

High-Torque Ball Spline

Models LBS, LBST, LBF, LBR, and LBH

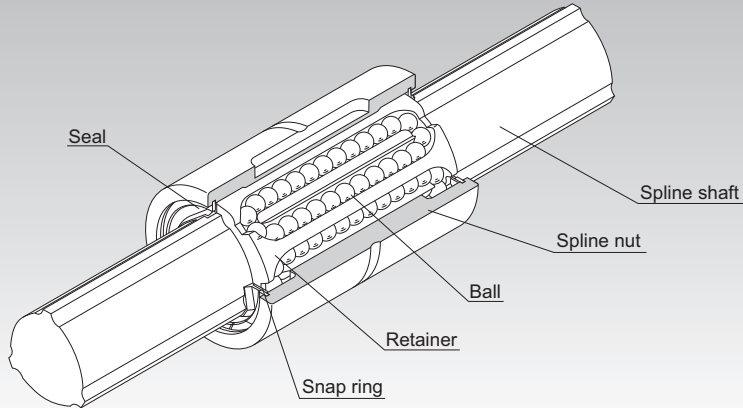


Fig. 1: Structure of High-Torque Ball Spline Model LBS

Selection Criteria	A3-6
Design Highlights	A3-125
Options	A3-128
Model No.	A3-130
Handling Precautions	A3-131
Lubrication Accessories	A24-1
Mounting Procedure and Maintenance	B3-32
Cross-Sectional Characteristics of the Spline Shaft	A3-17
Equivalent Factor	A3-29
Clearance in the Rotational Direction	A3-32
Accuracy Standards	A3-37
Maximum Manufacturing Lengths by Accuracy	A3-123

Structure and Features

With the high-torque ball spline, the spline shaft has three crests formed equidistantly every 120° . Six rows of balls (two for each crest) are arranged to hold the crests from both sides, as shown in Fig. 1.

The raceways are precision ground into round grooves whose diameters are approximate to the ball diameter. When a torque is generated from the spline shaft or the spline nut, the three rows of balls on the load-bearing side evenly receive the torque, and the center of rotation is automatically determined. When the rotation reverses, the remaining three rows of balls on the unloaded side receive the torque.

The rows of balls are held in a retainer incorporated in the spline nut so that they smoothly roll and circulate. With this design, balls will not fall out even if the spline shaft is removed from the nut.

No Angular Backlash

With the high-torque ball spline, a single spline nut provides a preload to eliminate angular backlash and increase the rigidity.

Unlike conventional ball splines with circular-arc grooves or Gothic-arch grooves, the high-torque ball spline eliminates the need for twisting two spline nuts to provide a preload, thus allowing compact design to be achieved easily.

High Rigidity and Accurate Positioning

Since these models have a large contact angle and provide a preload from a single spline nut, the initial displacement is minimal and high rigidity and high positioning accuracy are achieved.

High-Speed Motion, High-Speed Rotation

Adoption of a structure with high grease retention and a rigid retainer enables the ball spline to operate over a long period with grease lubrication even in high-speed linear motion. Since the distance in the radial direction is almost uniform between the loaded balls and the unloaded balls, the balls are little affected by the centrifugal force of high-speed rotation, and the ball spline achieves smooth linear motion.

Compact Design

Unlike conventional ball splines, unloaded balls do not circulate on the outer surface of the spline nut with these models. As a result, the outer diameter of the spline nut is reduced and a space-saving and compact design is achieved.

Ball Retention

Use of a retainer prevents the balls from falling out even if the spline shaft is pulled out of the spline nut.

Can be Used as a Linear Bushing for Heavy Loads

Since the raceways are machined into round grooves whose diameter is almost equal to the ball diameter, the contact area of the ball is large and the load capacity is also high in the radial direction.

Two Parallel Shafts can be Replaced with a Single Shaft

Since a single shaft is capable of receiving a load in the torque direction and the radial direction, double shafts in parallel configuration can be replaced with a single-shaft configuration. This allows easy installation and achieves space-saving design.

Applications

The high-torque ball spline is a reliable linear motion system used in a wide array of applications such as the columns and arms of industrial robots, automatic loaders, transfer machines, automatic conveyance systems, tire forming machines, spindles of spot welding machines, guide shafts of high-speed automatic coating machines, riveting machines, wire winders, work heads of electric discharge machines, spindle drive shafts of grinding machines, speed gears, and precision indexing shafts.

