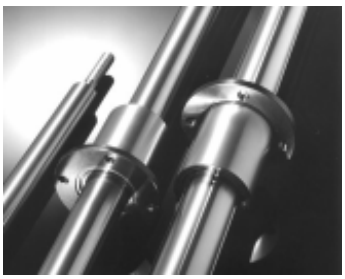
NSB

BALL SPLINE

PRECISION BALL SPLINE

ECONOMY BALL SPLINE

ROTARY BALL SPLINE



SUPER SPLINE BUSH

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Nippon Special Bearing Co.,Ltd

PRECISION BALL SPLINE

Dimensions

• R-A (3grooves) -- A20
• R-C (6grooves) -- A21

• FR-A (3grooves) -- A22
• FR-C (6grooves) -- A23

• MR-A (3grooves) -- A24
• MR-C (6grooves) -- A25

• MFR-A (3grooves) -- A26
• MFR-C (6grooves) -- A27

• KR-A (3grooves) -- A28
• KR-C (6grooves) -- A29

• H-A (3grooves) -- A30
• H-C (6grooves) -- A31

• FH-A (3grooves) -- A32
• FH-C (6grooves) -- A33

Dimensions
(Non Circulating ball type)

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ECONOMY BALL SPLINE

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ROTARY BALL SPLINE

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Spline shaft (Special design shaft)
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Incomplete length of the groove ----- C6
Accuracy standard ---------- C7
Clearance ---------- C8
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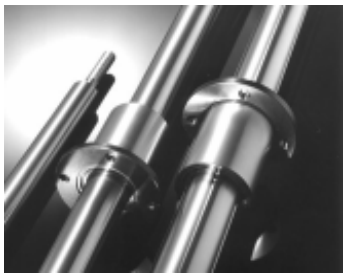
SUPER SPLINE BUSH



Features ---------- D1
Construction ---------- D1
Material . heat . treatment . Hardness ---- D2
Accuracy standard ---------- D2
Fit ---------- D2
Clearance ---------- D2
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Dimensions

SSB-F ---------- D3

Document to select ball splines

Basic dynamic rated load and operational life

● **Basic dynamic rated load (C)**

Basic dynamic rated load is defined as the constant load,under which 90 % of the bearings tested can sustain 50 km of running distance without flaking, when a group of linearly guided bearings is driven individually under the same condition.

● **Basic static rated load (Co) and factor of safety (S)**

Basic static rated load is defined as the load under which balls undergo permanent deformation of more than 0.000l times of their diameter, at the contact point of steel balls and guide groove, when balls receive maximum stress. In selecting ball spine for specific application, firstly it is necessary they have enough working life, and secondly their maximum load carrying capacity and basic static rated load Fmax should satisfy the re1ation expressed in the formula 1-1.

$$F\,max = \frac{Co}{S} \qquad (\text{Table 1-1})$$

Fmax : Maximum load ---------- (N)
Co : Basic static rated load ---------- (N)
S : factor of safety ---------- (Table 1-1)

Select the factor of safety from Table l-1,taking account of external variable load acting on the ball spline, as well a driving condition thereof.

Table 1-1

Conditio of operation	S
Normal operation	1 ～ 3
Operation with Vibration or shock	3 ～ 5

Calculating formula for the life

Life of the NSB ball spline is defined as the time the first symptom of flaking (spalling due to fatigue) appears on sleeve (bushing), guide roller or spline shaft.

● **In the case where radial load is applied**

$$L = \left(\frac{Cr \cdot ft \cdot fh \cdot fp}{F \cdot fw} \right)^3 Lo \qquad \text{(Formula 1-2)}$$

● **In the case where torque is applied**

$$L = \left(\frac{Ct \cdot ft \cdot fh}{T \cdot fw} \right)^3 Lo \qquad \text{(Formula 1-3)}$$

● **In the case where composite load is applied**
(Simultaneous application of radial load and torque)

$$L = \left(\frac{Cr \cdot ft \cdot fh \cdot fp}{\sqrt{\left(\frac{T}{fs} \right)^2 + F^2} \cdot fw} \right)^3 Lo \qquad \text{(Formula 1-4)}$$

L : Travel life ---------- (km)
Cr : Basic dynamic radial load ---------- (N)
Ct : Basic dynamlc torque ---------- (N・m)
F : Working radial load ---------- (N)
T : Working torque ---------- (N・m)
f s : Composite load factor ---------- (Table 1-3)
f t : Temperature factor ---------- (Fig1-1)
f h : Hardness factor ---------- (Fig1-2)
fw : Load factor ---------- (Table 1-2)
f p : Ratio of rated load ---------- (Fig1-3)
L o : Basic travelling life = 50 km

● **Calculation of the life**

The life of the bearing can be calculated by the formula l-5 taking into account of stroke length and strokes per minutes.

$$LH = \frac{10^6 \cdot L}{120 \cdot St \cdot n} \qquad \text{(Formula 1-5)}$$

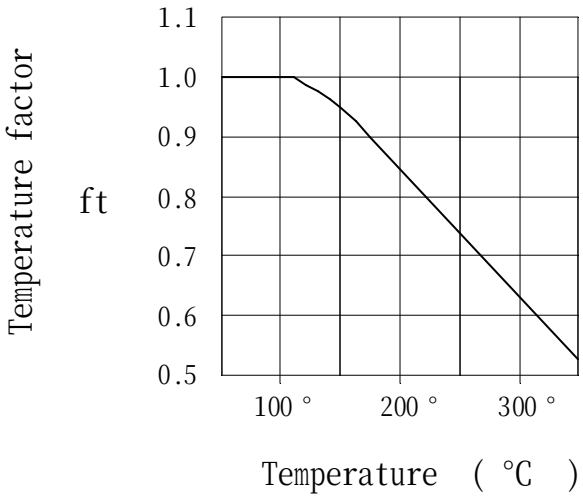
LH : Life duration---------- (hr)
L : Travel life ---------- (km)
St l : Stroke length---------- (mm)
n : Number of reciprocal motion per minute --- (cpm)

Factor affecting the life of the ball splines

● **Temperature factor** (ft)

The basic rating load can only be applied for operating temperature below l00℃.
When operating continuouslv or temporary above this temperature, multiplication of the temperature factor is necessary.

Fig 1-1



Note : Retainer for **NSB** economy ball spline is made of synthetic resin,thus there is a limit for operating temperature. Please use it under the operating temperature below 80℃.

● **Load factor** (fw)

Higher load than calculated value may be acting during vibration or impact . Load factor shown in the Table l-2 should be adopted according to the condition applied.

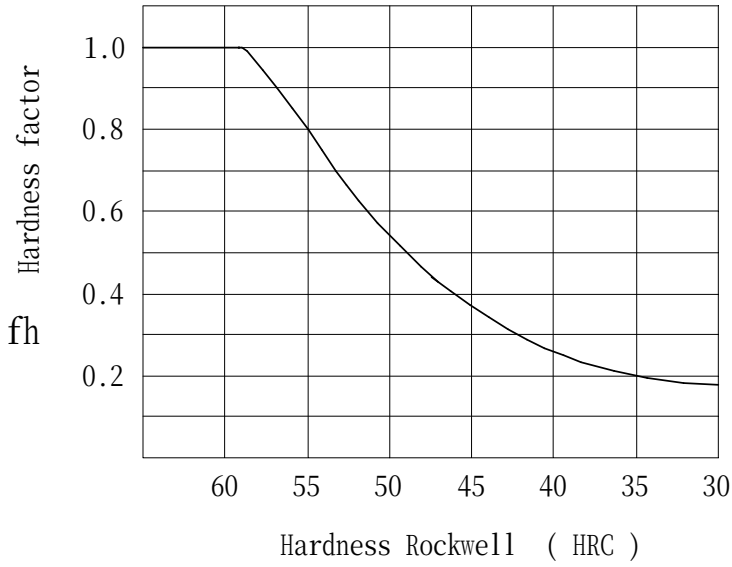
Table l-2

Condition of operation	f w
Operation scarcely with vibration or shock Low speed driving .Less than 15 m/min	1.0 ～ 1.2
Operation with some vibration or shock Medium speed driving .Less than 60 m/min	1.2 ～ 2.0
Operation with severe vibration or shock High speed driving .More then 60 m/min	2.0 ～ 3.5

● **Hardness factor** (fh)

The basic rating load can only be applied for rolling surfaces with hardness of HRC 58 or more. When using rolling surfaces with hardness of less than this value, multiplication of the hardness factor is necessary.

Fig 1-2



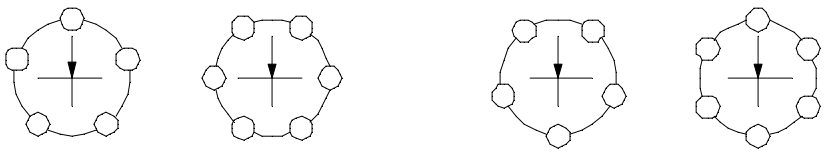
● **Ratio of rated load** (f p)

Basic rated radial loads are adopted only for balanced loads as shown in Fig.1-3(a). Please multiply ratio of rated load (fp) in the case when load is applied directly above, as shown in Fig.1-3(b).

Fig 1-3 (a)

fp = 1 fp = 1 fp = 1 fp = 0.71

Fig 1-3 (b)



fp = 1 fp = 1 fp = 0.68 fp = 0.78

● **Composite load factor** (fs)

The composite load factor is applied when both the radial load and the torque are applied simultaneously. Adopt composite load factor in the Table l-3 for the equation l-4.

• **Precision Ball Spline** (fs)

Table l-3

Shaft diameter (mm)	R • FR MR • MFR • KR H • FH		SR FSR KSR	
	A	C	A	C
6	0.009	-	0.011	-
8 (6.9)	0.013	-	0.015	-
10 (8.9)	0.016	-	0.018	-
12 (10.9)	0.019	-	0.021	-
16 (14.5)	0.024	-	0.027	-
20 (18.5)	0.031	-	0.033	-
25 (23.5)	0.039	-	0.041	-
30 (28.0)	0.046	0.092	0.050	0.100
40 (36.5)	0.060	0.120	0.066	0.132
50 (46.5)	0.075	0.150	0.082	0.164
60 (55.0)	0.091	0.182	0.096	0.192
80 (74.5)	0.122	0.244	-	-
100 (92.0)	0.152	0.304	-	-

Note 1.Dimensions in parentheses indicate axes diameters of FH and H type.

2. “ A ” indicates three grooves ,while “ C ” is for six grooves.

• **Economy ball spline . Rotary ball spline. Super spline bush** (fs)

Table l-4

Type	LSK LSF LST LS-R LS-RY LK-R	LSKL LSKW LSFL LSFW LSTW SSB
6	0.011	-
8	0.014	-
10	0.020	
13	0.032	
16	0.057	
20	0.068	
25	0.073	
30	0.085	

Lubrication

In NSB ball spline, bearing balls rotate along with the stroking of the shaft, thus this bearing will not seize even if the bearg is used without any lubricant. This is one of the excellent features of this bearing. It is recommended, however, to apply the lubricants as shown in the Table l-5, in order to reduce wear, improve life and suppress noise during operation. Rough idea for lubricating interval may be for each l00 km of normal usage.

Table l-5

Lubricants	Kind	Brand name	Maker
Grease	Lithium Soap Group Grease	Alvania No.2	Shell Oil
Oil	Spindle oil # 60 Turbine # 90 ～ 180	Teresso 52	Esso

Frictional resistance

NSB rolling linearly guided bearing can move axes linearly with less power by using a number of steel balls. Frictional resistance of the bearing can be expressed by formula l-6, though the resistance may vary according to the type of the bearing , type of the load application , stroking velocity , lubricant and amount of preloading.

Table 1-6

Bearing type	Coefficient of friction μ
R . FR . MR . MFR KR . H . FH SR . FSR . KSR	0.002 ～ 0.004
LSK . LSF . LST LSKL . LSFL LSKW . LSFW. LSTW LS-R. LS-RY. LK-R SSB	0.004 ～ 0.006

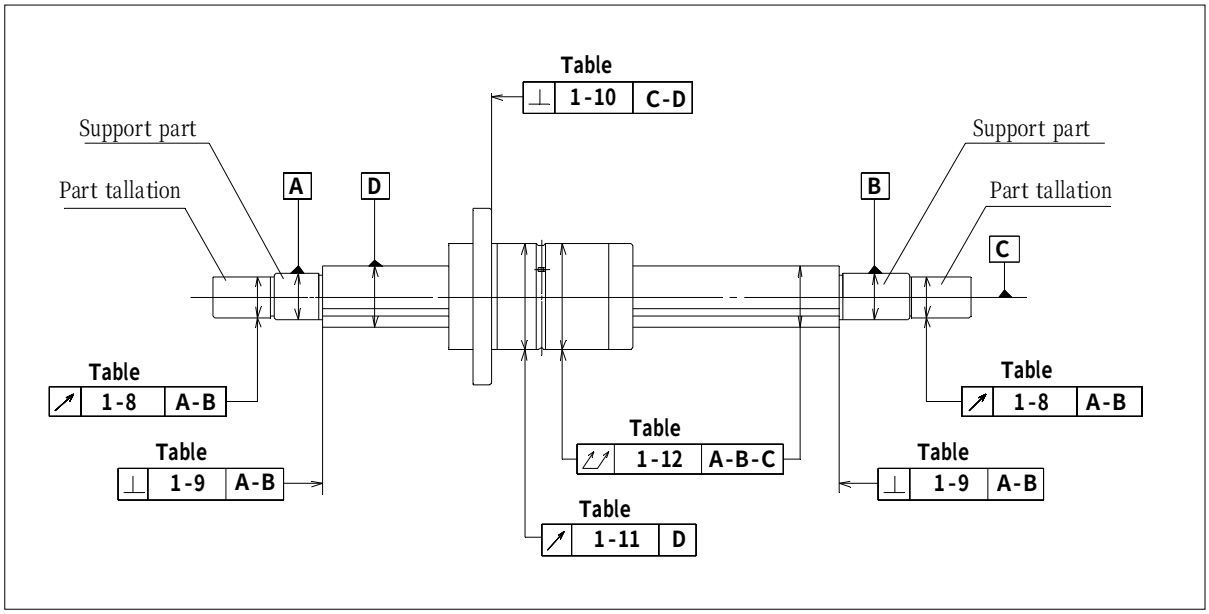
$F = \mu W$ ---------- (formula 1-6)

F : Frictional resistance ---------- (N)
μ : Coefficient of friction ---------- (Table 1-6)
W : Load acting on the bearing ---------- (N)

When seal is adopted, its friction should be added. The seal presses axes by about 0.1N, seal resistance will reach up to about ten times compared with the case where no seal is adopted.

Accuracy Standard

NSB Ball splines arc ranked Normal grade. high grade (H) and precision grade (P).



● **Tolerance of twist of groove m refer6nce to effective length of spline**

Tolerance of twist of groove m spline is expressed for arbitrary chosen 100 mm effective length of spline portion of spline shaft . See Table 1-7.
If relative movement between sleeve and spline shaft exceeds 100 mm ,correct the tolerance shown in Table 1-7,in proportion to the stroke.

Table 1-7 (Unet: μm)

Tolerance of twist		
Normal grade	High grade (H)	Precision grade (P)
33	13	6

● **Radial .Circumferential run out of installed position of part to supporting axis of spline shaft** Note. Diamension in parentheses indicate axes diameters of H and FH types.

Table 1-8 (Unet: μm)

	Run-out (Max)		
	Normal grade	High grade (H)	Precision grade (P)
6 8 (6.9)	33	14	8
10 (8.90) 12 (10.9)	41	17	10
13 16 (14.5) 20 (18.5)	46	19	12
25 (23.5) 30 (28.0)	53	22	13
40 (36.5) 50 (46.5)	62	25	15
60 (55.0) 80 (74.5)	73	29	17
100 (92.0)	86	34	20

● **Squareness of end face of spline portion to supporting axis of spline shaft.**

Note. Diamension in parentheses indicate axes diameters of H and FH types.

Table 1-9 (Unet: μm)

Type	Squareness (Max)		
	Normal grade	High grade (H)	Precision grade (P)
6 8 (6.9)	22	9	6
10 (8.90) 12 (10.9)	22	9	6
13 16 (14.5) 20 (18.5)	27	11	8
25 (23.5) 30 (28.0)	33	13	9
40 (36.5) 50 (46.5)	39	16	11
60 (55.0) 80 (74.5)	46	19	13
100 (92.0)	54	22	15

● **Squareness of reference end face of sleeve or flange mating surface to center line of spline axis.**

Note. Diamension in parentheses indicate axes diameters of H and FH types.

Table 1-10 (Unet: μm)

Type	Squareness (Max)		
	Normal grade	High grade (H)	Precision grade (P)
6 8 (6.9)	27	11	8
10 (8.90) 12 (10.9)	33	13	9
13 16 (14.5) 20 (18.5)	39	16	11
25 (23.5) 30 (28.0)	46	19	13
40 (36.5) 50 (46.5)	54	22	15
60 (55.0) 80 (74.5)	63	25	18
100 (92.0)	72	29	20

● **Radial ,circumferential run out of sleeve outer surface to center line of spline shaft.**

Note. Diamension in parentheses indicate axes diameters of H and FH types.

Table 1-11 (Unet: μm)

Type	Run-out (Max)		
	Normal grade	High grade (H)	Precision grade (P)
6 8 (6.9)	27	11	5
10 (8.90) 12 (10.9)	33	13	6
13 16 (14.5) 20 (18.5)	39	16	7
25 (23.5) 30 (28.0)	46	19	8
40 (36.5) 50 (46.5)	54	22	10
60 (55.0) 80 (74.5)	63	25	12
100 (92.0)	72	29	14

● **Total radial run out of center line of spline Shaft.**

Note. Diamension in parentheses indicate axes diameters of H and FH types.

Table 1-12 (Unet: μm)

Total shaft diameter (mm) Over ～ Incl	**Normal grade** Run-out (Max) Shaft diameter (mm) 6 ～ 8 (6.9)	10 (8.9) ～ 12 (10.9)	13 16 (14.5) ～ 20 (18.5)	25 (23.5) ～ 30 (28.0)	40 (36.5) ～ 50 (46.5)	60 (55.0) ～ 80 (74.5)	100 (92.0)
～ 200	72	59	56	53	53	51	51
200 ～ 315	133	83	71	58	58	55	53
315 ～ 400		103	83	70	63	58	55
400 ～ 500		123	95	78	68	61	57
500 ～ 630			112	88	74	65	60
630 ～ 800			137	103	84	71	64
800 ～ 1000			170	124	97	79	69
1000 ～ 1250				151	114	90	76
1250 ～ 1600				190	139	106	86
1600 ～ 2000					173	128	99
2000 ～ 2500						156	117

Table 1-12 (Unet: μm)

Total shaft diameter (mm) Over ～ Incl	**High grade (H)** Run-out (Max) Shaft diameter (mm) 6 ～ 8 (6.9)	10 (8.9) ～ 12 (10.9)	13 16 (14.5) ～ 20 (18.5)	25 (23.5) ～ 30 (28.0)	40 (36.5) ～ 50 (46.5)	60 (55.0) ～ 80 (74.5)	100 (92.0)
～ 200	46	36	34	32	32	30	30
200 ～ 315	89	54	45	39	36	34	32
315 ～ 400		68	53	44	39	36	34
400 ～ 500		82	62	50	43	38	35
500 ～ 630			75	57	47	41	37
630 ～ 800			92	68	54	45	40
800 ～ 1000			115	83	63	51	43
1000 ～ 1250				102	76	59	48
1250 ～ 1600				130	93	70	55
1600 ～ 2000					118	86	65
2000 ～ 2500						106	78

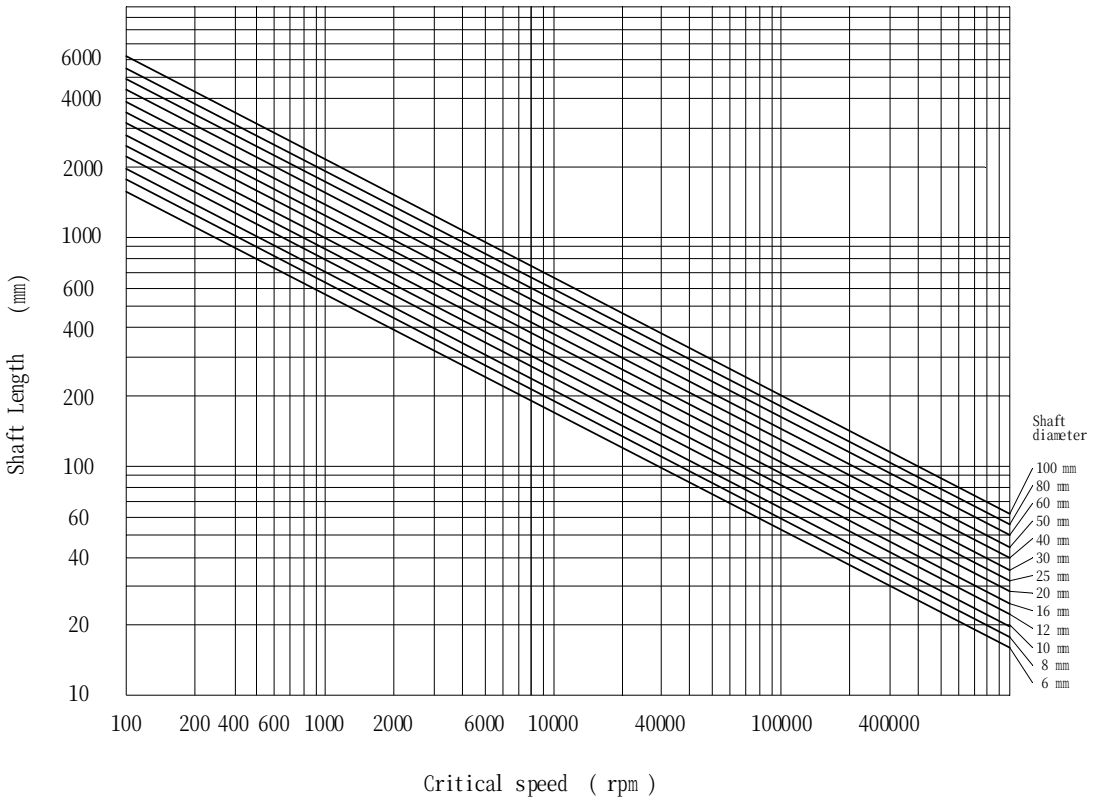
Table 1-12 (Unet: μm)

Total shaft diameter (mm) Over ～ Incl	**Precision grade (P)** Run-out (Max) Shaft diameter (mm) 6 ～ 8 (6.9)	10 (8.9) ～ 12 (10.9)	13 16 (14.5) ～ 20 (18.5)	25 (23.5) ～ 30 (28.0)	40 (36.5) ～ 50 (46.5)	60 (55.0) ～ 80 (74.5)	100 (92.0)
～ 200	26	20	18	18	16	16	16
200 ～ 315	57	32	25	21	19	17	17
315 ～ 400		41	31	25	21	19	17
400 ～ 500		51	38	29	24	21	19
500 ～ 630			46	34	27	23	20
630 ～ 800			58	42	32	26	22
800 ～ 1000			75	52	38	30	24
1000 ～ 1250				65	47	35	28
1250 ～ 1600				85	59	43	33
1600 ～ 2000					77	54	40
2000 ～ 2500						68	49

Critical Speed

For high speed revolution application of spline shaft, shaft length and diameter should be selected considering strength ,rigidity and above all ,critical speed .Fig.1-4 shows critical speed of ball spline shafts .In selecting shaft diameter of the ball spline ,operating rotational speed should be at least 20% higher or lower than the critical speed.

Fig.1-4



Strength of the shaft

● Change in geometrical moment of inertia and polar moment of inertia

Geometrical moment of inertia (second moment of area) Iz and polar moment of inertia Ip are shown in Table 1-13

Please refer these values when examination of bending rigidity or torsional rigidity of the shaft is necessary from standpoint of design.

Table 1-13 (a)

(mm)

Precision ball spline				
Shaft dia	Geometrical moment of inertia		Polar moment of inertia	
	($\times 10^4$ mm^4)			
	I z		I p	
	A (3grooves)	C (6grooves)	A (3grooves)	C (6rooves)
6	0.0052	-	0.0104	-
8	0.0175	-	0.0349	-
10	0.0433	-	0.087	-
12	0.0935	-	0.1871	-
16	0.2854	-	0.5707	-
20	0.7265	-	1.453	-
25	1.8235	-	3.6471	-
30	3.7654	3.5546	7.5307	7.1092
40	12.0261	11.4857	24.0521	22.9713
50	29.207	27.7344	58.414	55.5915
60	60.4364	57.1919	120.8728	114.5111
80	192.6173	184.1728	385.6368	368.7476
100	467.8028	444.7317	935.6056	889.4634

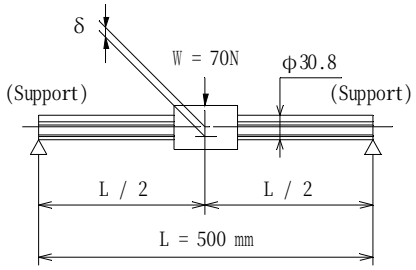
Table 1-13 (b)

(mm)

Economy ball spline Rotary ball spline Super spline bush		
Shaft dia	Geometrical moment of inertia	Polar moment of inertia
	($\times 10^4$ mm^4)	
	I z	I p
6	0.0062	0.0124
8	0.0197	0.0394
10.4	0.0557	0.1114
13.4	0.1551	0.3102
16.6	0.3616	0.7232
20.6	0.8742	1.7484
25.8	2.1314	4.2628
30.8	4.3733	8.7466

● Example of calculation

(1) Calculate the deflection of spline shaft of the type LSK30 ball spline, shown in the following figure.



$$\text{Deflection } \delta = \frac{W L^3}{48 E \cdot I z} \quad (\text{mm})$$

$$= \frac{70 \times 500^3}{48 \times 21.56 \times 10^4 \times 4.3733 \times 10^4}$$

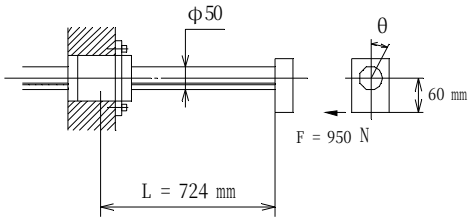
$$= 0.019 \text{ mm}$$

Modulus of longitudinal elasticity $E = 21.56^4 \times 10^2$ N / mm

Geometrical moment of inertia $I z = 4.3733^4 \times 10^4$ mm

(See table 1-13 (b) Page 13)

(2) Calculate the twist angle of spline shaft alone for the FR50C ball spline.



$$\text{Twist angle } \theta = \frac{F \cdot h \cdot L}{G \cdot I p} \times \frac{180}{\pi} \quad (°)$$

$$= \frac{950 \times 60 \times 724}{8.33 \times 10^4 \times 55.5915 \times 10^4} \times \frac{180}{3.14}$$

$$= 0.05 ° = 3 '$$

Modulus of transverse elasticity $G = 8.33^4 \times 10^2$ N / mm

Polar moment of inertia $I p = 55.5915^4 \times 10^4$ mm

(See table 2-15 (a) Page 13)

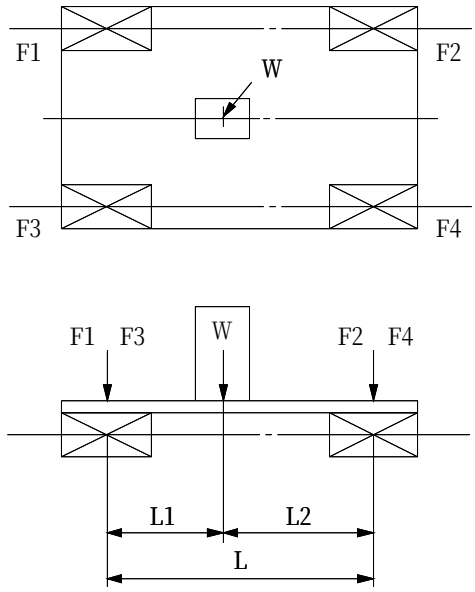
Acting load

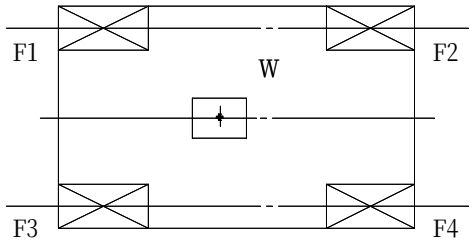
● **Load distribution**

Load distribution to the linearly guided bearing varies according to bearing arrangement and position of load application. Load distribution for conventional two parallel axes arrangement is as shown in Fig.1-5.

