$
7	Fixed - Free		$\delta_{max}=\frac{P\ell^3}{3EI}=16P\ell^3C$	$i_1=\frac{P\ell^2}{2EI}=24P\ell^2C$ $i_2=0$
8	Fixed - Free		$\delta_{max}=\frac{P\ell^4}{8EI}=6P\ell^4C$	$i_1=\frac{P\ell^3}{6EI}=8P\ell^3C$ $i_2=0$
9	Support - Support		$\delta_{max}=\frac{\sqrt{3}Mo\ell^2}{216EI}=\frac{\sqrt[3]{3}}{9}Mo\ell^2C$	$i_1=\frac{Mo\ell}{12EI}=4Mo\ell C$ $i_2=\frac{Mo\ell}{24EI}=2Mo\ell C$
10	Fixed - Fixed		$\delta_{max}=\frac{Mo\ell^2}{216EI}=\frac{2}{9}Mo\ell^2C$	$i_1=\frac{Mo\ell}{16EI}=3Mo\ell C$ $i_2=0$

δ_1 : Deflection when load is applied(mm). δ_{max} : Maximum deflection(mm). i : Deflection angle when load is applied(red). i_2 : Deflection angle at the support(red). Mo : Moment (N+mm). P : Concentrated load(N). p : Uniformly distributed loan(N/mm). a, b : Loading point distance. ℓ : Span(mm). I : geometrical moment of inertia(mm^4). E : Modulus of direct elasticity 2.06×10^5(N/mm^2). C : 1/48EI($1/N+mm^2$).

THE I FORMULA OF SOLID SHAFT AND HOLLOW SHAFT (C=1/48EI)

- For solid shaft : $I=\frac{\pi D^4}{64}$
- For hollow shaft : $I=\frac{\pi}{64}(D^4-d^4)$