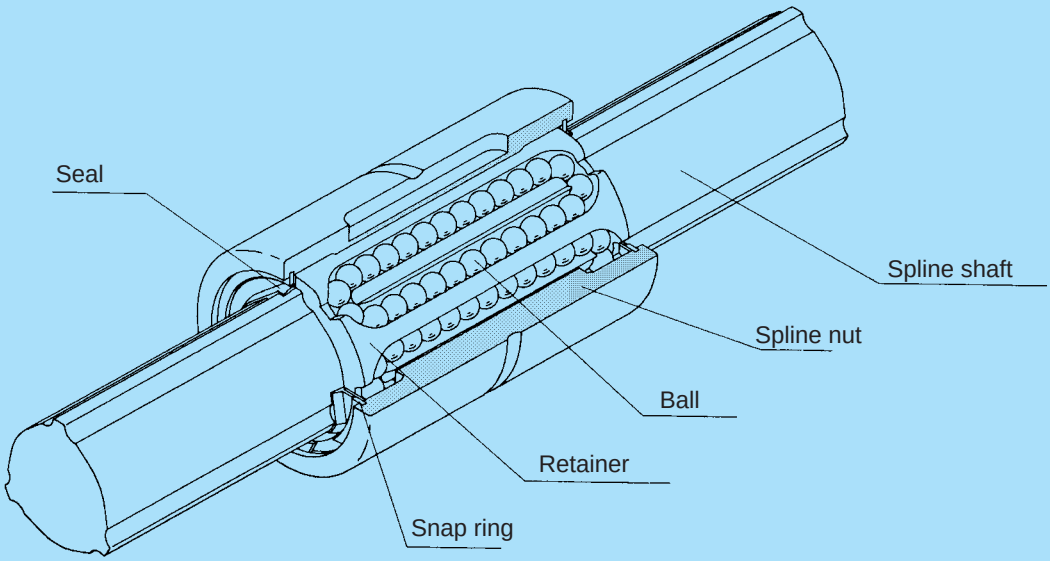


Fig. 1 Construction of Ball Spline Type LBS

Construction and Features

In Ball Spline type LBS, as shown in Fig. 1, the spline shaft has three crests positioned equidistantly at 120°, on both sides of which a total of six trains of load-bearing balls are arranged so as to hold the crests from both sides.

The raceways are precision-ground into R-grooves so as to have a radius approximately the same as the ball radius. When the Ball Spline receives torque from the spline shaft or spline nut, the three trains of balls in the torque loading direction bear equal parts of the load, and as a result the center of rotation is set automatically. With the rotation reversed, the other three trains of balls in the opposite direction bear the load.

As the trains of balls are held in place so that they are caused to circulate in line by the retainer built into the spline-nut interior, the balls do not fall off if the spline shaft is removed.

Zero angular backlash

The construction of type LBS, as described above, can minimize angular backlash (clearance in the rotational direction). Preloading on a spline nut can reduce angular backlash to zero if necessary, thereby increasing rigidity.

Unlike conventional types of Ball Splines designed with a circular-arc or Gothic groove, type LBS has eliminated the need to twist two spline nuts in order to bear a preload, thereby facilitating compact design.

High rigidity and accurate positioning

Type LBS has a wide contact angle and is capable of bearing a preload with a single spline nut. Therefore, the initial displacement is limited, providing the system with high rigidity and high positioning accuracy.

High-speed linear motion and rotation possible

The retainer, with its low friction, superior lubricant-retaining structure, and high rigidity, helps ensure low-maintenance, high-speed linear with grease lubrication alone. Furthermore, as the radial distance to loaded balls and that to free balls are virtually equal, the centrifugal force exerted on the balls is insignificant even during high-speed rotation. These characteristics combine to provide smooth linear motion.

Compact design

In type LBS, free balls do not circulate in the outer tracks as they formerly did in conventional types of Ball Splines, enabling the spline-nut outer diameter to be kept low. The LBS design can therefore be made compact, so that relatively little space is required for installation.

Simple assembly

Even if it is necessary to remove the spline shaft due to special mounting conditions, such as the need to use blind holes or attach a Ball Spline to a complicated structure, the balls will not fall off. As a result, assembly, maintenance, and checking are simple to perform.

A linear bush can be used for heavy loads

The raceways on which balls roll are round-grooved to a radius approximately the same as that of the ball, thereby allowing the balls and raceway to contact each other over a wide range. Type LBS therefore has a high load-bearing capacity against radial and other loads.

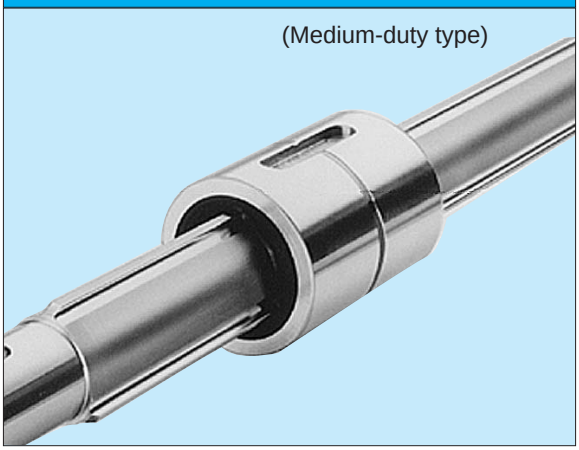
Two parallel axes integrated into a one-axis configuration

In type LBS, a single axis can bear loads in both the torque-applying and radial directions. Therefore, an installation that formerly required two parallel axes can be configured using only one axis. This simplifies installation procedures and saves space.

Uses

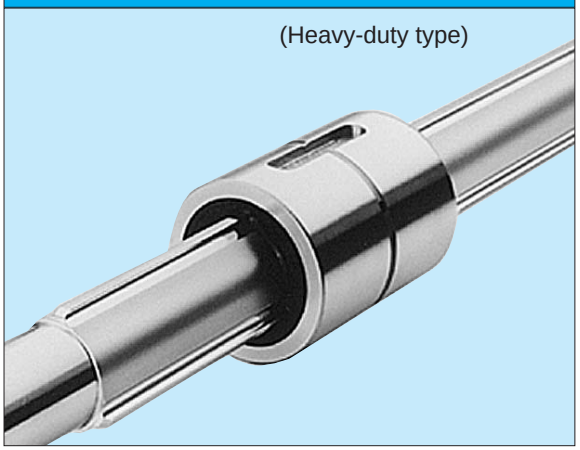
Ball spline LBS is a highly reliable linear motion system applied to:
industrial-robot supporting pole and arm / automatic loader / transfer machine / automatic conveyance system / tire-molding machine / spot-welding-machine spindle / high-speed automatic-painting-machine guide shaft / riveting machine / wire winder / electric-discharge-machine work head / grinding-machine spindle drive shaft / various speed-change gears / precision indexing shaft