W : Load weight ---------- (N)
P : Thrust ---------- (N)
Fn: Bearing load ---------- (N)
V : Speed ---------- (mm/sec)
t : Time ---------- (sec)
L n : Arm length ---------- (mm)
g : Gravitational acceleration ------- (9.8×10^{3} mm / sec^{2})

Fig.1-5

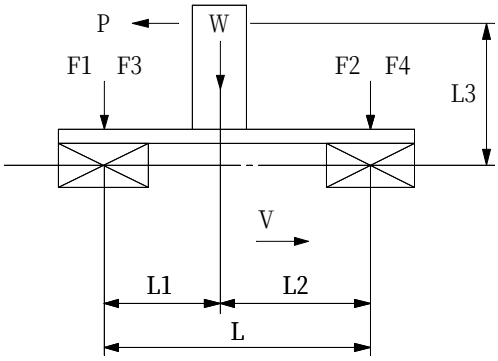
Bearing arrange	Gravitational Load on One Slide Bearing
	$F1 = F3 = \frac{W\,L2}{2\,L}$ $F2 = F4 = \frac{W\,L1}{2\,L}$



(1) In motion at a constnt speed

$$F1 = F3 = \frac{W\ L2}{2\ L}$$

$$F2 = F4 = \frac{W\ L1}{2\ L}$$

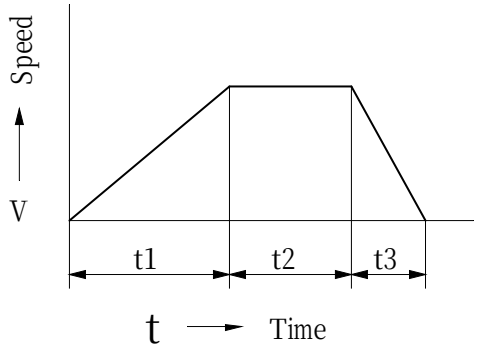


(2) On accelerating

$$P = \frac{W}{g} \cdot \frac{V}{t\ 1}$$

$$F1 = F3 = \frac{W}{2\ L} \left\langle L\ 2 + \frac{V\ L\ 3}{g\ t\ 1} \right\rangle$$

$$F2 = F4 = \frac{W}{2\ L} \left\langle L\ 1 - \frac{V\ L\ 3}{g\ t\ 1} \right\rangle$$



(3) On decelerating

$$P = \frac{W}{g} \cdot \frac{V}{t\ 3}$$

$$F1 = F3 = \frac{W}{2\ L} \left\langle L\ 2 - \frac{V\ L\ 3}{g\ t\ 3} \right\rangle$$

$$F2 = F4 = \frac{W}{2\ L} \left\langle L\ 1 + \frac{V\ L\ 3}{g\ t\ 3} \right\rangle$$

● **Mean load**

When load imposed on the bearing varies ,find out mean load which is equivalent to varied load ,in order to calculate the life of lineary guided bearing.

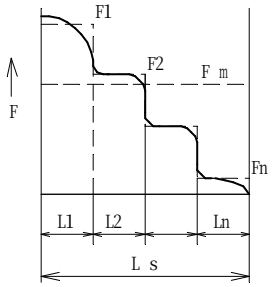
$$F_m = \sqrt[3]{\frac{1}{L_s}\int \cdot F_n^{3} \cdot L_n}$$

Fm : Mean Load ---------- (N)
F n : Fluctuating Load ---------- (N)
L s : Total travel distance ---------- (m)
L n : Travel distance under F n ------- (m)

Fig 1-6

Gradually Fluctuating Load (Formula1-7)

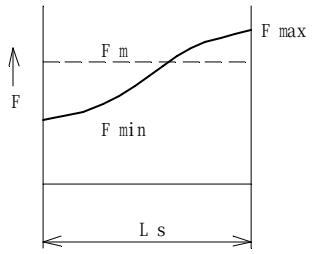
$$F_m = \sqrt[3]{\frac{1}{L_s}\left(F_1^{3} \cdot L_1 + F_2^{3} \cdot L_2 \cdots + F_n^{3} \cdot L_n\right)}$$



Simple Load Variation (Formula1-8)

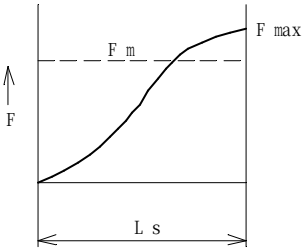
$$F_m = \frac{1}{3}\left(F_{min} + 2F_{max}\right)$$

(F min : Min Load (N)
F max : Max Load (N))

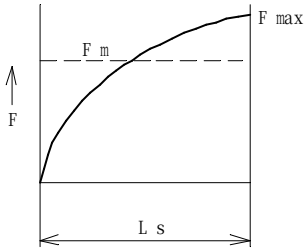


Sinusoidal Load Variation

F m 0.65 F max (Formula1-9)



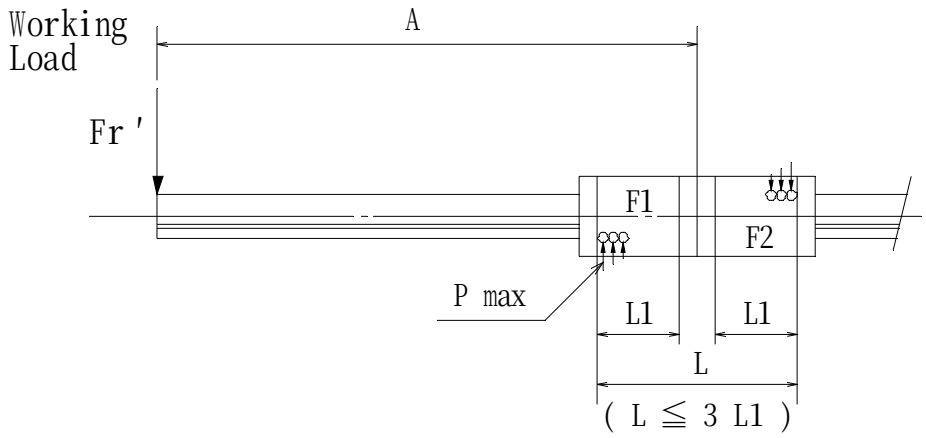
F m 0.75 F max (Formula1-10)



● **Moment load**

When NSB ball spline is used in the manner as shown in Fig. 1-7 and Fig.1-9, moment load is acting on the sleeve .The steel balls installed in the sleeve sustain uneven loads. However, if the distance between sleeves is large, loads are assumed to be uniformly distributed as approximation. Therefore, operational life can be calculated by one of the methods shown in Fig. 1-7 or Fig. 1-9, according to the sleeve distance. In the case only one sleeve is used ,operational life and maintenance of accuracy will be excessively diminished. Adoption of two sleeves is strongly recommended.

Fig. 1-7



When sleeves are installed closely as shown in Fig.1-7, or installation interval is less than three times of sleeve body length, find out the maximum distributed load Pmax, Which is the maximum value of unevenly distributed load. This value can be obtained from Fig.1-8

That is, K value in the ordinate of Fig.1-8 indicates ratio of maximum distributed load acting on steel ball Pmax, to mean load Fr ′ / i・z

$$K = \frac{Pmax}{Fr'/i \cdot z} \qquad (\text{Formula 1-11})$$

Where

i : Number of sleeves

z : Number of actually load carrying ball in a row of a sleeve

Type of the sleeve	z
R . FR . KR . H . FH	15
MR . MFR	10
SR . FSR . KSR	3
LSK . LSF . LST . LS-R . LS-RY . LK-R . SSB	6
LSKL . LSFL	9
LSKW . LSFW . LSTW	12

Thus Pmax can be calculated as P max = K・Fr ′ / i・z. To calculate operational life of ball spline, we assume Pmax is acting on all load carrying ball in a row, and radial load F is being applied:

F = P max・i・z = K・Fr ′ ---------- (Formula 1-12)

Length of steel ball rolling portion sustaining load (L1)

Item		L1
Precision ball spline	Circulating ball type	Length of sleeve = 1
	Non- circulating ball type	Length of sleeve = 1 / 4
Economy ball spline Rotary ball spline Super spline bush	LSK . LSF . LST LS-R. LS-RY.LK-R. SSB	Length of sleeve = 1 / 2
	LSKL . LSFL	Length of sleeve = 2 / 3
	LSKW . LSFW . LSTW	Length of sleeve = 3 / 4

Fig.1-8

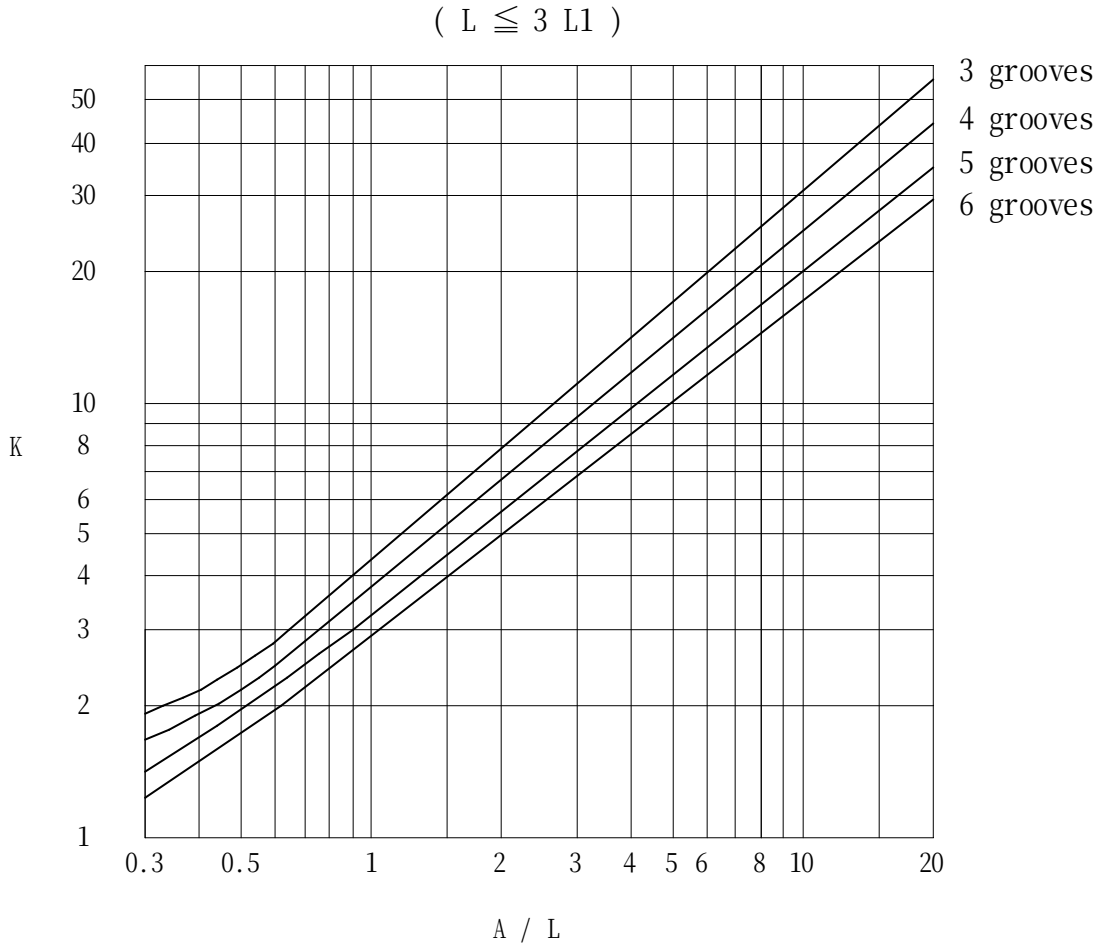
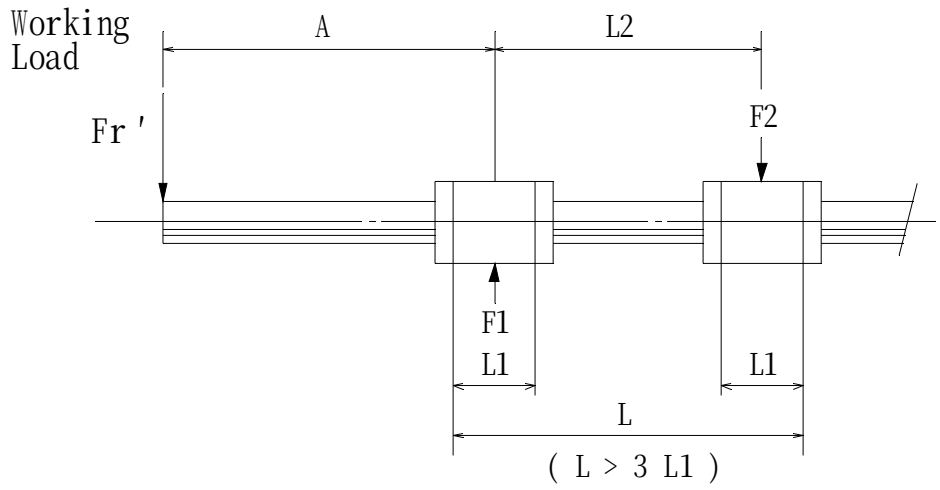


Fig.1-9



When the installation interval of sleeve exceeds three times of sleeve body length L1, radial load acting on sleeve may be calculated, assuming uniform load is applied to steel balls in the sleeve.

$$F1 = \frac{(L2+A)\,Fr'}{L2} \qquad \text{(Formula 1-13)}$$

$$F2 = \frac{A \cdot Fr'}{L2} \qquad \text{(Formula 1-14)}$$

Precision Ball spline

Feather key or spline with square section are often used as mechanical element to transfer torque and stroking axially simultaneously. These elements, however, have various problems concerning tribology features such as friction, too much wear ,and method of lubrication.

Ball spline, on the other hand, differs radically from above mentioned mechanisms, in that it uses steel balls between spline shaft and sleeve. These balls rotate and circulate, allowing the shaft to move smoothly m axial direction for both short and long strokes. Coefficient of friction of the ball spline is less than 0.004, which is about l/40 of the square spline. Therefore, only small force is necessary to move shaft axially while transmitting large torque. Also change m coefficient of friction is very small, thus no stick-slip phenomenon will occur. Repeated positioning with high accuracy is possible.

NSB Precision ball spline was developed in l968. We have ample know-how on machining this spline, such as development of our original grinding machine for spline groove inside the sleeve. Performances of ball spline are studied for a long time, thus our products have high accuracy and excellent performance, which will satisfy all customers. We recommend our NSB ball spline with utmost confidence.

Features

① Rolling surfaces of balls under load have semicircular grooves. This portion is ground with high accuracy after heat treatment, then finished by lapping. Thus this mechanism has high load carrying capacity, and smooth and stable starting action is possible.

② As frictional resistance is very small, big power saving call be expected. Also very accurate positioning is possible.

③ Man-hour can be saved, because frequent oiling or lubrication is not necessary. Failure such as seizure is prevented.

④ Two kinds of ball grooves, i.e, three and six (for shaft with 30 mm diameter or bigger) grooves are available . Please select one of them according to the load.

⑤ For circulating ball type, balls travel smoothly by the end-cap system adopted specially for NSB splines.

⑥ Backlash can be eliminated due to the fact that pre-load is applicable. This also results in enhancing rigidity against torsional moment.

Applications

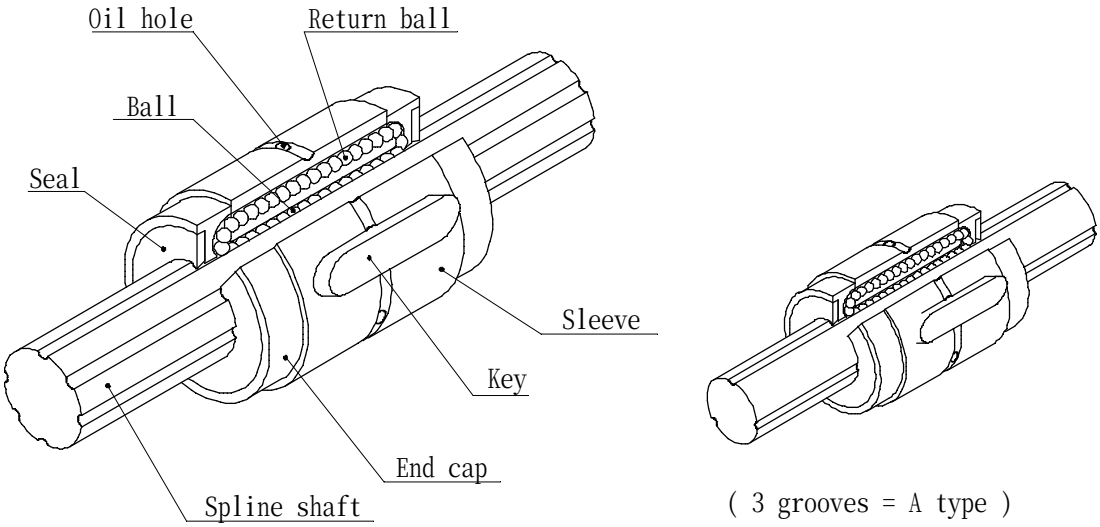
- Industrial robots
- Robots for taking out products
- Coil winding machines
- Inserting machines for electronic parts
- Paper cylinder formers
- Electic terminal crimping machines
- Honing machines
- Robots for welding
- Semiconductor producing machines
- Glass forming machines

etc.

Configuration

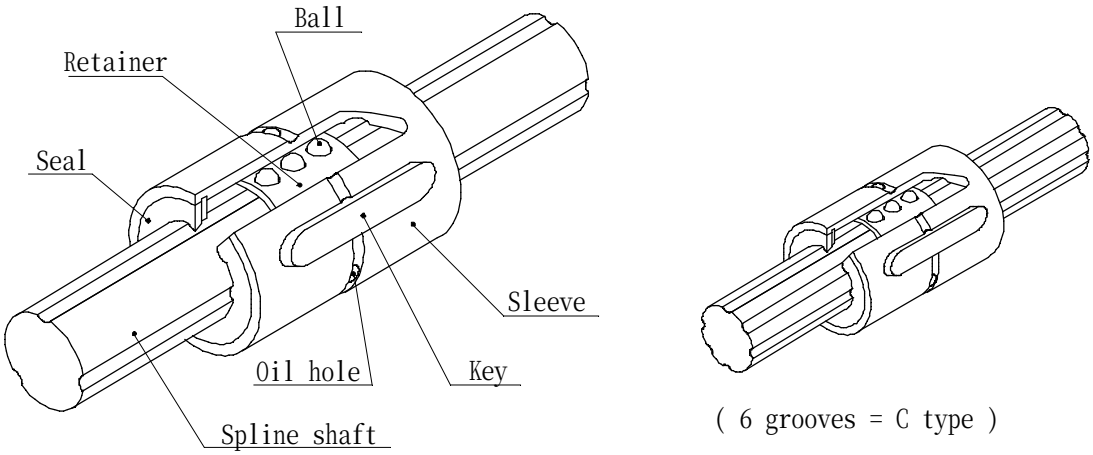
Circulating ball type NSB precision ball spline consists of spline shaft and sleeve moving on it ,as shown in Fig.2-1. The sleeve consists of sleeve body, end-cap and steel balls. Steel balls roll in the groove machined on the sleeve body and the spline shaft. This is limitless stroke type, in which balls circulate through return hole provided in sleeve body. (Please refer figure in the dimension table in H type and FH type)

Fig 2-1



Non- Circulating ball type NSB precision ball spline consists of spline shaft and sleeve moving on it, as shown in Fig.2-2. The sleeve consists of steel balls and retainer. Contrary to circulating type , sleeve is not provided with return hole for steel balls ,thus steel ball do not circulate .Movement of sleeve on spline shaft , therefore , it limited depending upon the shaft diameter . This non- circulating type is to be used for a limited stroke .

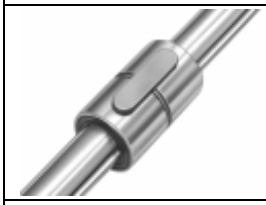
Fig 2-2



Kind of the sleeve (Circulating ball type)

Standard type		
	R-A (3 grooves) **R-C** (6 grooves)	Has high load carrying capacity for radial load. Fitted for transmission of the torque. Has high strength for moment load. This is a typical ball spline bearing.
	FR-A (3 grooves) **FR-C** (6 grooves)	
Medium-sized type		
	MR-A (3 grooves) **MR-C** (6 grooves)	Only small installation space is necessary, due to shot overall length. This is a compact type bearing. Best fitted for applying pre-load or when weight reduction is necessary.
	MFR-A (3 grooves) **MFR-C** (6 grooves)	
Setting radial bearing type		
	KR-A (3 grooves) **KR-C** (6 grooves)	This is a bearing which allows direct installation of rotary bearing at outer surface of the sleeve.
Retainer type		
	H-A (3 grooves) **H-C** (6 grooves)	Handling is easy because the retainer prevents balls from falling off when sleeve is extracted from the spline shaft. (Sizes and performances of the sleeve is the same as R,FR types.)
	FH-A (3 grooves) **FH-C** (6 grooves)	

Kind of the sleeve (None-circulating ball type)

Standard type		
	**SR-A** (3 grooves) **SR-C** (6 grooves)	This is a non-circulating ball type bearing with a sleeve of small diameter. Particularly fitted for limited stroke application.
	FSR-A (3 grooves) **FSR-C** (6 grooves)	
Setting radial bearing type		
	KSR-A (3 grooves) **KSR-C** (6 grooves)	This is a non-circulating ball type bearing bearing which allows direct installation of rotary bearing at outer surface of the sleeve.

Material . Heat treatment . Hardness . Surface finish

Table 2-1

Item	Material	Heat treatment	Hardness	Surface finish
Spline shaft	SUJ 2	Induction hardening	HRC 58 up	-
Sleeve	SUJ 2	Hardening	HRC 58 up	-
Steel ball	SUJ 2	Hardening	HRC 60 up	-
End cap	S50C	-	-	Phosphate coating
Retainer	Al . BC	-	-	-

Note. Retainers are using for type H . FH. SR. FSR. KSR.

Designation

NSB precision ball splines are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft. When you issue an order, please use the following form.

FR40 C UU - 2 - E - P - 1280 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

Table 2-2

①	Type of sleeve	**FR40** (Flange type. Shaft outer diameter = 40 mm)
②	Symbol for the number of grooves	**C** = 6 grooves (**A** = 3 grooves)
③	Seal	**UU** (Symbol for the ball spline with seals at both ends)
④	Number of sleeves per shaft	**2**
⑤	Clearance	**E** (See page A10 Table 2-6)
⑥	Symbol for accuracy levels	**P** (See page 8 Table 1-7 ～ 1-12)
⑦	Total length of shaft	**1280** mm
⑧	Other then standard stock	**T =** with additional machining
		L = without additional machining
⑨	Symbol for hollow shaft No symbol = Solid shaft	**M** (See page 8 Table 2-4)

※ Standard stock for shafts ("J" mark). See page A17 ～ A19. Table 2-9 (a) and (b)

Spline shaft (special design shaft)

● **Maximum length of the shafts**

Maximum length of the spline shafts we manufacture is shown in Table 2-3. Longer shafts can be manufactured to order .Please contact NSB.

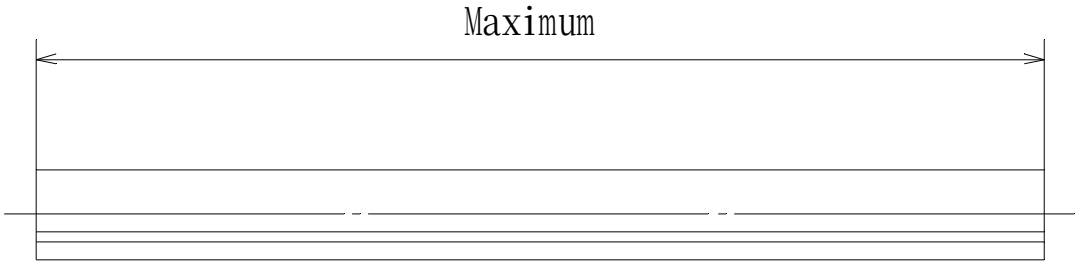


Table 2-3

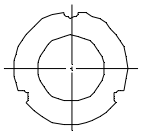
Shaft diameter (mm)	Maximum length of the spline shaft （mm）
6	200
8 (6.9)	300
10 (8.9)	400
12 (10.9)	500
16 14.5)	800
20 (18.5)	1200
25 (23.5)	1500
30 (28.0)	2000
40 (36.5)	3000
50 (46.5)	3000
60 (55.0)	3000
80 (74.5)	2500
100 (92.0)	1300

Note. Diamension in parentheses indicate axes diameters of H and FH types.

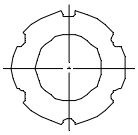
● **Hollow shaft** (M-mark)

We wm supply hollow shafts as shown in Table 2-4, when reduction of spline shaft weight or air passage through the shaft is necessary.

A = 3 grooves



C = 6 grooves



(Up to 30 mm)

Table 2-4

Shaft diameter (mm)	Hollow diameter (mm)
6	2
8 (6.9)	3
10 (8.9)	3
12 (10.9)	4
16 14.5)	6
20 (18.5)	8
25 (23.5)	12
30 (28.0)	17
40 (36.5)	21
50 (46.5)	28
60 (55.0)	33
80 (74.5)	52
100 (92.0)	68

Note. Dimension in parentheses indicate axes diameters of H and FH types.

● **Incomplete length of the groove**

When stepped machining is necessary ,use incomplete length Lt of spline shaft indicated in Table 2-5.

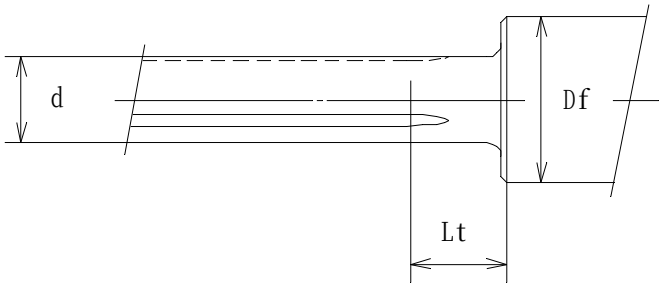


Table 2-5

d (mm)	Df (mm)															
	6	8	10	12	16	20	25	30	40	50	60	80	100	120	140	160
6	8	13	16	18	-	-	-	-	-	-	-	-	-	-	-	-
8 (6.9)	-	9	13	16	21	-	-	-	-	-	-	-	-	-	-	-
10 (8.9)	-	-	8	12	18	22	-	-	-	-	-	-	-	-	-	-
12 (10.9)	-	-	-	9	16	21	25	-	-	-	-	-	-	-	-	-
16 (14.5)	-	-	-	-	11	17	22	26	-	-	-	-	-	-	-	-
20 (18.5)	-	-	-	-	-	11	19	23	30	-	-	-	-	-	-	-
25 (23.5)	-	-	-	-	-	-	11	18	27	33	-	-	-	-	-	-
30 (28.0)	-	-	-	-	-	-	-	12	24	32	35	-	-	-	-	-
40 (36.5)	-	-	-	-	-	-	-	-	16	25	31	39	-	-	-	-
50 (46.5)	-	-	-	-	-	-	-	-	-	16	26	36	42	-	-	-
60 (55.0)	-	-	-	-	-	-	-	-	-	-	18	33	40	44	-	-
80 (74.5)	-	-	-	-	-	-	-	-	-	-	-	19	33	40	44	-
100 (92.0)	-	-	-	-	-	-	-	-	-	-	-	-	23	35	41	44

Note. Diamension in parentheses indicate axes diameters of H and FH types.