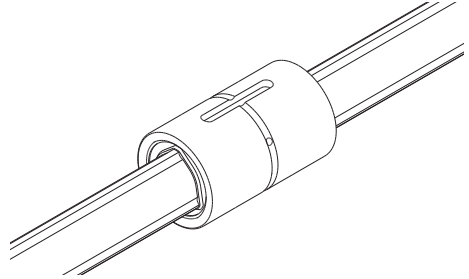
Types and Features

Types of Spline Nuts

Cylindrical Ball Spline Model LBS (Medium Load Type)

Dimensional Table⇒ [A3-60](#)

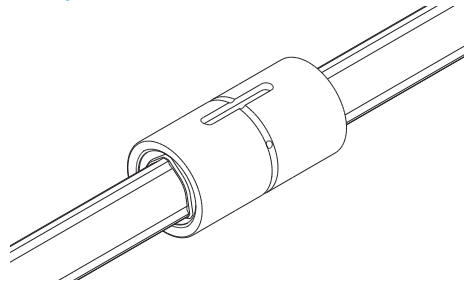
This is the most compact type with a straight cylindrical spline nut. When transmitting a torque, a key is driven into the body.



Cylindrical Ball Spline Model LBST (Heavy Load Type)

Dimensional Table⇒ [A3-62](#)

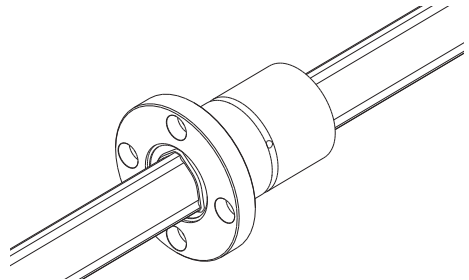
This is a heavy-load type that has the same spline nut diameter as Model LBS, but has a longer spline nut length. It is optimal for locations where the space is small, a large torque is applied, and an overhanging load or moment load is applied.



Flanged Ball Spline Model LBF

Dimensional Table⇒ [A3-64](#)

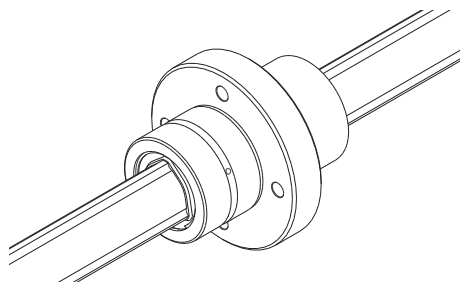
The spline nut can be attached to the housing via the flange, making assembly simple. It is optimal for locations where the housing may be deformed if a keyway is machined on its surface, and where the housing width is small.



Flanged Ball Spline Model LBR

Dimensional Table⇒ **A3-66**

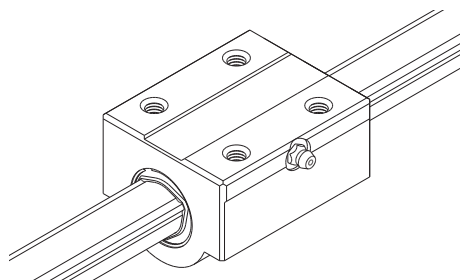
Based on the heavy-load Model LBST, this model has a flange in the central area, making it optimal for locations under moment loads such as arms of industrial robots.



Rectangular Ball Spline Model LBH

Dimensional Table⇒ **A3-68**

This model's rigid rectangular spline nut does not require a housing and can be directly mounted on the machine body. Thus, a compact and highly rigid linear guide system is achieved.



Types of Spline Shafts

Precision Solid Spline Shaft (Standard Type)

The spline shaft is cold-drawn and its raceway is precision ground. It is used in combination with a spline nut.



Special Spline Shaft

THK manufactures a spline shaft with thicker ends or thicker middle area through special processing at your request.



Hollow Spline Shaft (Type K)

A drawn, hollow spline shaft is available for requirements such as piping, wiring, air ventilation, and weight reduction.