Cylindrical Ball Spline Type LBS



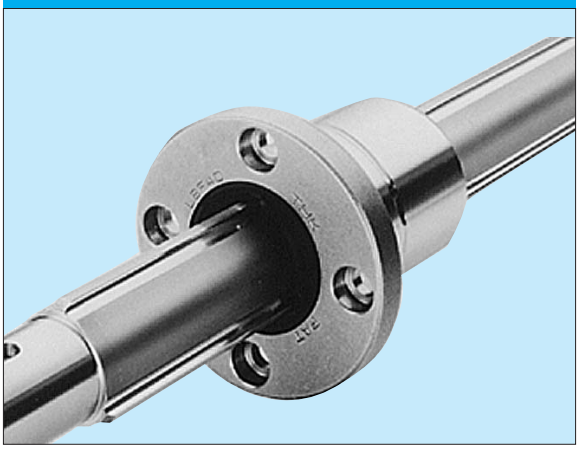
The spline nut is of a straight cylindrical shape. When it is necessary to apply a torque, insert a key into the keyway. Type LBS is the most compact of all Ball Spline types. The spline-nut exterior is provided with anti-carbonization treatment.

Cylindrical Ball Spline Type LBST



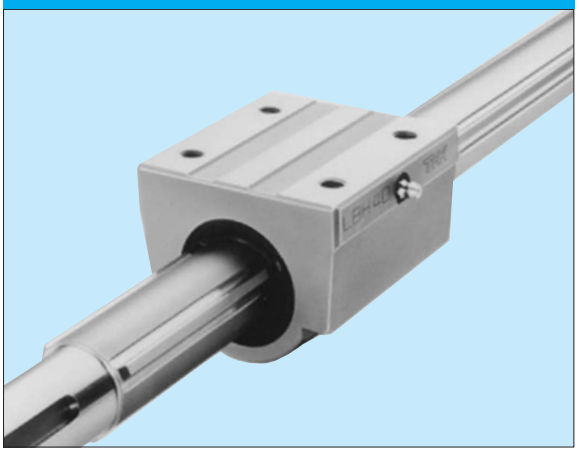
The outer diameter is the same as that of type LBS, but the spline nut is made longer to enable it to bear heavy loads. This type is most suitable where there is insufficient installation space and where high torque, overhanging load, and moments are exerted.

Flanged Ball Spline Type LBF



The spline nut can be attached to the housing via the flange, making assembly simple. It is most suitable where the housing may deform if a keyway is cut thereon, and where the housing width is limited. Knock pins that can be driven into the flange completely eliminate the angular backlash that occurs in fitting part.

Square Ball Spline Type LBH

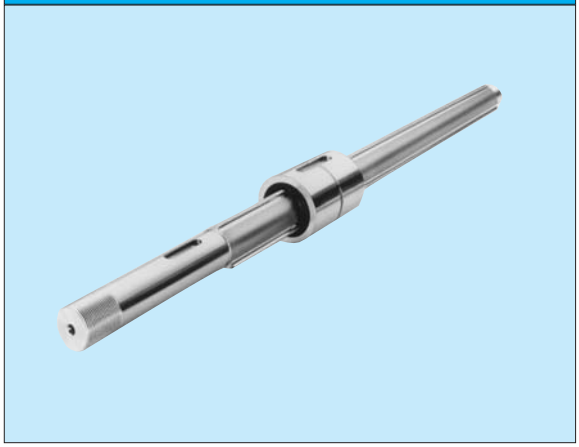


The rigid square spline nut does not require a housing, and can therefore be attached directly to a machine body. This provides a compact, high-rigidity linear quide part.

Standard Ball Spline (standard off-the-shelf item)

Precision-ground spline shafts of various standardized lengths (LBS15 through LBS50) and a variety of spline nuts can be freely combined to your specifications, enabling quick delivery at a low price. For the standards, see page B-58.

Precision Solid Spline Shaft (standard type)



The spline shaft is formed by cold drawing, and the raceways are cut into the shaft to a high degree of precision. A spline nut is attached to the resulting spline shaft.

Hollow Spline Shaft (type K)

This type is made hollow through cold drawing, to enable it to accommodate pipes and wires and vent air, or to reduce its weight.

Special Spline Shaft

A shaft with a greater diameter at its ends or mid-point can be produced upon request, by machining it to the required spline shape.

Full Spline (standard off-the-shelf item)

Full Spline Type LBS features more than one spline nut attached to a long, straight shaft. The spline-shaft length and the number of spline nuts can be changed freely as required through reworking.

Spline-Shaft Strength

See page B-13.

Accuracy Standards

See page B-33.

Clearance in the Rotational Direction

The clearance of the Ball Spline in the rotational direction significantly affects the rigidity and precision of the spline nut.
It is very important, therefore, to determine the appropriate clearance for the intended uses. As repeated swiveling and reciprocal linear motions cause heavy vibration and impact, preloading the system drastically improves its service life and accuracy.

We will determine the optimum clearance for your operating conditions. Please contact us.

		Operating conditions
Clearance in the rotational direction	CM	• High rigidity is required; vibration and impact are heavy. • Moment loads must be borne by a single spline nut.
	CL	• Overhang loads and moments are applied. • Highly reproducible accuracy is required. • Alternate loads are applied.
	Normal	• Smooth movement should be achieved with only a low magnitude of force. • Torque is continually applied in a given direction.

Table 1 Ball Spline Clearance in the Rotational Direction

Unit: μm

Nominal shaft diameter \ Symbol	Normal	Light preload	Medium preload
	No symbol	CL	CM
15	– 3 ~ +2	– 9 ~ – 3	–15 ~ – 9
20 25 30	4 ~ +2	–12 ~ – 4	–20 ~ –12
40 50 60	– 6 ~ +3	–18 ~ – 6	–30 ~ –18
70 85	– 8 ~ +4	–24 ~ – 8	–40 ~ –24
100 120	–10 ~ +5	–30 ~ –10	–50 ~ –30
150	–15 ~ +7	–40 ~ –15	–70 ~ –40

Note: For normal clearance, do not append any symbol to a model number. For medium and light preloads, append “CM” or “CL”. (For model-number coding, see page B-56.)

Housing Inner-Diameter Tolerance

See page B-37.