Clearance

For NSB precision ball splines , appropriate clearance adapted to usage is necessary in order to obtain long life and high accuracy. Please select correct clearance for the application.

Table 2-6 (Unet:mm)

Shaft diameter (mm)	E0	E	Normal (No symbol)	E1
6 8 (6.9) 10 (8.90)	—	-0.006 ～ -0.001	-0.001 ～ +0.004	+0.004 ～ +0.010
12 (10.9) 16 (14.5) 20 (18.5)	-0.012 ～ -0.006	-0.008 ～ -0.002	-0.002 ～ +0.005	+0.005 ～ +0.012
25 (23.5) 30 (28.0)	-0.014 ～ -0.006	-0.008 ～ -0.002	-0.002 ～ +0.006	+0.006 ～ +0.015
40 (36.5) 50 (46.5) 60 (55.0)	-0.020 ～ -0.012	-0.012 ～ -0.004	-0.004 ～ +0.008	+0.008 ～ +0.020
80 (74.5) 100 (92.0)	-0.025 ～ -0.016	-0.016 ～ -0.006	-0.006 ～ +0.010	+0.010 ～ +0.030
Condition of operation	・Receiving severe vibration or shock. ・Receiving over-hanged load. ・Places requiring high stiffness and exposed.	・Receiving weak vibration or shock. ・Places with alternating loads.	・When smooth driving with mall power is necessary. ・Receiving load in one direction only.	・For very long shaft. ・Where tempreature change is expected.

Note

1. Dimensions in parentheses indicate outer diameter of shafts for H and FH types.

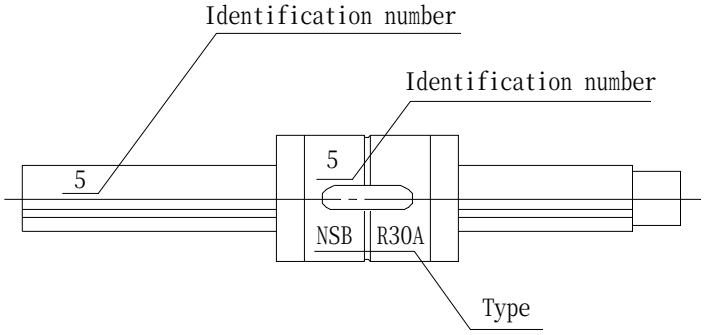
Remarks for application

NSB precision ball splines are very precisely machined parts. If handled improperly ,the accuracy may be wasted .During operation please take care of the following instructions.

① For installing sleeve into housing box do not knock end caps at both ends of sleeve ,directly. Also ,do not use outer surface of end cap to guide the sleeve into housing box.

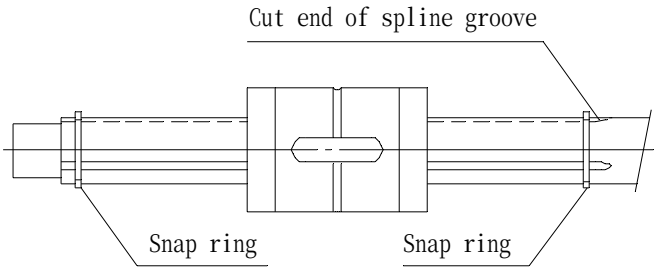
② Sleeve and spline shaft have identification numbers as shown in Fig.2-3. When disassembled using special tools ,please confirm identification number, direction of characters ,and relative position ,be fore re-assembling.

Fig.2-3



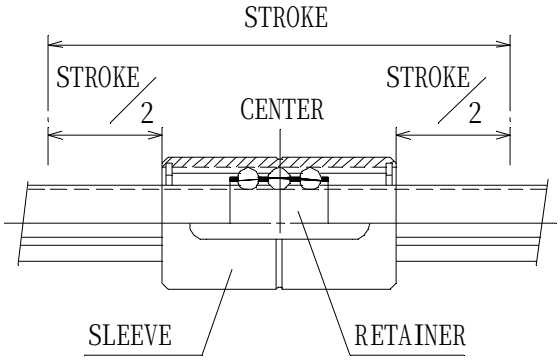
③ For spline shaft ,use of locating snap ring is recommended to prevent falling off of the sleeve and to protect the damage of the end cap from the attack of cut end of spline groove.

Fig.2-4



④ SR, FSR, and KSR types are ball spline with non-circulating retainer, having limited strokes. When removing the sleeve form the shaft, or installing sleeve to desired position, steel balls sustain first rolling condition and then slide without rolling. So during-in action, cares should be taken not to give shocks to the balls.
The retainer should be located in the center. (Fig2-5)
Available stroke should be limited to 80% of the maximum stroke indicated in the Table.

Fig2-5

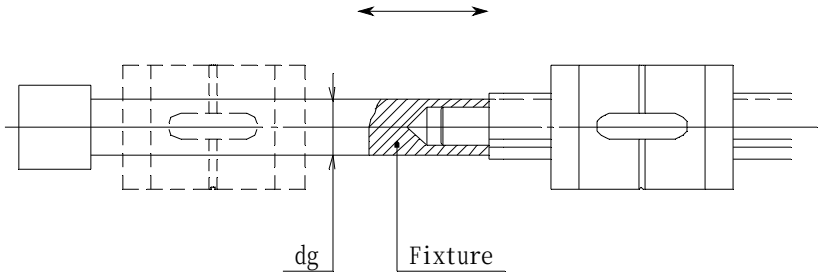


● **Use of dis-assembling fixture**

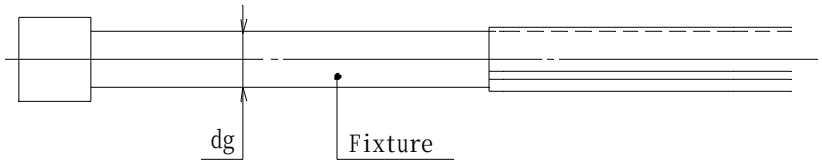
In NSB precision ball spline ,steel balls will fall off if the sleeve is moved beyond the end of the spline shaft .Use sleeve disassembling fixture to remove the sleeve from spline shaft ,in assembling.(Sec Fig.2-6) For fabrication of the fixture and reassembling of the ball spline When steel balls have fallen off, please contact NSB.

(H , FH , types have retainers ,thus no disassembling fixture is necessary.)

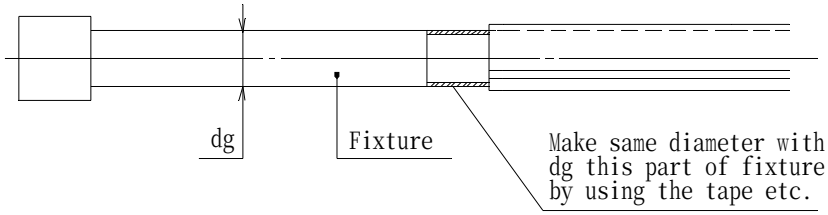
Fig.2-6



・The case without machining of end facf.



・The case without machining diameter is
ca.1 mm smaller than minor diameter.



Note. Outer diameter of the fixture dg should be ca. 0.1 mm smaller then the minor diameter do which is shown in dimension table for each types.

Fit

For the fit value in installing NSB precision ball spline into housing box,We recommend the figure in Table 2-7.

For the tolerance of key groove in installing ball spline with key into housing box ,please use the figures expressed in Table 2-8.

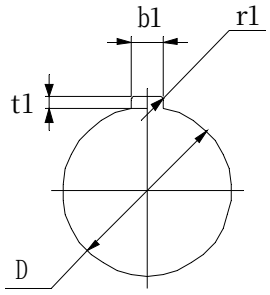


Table 2-7 (mm)

D Over～Upto	Fit	
	Loose fit (H7)	Tight fit (J7)
10 ～ 18	+0.018 0	+0.010 -0.008
18 ～ 30	+0.021 0	+0.012 -0.009
30 ～ 50	+0.025 0	+0.014 -0.011
50 ～ 80	+0.03 0	+0.018 -0.012
80 ～ 120	+0.035 0	+0.022 -0.013
120 ～ 180	+0.040 0	+0.026 -0.014
180 ～ 250	+0.046 0	+0.030 -0.016

Table 2-8 (mm)

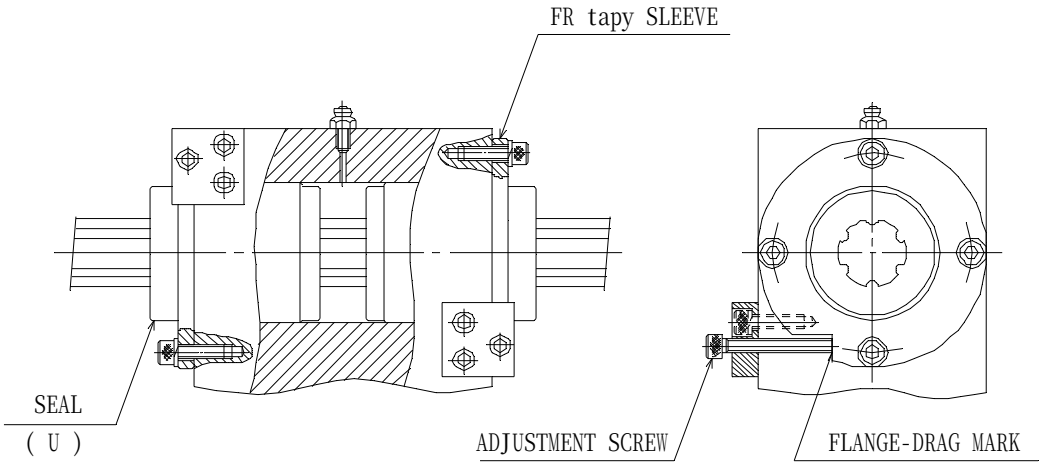
D Over～Upto	Key groove				
	b1	Tol.	t1	Tol.	r1
10 ～ 13	4	+0.030	1.8	+0.1 0	0.1
13 ～ 20	5	0	2.3		0.16
20 ～ 30	7	+0.036	3.3	+0.2 0	
30 ～ 40	10	0	3.8		0.25
40 ～ 50	12	+0.043	3.8		
50 ～ 60	15		5.4		0.4
60 ～ 70	18	0	6.4		
70 ～ 80	20	+0.052	6.4		
80 ～ 95	24		8.4	+0.3 0	0.7
95 ～ 110	28	0	9.4		
125 ～ 140	35	+0.062	11.4		
140 ～ 180	42	0	13.4		

How to apply pre-1oad

NSB precision ball splinc can apply pre-load. It is effective in enhancing rigidity ,elimination of backlash or extension of service life.

In order to apply pre-1oad,two sleeves with flange are installed to housing in the manner shown in Fig.2-7,and manipulate adjusting screw.0ptimum quantity of pre-load is about one third of transmitting torque.

Fig.2-7

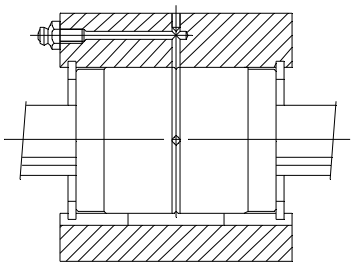


Example of installation of the sleeve

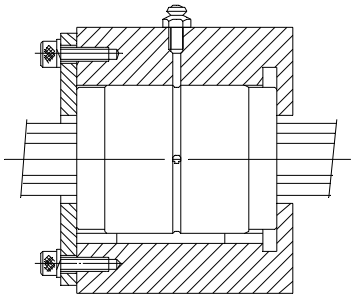
The method shown in Fig.2-8 is generally adopted for installing NSB precision ball spline into the housing box.

Fig.2-8

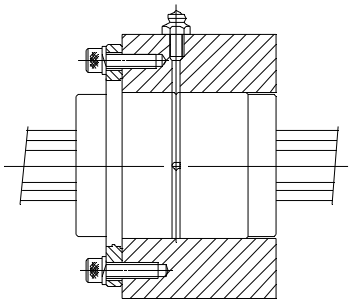
Key type



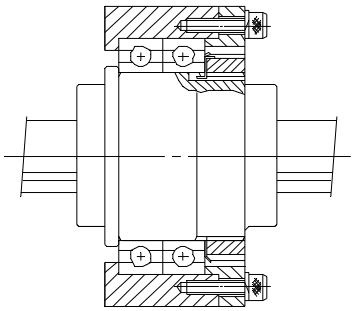
Key type



Flange type



Setting radial bearing type

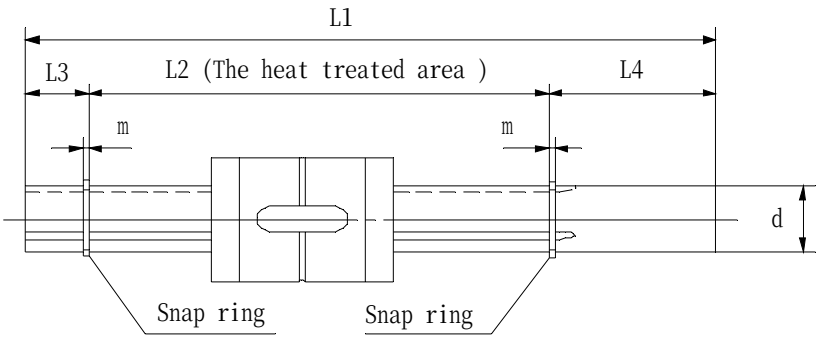


Some sleeve type has one row of revolving bearing.

Standard stock for shafts (J - mark)

For NSB precision ball spline ,we keep in stock circulating type standard shaft of up to 30 mm diameter , as shown in Table 2-9(a) Key type and 2-9(b) Flange type rlease make use of them.

● **Key type**



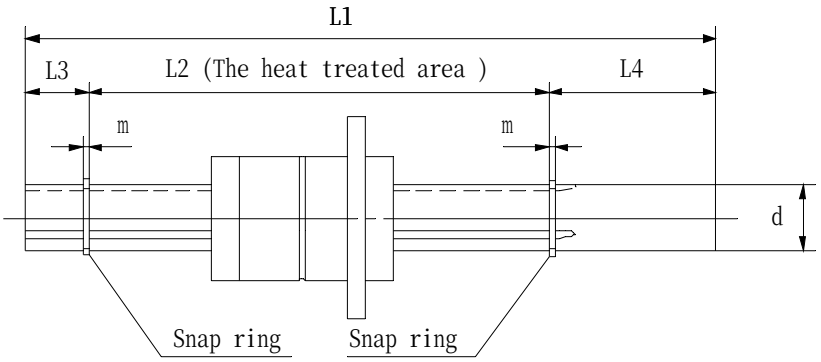
【Standard shaft designation 】 **R8AUU-H-250J**

Table2-9(a) (mm)

Key type	L1	L2	L3	L4	m	do	d (h7)
R6AUU - H - 150 J	150	90	10	50	0.8	4.6	6
R8AUU - H - 150 J	150	105	10	35	0.8	6.3	8
R8AUU - H - 250 J	250	205	10	35	0.8	6.3	8
R10AUU - H - 200 J	200	145	10	45	1	8.3	10
R10AUU - H - 300 J	300	245	10	45	1	8.3	10
R12AUU - H - 250 J	250	195	10	45	1	10.2	12
R12AUU - H - 400 J	400	345	10	45	1	10.2	12
R16AUU - H - 300 J	300	235	15	50	1	13.5	16
R16AUU - H - 600 J	600	535	15	50	1	13.5	16
R20AUU - H - 350 J	350	285	15	50	1.2	17.2	20
R20AUU - H - 800 J	800	735	15	50	1.2	17.2	20
R25AUU - H - 400 J	400	335	15	50	1.2	22.5	25
R25AUU - H - 1000 J	1000	935	15	50	1.2	22.5	25
R30AUU - H - 450 J	450	380	20	50	1.5	26.7	30
R30AUU - H - 1000 J	1000	930	20	50	1.5	26.7	30

・For dismantling sleeve from spline shaft ,special fixture for extraction is necessary .Please refer Page A13.

● Flange type



【Standard shaft designation】 **FR8AUU-H-250J**

Table2-9(b) (mm)

Flange type	L1	L2	L3	L4	m	do	d (h7)
FR6AUU - H -150 J	150	90	10	50	0.8	4.6	6
FR8AUU - H - 150 J	150	105	10	35	0.8	6.3	8
FR8AUU - H - 250 J	250	205	10	35	0.8	6.3	8
FR10AUU - H - 200 J	200	145	10	45	1	8.3	10
FR10AUU - H - 300 J	300	245	10	45	1	8.3	10
FR12AUU - H - 250 J	250	195	10	45	1	10.2	12
FR12AUU - H - 400 J	400	345	10	45	1	10.2	12
FR16AUU -H - 300 J	300	235	15	50	1	13.5	16
FR16AUU - H - 600 J	600	535	15	50	1	13.5	16
FR20AUU - H - 350 J	350	285	15	50	1.2	17.2	20
FR20AUU - H - 800 J	800	735	15	50	1.2	17.2	20
FR25AUU - H - 400 J	400	335	15	50	1.2	22.5	25
FR25AUU - H - 1000 J	1000	935	15	50	1.2	22.5	25
FR30AUU - H - 450 J	450	380	20	50	1.5	26.7	30
FR30AUU - H - 1000 J	1000	930	20	50	1.5	26.7	30

・For dismantling sleeve from spline shaft ,special fixture for extraction is necessary .Please refer Page A13.

Note.

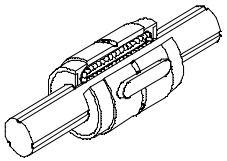
1. 0nc sleeve is supplied with a shaft.(lf you need more than one sleeve ,please indicate in your order.)

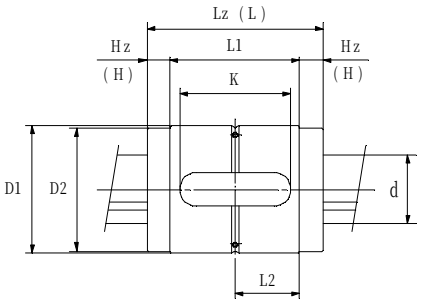
2. Type of sleeve is both ended seal (UU type). both for attached key type and attached flange type.

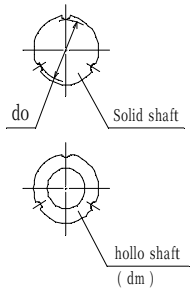
3. Standard Clearance is “normal” (without any symbol.) High precision class is designated “upper” class (symbol H).

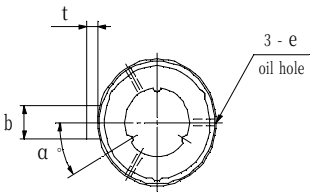
4. Number of spline groove is three, and the groove is A type.

5. For locating snap ring ,use JIS B2804. (JIS stands for Japanese Industrial Standard available from Japan Standard Assn.)









(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of Key							Oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal														Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	b	(h8)	t	K	L1	L2	α °	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
R6AUU	R6A	16	0 -0.011	27	5	23	3	15.4	4		1.5	13	17	8.5		1	2	4.6		1.5	1.9	6.1	14.2	7.5	35.9	0.23	0.03	6
R8AUU	R8A	20	0	32	6	28	4	19.6	5	0	2	16	20	10		1	3	6.3		2.4	3.0	13.2	30.3	13.4	65.8	0.39	0.07	8
R10AUU	R10A	24	-0.013	36	7	32	5	23	5	-0.018	2	19	22	11		2	3	8.3		2.6	3.3	18.0	41.4	15.8	82.1	0.61	0.09	10
R12AUU	R12A	28		38	7	34	5	27	7	0	3	20	24	12		2	4	10.2		2.9	3.6	23.3	53.6	18.5	94.2	0.88	0.15	12
R16AUU	R16A	36	0	57	9	52	6.5	35	10	-0.022	3.5	33	39	19.5		2	6	13.5		5.7	7.2	63.4	145	60.9	290	1.56	0.34	16
R20AUU	R20A	42	-0.016	58	9	53	6.5	40.5	12	0	3.5	34	40	20		2	8	17.2		5.7	7.2	77.4	178	63.7	301	2.45	0.45	20
R25AUU	R25A	47		69	9.5	64	7	45	12	-0.027	3.5	40	50	25	30 °	2.5	12	22.5	3	7.2	9.0	122	280	95.1	446	3.83	0.61	25
R30AUU	R30A	55	0	82	11	76	8	53.5	15		5	51	60	30		2.5	17	26.7		14.3	18.0	289	665	153	712	5.52	1.00	30
R40AUU	R40A	72	-0.019	105	12.5	98	9	71	20	0	6	72	80	40		3	21	35.1		33.7	42.6	887	2039	353	1591	9.82	2.18	40
R50AUU	R50A	90	0	137	18.5	130	15	88	24	-0.033	8	80	100	50		3.5	28	44.6		56.2	71.0	1890	4343	742	3540	15.4	4.58	50
R60AUU	R60A	110	-0.022	158	19	150	15	108	28		9	98	120	60		3.5	33	52.8		57.2	72.3	2295	5274	878	4013	22.1	8.20	60
R80AUU	R80A	140	0	215	25.5	200	18	138	35	0	11	135	164	82		4	52	71.9		93.4	118	5023	11540	1928	8677	39.3	16.1	80
R100AUU	R100A	180	-0.025	265	33.5	250	26	178	42	-0.039	13	148	198	99		4	68	88.2		146	185	9764	22431	3802	17586	61.4	35.7	100

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

R16 A UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

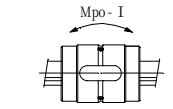
※ See page A6

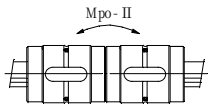
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

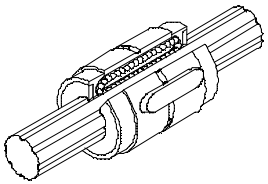
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

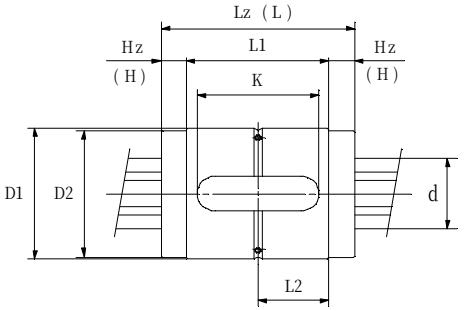
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

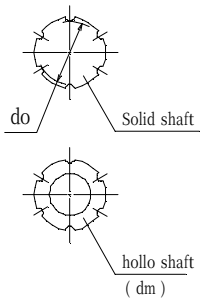
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)

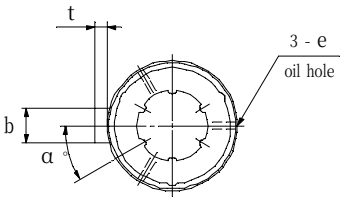












(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of Key							oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal														Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	b	(h8)	t	K	L1	L2	α °	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	shaft/m	Sleeve	d
R30CUU	R30C	55	0	82	11	76	8	53.5	15	0 -0.027	5	51	60	30	30	2.5	17	26.7	6	24.7	31.3	579	1331	266	1233	5.52	1.00	30
R40CUU	R40C	72	-0.019	105	12.5	98	9	71	20	0 -0.033	6	72	80	40		3	21	35.1		58.4	73.8	1775	4078	612	2755	9.82	2.18	40
R50CUU	R50C	90	0	137	18.5	130	15	88	24		8	80	100	50		3.5	28	44.6		97.3	123	3781	8687	1286	6132	15.4	4.58	50
R60CUU	R60C	110	-0.022	158	19	150	15	108	28		9	98	120	60		3.5	33	52.8		99.2	125	4591	10548	1522	6951	22.1	8.20	60
R80CUU	R80C	140	0	215	25.5	200	18	138	35	0 -0.039	11	135	164	82		4	52	71.9		161	204	10046	23080	3339	15029	39.3	16.1	80
R100CUU	R100C	180	-0.025	265	33.5	250	26	178	42		13	148	198	99		4	68	88.2		253	320	19528	44863	6586	30460	61.4	35.7	100
																				1 k N	102kgf		1 N·m	0.102 kgf·m				

【 Designation 】

R40 C UU - 2 - E - H - 980 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

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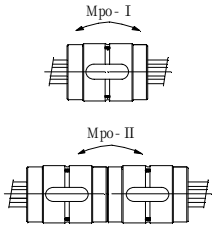
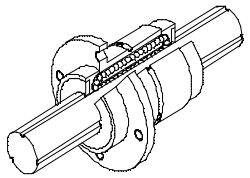
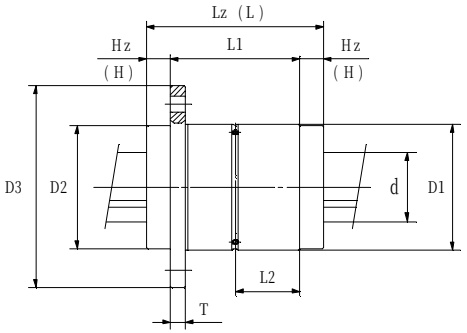
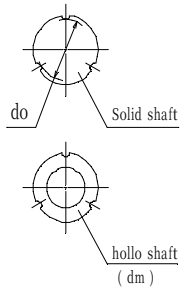
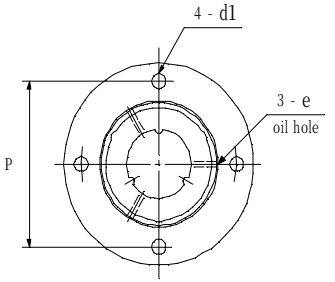










(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of flange						oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal													Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	D3	T	P	d1	L1	L2	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
FR6AUU	FR6A	16	0 -0.011	27	5	23	3	15.4	31	3	24	3.5	17	8.5	1	2	4.6		1.5	1.9	6.1	14.2	7.5	35.9	0.23	0.04	6
FR8AUU	FR8A	20	0	32	6	28	4	19.6	40	4	30	4.5	20	10	1	3	6.3		2.4	3.0	13.2	30.3	13.4	65.8	0.39	0.09	8
FR10AUU	FR10A	24	-0.013	36	7	32	5	23	44	4	34	4.5	22	11	2	3	8.3		2.6	3.3	18.0	41.4	15.8	82.1	0.61	0.13	10
FR12AUU	FR12A	28		38	7	34	5	27	48	4	38	4.5	24	12	2	4	10.2		2.9	3.6	23.3	53.6	18.5	94.2	0.88	0.18	12
FR16AUU	FR16A	36	0	57	9	52	6.5	35	60	5	48	5.5	39	19.5	2	6	13.5		5.7	7.2	63.4	145	60.9	290	1.56	0.38	16
FR20AUU	FR20A	42	-0.016	58	9	53	6.5	40.5	66	5	54	5.5	40	20	2	8	17.2		5.7	7.2	77.4	178	63.7	301	2.45	0.50	20
FR25AUU	FR25A	47		69	9.5	64	7	45	72	6	60	5.5	50	25	2.5	12	22.5	3	7.2	9.0	122	280	95.1	446	3.83	0.68	25
FR30AUU	FR30A	55	0	82	11	76	8	53.5	88	7	72	6.5	60	30	2.5	17	26.7		14.3	18.0	289	665	153	712	5.52	1.18	30
FR40AUU	FR40A	72	-0.019	105	12.5	98	9	71	112	10	92	8.5	80	40	3	21	35.1		33.7	42.6	887	2039	353	1591	9.82	2.50	40
FR50AUU	FR50A	90	0	137	18.5	130	15	88	134	12	112	10.5	100	50	3.5	28	44.6		56.2	71.0	1890	4343	742	3540	15.4	4.75	50
FR60AUU	FR60A	110	-0.022	158	19	150	15	108	154	12	132	10.5	120	60	3.5	33	52.8		57.2	72.3	2295	5274	878	4013	22.1	8.53	60
FR80AUU	FR80A	140	0	215	25.5	200	18	138	184	16	162	14	164	82	4	52	71.9		93.4	118	5023	11540	1928	8677	39.3	17.4	80
FR100AUU	FR100A	180	-0.025	265	33.5	250	26	178	230	18	206	16	198	99	4	68	88.2		146	185	9764	22431	3802	17586	61.4	37.8	100