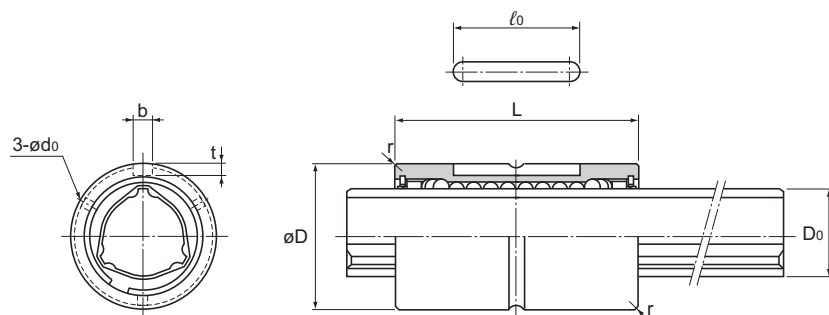
Housing Inner-Diameter Tolerance

When fitting the spline nut to the housing, transition fit is normally recommended. If the accuracy of the ball spline does not need to be very high, clearance fit is also acceptable.

Table 1: Housing Inner-Diameter Tolerance

Housing inner-diameter tolerance	General conditions	H7
	When clearance needs to be small	J6

Model LBS (Medium-Load Type)



Model No.	Spline nut dimensions											
	Outer diameter		Length		L ₂	L ₃	D ₂	Keyway dimensions			r	C
	D	Tolerance	L	Tolerance				b H8	t +0.1 0	l ₀		
LBS 15	23	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	40	$\begin{matrix} 0 \\ -0.2 \end{matrix}$	—	—	—	3.5	2	20	0.5	—
○● LBS 20	30	$\begin{matrix} 0 \\ -0.016 \end{matrix}$	50	$\begin{matrix} 0 \\ -0.3 \end{matrix}$	—	—	—	4	2.5	26	0.5	—
○● LBS 25	37		60		—	—	—	5	3	33	0.5	—
○● LBS 30	45		70		—	—	—	7	4	41	1	—
○● LBS 40	60	$\begin{matrix} 0 \\ -0.019 \end{matrix}$	90	$\begin{matrix} 0 \\ -0.4 \end{matrix}$	—	—	—	10	4.5	55	1	—
○● LBS 50	75	100	—		—	—	15	5	60	1.5	—	
○● LBS 70	100	$\begin{matrix} 0 \\ -0.022 \end{matrix}$	110		—	—	—	18	6	68	2	—
○● LBS 85	120	$\begin{matrix} 0 \\ -0.025 \end{matrix}$	140	$\begin{matrix} 0 \\ -0.4 \end{matrix}$	—	—	—	20	7	80	2.5	—
○● LBS 100	140		160		—	—	—	28	9	93	3	—

○: Indicates model numbers able to handle high temperatures (with metal retainers, the operating temperature is up to 100°C).
Compatible model numbers: LBS20 to 100

(Example) LBS20 A CL+500L H

High temperature symbol

●: Indicates model numbers compatible with felt seals. Compatible model numbers: LBS20 to 100
Felt seals cannot be attached to ball spline models using metal retainers.
When equipping felt seals, the length dimensions of the nuts will change.

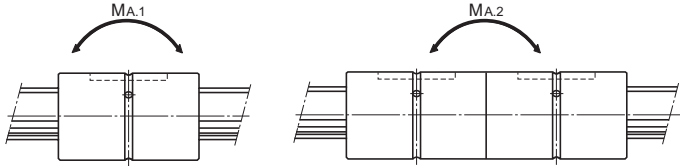
Model number coding

2 LBS40 UU CL +1000L P K

2: Model No.
 LBS40: Number of spline nuts on one shaft (no symbol for one nut)
 UU: Contamination protection accessory symbol¹
 CL: Symbol for clearance in the rotational direction²
 +1000L: Overall spline shaft length⁵ (in mm)
 P: Accuracy symbol³
 K: Symbol for spline shaft⁴

¹ See **A3-128**. ² See **A3-32**. ³ See **A3-37**. ⁴ See **A3-71**. ⁵ See **A3-123**.