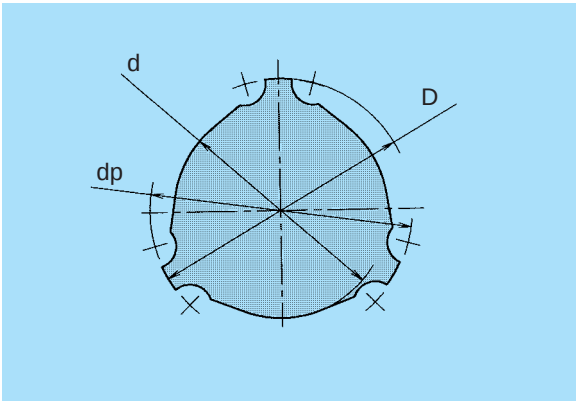
Spline Shaft

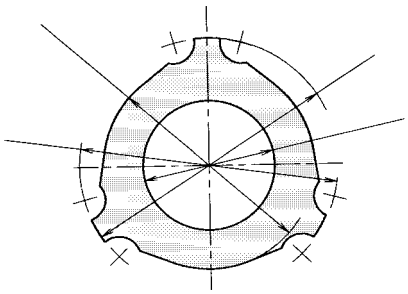
The spline shaft comes in three spline types, as shown on page B-49: the standard ground type, hollow type, and special machined type. Spline shafts of special shapes can be provided upon request. When requesting an estimate or placing an order, please provide relevant drawings.

Details on the standard-type Ball Spline (standard off-the-shelf item), which can be delivered quickly and at a low price, are presented on page B-58.

Spline-shaft cross-sectional shape

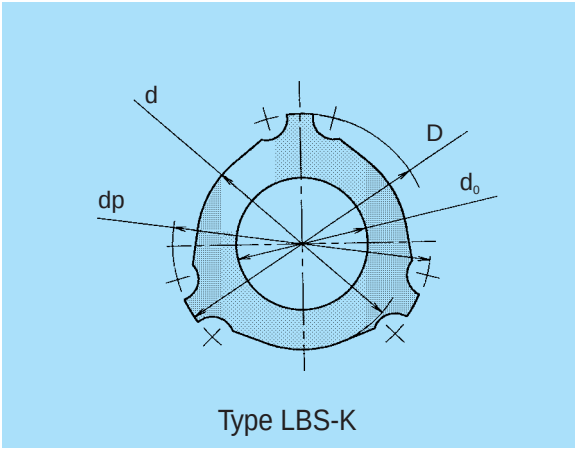
Table 2 presents the cross-sectional shape of various spline shafts. If it is necessary to rework shaft ends to a cylindrical shape, limit the diameter to the minor diameter (d) or less, if possible.





Hollow shape of the standard hollow spline shaft

Table 3 illustrates the hollow shape of the standard hollow spline shaft. Use this type to encase pipes and wires and vent air, or to reduce its weight.



Type LBS-K

Table 3 Inner Dimensions of the Standard Hollow Spline Shaft

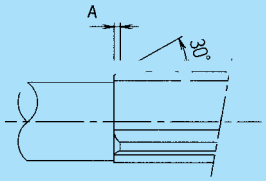
Nominal shaft diameter	Hollow diameter d_0	Mass kg/m
20	6	1.58
25	8	2.3
30	12	2.9
40	18	4.9
50	24	7.0
60	30	10.0
70	35	13.7
85	45	19.5
100	56	25.7
120	60	47.3
150	80	77.1

Chamfering spline-shaft ends

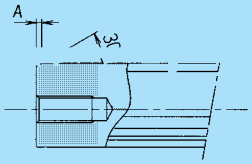
Spline-shaft ends are chamfered to aid in insertion of the spline nut. Unless otherwise specified, the chamfering dimensions specified below apply.

Chamfer A

When the spline-shaft end is provided with a step, tapped hole, or plain hole for a specific purpose, the chamfer A dimensions shown in Table 4 apply.



Stepped end



Tapped end

Fig. 2 Chamfer A

Chamfer B

As in Ball Splines supported on one side only, if either spline-shaft end is not in use it is chamfered to B dimensions, as shown in Table 4.

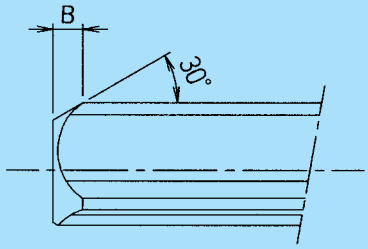


Fig. 3 Chamfer B

Table 4 Chamfering Dimensions of Spline-Shaft Ends

Unit: mm

Nominal shaft diameter	15	20	25	30	40	50	60	70	85	100	120	150
Chamfer A	1.0	1.0	1.5	2.5	3.0	3.5	5.0	6.5	7.0	7.0	7.5	8.0
Chamfer B	3.5	4.5	5.5	7.0	8.5	10.0	13.0	15.0	16.0	17.0	17.0	18.0

Note: Spline shafts of nominal diameters 6, 8, and 10 are chamfered to C0.5.

Length of incomplete spline portion in special spline-shaft

To obtain a spline-shaft end or mid-point diameter greater than the minor diameter (d), an incomplete spline portion is required to provide a recess under the grinding wheel. Table 5 shows the relationship between the incomplete spline length (S) and the flange diameter (D_0). This, however, does not apply to spline shafts with an overall length of 1,500 mm or more. For spline shafts with an overall length greater than 1,500 mm, contact us.

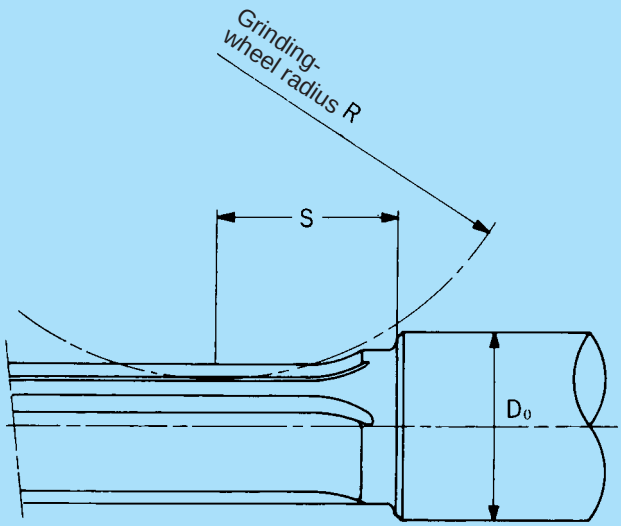


Table 5 Incomplete Spline Length S

Unit: mm

Nominal shaft diameter \ Flange diameter D_0	15	20	25	30	35	40	50	60	80	100	120	140	160	180	200
15	23	35	42	47	52	-	-	-	-	-	-	-	-	-	-
20	-	25	36	43	48	53	-	-	-	-	-	-	-	-	-
25	-	-	32	46	55	62	73	-	-	-	-	-	-	-	-
30	-	-	-	35	48	56	69	78	-	-	-	-	-	-	-
40	-	-	-	-	-	38	59	71	88	-	-	-	-	-	-
50	-	-	-	-	-	-	42	61	82	96	-	-	-	-	-
60	-	-	-	-	-	-	-	45	74	91	102	-	-	-	-
70	-	-	-	-	-	-	-	-	64	85	98	108	-	-	-
85	-	-	-	-	-	-	-	-	34	72	90	102	-	-	-
100	-	-	-	-	-	-	-	-	-	70	110	134	153	-	-
120	-	-	-	-	-	-	-	-	-	-	72	112	137	155	-
150	-	-	-	-	-	-	-	-	-	-	-	42	103	133	153

Accessories

Ball Spline types LBS and LBST come with one of the standard keys listed in Table 6.