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

FR20 A UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

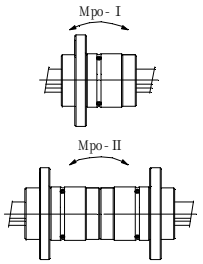
※ See page A6

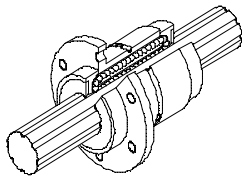
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

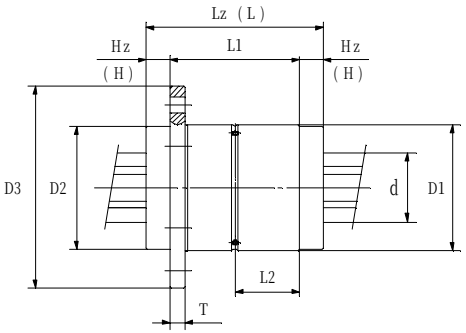
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

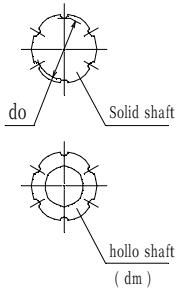
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

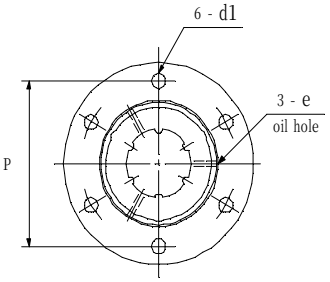
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of flange						oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal													Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	D3	T	P	d1	L1	L2	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
FR30CUU	FR30C	55	0	82	11	76	8	53.5	88	7	72	6.5	60	30	2.5	17	26.7	6	24.7	31.3	579	1331	266	1233	5.52	1.18	30
FR40CUU	FR40C	72	-0.019	105	12.5	98	9	71	112	10	92	8.5	80	40	3	21	35.1		58.4	73.8	1775	4078	612	2755	9.82	2.50	40
FR50CUU	FR50C	90	0	137	18.5	130	15	88	134	12	112	10.5	100	50	3.5	28	44.6		97.3	123	3781	8687	1286	6132	15.4	4.75	50
FR60CUU	FR60C	110	-0.022	158	19	150	15	108	154	12	132	10.5	120	60	3.5	33	52.8		99.2	125	4591	10548	1522	6951	22.1	8.53	60
FR80CUU	FR80C	140	0	215	25.5	200	18	138	184	16	162	14	164	82	4	52	71.9		161	204	10046	23080	3339	15029	39.3	17.4	80
FR100CUU	FR100C	180	-0.025	265	33.5	250	26	178	230	18	206	16	198	99	4	68	88.2		253	320	19528	44863	6586	30460	61.4	37.8	100

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

FR40 C UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

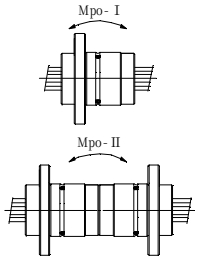
※ See page A6

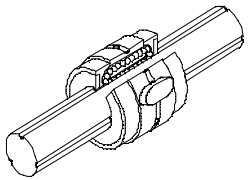
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

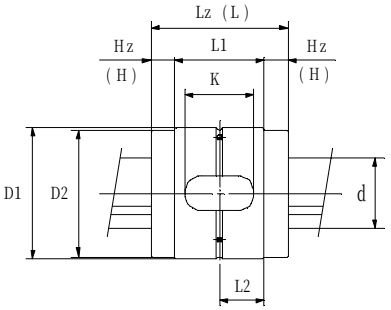
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

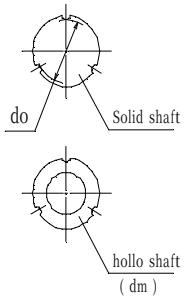
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

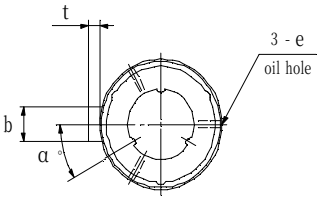
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of Key							Oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal														Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	b	(h8)	t	K	L1	L2	α °	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
MR10AUU	MR10A	24	0	28	7	24	5	23	5	0 -0.018	2	11	14	7		2	3	8.3		1.6	2.1	11.0	26.3	7.2	41.7	0.61	0.06	10
MR12AUU	MR12A	28	-0.013	30	7	26	5	27	7	0	3	12	16	8		2	4	10.2		1.9	2.4	15.0	35.6	9.1	50.6	0.88	0.07	12
MR16AUU	MR16A	36	0	41	9	36	6.5	35	10	-0.022	3.5	17	23	11.5		2	6	13.5		3.3	4.2	35.6	84.9	24.0	126	1.56	0.22	16
MR20AUU	MR20A	42	-0.016	41	9	36	6.5	40.5	12	0	3.5	17	23	11.5		2	8	17.2		3.3	4.2	43.5	103	24.0	126	2.45	0.30	20
MR25AUU	MR25A	47		49	9.5	44	7	45	12	-0.027	3.5	20	30	15		2.5	12	22.5		4.3	5.4	70.9	168	38.0	194	3.83	0.40	25
MR30AUU	MR30A	55	0	58	11	52	8	53.5	15		5	27	36	18	30 °	2.5	17	26.7	3	8.5	10.8	168	399	61.8	309	5.52	0.66	30
MR40AUU	MR40A	72	-0.019	73	12.5	66	9	71	20	0	6	40	48	24		3	21	35.1		21.0	26.6	537	1274	141	678	9.82	1.37	40
MR50AUU	MR50A	90	0	97	18.5	90	15	88	24	-0.033	8	40	60	30		3.5	28	44.6		33.7	42.6	1099	2606	296	1551	15.4	3.02	50
MR60AUU	MR60A	110	-0.022	110	19	102	15	108	28		9	50	72	36		3.5	33	52.8		34.3	43.4	1334	3164	353	1733	22.1	5.46	60
MR80AUU	MR80A	140	0	147	25.5	132	18	138	35	0	11	67	96	48		4	52	71.9		54.9	69.4	2863	6787	737	3540	39.3	10.45	80
MR100AUU	MR100A	180	-0.025	183	33.5	168	26	178	42	-0.039	13	66	116	58		4	68	88.2		87.9	111	5677	13458	1464	7352	61.4	24.03	100

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

MR20 A UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

① Type of sleeve
② Symbol for the number of grooves
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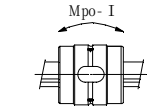

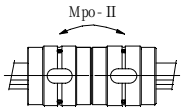

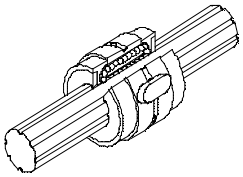

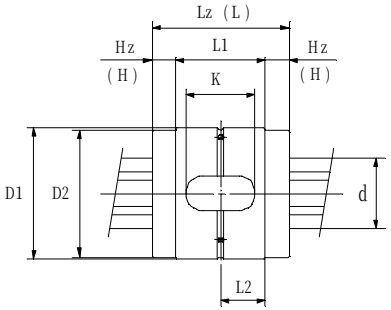

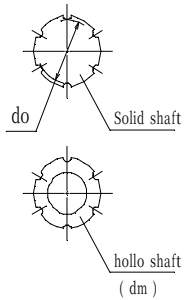

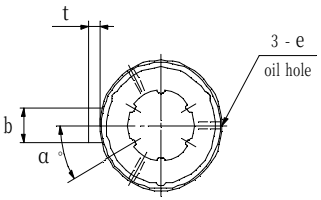

(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of Key										Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal													Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	b	(h8)	t	K	L1	L2	α °	e	dm	do	Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
MR30CUU	MR30C	55	0	58	11	52	8	53.5	15	0 -0.027	5	27	36	18	30 °	2.5	17	26.7	6	14.8	18.7	336	798	107	536	5.52	0.66	30
MR40CUU	MR40C	72	-0.019	73	12.5	66	9	71	20	0	6	40	48	24		3	21	35.1		36.5	46.1	1074	2548	245	1175	9.82	1.37	40
MR50CUU	MR50C	90	0	97	18.5	90	15	88	24	-0.033	8	40	60	30		3.5	28	44.6		58.4	73.8	2198	5212	513	2686	15.4	3.02	50
MR60CUU	MR60C	110	-0.022	110	19	102	15	108	28		9	50	72	36		3.5	33	52.8		59.5	75.2	2669	6329	612	3001	22.1	5.46	60
MR80CUU	MR80C	140	0	147	25.5	132	18	138	35	0	11	67	96	48		4	52	71.9		95.2	120	5726	13575	1277	6131	39.3	10.45	80
MR100CUU	MR100C	180	-0.025	183	33.5	168	26	178	42	-0.039	13	66	116	58		4	68	88.2		152	192	11355	26917	2535	12735	61.4	24.03	100
																				1 k N	102kgf		1 N·m	0.102 kgf·m				

【 Designation 】

MR40 C UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

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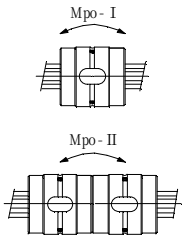
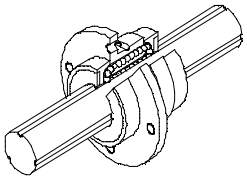
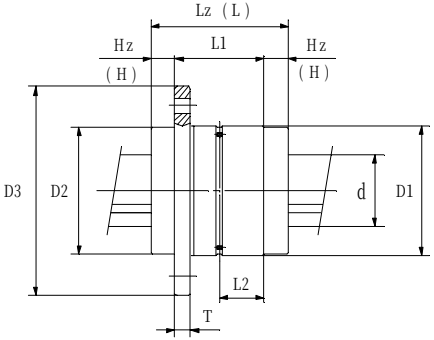
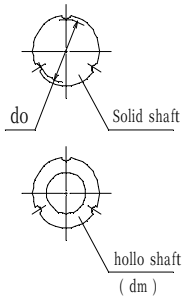
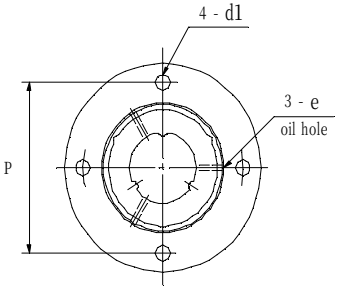










(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Outer diameter D1	Outer diameter (h6)	Total length of sleeve with seal Lz	Total length of sleeve with seal Hz	Total length of sleeve without seal L	Total length of sleeve without seal H	D2	Dimension of flange D3	Dimension of flange T	Dimension of flange P	Dimension of flange d1	L1	L2	oil hole e	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N · m) Dynamic rating Ct	Basic rated torque (N · m) Static rating Cot	Static rated moment (N · m) Mpo- I	Static rated moment (N · m) Mpo- II	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
MFR10AUU	MFR10A	24	0	28	7	24	5	23	44	4	34	4.5	14	7	2	3	8.3		1.6	2.1	11.0	26.3	7.2	41.7	0.61	0.08	10
MFR12AUU	MFR12A	28	-0.013	30	7	26	5	27	48	4	38	4.5	16	8	2	4	10.2		1.9	2.4	15.0	35.6	9.1	50.6	0.88	0.11	12
MFR16AUU	MFR16A	36	0	41	9	36	6.5	35	60	5	48	5.5	23	11.5	2	6	13.5		3.3	4.2	35.6	84.9	24.0	126	1.56	0.25	16
MFR20AUU	MFR20A	42	-0.016	41	9	36	6.5	40.5	66	5	54	5.5	23	11.5	2	8	17.2		3.3	4.2	43.5	103	24.0	126	2.45	0.34	20
MFR25AUU	MFR25A	47		49	9.5	44	7	45	72	6	60	5.5	30	15	2.5	12	22.5	3	4.3	5.4	70.9	168	38.0	194	3.83	0.46	25
MFR30AUU	MFR30A	55	0	58	11	52	8	53.5	88	7	72	6.5	36	18	2.5	17	26.7		8.5	10.8	168	399	61.8	309	5.52	0.82	30
MFR40AUU	MFR40A	72	-0.019	73	12.5	66	9	71	112	10	92	8.5	48	24	3	21	35.1		21.0	26.6	537	1274	141	678	9.82	1.62	40
MFR50AUU	MFR50A	90	0	97	18.5	90	15	88	134	12	112	10.5	60	30	3.5	28	44.6		33.7	42.6	1099	2606	296	1551	15.4	3.19	50
MFR60AUU	MFR60A	110	-0.022	110	19	102	15	108	154	12	132	10.5	72	36	3.5	33	52.8		34.3	43.4	1334	3164	353	1733	22.1	6.06	60

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

MFR20 A UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

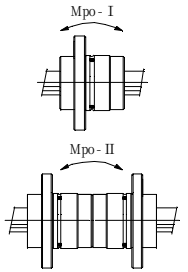
※ See page A6

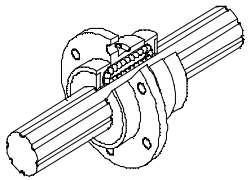
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

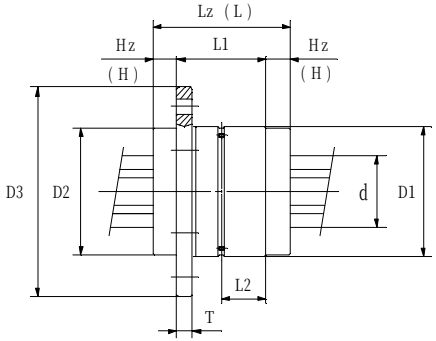
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

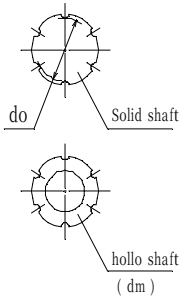
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

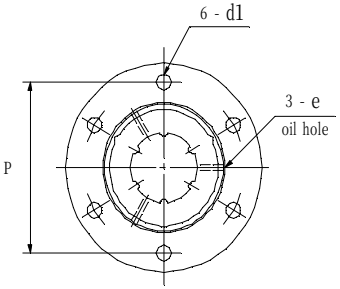
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of flange						oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal													Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	D3	T	P	d1	L1	L2	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
MFR30CUU	MFR30C	55	0	58	11	52	8	53.5	88	7	72	6.5	36	18	2.5	17	26.7	6	14.8	18.7	336	798	107	536	5.52	0.82	30
MFR40CUU	MFR40C	72	-0.019	73	12.5	66	9	71	112	10	92	8.5	48	24	3	21	35.1		36.5	46.1	1074	2548	245	1175	9.82	1.62	40
MFR50CUU	MFR50C	90	0	97	18.5	90	15	88	134	12	112	10.5	60	30	3.5	28	44.6		58.4	73.8	2198	5212	513	2686	15.4	3.19	50
MFR60CUU	MFR60C	110	-0.022	110	19	102	15	108	154	12	132	10.5	72	36	3.5	33	52.8		59.5	75.2	2669	6329	612	3001	22.1	6.06	60
																			1k N	102kgf		1N·m	0.102 kgf·m				

【 Designation 】

MFR40 C UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

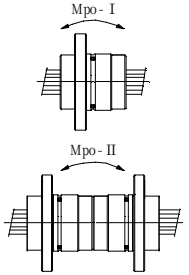
※ See page A6

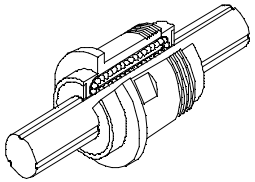
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

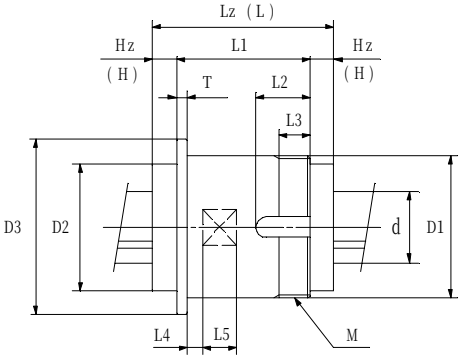
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

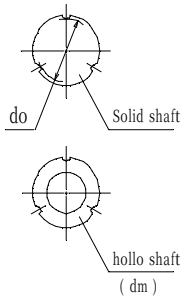
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

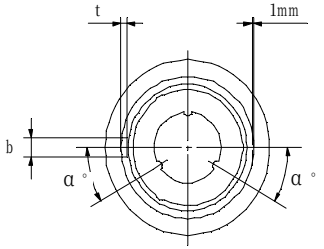
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Outer diameter D1	Outer diameter (h6)	Total length of sleeve with seal Lz	Total length of sleeve with seal Hz	Total length of sleeve without seal L	Total length of sleeve without seal H	D2	M	L1	D3	T	L2	L3	L4	L5	b	t	α °	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N · m) Dynamic rating Ct	Basic rated torque (N · m) Static rating Cot	Static rated moment (N · m) Mpo- I	Static rated moment (N · m) Mpo- II	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
KR8AUU	KR8A	25	0 -0.013	32	6	28	4	19.6	M25×1.5	20	33	2	15	9	2	5	5.5	2.1		3	6.3		2.4	3.0	13.2	30.3	13.4	65.8	0.39	0.10	8
KR10AUU	KR10A	30		36	7	32	5	23	M30×1.5	22	38	2	15	9	2	7	5.5	2.6		3	8.3		2.6	3.3	18.0	41.4	15.8	82.1	0.61	0.13	10
KR12AUU	KR12A	35	0 -0.016	38	7	34	5	27	M35×1.5	24	45	2	17	10	2	8	6.5	2.6		4	10.2		2.9	3.6	23.3	53.6	18.5	94.2	0.88	0.21	12
KR16AUU	KR16A	40		57	9	52	6.5	35	M40×1.5	39	50	4	19	12	5	12	6.5	2.6		6	13.5		5.7	7.2	63.4	145	60.9	290	1.56	0.40	16
KR20AUU	KR20A	50		58	9	53	6.5	40.5	M50×1.5	40	62	4	22	14	5	12	6.5	2.6	30 °	8	17.2	3	5.7	7.2	77.4	178	63.7	301	2.45	0.86	20
KR25AUU	KR25A	55	0 -0.019	69	9.5	64	7	45	M55×2	50	67	5	24	14	7	15	8.5	2.6		12	22.5		7.2	9.0	122	280	95.1	446	3.83	1.00	25
KR30AUU	KR30A	60		82	11	76	8	53.5	M60×2	60	74	5	24	14	7	15	8.5	2.6		17	26.7		14.3	18.0	289	665	153	712	5.52	1.18	30
KR40AUU	KR40A	80		105	12.5	98	9	71	M80×2	80	94	6	31	20	10	28	11	3.6		21	35.1		33.7	42.6	887	2039	353	1591	9.82	2.66	40
KR50AUU	KR50A	95	0 -0.022	137	18.5	130	15	88	M95×2	100	111	8	35	22	10	35	11	3.6		28	44.6		56.2	71.0	1890	4343	742	3540	15.4	4.89	50

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

KR20 A UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
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⑦ Shaft length [mm]
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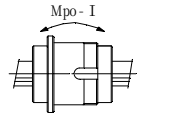
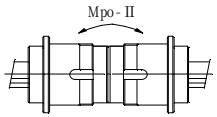
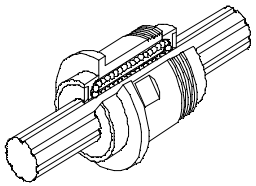
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

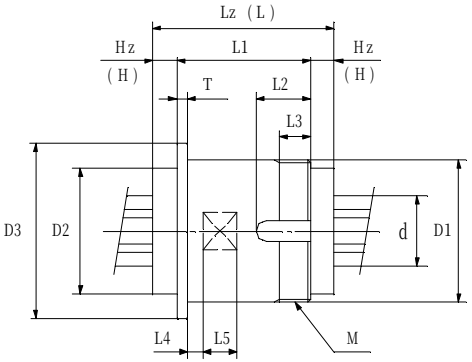
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

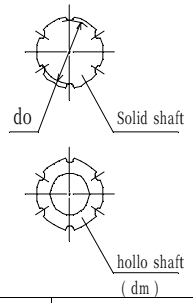
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)

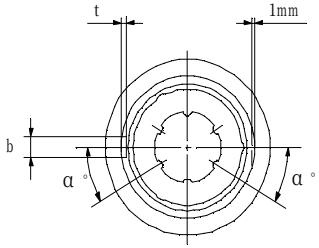












(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve																Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal																Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	M	L1	D3	T	L2	L3	L4	L5	b	t	α °	dm	do	Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
KR30CUU	KR30C	60	0	82	11	76	8	53.5	M60×2	60	74	5	24	14	7	15	8.5	2.6		17	26.7	24.7	31.3	579	1331	266	1233	5.52	1.18	30
KR40CUU	KR40C	80	-0.019	105	12.5	98	9	71	M80×2	80	94	6	31	20	10	28	11	3.6	30 °	21	35.1	58.4	73.8	1775	4078	612	2755	9.82	2.66	40
KR50CUU	KR50C	95	0 -0.022	137	18.5	130	15	88	M95×2	100	111	8	35	22	10	35	11	3.6		28	44.6	97.3	123	3781	8687	1286	6132	15.4	4.89	50

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

KR40 C UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
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⑦ Shaft length [mm]
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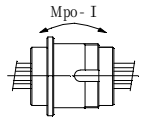
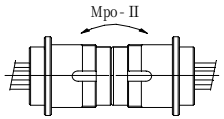
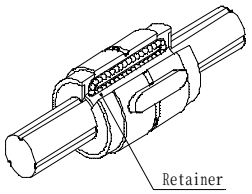
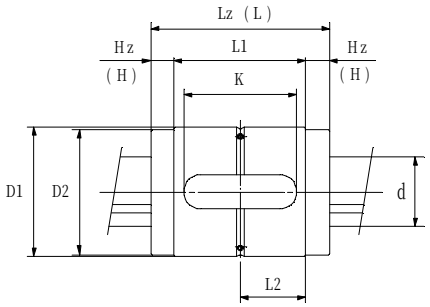
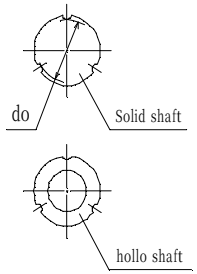
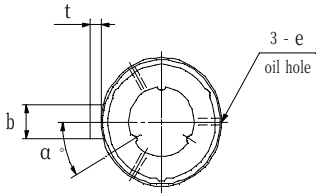












(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Outer diameter D1	Outer diameter (h6)	Total length of sleeve with seal Lz	Total length of sleeve with seal Hz	Total length of sleeve without seal L	Total length of sleeve without seal H	D2	Dimension of Key b	Dimension of Key (h8)	Dimension of Key t	Dimension of Key K	L1	L2	α °	Oil hole e	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N · m) Dynamic rating Ct	Basic rated torque (N · m) Static rating Cot	Static rated moment (N · m) Mpo- I	Static rated moment (N · m) Mpo- II	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
H069AUU	H069A	20	0	32	6	28	4	19.6	5	0	2	16	20	10		1	3	6.3		2.4	3.0	13.2	30.3	13.4	65.8	0.39	0.07	6.9
H089AUU	H089A	24	-0.013	36	7	32	5	23	5	-0.018	2	19	22	11		2	3	8.3		2.6	3.3	18.0	41.4	15.8	82.1	0.61	0.09	8.9
H109AUU	H109A	28		38	7	34	5	27	7	0	3	20	24	12		2	4	10.2		2.9	3.6	23.3	53.6	18.5	94.2	0.88	0.15	10.9
H145AUU	H145A	36	0	57	9	52	6.5	35	10	-0.022	3.5	33	39	19.5		2	6	13.5		5.7	7.2	63.4	145	60.9	290	1.56	0.33	14.5
H185AUU	H185A	42	-0.016	58	9	53	6.5	40.5	12	0	3.5	34	40	20		2	8	17.2		5.7	7.2	77.4	178	63.7	301	2.45	0.43	18.5
H235AUU	H235A	47		69	9.5	64	7	45	12	-0.027	3.5	40	50	25		2.5	12	22.5		7.2	9.0	122	280	95.1	446	3.83	0.61	23.5
H280AUU	H280A	55	0	82	11	76	8	53.5	15		5	51	60	30	30 °	2.5	17	26.7	3	14.3	18.0	289	665	153	712	5.52	0.99	28.0
H365AUU	H365A	72	-0.019	105	12.5	98	9	71	20	0	6	72	80	40		3	21	35.1		33.7	42.6	887	2039	353	1591	9.82	2.17	36.5
H465AUU	H465A	90	0	137	18.5	130	15	88	24	-0.033	8	80	100	50		3.5	28	44.6		56.2	71.0	1890	4343	742	3540	15.4	4.55	46.5
H550AUU	H550A	110	-0.022	158	19	150	15	108	28		9	98	120	60		3.5	33	52.8		57.2	72.3	2295	5274	878	4013	22.1	8.06	55.0
H745AUU	H745A	140	0	215	25.5	200	18	138	35	0	11	135	164	82		4	52	71.9		93.4	118	5023	11540	1928	8677	39.3	16.2	74.5
H920AUU	H920A	180	-0.025	265	33.5	250	26	178	42	-0.039	13	148	198	99		4	68	88.2		146	185	9764	22431	3802	17586	61.4	34.8	92.0

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

H185 A UU - 2 - E - H - 680 T M
① ②③ ④ ⑤ ⑥ ⑦ ⑧⑨

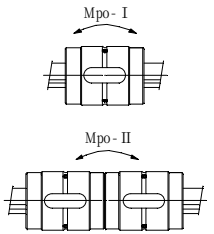
※ See page A6

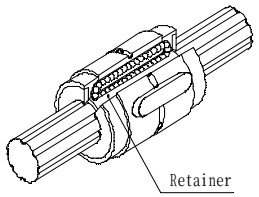
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

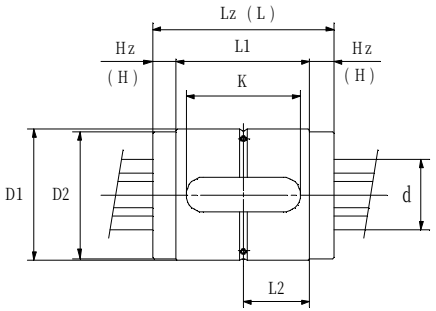
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

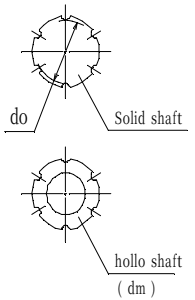
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