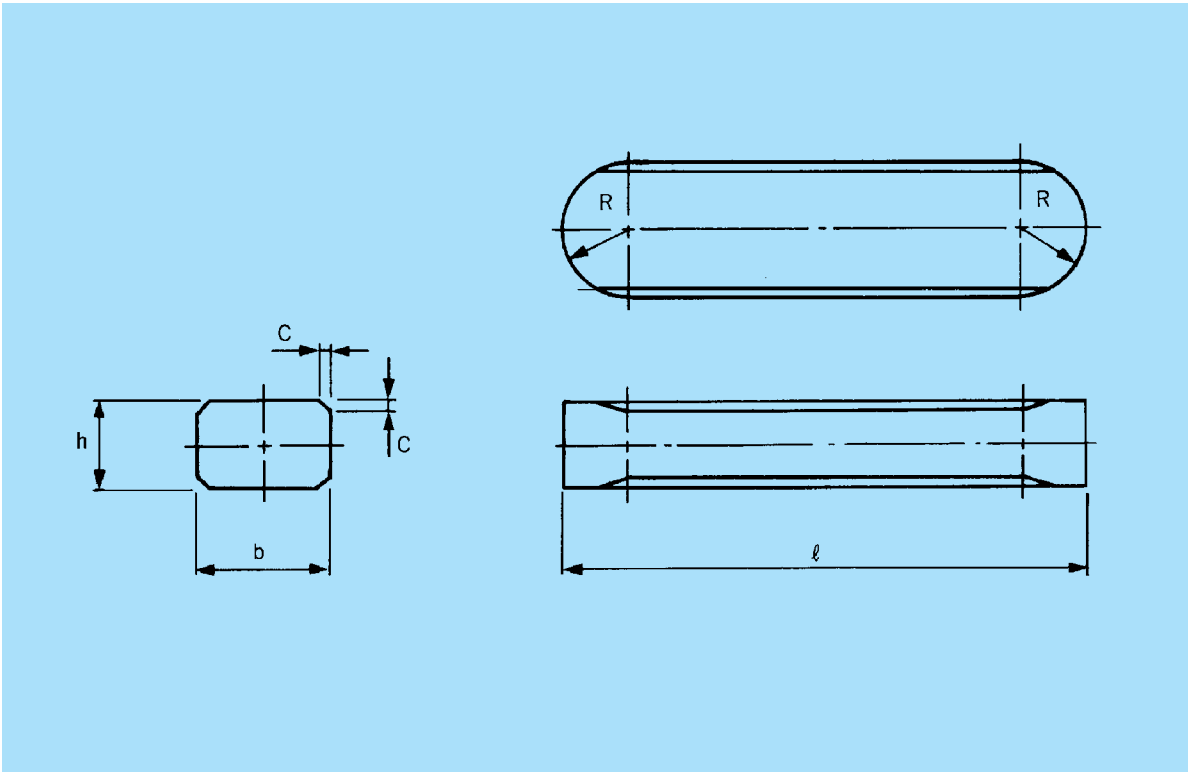


Table 6 LBS and LBST Standard Keys

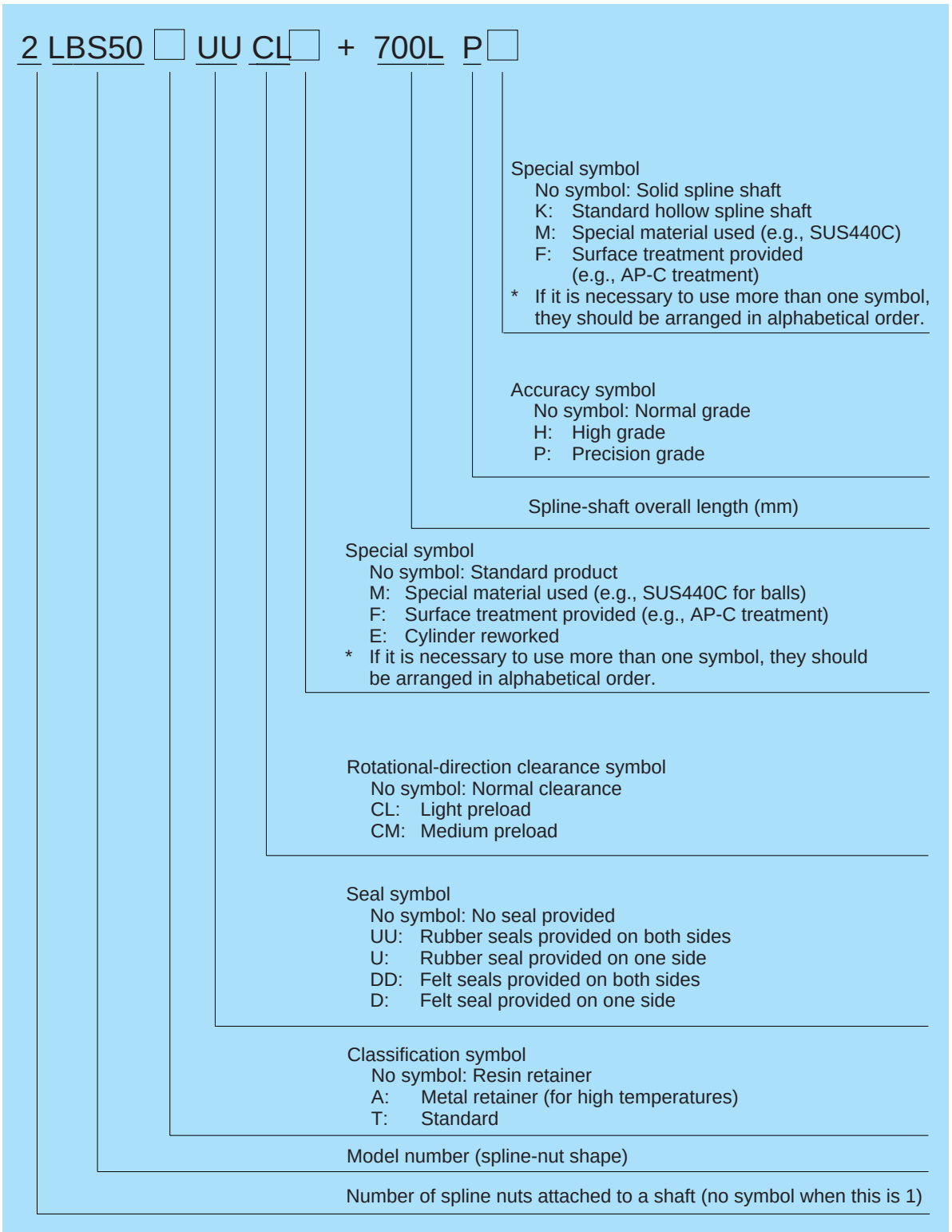
Unit: mm

Model No.	Width b	Tolerance (p7)	Height h	Tolerance (h9)	Length *l*	Tolerance (h12)	R	C
LBS 15	3.5	+0.024 +0.012	3.5	0 –0.030	20	0 –0.210	1.75	0.5
LBS 20 LBST 20	4		4		26		2	
LBS 25 LBST 25	5		5		33	0 –0.250	2.5	
LBS 30 LBST 30	7	+0.030 +0.015	7	0 –0.036	41		3.5	
LBS 40 LBST 40	10		8		55	0 –0.300	5	0.8
LBS 50 LBST 50	15	+0.036 +0.018	10		60		7.5	
LBST 60 LBS 70 LBST 70	18		12	0 –0.043	68		9	1.2
LBS 85 LBST 85	20	+0.043 +0.022	13		80		10	
LBS 100 LBST 100	28		18		93	0 –0.350	14	
LBST 120	28		18		123	0 –0.400	14	
LBST 150	32	+0.051 +0.026	20	0 –0.052	157		16	2

B-II

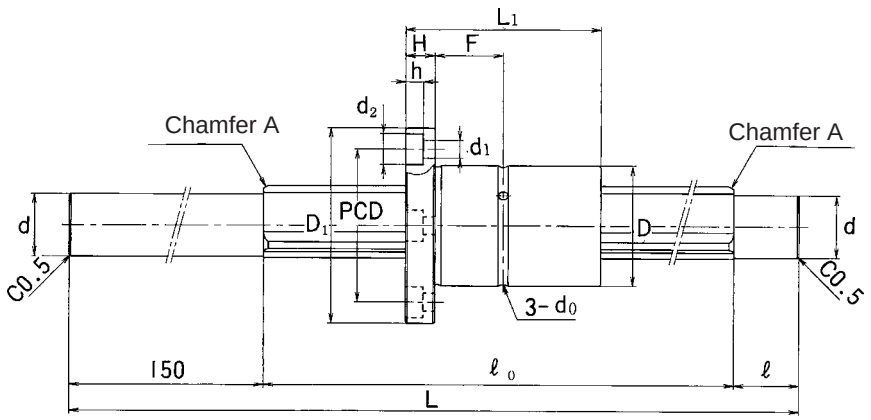
Model-Number Coding

The coding of Ball Spline model numbers is as specified below.



Standard Ball Spline Type LBS

(Standard off-the-shelf item)

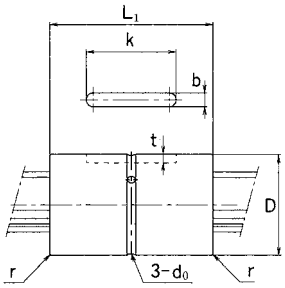


Type LBF-T

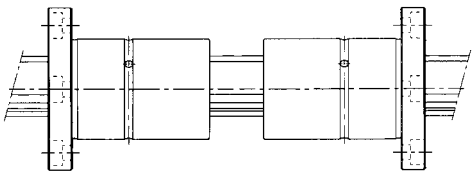
Model No.	Spline nut dimensions												
	Outer diameter		Length		Flange dimensions						Keyway dimensions		
	D	Tolerance	L_1	Tolerance	D_1	Tolerance	H	F	PCD	$d_1 \times d_2 \times h$	b H8	t +0.05 0	k
LBS 15 T	23	0 −0.013	40	0 −0.2	-	0 −0.2	-	-	-	———	3.5	2	20
LBF 15 T	23		40		43		7	13	32	4.5 × 8 × 4.4	-	-	-
2LBF 15 T	23		40		43		7	13	32	4.5 × 8 × 4.4	-	-	-
LBS 20 T	30	0 −0.016	50		-		-	-	-	———	4	2.5	26
LBF 20 T	30		50		49		7	18	38	4.5 × 8 × 4.4	-	-	-
2LBF 20 T	30		50		49		7	18	38	4.5 × 8 × 4.4	-	-	-
LBS 25 T	37		60	0 −0.3	-	0 −0.3	-	-	-	———	5	3	33
LBF 25 T	37		60		60		9	21	47	5.5 × 9.5 × 5.4	-	-	-
2LBF 25 T	37		60		60		9	21	47	5.5 × 9.5 × 5.4	-	-	-
LBS 30 T	45		70		-		-	-	-	———	7	4	41
LBF 30 T	45		70		70		10	25	54	6.6 × 11 × 6.5	-	-	-
2LBF 30 T	45		70		70		10	25	54	6.6 × 11 × 6.5	-	-	-
LBS 40 TX	60	0 −0.019	90		-		-	-	-	———	10	4.5	55
LBF 40 TX	57		90		90		14	31	70	9 × 14 × 8.6	-	-	-
2LBF 40 TX	57		90		90		14	31	70	9 × 14 × 8.6	-	-	-
LBS 50 TX	75		100		-		-	-	-	———	15	5	60
LBF 50 TX	70		100		108		16	34	86	11 × 17.5 × 11	-	-	-
2LBF 50 TX	70		100		108		16	34	86	11 × 17.5 × 11	-	-	-

Notes:

- The basic torque and load ratings are for single-spline nut use.
- Only the spline section is induction-hardened to a surface hardness of HRC58 through HRC64.
- Both the rotational-direction clearance and accuracy grade are normal.
- If a model with seals is required, please specify.
- The spline nut accommodates a retainer made of synthetic resin.
- For model-number coding, see page B-56.