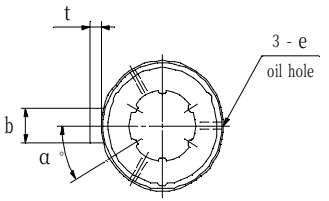
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of Key							Oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal														Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	b	(h8)	t	K	L1	L2	α °	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
H280CUU	H280C	55	0	82	11	76	8	53.5	15	0 -0.027	5	51	60	30	30 °	2.5	17	26.7	6	24.7	31.3	579	1331	266	1233	5.52	0.99	28.0
H365CUU	H365C	72	-0.019	105	12.5	98	9	71	20	0	6	72	80	40		3	21	35.1		58.4	73.8	1775	4078	612	2755	9.82	2.17	36.5
H465CUU	H465C	90	0	137	18.5	130	15	88	24	-0.033	8	80	100	50		3.5	28	44.6		97.3	123	3781	8687	1286	6132	15.4	4.55	46.5
H550CUU	H550C	110	-0.022	158	19	150	15	108	28		9	98	120	60		3.5	33	52.8		99.2	125	4591	10548	1522	6951	22.1	8.06	55.0
H745CUU	H745C	140	0	215	25.5	200	18	138	35	0	11	135	164	82		4	52	71.9		161	204	10046	23080	3339	15029	39.3	16.2	74.5
H920CUU	H920C	180	-0.025	265	33.5	250	26	178	42	-0.039	13	148	198	99		4	68	88.2		253	320	19528	44863	6586	30460	61.4	34.8	92.0

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

H365 C UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

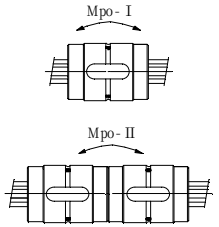
※ See page A6

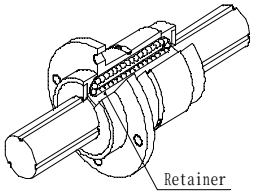
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

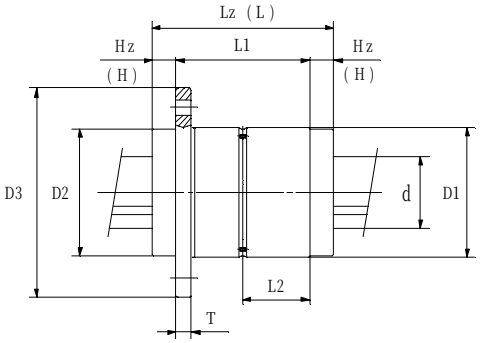
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

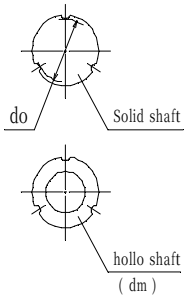
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

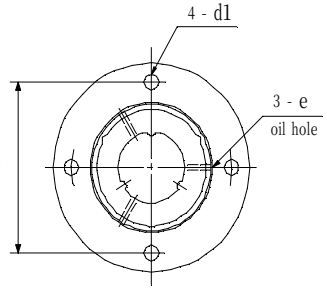
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of flange						oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N・m)		Static rated moment (N・m)		Weight (kg)		Dia (h7)
				with seal		without seal													Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	D3	T	P	d1	L1	L2	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
FH069AUU	FH069A	20	0	32	6	28	4	19.6	40	4	30	4.5	20	10	1	3	6.3		2.4	3.0	13.2	30.3	13.4	65.8	0.28	0.10	6.9
FH089AUU	FH089A	24	-0.013	36	7	32	5	23	44	4	34	4.5	22	11	2	3	8.3		2.6	3.3	18.0	41.4	15.8	82.1	0.52	0.14	8.9
FH109AUU	FH109A	28		38	7	34	5	27	48	4	38	4.5	24	12	2	4	10.2		2.9	3.6	23.3	53.6	18.5	94.2	0.66	0.19	10.9
FH145AUU	FH145A	36	0	57	9	52	6.5	35	60	5	48	5.5	39	19.5	2	6	13.5		5.7	7.2	63.4	145	60.9	290	1.28	0.38	14.5
FH185AUU	FH185A	42	-0.016	58	9	53	6.5	40.5	66	5	54	5.5	40	20	2	8	17.2	3	5.7	7.2	77.4	178	63.7	301	2.09	0.49	18.5
FH235AUU	FH235A	47		69	9.5	64	7	45	72	6	60	5.5	50	25	2.5	12	22.5		7.2	9.0	122	280	95.1	446	3.39	0.69	23.5
FH280AUU	FH280A	55	0	82	11	76	8	53.5	88	7	72	6.5	60	30	2.5	17	26.7		14.3	18.0	289	665	153	712	4.80	1.18	28.0
FH365AUU	FH365A	72	-0.019	105	12.5	98	9	71	112	10	92	8.5	80	40	3	21	35.1		33.7	42.6	887	2039	353	1591	8.14	2.50	36.5
FH465AUU	FH465A	90	0	137	18.5	130	15	88	134	12	112	10.5	100	50	3.5	28	44.6		56.2	71.0	1890	4343	742	3540	13.24	4.73	46.5
FH550AUU	FH550A	110	-0.022	158	19	150	15	108	154	12	132	10.5	120	60	3.5	33	52.8		57.2	72.3	2295	5274	878	4013	18.51	8.45	55.0

1k N 102kgf 1N・m 0.102 kgf・m

【 Designation 】

FH185 A UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

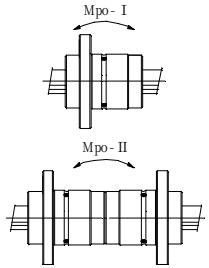
※ See page A6

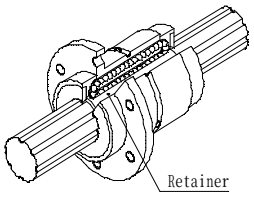
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

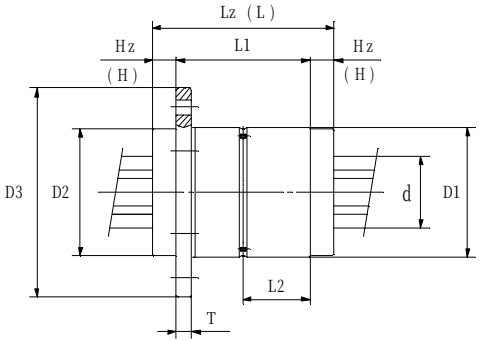
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

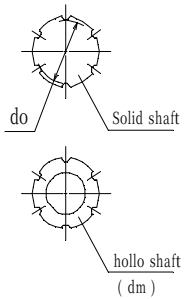
・ Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

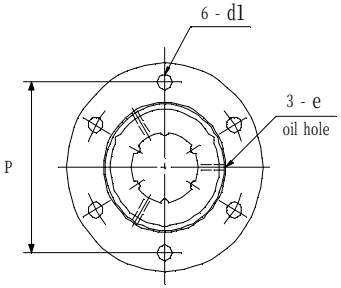
・ Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)











(Unit : mm)

Type of sleeve		Outer diameter		Total length of sleeve					Dimension of flange						oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)		Weight (kg)		Dia (h7)
				with seal		without seal													Dynamic rating	Static rating	Dynamic rating	Static rating					
With seal	Without seal	D1	(h6)	Lz	Hz	L	H	D2	D3	T	P	d1	L1	L2	e	dm	do		Cr	Cor	Ct	Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
FH280CUU	FH280C	55	0	82	11	76	8	53.5	88	7	72	6.5	60	30	2.5	17	26.7	6	24.7	31.3	579	1331	266	1233	4.80	1.18	28.0
FH365CUU	FH365C	72	-0.019	105	12.5	98	9	71	112	10	92	8.5	80	40	3	21	35.1		58.4	73.8	1775	4078	612	2755	8.14	2.50	36.5
FH465CUU	FH465C	90	0	137	18.5	130	15	88	134	12	112	10.5	100	50	3.5	28	44.6		97.3	123	3781	8687	1286	6132	13.24	4.73	46.5
FH550CUU	FH550C	110	-0.022	158	19	150	15	108	154	12	132	10.5	120	60	3.5	33	52.8		99.2	125	4591	10548	1522	6951	18.51	8.45	55.0
																			1k N	102kgf	1N·m	0.102 kgf·m					

【 Designation 】

FH365 C UU - 2 - E0 - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

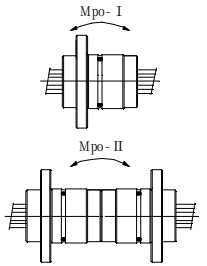
※ See page A6

Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

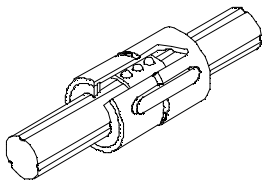
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

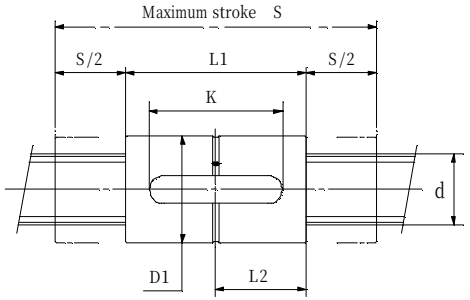
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

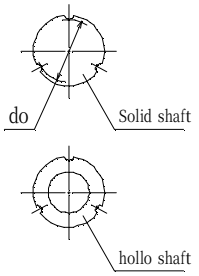
· Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)

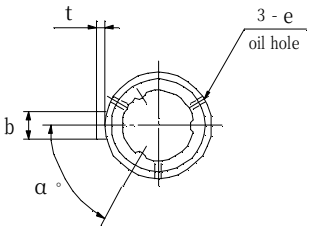


Non-circulating ball type (Limited stroke)









(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Maximum stroke	Outer diameter		Total length	Dimension of Key						Oil hole	hollow shaft	Minor diameter	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N · m)		Static rated moment (N · m)	Weight (kg)		Dia (h7)
																Dynamic rating	Static rating	Dynamic rating	Static rating				
		S	D1	(h6)	L1	b	(h8)	t	K	L2	α °	e	dm	do		Cr	Cor	Ct	Cot	Mpo - I	Shaft/m	Sleeve	d
SR6AUU	SR6A	22	12	0 -0.011	29	4	0 -0.018	1.5	19	14.5	60 °	1	2	5.1	3	0.8	1.0	3.9	9.1	2.5	0.23	0.01	6
SR8AUU	SR8A	26	16		34	5		2	24	17		1	3	6.8		1.8	2.3	11.9	27.6	6.9	0.39	0.03	8
SR10AUU	SR10A	30	20	0 -0.013	40	5		2	30	20		2	3	8		2.8	3.6	22.5	51.8	14.4	0.61	0.08	10
SR12AUU	SR12A	32	24		41	7		3	31	20.5		2	4	10		2.8	3.6	26.3	60.5	14.4	0.88	0.10	12
SR16AUU	SR16A	40	28		48	7	0 -0.022	3	38	24		2	6	13.5		4.1	5.2	49.6	114	23.4	1.56	0.12	16
SR20AUU	SR20A	50	32	0 -0.016	53	10		3.5	40	26.5		2	8	17.5		4.1	5.2	60.4	139	23.4	2.45	0.15	20
SR25AUU	SR25A	50	40		56	10		3.5	40	28		2.5	12	22		5.6	7.0	101	234	34.7	3.83	0.27	25
SR30AUU	SR30A	80	45		76	12	0 -0.027	3.5	56	38	30 °	2.5	17	26.8		7.3	9.2	160	368	36.7	5.52	0.54	30
SR40AUU	SR40A	100	62	0 -0.019	95	18		6	75	47.5		3	21	36		11.4	14.4	332	762	52.1	9.82	1.01	40
SR50AUU	SR50A	130	76		116	20	0 -0.033	6	86	58		3.5	28	45.2		16.4	20.38	595	1368	86.8	15.4	1.81	50
SR60AUU	SR60A	130	85	0 -0.022	121	24		8	91	60.5		3.5	33	55.2		16.4	20.8	704	1618	95.8	22.1	2.16	60

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

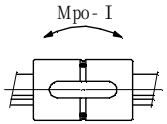
SR20 A UU - 1 - E - H - 170 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

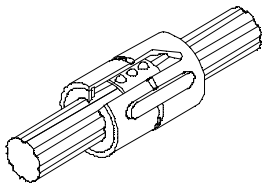
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

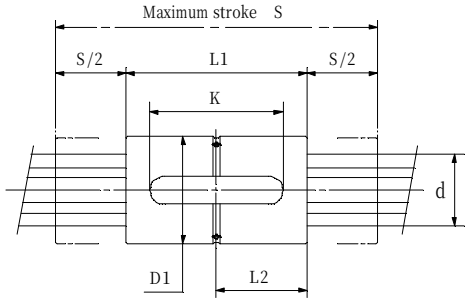
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

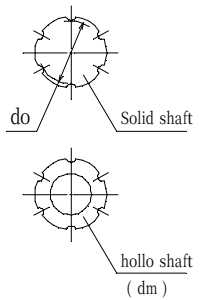
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

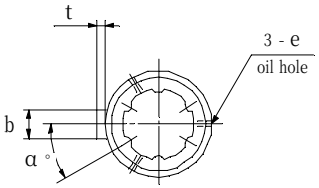


Non-circulating ball type (Limited stroke)









(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Maximum stroke S	Outer diameter D1	Outer diameter (h6)	Total length L1	Dimension of Key b	Dimension of Key (h8)	Dimension of Key t	Dimension of Key K	L2	α °	Oil hole e	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N · m) Dynamic rating Ct	Basic rated torque (N · m) Static rating Cot	Static rated moment (N · m) Mpo- I	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
SR30CUU	SR30C	80	45	0 -0.016	76	12	0 -0.027	3.5	56	38	30 °	2.5	17	26.8	6	12.6	16	320	736	63.6	5.52	0.54	30
SR40CUU	SR40C	100	62	0 -0.019	95	18		6	75	47.5		3	21	36		19.8	25	664	1525	90.2	9.82	1.01	40
SR50CUU	SR50C	130	76		116	20	0 -0.033	6	86	58		3.5	28	45.2		28.5	36	1191	2736	150	15.4	1.81	50
SR60CUU	SR60C	130	85	0 -0.022	121	24		8	91	60.5		3.5	33	55.2		28.5	36	1408	3236	166	22.1	2.16	60

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

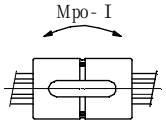
SR40 C UU - 1 - E - H - 280 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

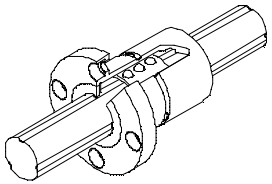
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

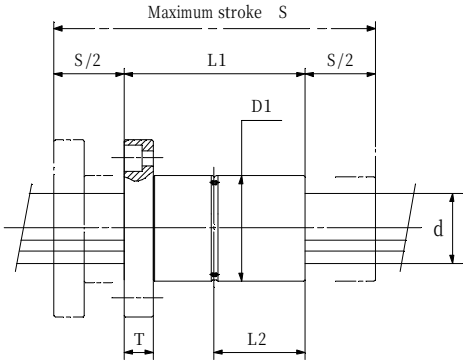
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

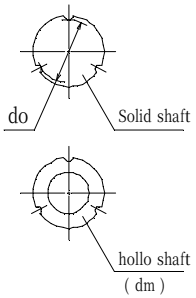
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

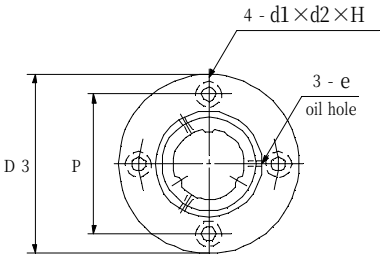


Non-circulating ball type (Limited stroke)









(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Maximum stroke S	Outer diameter D1	Outer diameter (h6)	Total length L1	Dimension of Flange D3	T	P	d1	d2	H	L2	Oil hole e	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N・m) Dynamic rating Ct	Basic rated torque (N・m) Static rating Cot	Static rated moment (N・m) Mpo- I	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
FSR6AUU	FSR6A	22	12	0 -0.011	29	27	6	18	3.4	6.5	3.3	14.5	1	2	5.1	3	0.8	1.0	3.9	9.1	2.5	0.23	0.02	6
FSR8AUU	FSR8A	26	16		34	34	7	25	4.5	7.5	4	17	1	3	6.8		1.8	2.3	11.9	27.6	6.9	0.39	0.06	8
FSR10AUU	FSR10A	30	20	0 -0.013	40	38	7	29	4.5	7.5	4	20	2	3	8		2.8	3.6	22.5	51.8	14.4	0.61	0.10	10
FSR12AUU	FSR12A	32	24		41	42	7	33	4.5	7.5	4	20.5	2	4	10		2.8	3.6	26.3	60.5	14.4	0.88	0.14	12
FSR16AUU	FSR16A	40	28		48	49	8	38	5.5	9	5	24	2	6	13.5		4.1	5.2	49.6	114	23.4	1.56	0.19	16
FSR20AUU	FSR20A	50	32	0 -0.016	53	56	9	43	6.5	10.5	6	26.5	2	8	17.5		4.1	5.2	60.4	139	23.4	2.45	0.25	20
FSR25AUU	FSR25A	50	40		56	64	9	51	6.5	10.5	6	28	2.5	12	22		5.6	7.0	101	234	34.7	3.83	0.37	25
FSR30AUU	FSR30A	80	45		76	75	12	59	8.5	14	8	38	2.5	17	26.8		7.3	9.2	160	368	36.7	5.52	0.66	30
FSR40AUU	FSR40A	100	62	0 -0.019	95	92	12	76	8.5	14	8	47.5	3	21	36		11.4	14.4	332	762	52.1	9.82	1.34	40
FSR50AUU	FSR50A	130	76		116	112	14	92	10.5	17	10	58	3.5	28	45.2		16.4	20.8	595	1368	86.8	15.4	2.13	50
FSR60AUU	FSR60A	130	85	0 -0.022	121	121	14	101	10.5	17	10	60.5	3.5	33	55.2		16.4	20.8	704	1618	95.8	22.1	2.37	60

1 k N 102kgf 1 N・m 0.102 kgf・m

【 Designation 】

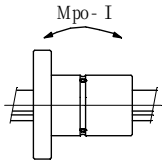
FSR20 A UU - 1 - E - H - 170 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

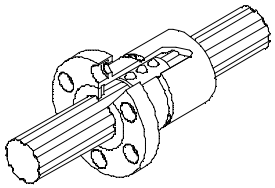
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

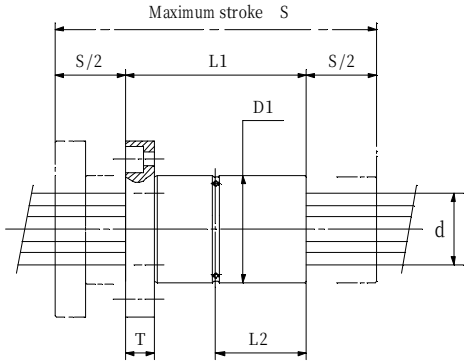
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

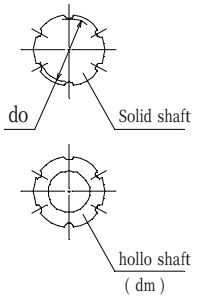
・ Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

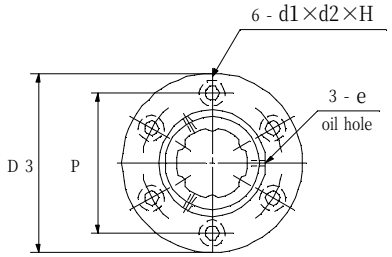


Non-circulating ball type (Limited stroke)









(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Maximum stroke S	Outer diameter D1	Outer diameter (h6)	Total length L1	Dimension of Flange D3	T	P	d1	d2	H	L2	Oil hole e	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N・m) Dynamic rating Ct	Basic rated torque (N・m) Static rating Cot	Static rated moment (N・m) Mpo- I	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
FSR30CUU	FSR30C	80	45	0 -0.016	76	75	12	59	8.5	14	8	38	2.5	17	26.8	6	12.6	16	320	736	63.6	5.45	0.66	30
FSR40CUU	FSR40C	100	62	0 -0.019	95	92	12	76	8.5	14	8	47.5	3	21	36		19.8	25	664	1525	90.2	9.71	1.34	40
FSR50CUU	FSR50C	130	76		116	112	14	92	10.5	17	10	58	3.5	28	45.2		28.5	36	1191	2736	150	15.2	2.13	50
FSR60CUU	FSR60C	130	85	0 -0.022	121	121	14	101	10.5	17	10	60.5	3.5	33	55.2		28.5	36	1408	3236	166	22.0	2.37	60

1 k N 102kgf 1 N・m 0.102 kgf・m

【 Designation 】

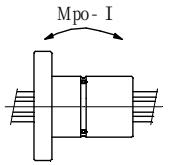
FSR40 C UU - 1 - E - H - 280 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

※ See page A6

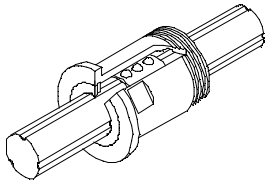
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

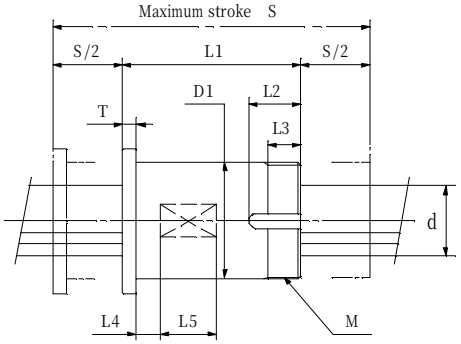
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

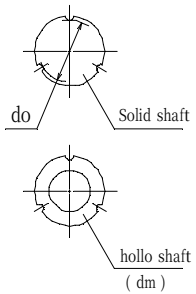
・ Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

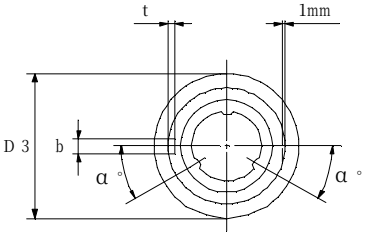


Non-circulating ball type (Limited stroke)









(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Maximum stroke S	Outer diameter D1	Outer diameter (h6)	Total length L1	M	D3	T	L2	L3	L4	L5	b	t	α °	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N · m) Dynamic rating Ct	Basic rated torque (N · m) Static rating Cot	Static rated moment (N · m) Mpo- I	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
KSR8AUU	KSR8A	26	20	0 -0.013	34	M20×1	27	3	13	8	5	10	4.5	1.6	30 °	3	6.8	3	1.8	2.3	11.9	27.6	6.9	0.37	0.07	8
KSR10AUU	KSR10A	30	25		40	M25×1.5	33	3	15	9	5	10	5.5	2.1		3	8		2.8	3.6	22.5	51.8	14.4	0.58	0.14	10
KSR12AUU	KSR12A	32	30		41	M30×1.5	38	3	15	9	5	10	5.5	2.6		4	10		2.8	3.6	26.3	60.5	14.4	0.85	0.18	12
KSR16AUU	KSR16A	40	35		48	M35×1.5	45	5	17	10	7	12	6.5	2.6		6	13.5		4.1	5.2	49.6	114	23.4	1.52	0.26	16
KSR20AUU	KSR20A	50	40	0 -0.016	53	M40×1.5	50	5	19	12	7	15	6.5	2.6		8	17.5		4.1	5.2	60.4	139	23.4	2.41	0.35	20
KSR25AUU	KSR25A	50	45		56	M45×1.5	56	5	19	12	7	15	6.5	2.6		12	22		5.6	7.0	101	234	34.7	3.78	0.43	25
KSR30AUU	KSR30A	80	50		76	M50×1.5	62	6	22	14	10	24	6.5	2.6		17	26.8		7.3	9.2	160	368	36.7	5.45	0.77	30
KSR40AUU	KSR40A	100	65	0 -0.019	95	M65×2	79	6	26	16	10	28	8.5	2.6		21	36		11.4	14.4	332	762	52.1	9.71	1.20	40
KSR50AUU	KSR50A	130	80		116	M80×2	94	8	31	20	10	35	11	3.6		28	45.2		16.4	20.8	595	1368	86.8	15.2	2.22	50
																			1 k N	102kgf		1 N·m	0.102 kgf·m			

【 Designation 】

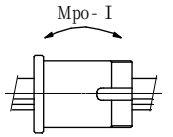
KSR20 A UU - 1 - E - H - 170 T M
① ②③ ④ ⑤ ⑥ ⑦ ⑧⑨

※ See page A6

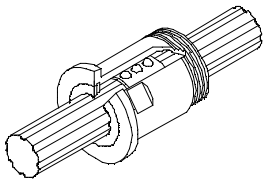
Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

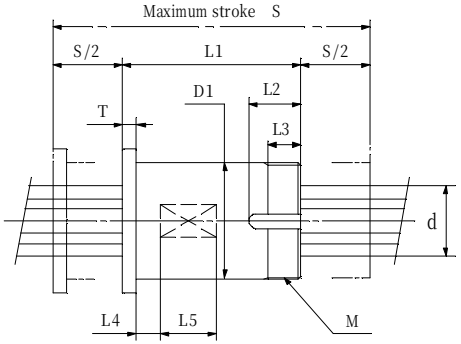
① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

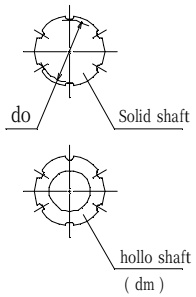
· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

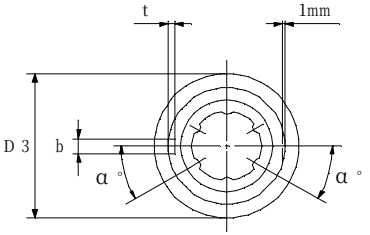


Non-circulating ball type (Limited stroke)









(Unit : mm)

Type of sleeve With seal	Type of sleeve Without seal	Maximum stroke S	Outer diameter D1	Outer diameter (h6)	Total length L1	M	D3	T	L2	L3	L4	L5	b	t	α °	hollow shaft dm	Minor diameter do	Number of grooves	Basic rated radial load (k N) Dynamic rating Cr	Basic rated radial load (k N) Static rating Cor	Basic rated torque (N · m) Dynamic rating Ct	Basic rated torque (N · m) Static rating Cot	Static rated moment (N · m) Mpo- I	Weight (kg) Shaft/m	Weight (kg) Sleeve	Dia (h7) d
KSR30CUU	KSR30C	80	50	0 -0.016	76	M50×1.5	62	6	22	14	10	24	6.5	2.6	30 °	17	26.8	6	12.6	16	320	736	63.6	5.45	0.77	30
KSR40CUU	KSR40C	100	65	0 -0.019	95	M65×2	79	6	26	16	10	28	8.5	2.6		21	36		19.8	25	664	1525	90.2	9.71	1.20	40
KSR50CUU	KSR50C	130	80		116	M80×2	94	8	31	20	10	35	11	3.6		28	45.2		28.5	36	1191	2736	150	15.2	2.22	50
																			1 k N	102kgf		1 N·m	0.102 kgf·m			

【 Designation 】

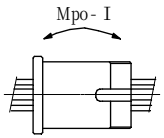
KSR40 C UU - 1 - E - H - 280 T M
① ②③ ④ ⑤ ⑥ ⑦ ⑧⑨

※ See page A6

Note. NSB Precision ball splinse are manufactured as set of sleeve and shaft, and are sold with sleeve installed on the shaft.

① Type of sleeve
② Symbol for the number of grooves
③ With saels at both ends
④ Number of sleeve per shaft
⑤ Clearance (See page A10)
⑥ Symbol for accuracy levels (See page 8)
⑦ Shaft length [mm]
⑧ Outer then standard stock T = With additional machining
L = Without additional machining
⑨ Symbol for hollow shaft (No symbol = Solid shaft)

· Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)



Economy Ball splines

Preface

NSB economy ball splines are ball circulating type spline bearing which are cheap and compact configuration . They have semicircular ball grooves on the shaft and on the sleeve . By installing steel balls between grooves , linear and rotary motion is possible.

Features

① Semi-circular grooves , serving as rolling surface for load carrying steel balls, furnish high loading capacity and long service life as ball splines.

② Circulating steel balls in the grooves enable torque transmission and linear motion of the shaft simultaneously.

③ Ample sleeve types and standard stock of spline shafts are always available for various applications.

Space saving type bearing consisting of two bearings within a sleeve is also available . This type has a high moment load capacity and is able to transmit big torque.

④ Handling is simple because this bearing is constructed in the way that steel balls do not fall off.

Applications

・ Industrial robots ・ Robots for taking out products ・Coil winding machines
・ Inserting machines for electronic parts ・ Semiconductor producing machines
・ Electic terminal crimping machines ・Honing machines ・Robots for welding

Configuration

NSB economy ball spline consists of a spline shaft and a sleeve moving on the shaft. Steel balls circulate in the sleeve , help in place by a retainer integrally formed.

Fig 3-1

(Standard type)

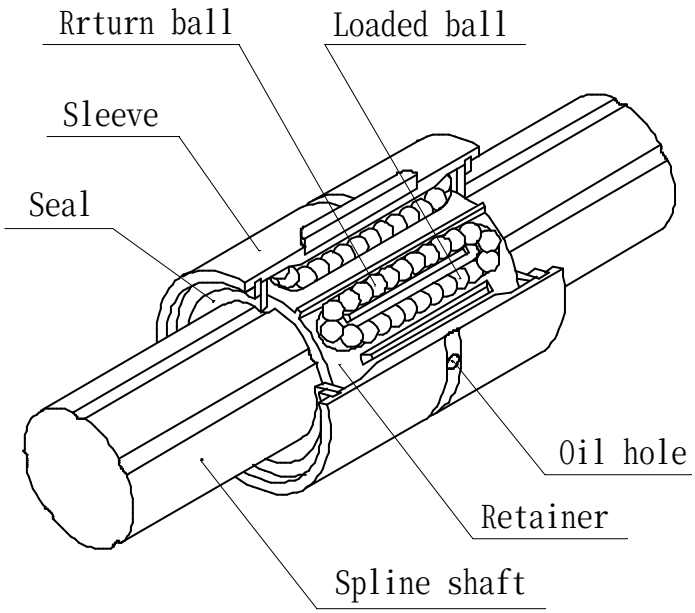
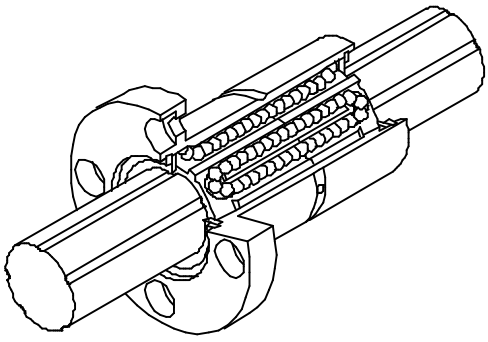


Fig 3-2

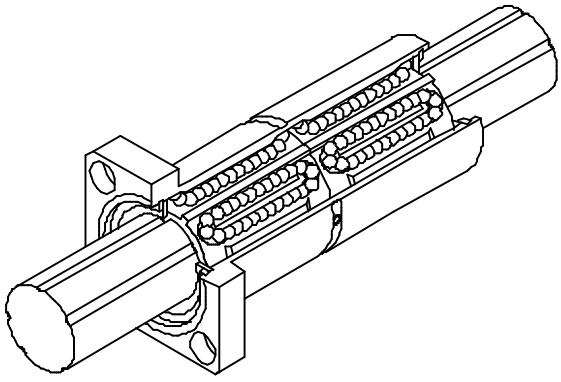
(Long type)



The sleeve is made longer to enable it bear high load

Fig 3-3

(Double type)



Single sleeve consists of two sleeve has high strength for moment load

Kind of the sleeve

Standard type		
LSK	LSF	LST
Single sleeve		

Long type	
LSKL	LSFL
The sleeve is made longer to enable it bear high load	

Double type		
LSKW	LSFW	LSTW
Single sleeve consists of two sleeves has high strength for moment load		

Material . Heat treatment . Hardness

Table 3-1

Item	Material	Heat treatment	Hardness
Spline shaft	SUJ 2	Induction hardening	HRC 58 up
Sleeve	SCM415	Carburizing hardening	HRC 58 up
Steel ball	SUJ 2	Hardening	HRC 60 up
Retainer	Synthetic resin	-	-

Designation

NSB Economy ball splines are manufactured as set of sleeve and shaft ,and are sold with sleeve installed on the shaft .When you issue an order ,please use the following form.

LSFL20	UU	-	2	-	E	-	H	-	680	T	M
①	②		③		④		⑤		⑥	⑦	⑧

Table 3-2

①	Type of sleeve	**LSFL20** (Flange long type)
②	Seal	**UU** (Symbol for the ball spline with seals at both ends)
③	Number of sleeves per shaft	**2**
④	Clearance	**E** (See page B8 Table 3-6)
⑤	Symbol for accuracy levels	**H** (See page 8 Table 1-7 ～ 1-12)
⑥	Total length of shaft	**680** mm
⑦	Other then standard stocks	**T =** with additional machining L = without additional machining
⑧	Symbol for hollow shaft No symbol = Solid shaft	**M** (See page B6 Table 3-4)

※ Standard stock items for See page B12

Spline shaft (special design shaft)

● **Maximum length of the shafts**

Maximum length of the spline shafts we manufacture is shown in Table 3-3. Longer shafts can be manufactured to order .Please contact NSB

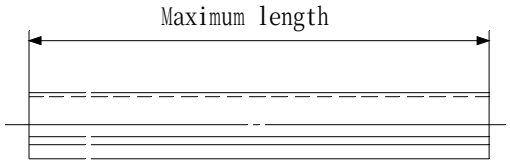


Table 3-3

Type	Maximum length of the spline shaft （mm）
6	250
8	350
10	500
13	800
16	1000
20	1500
25	2000
30	2400

● **Hollow shaft** (M-mark)

We will supply hollow shafts as shown in Table 3-4, when reduction of spline shaft weight or air passage through the shaft is necessary.

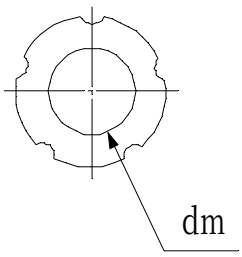


Table 3-4

Type	Reduction of weight dm （mm）
6	2
8	3
10	4
13	4
16	6
20	8
25	12
30	17

● **Incomplete length of the groove**

When stepped machining is necessary ,use incomplete length Lt of spline shaft indicated in Table 3-5.

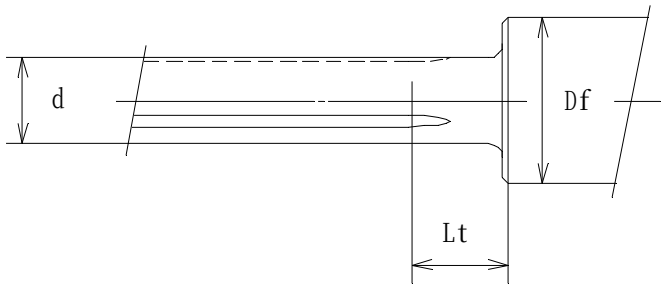


Table3-5 (Unit:mm)

Shaft dia	D f												
	6	8	10	13	16	20	25	30	35	40	50	60	80
6	5	11	14	18	21	25	-	-	-	-	-	-	-
8	-	5	11	16	19	23	27	30	-	-	-	-	-
10.4	-	-	-	12	17	21	25	29	-	-	-	-	-
13.4	-	-	-	-	12	18	23	27	30	-	-	-	-
16.6	-	-	-	-	-	14	20	25	28	31	-	-	-
20.6	-	-	-	-	-	-	15	21	25	29	34	-	-
25.8	-	-	-	-	-	-	-	15	21	25	32	36	-
30.8	-	-	-	-	-	-	-	-	15	21	29	34	41

Clearance

For NSB economy ball splines , appropriate clearance adapted to usage is necessary in order to obtain long life and high accuracy. Please select correct clearance for the application.

Table 3-6 (Unit:mm)

Type	E0	E	Normal (No symbol)	E1
6 8 10	—	-0.006 ～ -0.001	-0.001 ～ +0.004	+0.004 ～ +0.010
13 16 20	-0.012 ～ -0.006	-0.008 ～ -0.002	-0.002 ～ +0.005	+0.005 ～ +0.012
25 30	-0.014 ～ -0.006	-0.008 ～ -0.002	-0.002 ～ +0.006	+0.006 ～ +0.015
Condition of operation	・eceiving severe vibration or shock. ・eceiving overhanged load. ・Places requiring high stiffness and exposed.	・Receiving weak vibration or shock. ・Places with alternating loads.	・When smooth driving with small power is necessary. ・Receiving load in one direction only.	・For very long shaft. ・Where tempreature change is expected.

Remarks for application

① In installing the sleeve to the housing ,care should be taken not to afford shock to the sleeve.

② For assembling sleeve to spline shaft ,insert gently keeping sleeve axis parallel to the shaft .Do not pry.

③ This type is easy to handle ,because it has a retainer .The retainer ,however ,is made of synthetic resin ,thus it can not bear high temperature. Operating temperature should be between - 40℃ to + 80℃.

⑤ Relative location of spline grooves ,key groove on the outer surface of sleeve ,and mounting holes for the flange are shown in the drawing indicating dimensions for each types.

⑤ If additional machining of spline shaft is necessary ,chamfering of shaft end face should be more than C0.5 .(more than 0.5 mm chamfer)

Fit

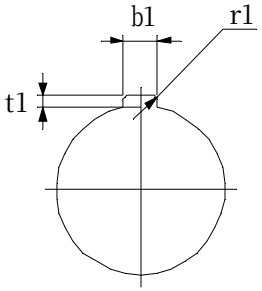
For the fit value in installing NSB economy ball spline into housing box , we recommend the figure in Table 3-7.

Table 3-7 (Unit : mm)

Type	Loose fit (H 7)	Tight fit (J 7)
6 8	+0.018 0	+0.010 -0.008
10 13	+0.021 0	+0.012 -0.009
16 20 25 30	+0.025 0	+0.014 -0.011

Dimension of key way and key

For inserting NSB economy ball spline with key way (LSK LSKL LSKW) ,into housing box ,refer Table 3-8 for key way tolerances ,and Table 3-9 for key dimensions.



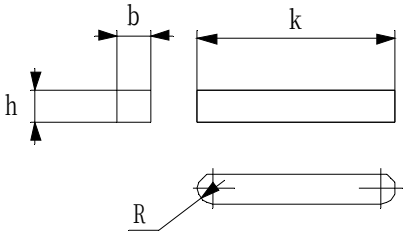


Table 3-8 (Unit : mm)

Type	Key way				
	b1	Tol.	t1	Tol.	r1
6	2.5	±0.013	1.5	+0.1 0	0.4
8					
10	3		1.7		
13					
16	3.5				
20	4	±0.015	1.8		
25					
30					

Table 3-9 (Unit : mm)

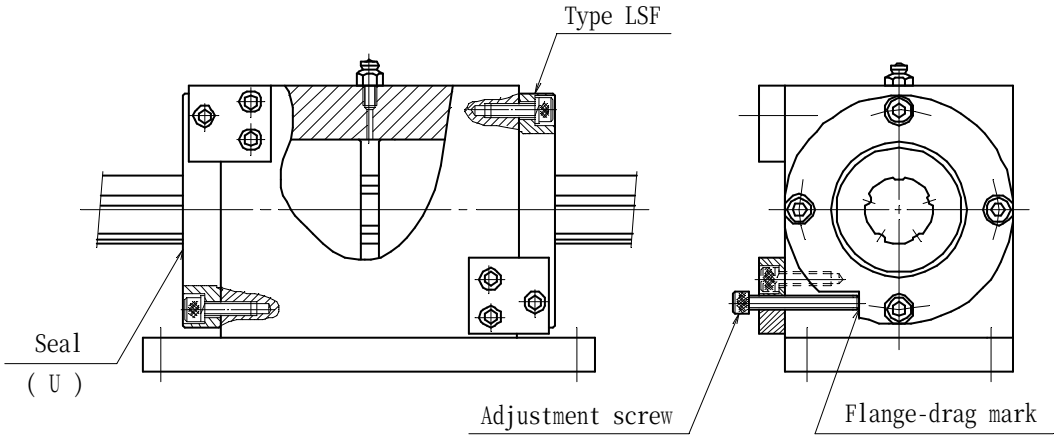
Type	Key							
	b	Tol.	h	Tol.	k (LSK) (LSKW)	k (LSKL)	Tol.	R
6	2.5	+0.016 +0.006	2.5	0 -0.025	10.5	-	0 -0.2	1.25
8								
10	3		3		14	17		1.5
13					14	17		
16	3.5		3.5		18	18		1.75
20	4	+0.024 +0.012	4	0 -0.030	20	29		2
25					29	33		
30					33	42		

How to apply pre-load

NSB economy ball spline can apply pre-load. It is effective in enhancing rigidity ,elimination of backlash or extension of service life..

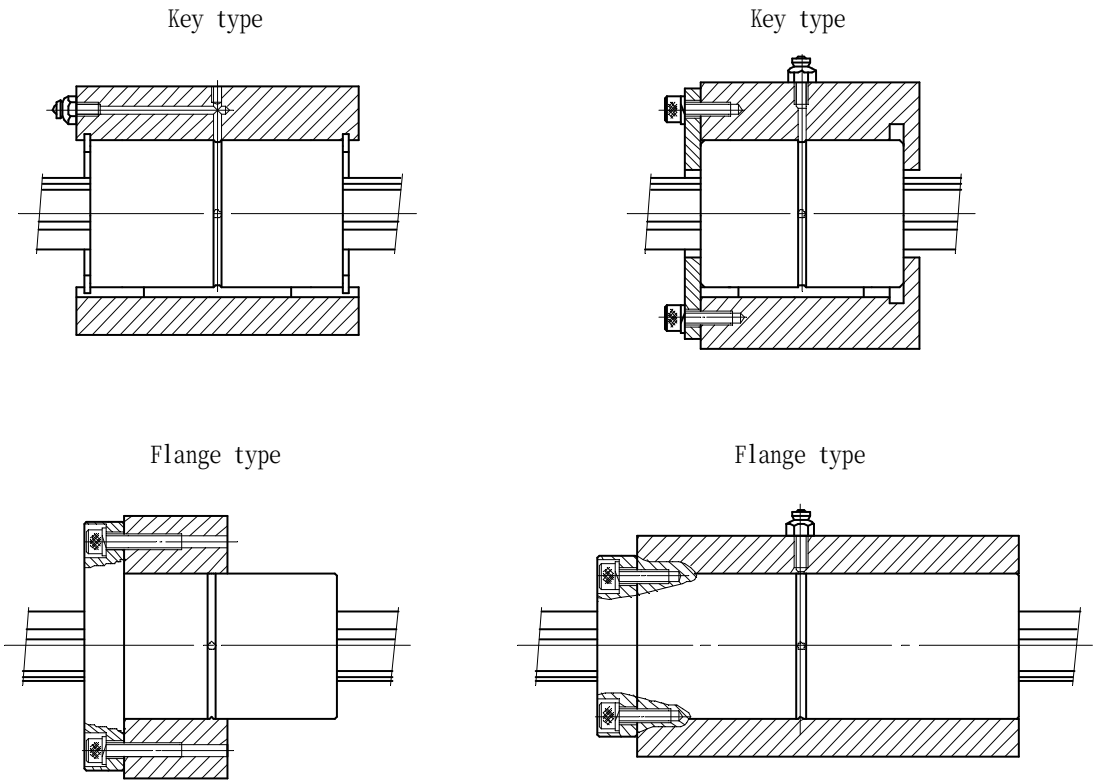
In order to apply pre-load ,two sleeves with flange are installed to housing in the manner shown in Fig.3-4, and manipulate adjusting screw. 0ptimum quantity of pre-load is about one third of transmitting torque.

Fig.3-4



Example of installation of the sleeve

Fig.3-5



Standard stocks

NSB' Economy Ball spline,as illustrated beiow,provides standard stock of full spline shaft with one sleeve or two sleeves installed on the shaft for short time delivery

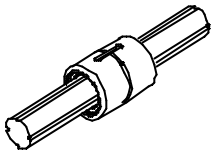
〔Example〕

One sleeve

LSK16 - 1 - 300 S
① ② ③ ④

① Type of sleeve (all seal type)
② Number of one sleeve per shaft
③ Standard Shaft length [mm]
④ Standard stock mark = "S"

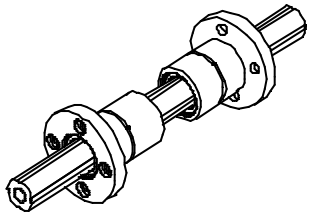
No symbol = Solid shaft
(Symbol for hollow shaft mark = "M")



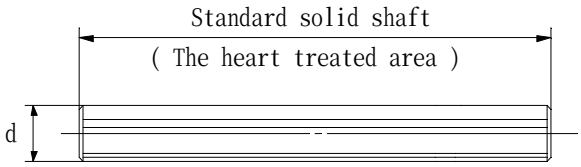
Two sleeve

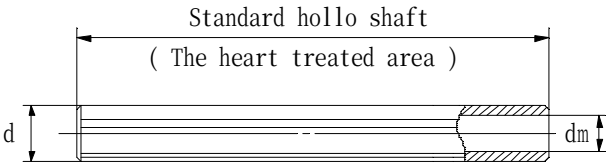
LSFL20 - 2 - 500 S M
① ② ③ ④ ⑤

① Type of sleeve (all seal type)
② Number of two sleeve per shaft
③ Standard Shaft length [mm]
④ Standard stock mark = "S"
⑤ Symbol for hollow shaft mark = "M"
(No symbol = Solid shaft)



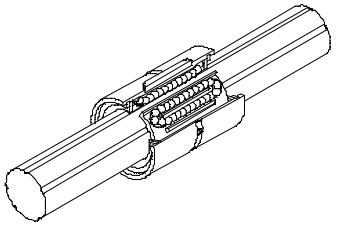
Note : (1) Clearance is normal clearance.(with no symbol)
(2) Grade of accuracy is standard class.

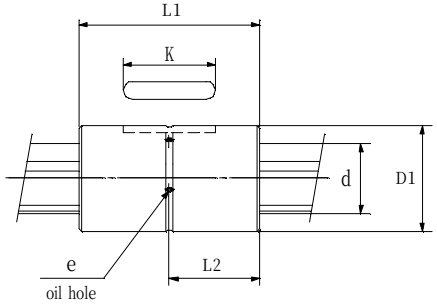


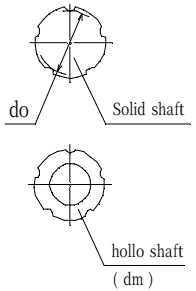


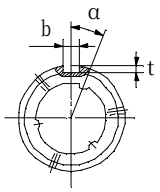
(Unit : mm)

Spline Shaft dia d (h7)	Shaft length of standard stock [full spline]						Hollow shaft (Mark "M") dm
6	100	150	200				2
8	100	150	200				3
10.4	100	200	300	400			4
13.4	200	300	400	500			4
16.6	200	300	400	500	600		6
20.6	300	400	500	600	700		8
25.8	400	500	600	700	800	1000	12
30.8	400	500	600	700	800	1000	17

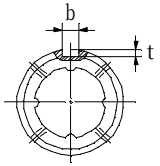




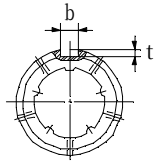




LSK6
LSK8



LSK10
LSK13



LSK16 LSK25
LSK20 LSK30

(Unit : mm)

Type of sleeve		Outer Diameter		Total length	Key way						Oil hole		Minor dia	Number of grooves		Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)		Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	b	(H8)	t		K	L2	e	dm	do		α °	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
CAD DATA **LSK6UU**	**LSK6**	14	0 -0.011	25	2.5	+0.014 0	1.2	+0.05 0	10.5	12.5	1.5	2	5.6	3	15 °	1.2	2.1	3.8	7.0	5	36	0.23	0.012	6
CAD DATA **LSK8UU**	**LSK8**	16		25	2.5		1.2		10.5	12.5	1.5	3	7.6		25 °	1.2	2.1	4.8	8.7	5	36	0.39	0.013	8
CAD DATA **LSK10UU**	**LSK10**	21	0 -0.013	33	3		1.5		14	16.5	1.5	4	10	4	-	2.4	4.3	11	21	15	102	0.65	0.04	10.4
CAD DATA **LSK13UU**	**LSK13**	24		36	3		1.5		14	18	1.5	4	13		-	3.3	5.9	20	37	22	148	1.11	0.05	13.4
CAD DATA **LSK16UU**	**LSK16**	31	0 -0.016	41	3.5	+0.018 0	2		18	20.5	1.5	6	16	5	-	3.8	6.9	32	58	32	216	1.65	0.12	16.6
CAD DATA **LSK20UU**	**LSK20**	35		46	4		2.5		20	23	2	8	20		-	4.6	8.3	46	84	42	276	2.57	0.14	20.6
CAD DATA **LSK25UU**	**LSK25**	42		60	4		2.5		29	30	2	12	25		-	10.8	19.4	135	244	113	773	4.04	0.23	25.8
CAD DATA **LSK30UU**	**LSK30**	47		66	4		2.5		33	33	2.5	17	30		-	12.3	22.2	181	327	136	937	5.85	0.29	30.8
																1 k N	102kgf	1 N·m	0.102 kgf·m					

【 Designation 】

LSK20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

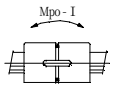
※ See page B5

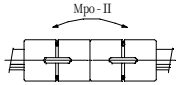
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

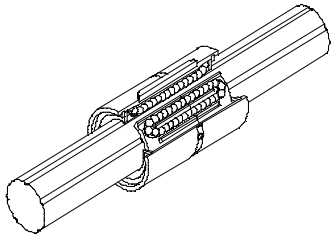
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stocl T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

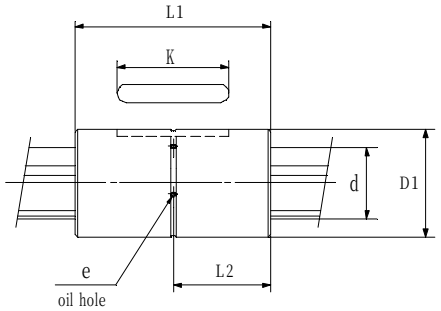
Note.2 Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

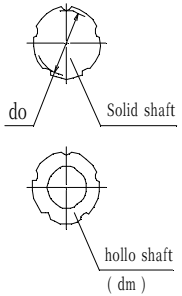
Note.3 Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)

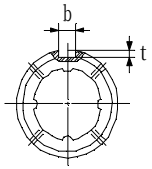




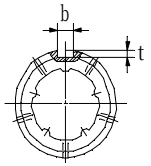








LSKL10
LSKL13



LSKL16 LSKL25
LSKL20 LSKL30

(Unit : mm)

	Type of sleeve		Outer Diameter		Total length	Key way					L2	Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)		Weight (kg)		Dia (h7)
	With seal	Without seal	D1	(h6)	L1	b	(H8)	t		K		e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
CAD DATA	LSKL10UU	LSKL10	21	0 -0.013	40	3	+0.014 0	1.5	+0.05 0	17	20	1.5	4	10	4	3.8	6.9	19	34	26	181	0.65	0.06	10.4
CAD DATA	LSKL13UU	LSKL13	24		44	3		1.5		17	22	1.5	4	13		4.6	8.3	28	52	36	251	1.11	0.07	13.4
CAD DATA	LSKL16UU	LSKL16	31	0 -0.016	50	3.5	+0.018 0	2		18	25	1.5	6	16	5	6.2	11.1	51	93	56	386	1.65	0.15	16.6
CAD DATA	LSKL20UU	LSKL20	35		63	4		2.5		29	31.5	2	8	20		8.5	15.3	85	154	83	611	2.57	0.20	20.6
CAD DATA	LSKL25UU	LSKL25	42		71	4		2.5		33	35.5	2	12	25		15.4	27.7	193	348	173	1248	4.04	0.29	25.8
CAD DATA	LSKL30UU	LSKL30	47		80	4		2.5		42	40	2.5	17	30		18.5	33.3	272	490	212	1581	5.85	0.37	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

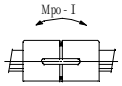
LSKL20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

※ See page B5

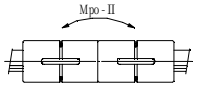
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

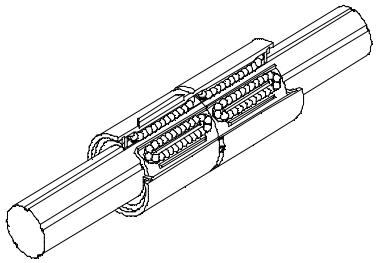
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stocl T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

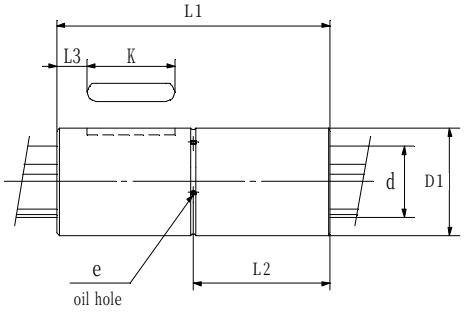
Note.2 Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

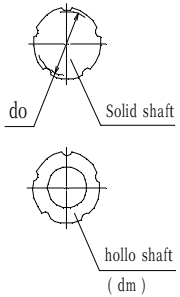


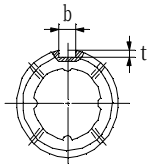
Note.3 Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)



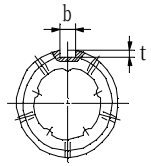








LSKW10
LSKW13



LSKW16 LSKW25
LSKW20 LSKW30

(Unit : mm)

Type of sleeve		Outer Diameter		Total length	Key way							Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)	Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	b	(H8)	t		K	L2	L3	e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Shaft/m	Sleeve	d
CAD DATA **LSKW10UU**	**LSKW10**	21	0 -0.013	59	3	+0.014 0	1.5	+0.05 0	14	29.5	9.5	1.5	4	10	4	4.8	8.7	23	43	82	0.65	0.07	10.4
CAD DATA **LSKW13UU**	**LSKW13**	24		64	3		1.5		14	32	11	1.5	4	13		6.6	11.8	41	74	116	1.11	0.09	13.4
CAD DATA **LSKW16UU**	**LSKW16**	31	0 -0.016	74	3.5	+0.018 0	2		18	37	11.5	1.5	6	16	5	7.7	13.9	64	116	176	1.65	0.19	16.6
CAD DATA **LSKW20UU**	**LSKW20**	35		84	4		2.5		20	42	13	2	8	20		9.3	16.7	93	168	228	2.57	0.23	20.6
CAD DATA **LSKW25UU**	**LSKW25**	42		110	4		2.5		29	55	15.5	2	12	25		21.6	38.9	271	488	640	4.04	0.37	25.8
CAD DATA **LSKW30UU**	**LSKW30**	47		122	4		2.5		33	61	16.5	2.5	17	30		24.7	44.4	363	653	787	5.85	0.50	30.8
																1 k N	102kgf	1 N·m	0.102 kgf·m				

【 Designation 】

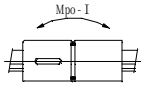
LSKW20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

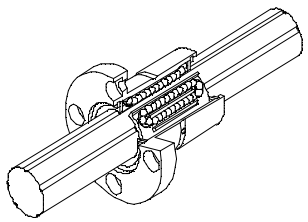
※ See page B5

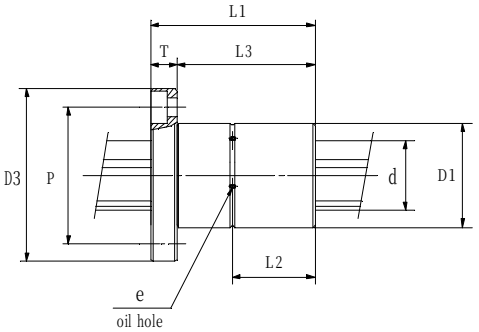
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

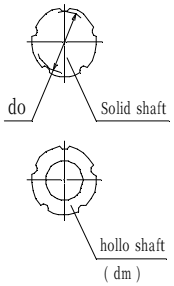
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard st(T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

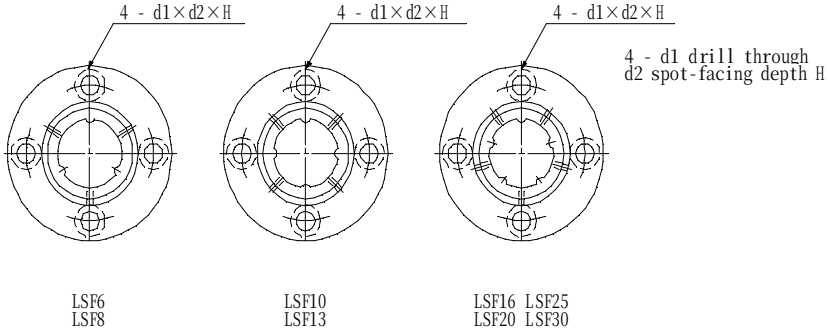
Note.2 Static rated moment load Mpo- I applies when one sleeves are positioned closely together.