Type LBS-T



Type 2LBF-T

Unit: mm

Oil hole d_0	r	Spline-shaft dimensions Length L(l_0)		d +0.1 0	l	Basic torque rating C_T Nm	Basic torque rating C_{0T} Nm	Basic load rating (radial) C kN	Basic load rating (radial) C_0 kN
2	0.5	265 (100)		11.7	15	30.4	74.5	4.4	8.4
2	-	365 (200)							
2	-	465 (300)							
2	0.5	365 (200)	665 (500)	15.2	15	74.5	160	7.8	14.9
2	-	465 (300)							
2	-	565 (400)							
2	0.5	370 (200)	670 (500)	19.2	20	154	307	13.0	23.5
2	-	470 (300)	870 (700)						
2	-	570 (400)							
3	1.0	470 (300)	770 (600)	22.2	20	273	538	19.3	33.8
3	-	570 (400)	970 (800)						
3	-	670 (500)	1170 (1000)						
3	1.0	575 (400)	1175 (1000)	30.2	25	599	1140	31.9	53.4
3	-	775 (600)	1375 (1200)						
3	-	975 (800)							
4	1.5	675 (500)	1375 (1200)	38.2	25	1100	1940	46.6	73.0
4	-	875 (700)	1775 (1600)						
4	-	1175 (1000)							

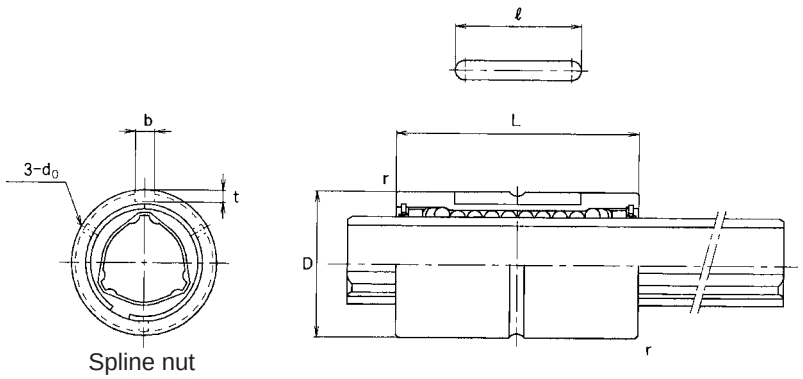
Type LBS

(medium-duty type)

Model No.	Spline-nut dimensions								
	Outer diameter D		Length L		Keyway dimensions				Oil hole
		Tolerance		Tolerance	b H8	$t^{+0.05}_{0}$	l	r	d_0
LBS 15	23	$^{0}_{-0.013}$	40	$^{0}_{-0.2}$	3.5	2	20	0.5	2
LBS 20	30	$^{0}_{-0.016}$	50		4	2.5	26	0.5	2
LBS 25	37		60	$^{0}_{-0.3}$	5	3	33	0.5	2
LBS 30	45		70		7	4	41	1.0	3
LBS 40	60	$^{0}_{-0.019}$	90		10	4.5	55	1.0	3
LBS 50	75		100		15	5	60	1.5	4
LBS 70	100	$^{0}_{-0.022}$	110		18	6	68	2.0	4
LBS 85	120		140	$^{0}_{-0.4}$	20	7	80	2.5	5
LBS 100	140	$^{0}_{-0.025}$	160		28	9	93	3.0	5

Notes:

- In model numbers 15 through 70, the spline nut accommodates a retainer made of synthetic resin that generates low noise during operation. If your operating temperature exceeds 80°C, use a model with a metal retainer. When specifying such a model, append an "A" to the model number.
  Please note, however, that there is no high-temperature model for type LBS15.
  [Ex.] LBS20 A CL + 500LH
  └ High-temperature symbol
- If a model with seals is required, please specify.
- For model-number coding, see page B-56.

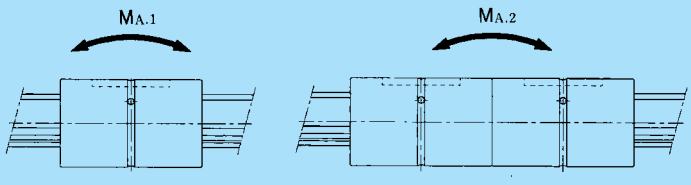


Spline nut

Unit: mm

Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
C_T Nm	C_{0T} Nm	C kN	C_0 kN	$M_{A.1}$ 1) Nm	$M_{A.2}$ 2) Nm	Spline nut kg	Spline shaft kg/m
30.4	74.5	4.4	8.4	25.4	185	0.06	1.0
74.5	160	7.8	14.9	60.2	408	0.14	1.8
154	307	13.0	23.5	118	760	0.25	2.7
273	538	19.3	33.8	203	1270	0.44	3.8
599	1140	31.9	53.4	387	2640	1.0	6.8
1100	1940	46.6	73.0	594	4050	1.7	10.6
2190	3800	66.4	102	895	6530	3.1	21.3
3620	6360	90.5	141	2000	12600	5.5	32.0
5910	12600	126	237	3460	20600	9.5	45.0

Notes:
1) $M_{A.1}$ represents the permissible moment in the axial direction when a single spline nut is used, as shown below.
2) $M_{A.2}$ represents the permissible moment in the axial direction when two closely linked spline nuts are used, as shown below.
(As type LBS does not provide sufficiently stable accuracy when used with a single spline nut, we recommend type LBST for single-spline-nut use, or type LBS for closely linked double spline-nut use.)



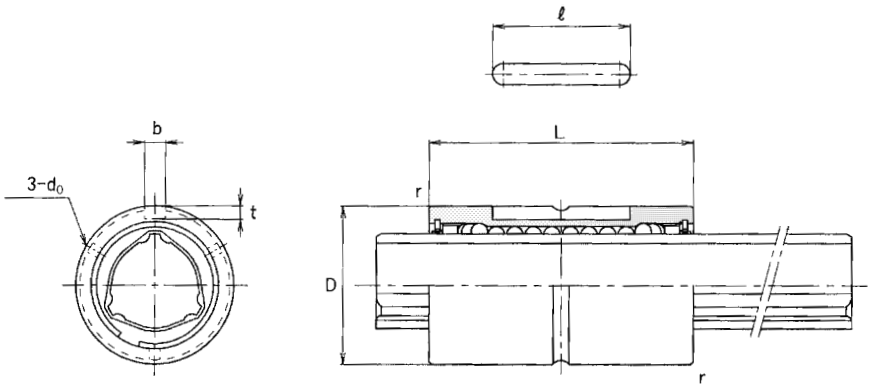
Type LBST

(heavy-duty type)

Model No.	Spline-nut dimensions								
	Outer diameter D		Length L		Keyway dimensions				Oil hole
		Tolerance		Tolerance	b H8	t +0.05 0	l	r	d_0
LBST 20	30	0 −0.016	60	0 −0.2	4	2.5	26	0.5	2
LBST 25	37		70	0 −0.3	5	3	33	0.5	2
LBST 30	45		80		7	4	41	1.0	3
LBST 40	60	0 −0.019	100		10	4.5	55	1.0	3
LBST 50	75		112		15	5	60	1.5	4
LBST 60	90	0 −0.022	127		18	6	68	1.5	4
LBST 70	100		135		18	6	68	2.0	4
LBST 85	120		155	0 −0.4	20	7	80	2.5	5
LBST 100	140	0 −0.025	175		28	9	93	3.0	5
LBST 120	160		200	0 −0.5	28	9	123	3.5	6
LBST 150	205	0 −0.029	250		32	10	157	3.5	6

Notes:

- In model numbers 20 through 70, the spline nut accommodates a retainer made of synthetic resin that generates low noise during operation. (There is no high-temperature model for type LBST70 or lower). If your operating temperature exceeds 80°C, use a model of type LBS accommodating a metal retainer (see page B-60).
- If a model with seals is required, please specify.
- For model-number coding, see page B-56.