(Unit : mm)

Type of sleeve		Outer Diameter		Total length	Dimension of flange								Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)		Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	D3	T	P	d1	d2	H	L2	L3	e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
CAD DATA **LSF6UU**	**LSF6**	14	0 -0.011	25	30	6	22	3.5	6	3.1	12.5	19	1.5	2	5.6	3	1.2	2.1	3.8	7.0	5	36	0.23	0.03	6
CAD DATA **LSF8UU**	**LSF8**	16		25	32	6	24	3.5	6	3.1	12.5	19	1.5	3	7.6		1.2	2.1	4.8	8.7	5	36	0.39	0.04	8
CAD DATA **LSF10UU**	**LSF10**	21	0 -0.013	33	41	8	30	4.5	8	5.3	16.5	25	1.5	4	10	4	2.4	4.3	11	21	15	102	0.65	0.10	10.4
CAD DATA **LSF13UU**	**LSF13**	24		36	45	8	34	4.5	8	5.3	18	28	1.5	4	13		3.3	5.9	20	37	22	148	1.11	0.11	13.4
CAD DATA **LSF16UU**	**LSF16**	31	0 -0.016	41	52	8	40	4.5	8	5.3	20.5	33	1.5	6	16	5	3.8	6.9	32	58	32	216	1.65	0.19	16.6
CAD DATA **LSF20UU**	**LSF20**	35		46	60	10	46	5.5	9.5	6.3	23	36	2	8	20		4.6	8.3	46	84	42	276	2.57	0.28	20.6
CAD DATA **LSF25UU**	**LSF25**	42		60	68	10	54	5.5	9.5	6.3	30	50	2	12	25		10.8	19.4	135	244	113	773	4.04	0.37	25.8
CAD DATA **LSF30UU**	**LSF30**	47		66	77	12	60	6.6	12.5	7.6	33	54	2.5	17	30		12.3	22.2	181	327	136	937	5.85	0.52	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

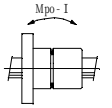
LSF20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

※ See page B5

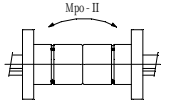
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stock T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

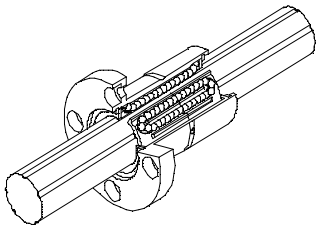
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

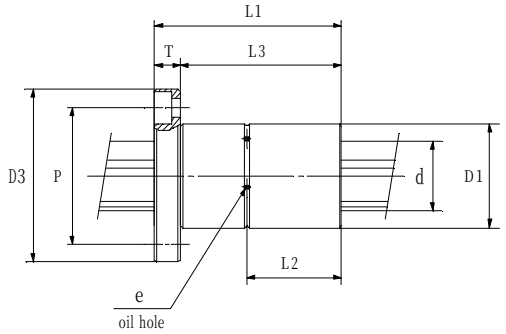
Note.2 Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

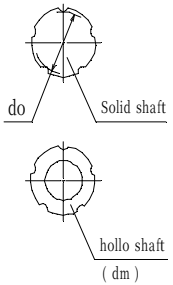


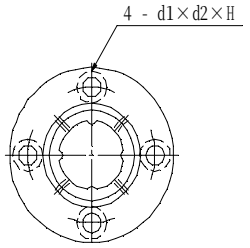
Note.3 Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)



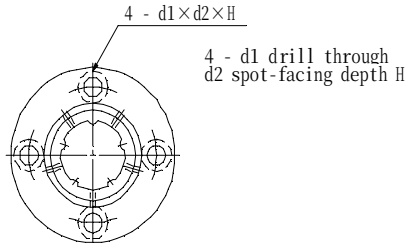








LSFL10
LSFL13



LSFL16 LSFL25
LSFL20 LSFL30

(Unit : mm)

Type of sleeve		Outer Diameter		Total length	Dimension of flange								Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)		Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	D3	T	P	d1	d2	H	L2	L3	e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
CAD DATA **LSFL10UU**	**LSFL10**	21	0 -0.013	40	42	6	32	4.5	8	4.4	20	34	1.5	4	10	4	3.8	6.9	19	34	26	181	0.65	0.09	10.4
CAD DATA **LSFL13UU**	**LSFL13**	24		44	44	7	33	4.5	8	4.4	22	37	1.5	4	13		4.6	8.3	28	52	36	251	1.11	0.11	13.4
CAD DATA **LSFL16UU**	**LSFL16**	31	0 -0.016	50	51	7	40	4.5	8	4.4	25	43	1.5	6	16	5	6.2	11.1	51	93	56	386	1.65	0.20	16.6
CAD DATA **LSFL20UU**	**LSFL20**	35		63	58	9	45	5.5	9.5	5.4	31.5	54	2	8	20		8.5	15.3	85	154	83	611	2.57	0.30	20.6
CAD DATA **LSFL25UU**	**LSFL25**	42		71	65	9	52	5.5	9.5	5.4	35.5	62	2	12	25		15.4	27.7	193	348	173	1248	4.04	0.40	25.8
CAD DATA **LSFL30UU**	**LSFL30**	47		80	75	10	60	6.6	11	6.5	40	70	2.5	17	30		18.5	33.3	272	490	212	1581	5.85	0.57	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

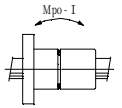
LSFL20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

※ See page B5

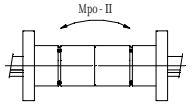
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stock T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

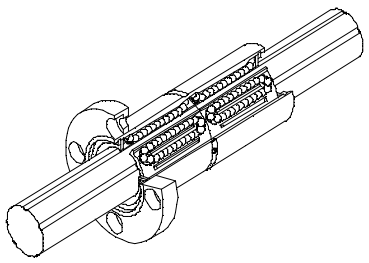
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

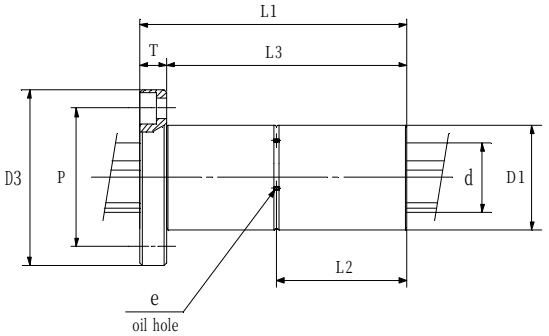
Note.2 Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

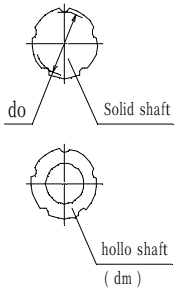


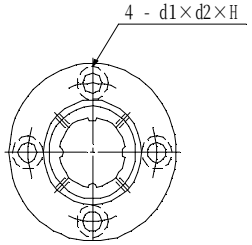
Note.3 Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower figure)



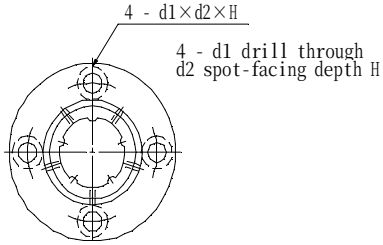








LSFW10
LSFW13



LSFW16 LSFW25
LSFW20 LSFW30

(Unit : mm)

Type of sleeve		Outer Diameter		Total length	Dimension of flange								Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)	Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	D3	T	P	d1	d2	H	L2	L3	e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Shaft/m	Sleeve	d
LSFW10UU	LSFW10	21	0 -0.013	59	41	8	30	4.5	8	5.3	29.5	51	1.5	4	10	4	4.8	8.7	23	43	82	0.65	0.13	10.4
LSFW13UU	LSFW13	24		64	45	8	34	4.5	8	5.3	32	56	1.5	4	13		6.6	11.8	41	74	116	1.11	0.15	13.4
LSFW16UU	LSFW16	31	0 -0.016	74	52	8	40	4.5	8	5.3	37	66	1.5	6	16	5	7.7	13.9	64	116	176	1.65	0.27	16.6
LSFW20UU	LSFW20	35		84	60	10	46	5.5	9.5	6.3	42	74	2	8	20		9.3	16.7	93	168	228	2.57	0.40	20.6
LSFW25UU	LSFW25	42		110	68	10	54	5.5	9.5	6.3	55	100	2	12	25		21.6	38.9	271	488	640	4.04	0.57	25.8
LSFW30UU	LSFW30	47		122	77	12	60	6.6	12.5	7.6	61	110	2.5	17	30		24.7	44.4	363	653	787	5.85	0.72	30.8
																	1 k N	102kgf	1 N·m	0.102 kgf·m				

【 Designation 】

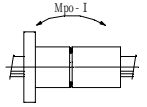
LSFW20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

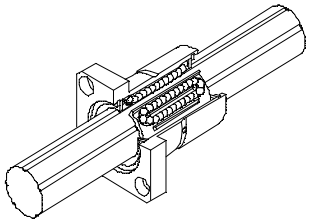
※ See page B5

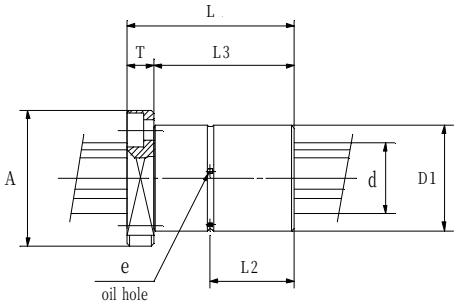
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

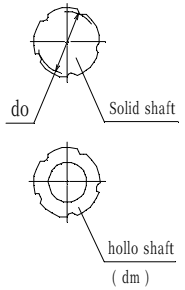
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stock T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

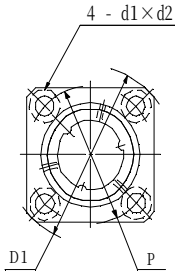
Note.2 Static rated moment load Mpo- I applies when one sleeves are positioned closely together.



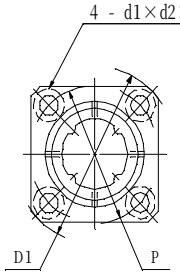




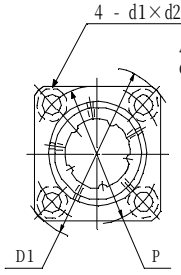




LST6
LST8



LST10
LST13



LST16 LST25
LST20 LST30

(Unit : mm)

Type of sleeve		Outer Diameter		Total length		Dimension of flange								Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)		Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	A	D3	T	P	d1	d2	H	L2	L3	e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Mpo- II	Shaft/m	Sleeve	d
LST6UU	LST6	14	0 -0.011	25	24	30	6	22	3.5	6	3.1	12.5	19	1.5	2	5.6	3	1.2	2.1	3.8	7.0	5	36	0.23	0.02	6
LST8UU	LST8	16		25	26	32	6	24	3.5	6	3.1	12.5	19	1.5	3	7.6		1.2	2.1	4.8	8.7	5	36	0.39	0.03	8
LST10UU	LST10	21	0 -0.013	33	32	41	8	30	4.5	8	5.3	16.5	25	1.5	4	10	4	2.4	4.3	11	21	15	102	0.65	0.08	10.4
LST13UU	LST13	24		36	35	45	8	34	4.5	8	5.3	18	28	1.5	4	13		3.3	5.9	20	37	22	148	1.11	0.09	13.4
LST16UU	LST16	31	0 -0.016	41	39	52	8	40	4.5	8	5.3	20.5	33	1.5	6	16	5	3.8	6.9	32	58	32	216	1.65	0.14	16.6
LST20UU	LST20	35		46	45	60	10	46	5.5	9.5	6.3	23	36	2	8	20		4.6	8.3	46	84	42	276	2.57	0.21	20.6
LST25UU	LST25	42		60	51	68	10	54	5.5	9.5	6.3	30	50	2	12	25		10.8	19.4	135	244	113	773	4.04	0.27	25.8
LST30UU	LST30	47		66	59	77	12	60	6.6	12.5	7.6	33	54	2.5	17	30		12.3	22.2	181	327	136	937	5.85	0.40	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

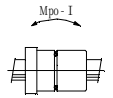
LST20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

※ See page B5

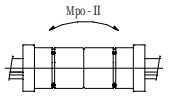
Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

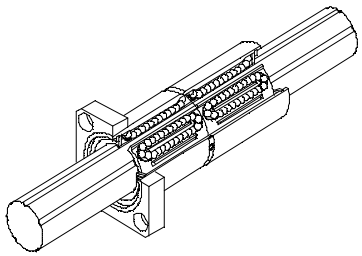
① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stock T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

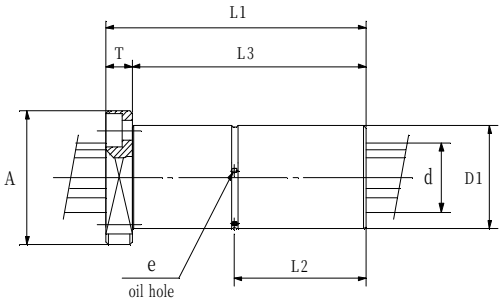
Note.2 Static rated moment load Mpo- I applies when one sleeve is positioned closely together. (See upper figure)

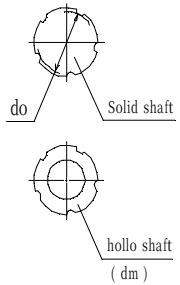


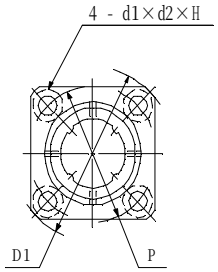
Note.3 Static rated moment load Mpo- II applies when two sleeves are positioned closely together. (See lower



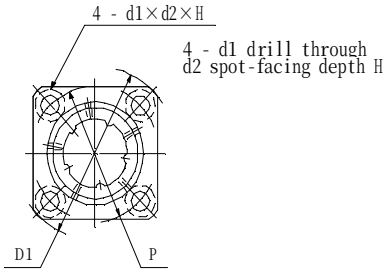








LSTW10
LSTW13



LSTW16 LSTW25
LSTW20 LSTW30

(Unit : mm)

Type of sleeve		Outer Diameter		Total length		Dimension of flange								Oil hole		Minor dia	Number of	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)	Weight (kg)		Dia (h7)
With seal	Without seal	D1	(h6)	L1	A	D3	T	P	d1	d2	H	L2	L3	e	dm	do	grooves	Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Shaft/m	Sleeve	d
CAD DATA **LSTW10UU**	**LSTW10**	21	0 -0.013	59	32	41	8	30	4.5	8	5.3	29.5	51	1.5	4	10	4	4.8	8.7	23	43	82	0.65	0.12	10.4
CAD DATA **LSTW13UU**	**LSTW13**	24		64	35	45	8	34	4.5	8	5.3	32	56	1.5	4	13		6.6	11.8	41	74	116	1.11	0.13	13.4
CAD DATA **LSTW16UU**	**LSTW16**	31	0 -0.016	74	39	52	8	40	4.5	8	5.3	37	66	1.5	6	16	5	7.7	13.9	64	116	176	1.65	0.22	16.6
CAD DATA **LSTW20UU**	**LSTW20**	35		84	45	60	10	46	5.5	9.5	6.3	42	74	2	8	20		9.3	16.7	93	168	228	2.57	0.33	20.6
CAD DATA **LSTW25UU**	**LSTW25**	42		110	51	68	10	54	5.5	9.5	6.3	55	100	2	12	25		21.6	38.9	271	488	640	4.04	0.47	25.8
CAD DATA **LSTW30UU**	**LSTW30**	47		122	59	77	12	60	6.6	12.5	7.6	61	110	2.5	17	30		24.7	44.4	363	653	787	5.85	0.60	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

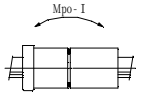
LSTW20 UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

※ See page B5

Note.1 NSB Economy ball splinse are manufactured as set of sleeve and shaft , and are sold with sleeve installed on the shaft .

① Type of sleeve
② With saels at both ends
③ Number of sleeve per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stock T = With additional machining
L = Without additional machining
⑧ Symbol for hollow shaft (No symbol = Solid shaft)

Note.2 Static rated moment load Mpo- I applies when one sleeves are positioned closely together.



Rotary Ball splines

Preface

NSB rotary ball splines of LS-R / LS-RY type are light weight, Compact and complex spline bearings which have been provided for both Functions of linear guide and rotary motion constructing precision-class deep groove ball bearings (ZZ type) on the spline sleeves of NSB Economy type ball splines and assembling in the spline housings directory as one nuit.

NSB LK-R type Rotary ball spline is the space saving and low Price simple construction which has been installed precision-class deep groove ball bearings in the flange and on the spline sleeve. When LK-R type is used together with LS-R type or LS-RY type as one unit, it is best suited for the case of large torqe condition and Non-angular-rash.

Features

① Handling is simple because this bearing is constructed in the way that steel balls do not fall off.

② The high precision ball bearing have been installed with appropriate adjustment, then exact rotary motion can be obtained.

③ The unit construction is able to easy installation, so you can use it instantly by means of fix it on your equipments.

④ Because of nickel non-electralysis plating upon spline housing and flange, so it is excellent to damage and rust on the surfaces.

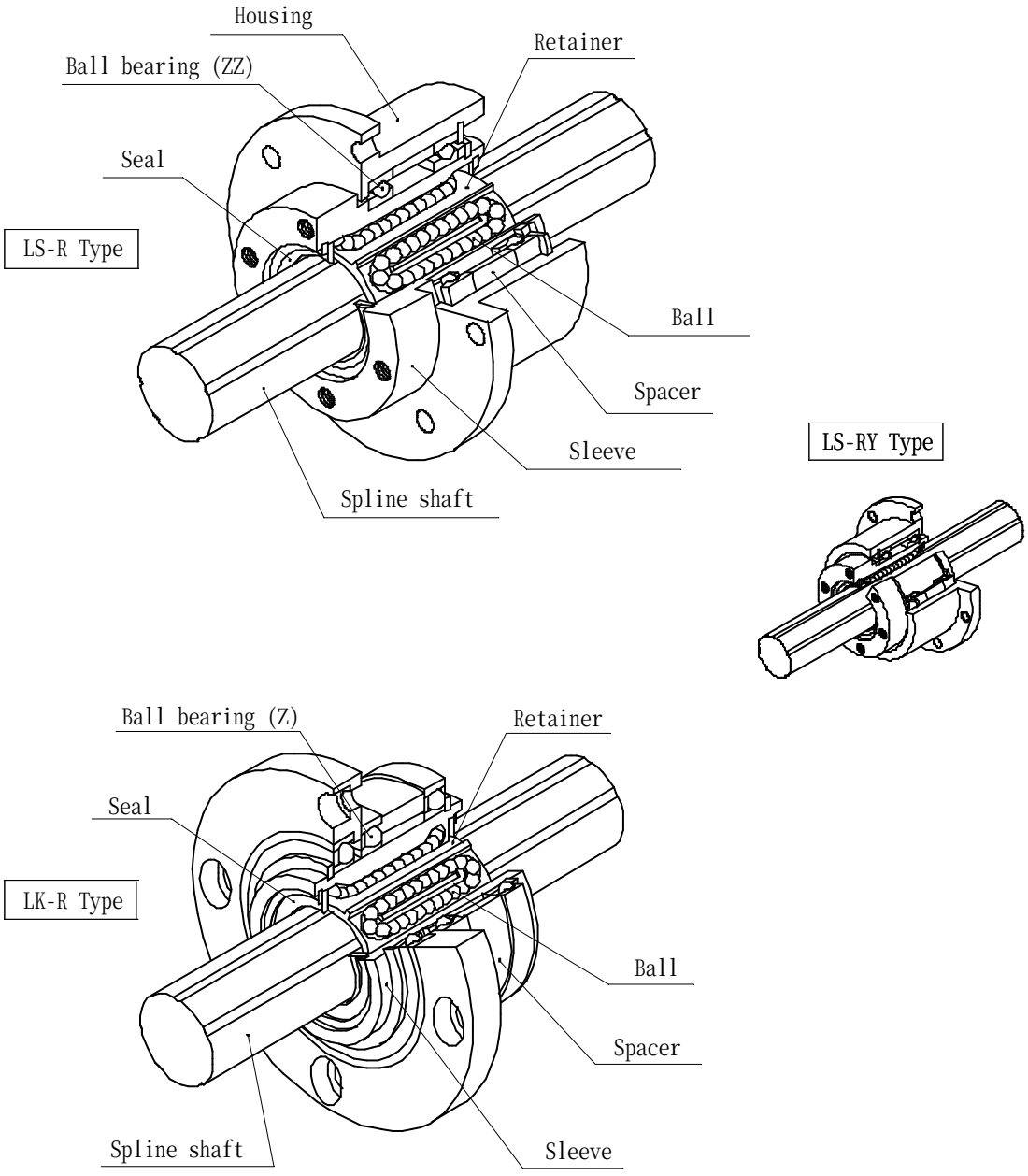
Applications

・ Industrial robots ・ Robots for taking out products ・Coil winding machines
・ Inserting machines for electronic parts ・ Semiconductor producing machines
・ Electic terminal crimping machines ・Honing machines ・Robots for welding

Configuration

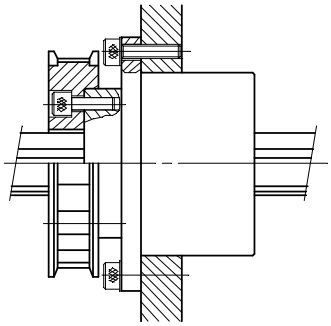
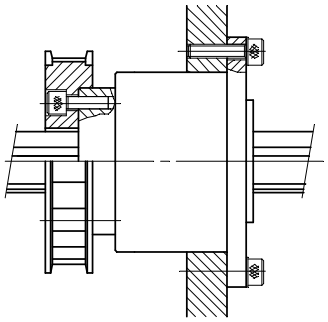
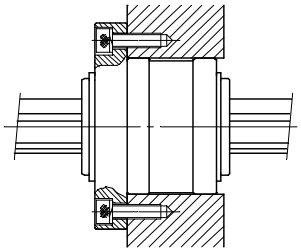
NSB rotary ball spline of LS-R / LS-RY type are composed of the spline shaft and moving unit on the shaft, as shown in Fig.4－1,the unit has been installed inside precision-class deep groove ball bearings and composed the retainer and balls in the spline sleeve inorder to roll the unit freely at the longitudinal direction. This type ball spline can be consistent with both rotary and linear Motions.

Fig 4-1



LK-R simple type rotary ball spline, as shown in Fig,4－1 (a),has been installed precision-class deep groove ball bearings in the flan-gee and on the sleeve, and it can be assembled in the housing of most equipment directly.

Kind of the sleeve

Unit type		
LS-R type	LS-RY type	LK-R type
		

Material . Heat treatment . Hardness

Table 4-1

Item	Material	Heat treatment	Hardness
Spline shaft	SUJ 2	Induction hardening	HRC 58 up
Sleeve	SCM415	Carburizing hardening	HRC 58 up
Steel ball	SUJ 2	Hardening	HRC 60 up
Retainer	Synthetic resin	-	-
Housing	S45C	-	-

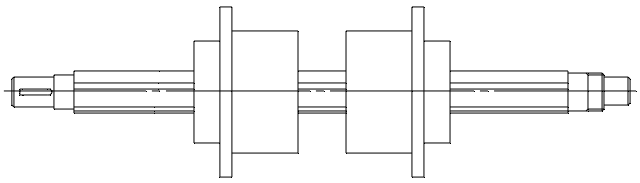
Designation

NSB Rotary ball splines are manufactured as set of unit and shaft ,and are sold with unit installed on the shaft .When you issue an order ,please use the following form.

Table 4-2

LS20R - 2 - E - H - 680 T

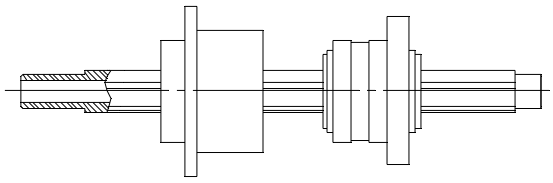
① ② ③ ④ ⑤ ⑥



①	Type of unit	**LS20R**
②	Number of unit per shaft	**2**
③	Clearance	**E** (Table 4-7 See page C8)
④	Symbol for accuracy levels	**H** (Table 4-6 See page C7 and See page 8)
⑤	Total length of shaft	**680** mm
⑥	Other then standard stocks	**T =** with additional machining L = without additional machining

LS20R+LK20R - E - H - 450 T M

① ② ③ ④ ⑤ ⑥



①	Type of unit	**LS20R + LK20R**
②	Clearance	**E** (Table 4-7 See page C8)
③	Symbol for accuracy levels	**H** (Table 4-6 See page C7 and See page 8)
④	Total length of shaft	**450** mm
⑤	Other then standard stocks	**T =** with additional machining L = without additional machining
⑥	Symbol for hollow shaft No symbol = Solid shaft	**M** (Table 4-4 See page C5)

Spline shaft (Special design shaft)

● **Maximum length of the shafts**

Maximum length of the spline shafts we manufacture is shown in Table 4-3. Longer shafts can be manufactured to order .Please contact NSB

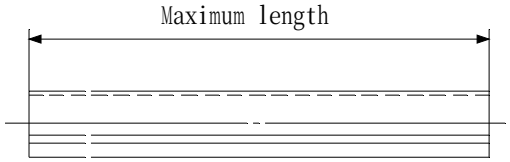


Table 4-3

Unit	Maximum length of the spline shaft （mm）
6	250
8	350
10	500
13	800
16	1000
20	1500
25	2000
30	2400

● **Hollow shaft** (M-mark)

We will supply hollow shafts as shown in Table 4-4, when reduction of spline shaft weight or air passage through the shaft is necessary.

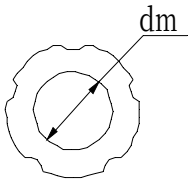


Table 4-4

Unit	Reduction of weight dm （mm）
6	2
8	3
10	4
13	4
16	6
20	8
25	12
30	17

● **Incomplete length of the groove**

When stepped machining is necessary ,use incomplete length Lt of spline shaft indicated in Table 4-5.

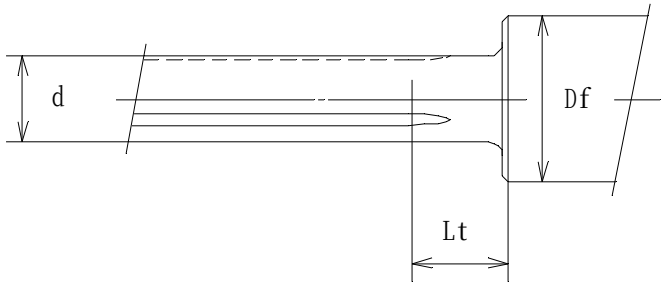
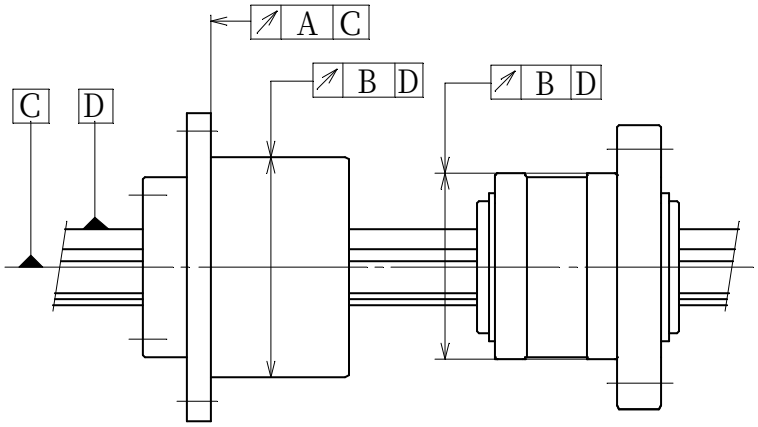


Table4-5 (mm)

Shaft dia d	D f												
	6	8	10	13	16	20	25	30	35	40	50	60	80
6	5	11	14	18	21	25	-	-	-	-	-	-	-
8	-	5	11	16	19	23	27	30	-	-	-	-	-
10.4	-	-	-	12	17	21	25	29	-	-	-	-	-
13.4	-	-	-	-	12	18	23	27	30	-	-	-	-
16.6	-	-	-	-	-	14	20	25	28	31	-	-	-
20.6	-	-	-	-	-	-	15	21	25	29	34	-	-
25.8	-	-	-	-	-	-	-	15	21	25	32	36	-
30.8	-	-	-	-	-	-	-	-	15	21	29	34	41

Accuracy Standard



[LS-R / LS-RY] [LK-R]

Table4-6 (Unit:mm)

Unit	Grade (H)	
	A	B
6 8	0.016	0.021
10 13	0.018	
16 20 25 30	0.021	

Clearance

For NSB Rotary ball splines , appropriate clearance adapted to usage is necessary in order to obtain long life and high accuracy. Please select correct clearance for the application.

Table 4-7 (Unit:mm)

Shaft diameter (mm)	E0	E	Normal (No symbol)
6 8 10.4	—	- 0.006 ～ - 0.001	- 0.001 ～ +0.004
13.4 16.6 20.6	- 0.012 ～ - 0.006	- 0.008 ～ - 0.002	- 0.002 ～ +0.005
25.8 30.8	- 0.014 ～ - 0.006	- 0.008 ～ - 0.002	- 0.002 ～ +0.006
Condition of operation	・eceiving severe vibration or shock. ・eceiving overhanged load. ・Places requiring high stiffness and exposed.	・Receiving weak vibration or shock. ・Places with alternating loads.	・When smooth driving with small power is necessary. ・Receiving load in one direction only.

Remarks for application

① In installing the sleeve to the housing ,care should be taken not to afford shock to the sleeve.

② For assembling sleeve to spline shaft ,insert gently keeping sleeve axis parallel to the shaft .Do not pry.

③ This type is easy to handle ,because it has a retainer .The retainer ,however ,is made of synthetic resin ,thus it can not bear high temperature. Operating temperature should be between - 40℃ to + 80℃.

⑤ Relative location of spline grooves ,key groove on the outer surface of sleeve ,and mounting holes for the flange are shown in the drawing indicating dimensions for each types.

⑤ If additional machining of spline shaft is necessary ,chamfering of shaft end face should be more than C0.5 .(more than 0.5 mm chamfer)

Fit

For the fit value in installing NSB Rotary ball spline into housing box , we recommend the figure in Table 4-8.

Table 4-8 (Unit : mm)

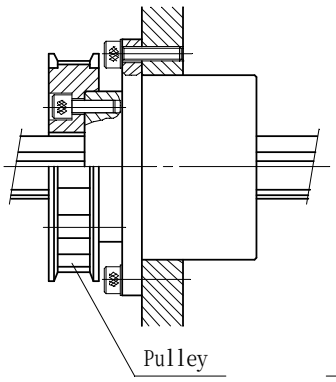
Type	Loose fit (H 7)
LS6R LS6RY	+0.018
LS8R LS8RY	0
LS10R LS10RY	+0.021
LS13R LS13RY	0
LS16R LS16RY	
LS20R LS20RY	+0.025
LS25R LS25RY	0
LS30R LS30RY	

Type	Tol.
LK6R	+0.016
LK8R	+0.003
LK10R	
LK13R	+0.020
LK16R	+0.004
LK20R	
LK25R	+0.025
LK30R	+0.005

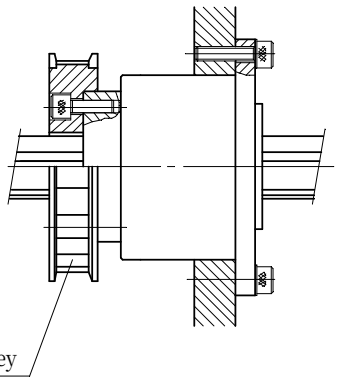
Example of installation of the sleeve

Fig 4-2

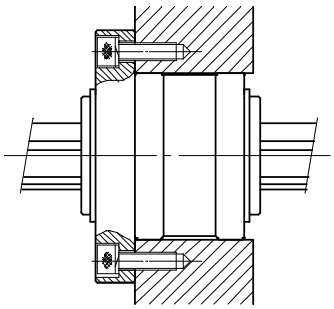
LS – R type



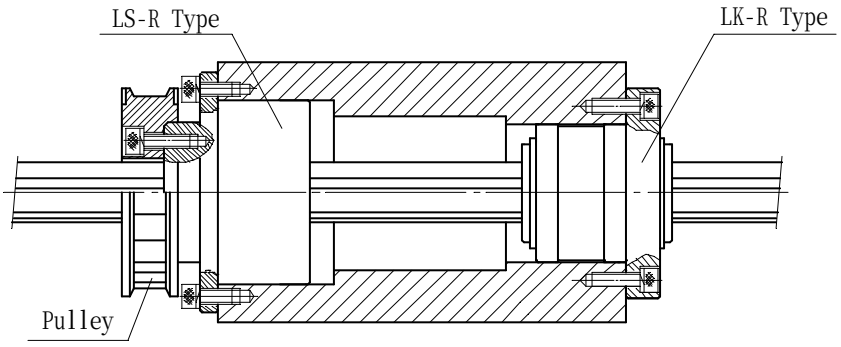
LS – R Y type

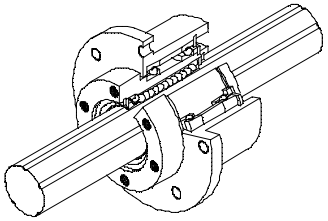


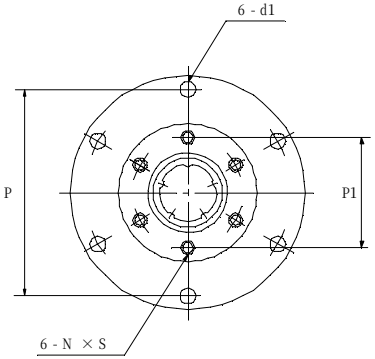
LK – R type

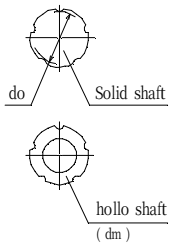


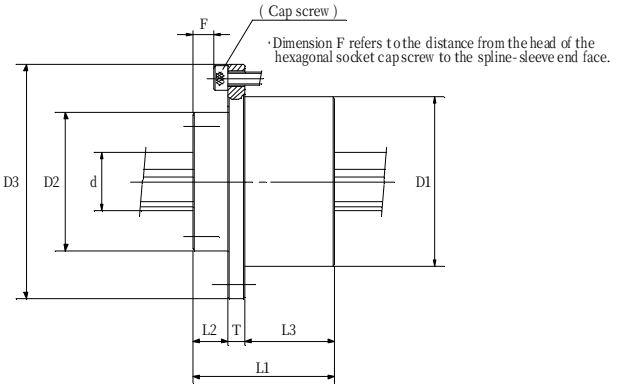
LS - R + LK - R type











(Unit : mm)

Unit type (With seal)	Outer diameter D1	(h7)	D2	(h7)	D3	Length L1	L2	L3	T	P1	N	S	P	d1	F	dm	Minor dia do	Number of grooves	Basic rated radial load (k N) Dynamic Cr	Static Cor	Basic rated torque (N·m) Dynamic Ct	Static Cot	Static rated moment (N·m) Mpo- I	Mpo- II	Unit radial ball bearings (k N) Dynamic Ca	Static Coa	Weight (kg) Shaft/m	Unit	Dia (h7) d
CAD DATA **LS6R**	30	0 -0.021	21	0 -0.021	40	25	5	17	3	16	M2	4	35	2.4	3	2	5.6	3	1.2	2.1	3.8	7.0	5	36	4.1	2.5	0.23	0.09	6
CAD DATA **LS8R**	32	0 -0.025	23		42	25	5	17	3	18	M2	4	37	2.4	3	3	7.6		1.2	2.1	4.8	8.7	5	36	4.4	2.9	0.39	0.11	8
CAD DATA **LS10R**	40		29		54	33	8	21	4	23	M3	6	47	3.4	5	4	10	4	2.4	4.3	11	21	15	102	8.0	4.9	0.65	0.24	10.4
CAD DATA **LS13R**	45		34	0 -0.025	59	36	8	24	4	28	M3	6	52	3.4	5	4	13		3.3	5.9	20	37	22	148	8.6	5.9	1.11	0.30	13.4
CAD DATA **LS16R**	52	0 -0.030	39.5		68	41	10	26	5	32	M4	8	60	4.5	6	6	16	5	3.8	6.9	32	58	32	216	9.4	7.3	1.65	0.46	16.6
CAD DATA **LS20R**	56		43.5		72	46	13	28	5	36	M4	8	64	4.5	9	8	20		4.6	8.3	46	84	42	276	9.8	8.1	2.57	0.55	20.6
CAD DATA **LS25R**	62		53	0 -0.030	78	60	15	40	5	45	M5	8	70	4.5	11	12	25		10.8	19.4	135	244	113	773	10.2	8.8	4.04	0.89	25.8
CAD DATA **LS30R**	80		65.5		105	66	18	40	8	55	M6	10	91	6.6	12	17	30		12.3	22.2	181	327	136	937	13.2	12.2	5.85	1.66	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

LS20R - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦

※ See page C4

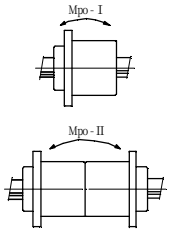
Note.1 NSB Rotary ball splinse are manufactured as set of unit and shaft , and are sold with unit installed on the shaft .

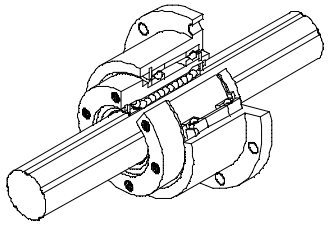
① Type of unit
② Number of sleeve per shaft
③ Clearance (See page C8)
④ Symbol for accuracy levels (See page C7)
⑤ Shaft length [mm]
⑥ Outer then standard stock T = With additional machining
L = Without additional machining

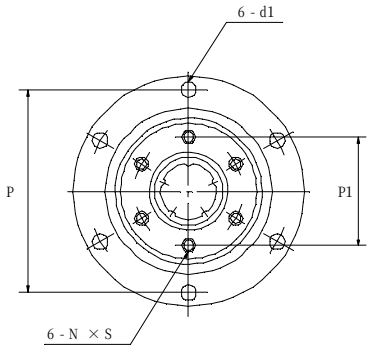
⑦ Symbol for hollow shaft (No symbol = Solid shaft)

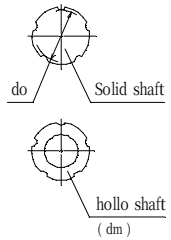
Note.2 Static rated moment load Mpo- I applies when one unit is positioned closely together. (See upper figure)

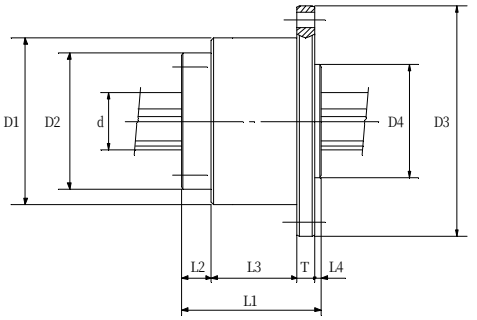
Note.3 Static rated moment load Mpo- II applies when two unit are positioned closely together. (See lower figure)











(Unit : mm)

Unit type (With seal)	Outer diameter D1	(h7)	D2	(h7)	D3	D4	Length L1	L2	L3	L3	T	P1	N	S	P	d1	dm	Minor dia do	Number of grooves	Basic rated radial load (k N) Dynamic Cr	Static Cor	Basic rated torque (N·m) Dynamic Ct	Static Cot	Static rated moment (N·m) Mpo- I	Mpo- II	Unit radial ball bearings (k N) Dynamic Ca	Static Coa	Weight (kg) Shaft/m	Unit	Dia (h7) d
CAD DATA **LS6RY**	30	0 -0.021	21	0 -0.021	40	15	25	5	17	0	3	16	M2	4	35	2.4	2	5.6	3	1.2	2.1	3.8	7.0	5	36	4.1	2.5	0.23	0.09	6
CAD DATA **LS8RY**	32	0 -0.025	23		42	17	25	5	17	0	3	18	M2	4	37	2.4	3	7.6		1.2	2.1	4.8	8.7	5	36	4.4	2.9	0.39	0.11	8
CAD DATA **LS10RY**	40		29		54	20	33	7	21	1	4	23	M3	6	47	3.4	4	10	4	2.4	4.3	11	21	15	102	8.0	4.9	0.65	0.24	10.4
CAD DATA **LS13RY**	45		34	0 -0.025	59	25	36	7	24	1	4	28	M3	6	52	3.4	4	13		3.3	5.9	20	37	22	148	8.6	5.9	1.11	0.30	13.4
CAD DATA **LS16RY**	52	0 -0.030	39.5		68	30	41.5	10.5	26	-0.5	5	32	M4	8	60	4.5	6	16	5	3.8	6.9	32	58	32	216	9.4	7.3	1.65	0.46	16.6
CAD DATA **LS20RY**	56		43.5		72	35	46	11	28	2	5	36	M4	8	64	4.5	8	20		4.6	8.3	46	84	42	276	9.8	8.1	2.57	0.55	20.6
CAD DATA **LS25RY**	62		53	0 -0.030	78	40	60	15	40	0	5	45	M5	8	70	4.5	12	25		10.8	19.4	135	244	113	773	10.2	8.8	4.04	0.89	25.8
CAD DATA **LS30RY**	80		65.5		105	50	66	16	40	2	8	55	M6	10	91	6.6	17	30		12.3	22.2	181	327	136	937	13.2	12.2	5.85	1.66	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

LS20RY - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦

※ See page C4

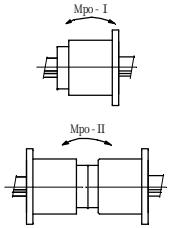
Note.1 NSB Rotary ball splinse are manufactured as set of unit and shaft , and are sold with unit installed on the shaft .

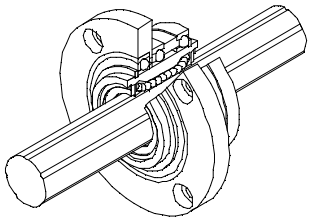
① Type of unit
② Number of sleeve per shaft
③ Clearance (See page C8)
④ Symbol for accuracy levels (See page C7)
⑤ Shaft length [mm]
⑥ Outer then standard stock T = With additional machining
L = Without additional machining

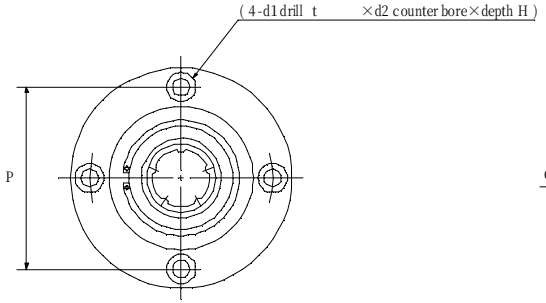
⑦ Symbol for hollow shaft (No symbol = Solid shaft)

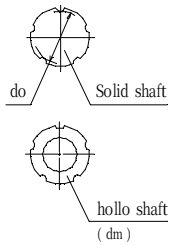
Note.2 Static rated moment load Mpo- I applies when one unit is positioned closely together. (See upper figure)

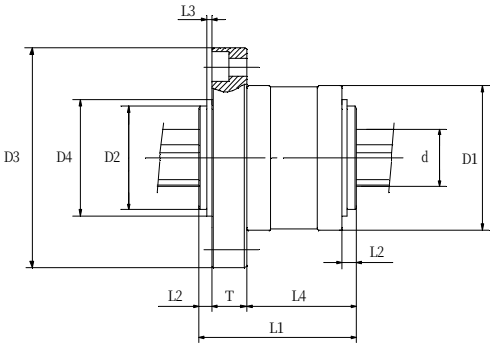
Note.3 Static rated moment load Mpo- II applies when two unit are positioned closely together. (See lower figure)











(Unit : mm)

Unit type (With seal)	Outer diameter D1	(h5)	D2	D3	D4	Length L1	L2	L3	L4	T	P	d1	d2	H	dm	Minor dia do	Number of grooves	Basic rated radial load (k N) Dynamic Cr	Static Cor	Static rated moment (N·m) Mpo- I	Mpo- II	Unit radial ball bearings (k N) Dynamic Ca	Static Coa	Weight (kg) Shaft/m	Unit	Dia (h7) d
CAD DATA **LK6R**	24	0 -0.009	15	38	19.2	25	3	1	16	6	31	2.4	4.8	3.0	2	5.6	3	1.2	2.1	5	36	5.2	3.2	0.23	0.08	6
CAD DATA **LK8R**	26	0 -0.011	17	40	21.5	25	3	1	16	6	33	2.4	4.8	3.0	3	7.6		1.2	2.1	5	36	5.6	3.7	0.39	0.09	8
CAD DATA **LK10R**	32		20	50	25.0	33	3.5	1.2	21	8.5	41	3.4	6.5	4.5	4	10	4	2.4	4.3	15	102	10.0	6.2	0.65	0.17	10.4
CAD DATA **LK13R**	37		25	55	30.6	36	3.5	1.2	24	8.5	46	3.4	6.5	4.5	4	13		3.3	5.9	22	148	10.8	7.4	1.11	0.23	13.4
CAD DATA **LK16R**	42	0 -0.013	30	64	36.1	41	4.5	1.5	28	8.5	53	4.5	8.0	5.5	6	16	5	3.8	6.9	32	216	11.8	9.1	1.65	0.33	16.6
CAD DATA **LK20R**	47		35	69	41.5	46	4.5	1.5	33	8.5	58	4.5	8.0	5.5	8	20		4.6	8.3	42	276	12.3	10.1	2.57	0.42	20.6
CAD DATA **LK25R**	52		40	74	47.8	60	6	1.75	45	9	63	4.5	8.0	5.5	12	25		10.8	19.4	113	773	12.8	11.0	4.04	0.53	25.8
CAD DATA **LK30R**	58		45	84	53.2	66	7	1.75	50	9	71	5.5	9.5	6.5	17	30		12.3	22.2	136	937	13.4	12.4	5.85	0.68	30.8

1 k N 102kgf

【 Designation 】

LK20R - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦

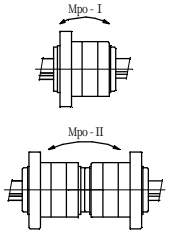
※ See page C4

Note.1 NSB Rotary ball splinse are manufactured as set of unit and shaft , and are sold with unit installed on the shaft .

① Type of unit
② Number of sleeve per shaft
③ Clearance (See page C8)
④ Symbol for accuracy levels (See page C7)
⑤ Shaft length [mm]
⑥ Outer then standard stock T = With additional machining
L = Without additional machining
⑦ Symbol for hollow shaft (No symbol = Solid shaft)

Note.2 Static rated moment load Mpo- I applies when one unit is positioned closely together. (See upper figure)

Note.3 Static rated moment load Mpo- II applies when two unit are positioned closely together. (See lower figure)



Super spline Bush

Super spline bush (SSB) is the unique and space-saving linear bearing for wide range use to both spline shaft or round shaft, when you use it as the ball spline, you can transmit some torque
under low longitudinal friction, and otherwise you can it as the linear ball guide.

Features

① In case of use SSB on the spline shaft, SSB is able to work as the ball spline transmitting some torque under low friction. otherwise use SSB on the round shaft, SSB can operate as the linear ball bearing (ball bush)

② Circular groove has been manufactured as each race ways. consequently SSB has 3~4 times loading capacity and 30~50 times operating life longer than usual linear ball bearing.

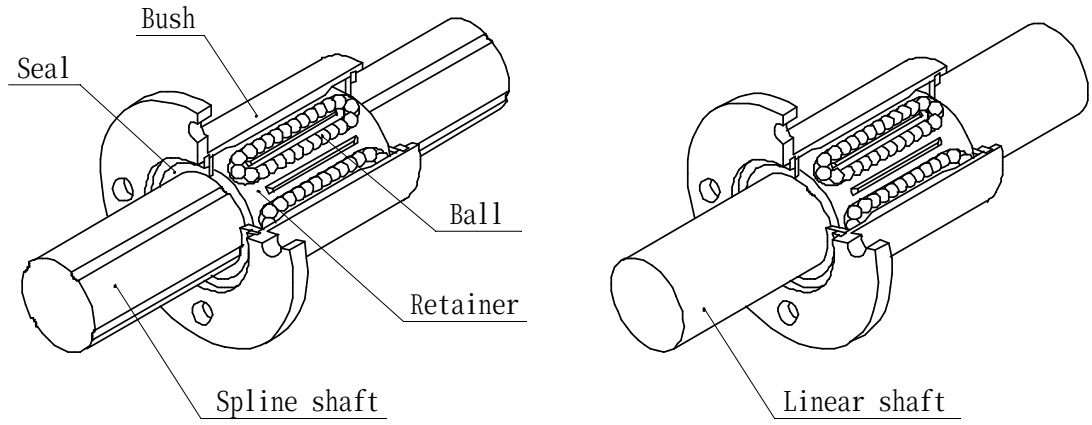
③ Outer diameters of SSB are equal to usual ball bushs. so you exchange them easily when larger loading capacities than the ball bushs are required.

④ SSB is the compact, low price and long life bearing, so it is effective to reduce the final total working cost of the equipment.

⑤ Handling is simple because this bearing is constructed in the way that steel balls do not fall off.

Configuration

Fig 5-1



Ball spline	Linear Bush (Ball bush)

Material . Heat treatment . Hardness

Table 5-1

Item	Material	Heat treatment	Hardness
Spline shaft	SUJ 2	Induction hardening	HRC 58 up
Bush	SCM415	Carburizing hardening	HRC 58 up
Steel ball	SUJ 2	Hardening	HRC 60 up
Retainer	Synthetic resin	-	-

Accuracy standard

NSB Super spline Bush arc ranked Normal grade. high grade (H)
.(Please refer page 8 of the Accuracy standard)

Fit

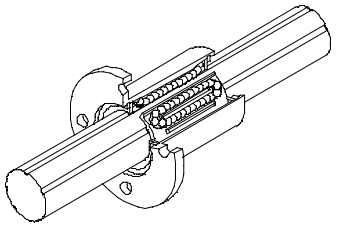
For the fit value in installing NSB Super spline bush into housing box, we recommend the figure in See B10 Table 3-7 (Loose fit (H 7)).

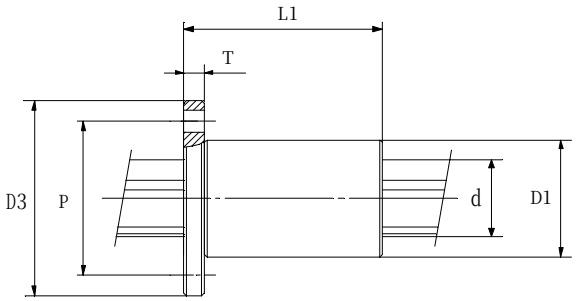
Clearance

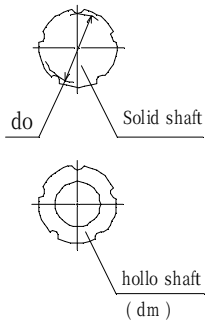
For NSB Super spline bush , appropriate clearance adapted to usage is necessary in order to obtain long life and high accuracy. Please select correct clearance for the application. (Please refer page B8 of the clearance)

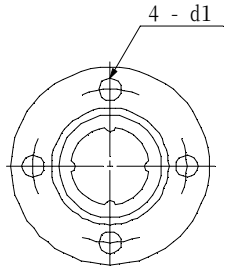
Remarks for application

Please see B9 of the Economy ball spline contents, regarding Cautions for application of SSB.

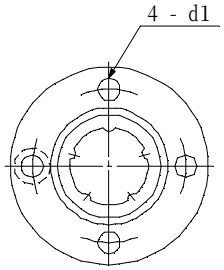








SSB10F
SSB13F



SSB16F SSB25F
SSB20F SSB30F

(Unit : mm)

Type of bush		Outer Diameter		Total length	Dimension of flange				Minor dia	Number of grooves	Basic rated radial load (k N)		Basic rated torque (N·m)		Static rated moment (N·m)		Weight (kg)		Maximum length of the shaft	Dia (h7)
With seal	Without seal	D1	(h6)	L1	D3	T	P	d1	dm	do		Dynamic Cr	Static Cor	Dynamic Ct	Static Cot	Mpo- I	Mpo- II	Shaft/m	Bush		d
SSB10FUU	SSB10F	19	0 -0.013	32	38	4	28	4.5	4	10	4	0.74	2.04	10	18	7.6	50.8	0.65	0.05	400	10.4
SSB13FUU	SSB13F	23		35	42	4	32	4.5	4	13		1.01	2.79	17	31	11.1	73.6	1.11	0.07	600	13.4
SSB16FUU	SSB16F	28		40	48	4	38	4.5	6	16	5	1.19	3.28	27	49	16.6	109	1.65	0.98	800	16.6
SSB20FUU	SSB20F	32	0 -0.016	45	56	5	44	5.5	8	20		1.43	3.94	40	72	21.8	140	2.57	0.14	1000	20.6
SSB25FUU	SSB25F	40		58	64	5	52	5.5	12	25		3.33	9.14	116	208	56.8	386	4.04	0.25	1200	25.8
SSB30FUU	SSB30F	45		64	72	6	58	6.5	17	30		3.80	10.45	155	280	68.2	469	5.85	0.32	1500	30.8

1 k N 102kgf 1 N·m 0.102 kgf·m

【 Designation 】

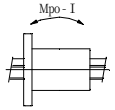
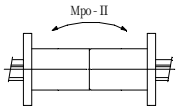
SSB20F UU - 2 - E - H - 680 T M
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Type of bush
② With saels at both ends
③ Number of bush per shaft
④ Clearance (See page B8)
⑤ Symbol for accuracy levels (See page 8)
⑥ Shaft length [mm]
⑦ Outer then standard stock
T = With additional machining
L = Without additional machining

⑧ Symbol for hollow shaft (No symbol = Solid shaft)

Note.1 NSB Super splinse bush are manufactured as set of bush and shaft , and are sold with bush installed on the shaft .

Note.2 Static rated moment load Mpo- I applies when one bush is positioned closely together. (See upper figure)



Note.3 Static rated moment load Mpo- II applies when two bush are positioned closely together. (See lower figure)