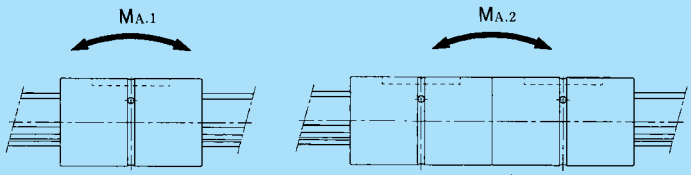


Spline nut

Unit: mm

Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
C_T Nm	C_{0T} Nm	C kN	C_0 kN	$M_{A.1}$ 1) Nm	$M_{A.2}$ 2) Nm	Spline nut kg	Spline shaft kg/m
90.2	213	9.4	20.1	103	632	0.17	1.8
176	381	14.9	28.7	171	1060	0.29	2.7
312	657	22.5	41.4	295	1740	0.50	3.8
696	1420	37.1	66.9	586	3540	1.1	6.8
1290	2500	55.1	94.1	941	5610	1.9	10.6
1870	3830	66.2	121	1300	8280	3.3	15.6
3000	6090	90.8	164	2080	11800	3.8	21.3
4740	9550	119	213	3180	17300	6.1	32.0
6460	14400	137	271	4410	25400	10.4	45.0
8380	19400	148	306	5490	32400	12.9	69.5
13900	32200	196	405	8060	55400	28.0	116.6

Notes:
1) M_{A1} represents the permissible moment in the axial direction when a single spline nut is used, as shown below.
2) M_{A2} represents the permissible moment in the axial direction when two closely linked spline nuts are used, as shown below.



Type LBF

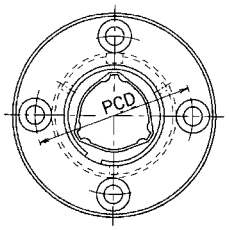
(medium-duty type)

Model No.	Spline-nut dimensions									
	Outer diameter D	Tolerance	Length L	Tolerance	Flange diameter D_1	Tolerance	H	F	Oil hole d_0	PCD
LBF 15	23	$^{0}_{-0.013}$	40	$^{0}_{-0.2}$	43	$^{0}_{-0.2}$	7	13	2	32
LBF 20	30	$^{0}_{-0.016}$	50		49		7	18	2	38
LBF 25	37		60	$^{0}_{-0.3}$	60		9	21	2	47
LBF 30	45		70		70		10	25	3	54
LBF 40	57	$^{0}_{-0.019}$	90		90		14	31	3	70
LBF 50	70		100		108	$^{0}_{-0.3}$	16	34	4	86
LBF 60	85		127		124		18	45.5	4	102
LBF 70	95	$^{0}_{-0.022}$	110		142		20	35	4	117
LBF 85	115		140	$^{0}_{-0.4}$	168		22	48	5	138
LBF 100	135	$^{0}_{-0.025}$	160		195	$^{0}_{-0.4}$	25	55	5	162

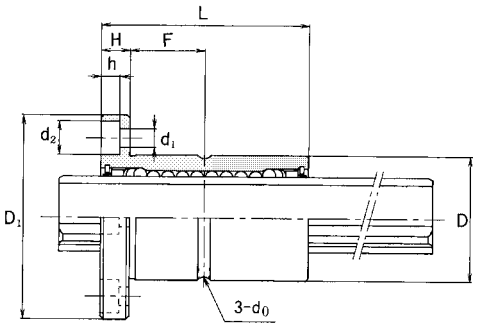
Notes:

- In model numbers 15 through 70, the spline nut accommodates a retainer made of synthetic resin that generates low noise during operation. If your operating temperature exceeds 80°C, use a model with a metal retainer. When specifying such a model, append an "A" to the model number.
  Please note, however, that there is no high-temperature model for types LBF15 and LBF60.
  [Ex.] LBF20 A CL + 500LH
  └── High-temperature symbol

- If a model with seals is required, please specify.
- For model-number coding, see page B-56.



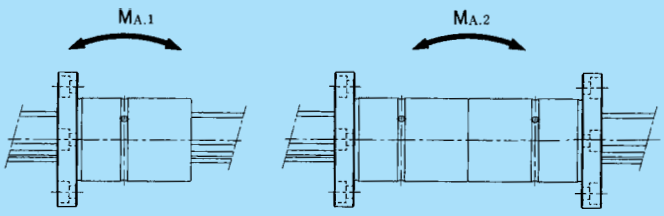
Spline nut



Unit: mm

Mounting hole $d_1 \times d_2 \times h$	Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
	C_T Nm	C_{0T} Nm	C kN	C_0 kN	$M_{A.1}$ 1) Nm	$M_{A.2}$ 2) Nm	Spline nut kg	Spline shaft kg/m
4.5 × 8 × 4.4	30.4	74.5	4.4	8.4	25.4	185	0.11	1.0
4.5 × 8 × 4.4	74.5	160	7.8	14.9	60.2	408	0.20	1.8
5.5 × 9.5 × 5.4	154	307	13.0	23.5	118	760	0.36	2.7
6.6 × 11 × 6.5	273	538	19.3	33.8	203	1270	0.60	3.8
9 × 14 × 8.6	599	1140	31.9	53.4	387	2640	1.2	6.8
11 × 17.5 × 11	1100	1940	46.6	73.0	594	4050	1.9	10.6
11 × 17.5 × 11	1870	3830	66.2	121	1300	8280	3.5	15.6
14 × 20 × 13	2190	3800	66.4	102	895	6530	3.6	21.3
16 × 23 × 15.2	3620	6360	90.5	141	2000	12600	6.2	32
18 × 26 × 17.5	5910	12600	126	237	3460	20600	11.0	45

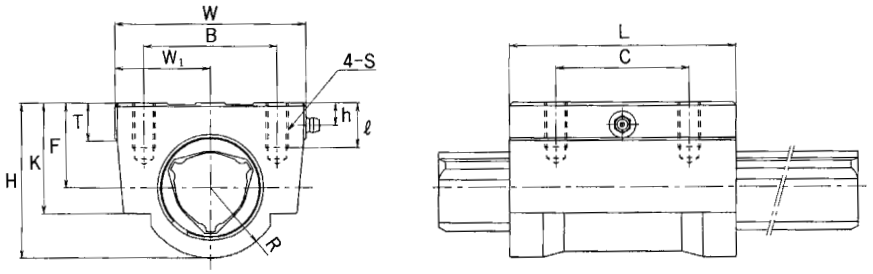
Notes:
1) M_{A1} represents the permissible moment in the axial direction when a single spline nut is used, as shown below.
2) M_{A2} represents the permissible moment in the axial direction when two closely linked spline nuts are used, as shown below.
(Due to insufficient stability in accuracy, we recommend the use of closely linked double spline nuts.)



Type LBH

Model No.	Spline-nut dimensions									
	Height H	Width W	Length L	B	C	S × *l*	F ±0.15	W_1 ±0.15	T	K
LBH 15	29	34	43	26	26	M 4 × 10	15	17	6	20
LBH 20	38	48	62	35	35	M 6 × 12	20	24	7	26
LBH 25	47.5	60	73	40	40	M 8 × 16	25	30	8	33
LBH 30	57	70	83	50	50	M 8 × 16	30	35	10	39
LBH 40	70	86	102	60	60	M 10 × 20	38	43	15	50
LBH 50	88	100	115	75	75	M 12 × 25	48	50	18	63

Notes:
- The spline nut accommodates a retainer made of synthetic resin that generates low noise during operation. (There is no high-temperature model for type LBH).
- If a model with seals is required, please specify.
- For model-number coding, see page B-56.

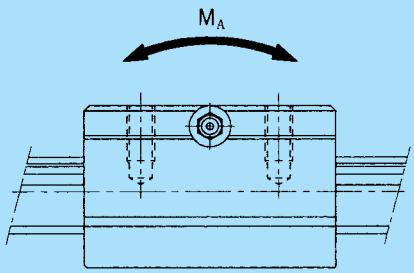


Spline nut

Unit: mm

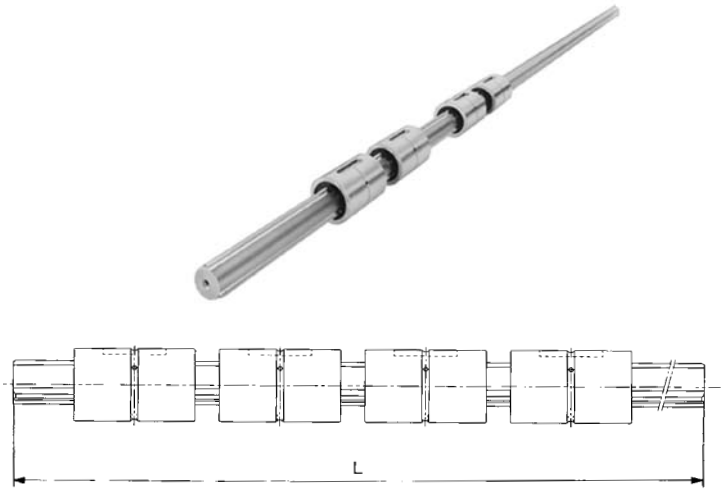
Dimensions			Basic torque rating		Basic load rating (radial)		Static permissible moment	Mass	
l	h	Grease nipple	C_T Nm	C_{OT} Nm	C kN	C_0 kN	M_A 1) Nm	Spline nut kg	Spline shaft kg/m
14	5	4 drive-fit nipple	30.4	74.5	4.4	8.4	25.4	0.23	1.0
18	7	A-M6F	90.2	213	9.4	20.1	103	0.58	1.8
22	6	A-M6F	176	381	14.9	28.7	171	1.10	2.7
26	8	A-M6F	312	657	22.5	41.4	295	1.73	3.8
32	10	A-M6F	696	1420	37.1	66.9	586	3.18	6.8
40	13.5	A-PT1/8	1290	2500	55.1	94.1	941	5.10	10.6

Note:
1) M_{A1} represents the permissible moment in the axial direction when a single spline nut is used, as shown below.



Full Spline Type LBS (standard off-the-shelf item)

This type has more than one spline nut attached to a long, straight shaft. The spline-shaft length and the number of spline nuts can be changed freely as required, through reworking. For single-spline-nut use with a short spline-shaft length, a number of spline shafts can be cut from this product. Moreover, the length of each shaft to be cut can be freely determined. Type LBS is therefore highly versatile. Only the normal accuracy and clearance, however, are available with this type.



Full spline shaft

Unit: mm

Model No.	Overall length L	Number of spline nuts
LBS 15	1500	5
LBS 20	1800	6
LBS 25	2500	6
LBS 30	3000	6
LBS 40	3000	4
LBS 50	3000	4

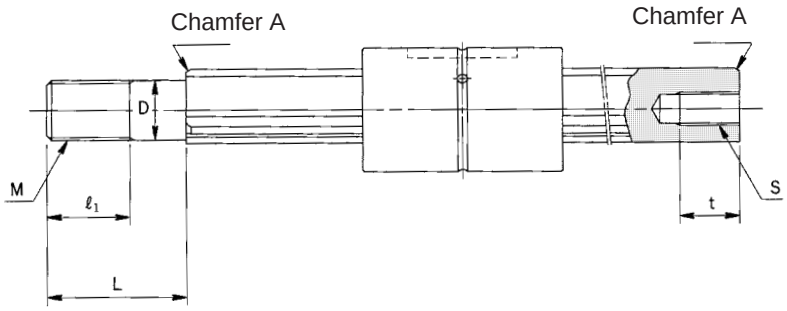
Notes:
- Flanged type LBF is also available.
- For model-number coding, see page B-56.

Reworking spline-shaft ends

The spline shafts of this type are induction-hardened on the surface over their entire length. To rework a shaft, follow the procedures specified below.

1. Using a cutting grinding wheel or the like, cut a shaft to the desired length.
2. Using a burner or the like, anneal a shaft end portion to be reworked (cool the remaining portion during annealing whenever possible).
3. Using the spline outer diameter (crest) as reference (i.e., chucking the shaft on the crests), rough and finish the subject portion with a lathe. When the subject portion is long and grinding is required to perform finishing, provide center holes.
4. If the amount of working that can be performed is limited, it is recommended that the spline-shaft crests be roughed, and then finished with a cylindrical grinding machine.

Recommended Spline-Shaft End Shape of Type LBS (for support)



Unit: mm

Model No.	D	Tolerance	L	M	l_1	S × t
LBS 15	10	$^{0}_{-0.015}$	23	M10 × 1.25	14	M 6 × 10
LBS 20	14	$^{0}_{-0.018}$	30	M14 × 1.5	18	M 8 × 15
LBS 25	18		42	M18 × 1.5	25	M10 × 18
LBS 30	20	$^{0}_{-0.021}$	46	M20 × 1.5	27	M12 × 20
LBS 40	30		70	M30 × 2.0	40	M18 × 30
LBS 50	36	$^{0}_{-0.025}$	80	M36 × 3.0	46	M20 × 35