High-Torque Ball Spline



Unit: mm

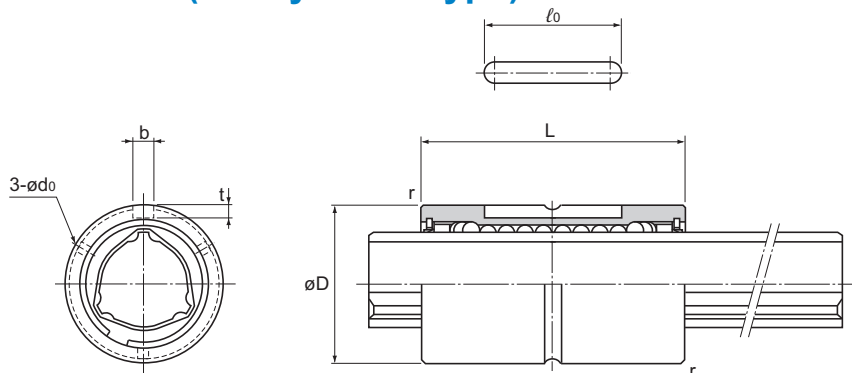
	Lubrication hole d_0	Spline shaft outer diameter		Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
		D_0	d_s	C_T N·m	C_{OT} N·m	C kN	C_0 kN	$M_{A,1}^1$ N·m	$M_{A,2}^2$ N·m	Spline nut kg	Spline shaft kg/m
	2	14.5	—	30.4	74.5	4.4	8.4	25.4	185	0.06	1
	2	19.7	—	74.5	160	7.8	14.9	60.2	408	0.14	1.8
	2	24.5	—	154	307	13	23.5	118	760	0.25	2.7
	3	29.6	—	273	538	19.3	33.8	203	1,270	0.44	3.8
	3	39.8	—	599	1,140	31.9	53.4	387	2,640	1	6.8
	4	49.5	—	1,100	1,940	46.6	73	594	4,050	1.7	10.6
	4	70	—	2,190	3,800	66.4	102	895	6,530	3.1	21.3
	5	84	—	3,620	6,360	90.5	141	2,000	12,600	5.5	32
	5	99	—	5,190	12,600	126	237	3,460	20,600	9.5	45

¹ $M_{A,1}$ indicates the permissible moment value in the axial direction when a single spline nut is used.

² $M_{A,2}$ indicates the allowable moment load value in the axial direction when using two spline nuts in contact with each other.

Note: For details on the maximum lengths of ball spline shafts by accuracy, please see **A3-123**.

Model LBST (Heavy-Load Type)



Model No.	Spline nut dimensions								
	Outer diameter		Length		Keyway dimensions			r	Lubrication hole d ₀
	D	Tolerance	L	Tolerance	b H8	t +0.1 0	ℓ ₀		
○● LBST 20	30	0 -0.016	60	0 -0.2	4	2.5	26	0.5	2
○● LBST 25	37		70		5	3	33	0.5	2
○● LBST 30	45	0 -0.019	80	0 -0.3	7	4	41	1	3
○● LBST 40	60		100		10	4.5	55	1	3
○● LBST 50	75	0 -0.022	112	0 -0.4	15	5	60	1.5	4
○ LBST 60	90		127		18	6	68	1.5	4
○● LBST 70	100	0 -0.025	135	0 -0.5	18	6	68	2	4
○● LBST 85	120		155		20	7	80	2.5	5
○● LBST 100	140	0 -0.029	175	0 -0.5	28	9	93	3	5
○ LBST 120	160		200		28	9	123	3.5	6
○ LBST 150	205		250		32	10	157	3.5	6

○: Indicates model numbers able to handle high temperatures (with metal retainers, the operating temperature is up to 100°C).

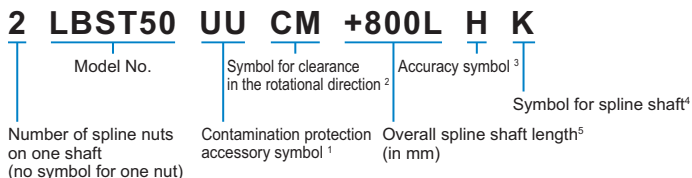
(Example) LBST25 A CM+400L H

High temperature symbol

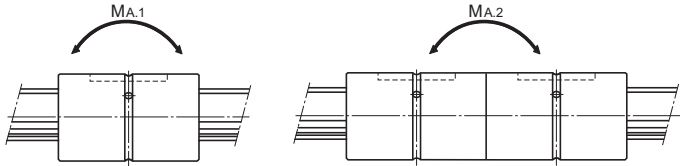
●: Indicates model numbers for which felt seals are available (see **A3-128**).

A felt seal cannot be attached to ball spline models using metal retainers.

Model number coding



¹ See **A3-128**. ² See **A3-32**. ³ See **A3-37**. ⁴ See **A3-71**. ⁵ See **A3-123**.



Unit: mm

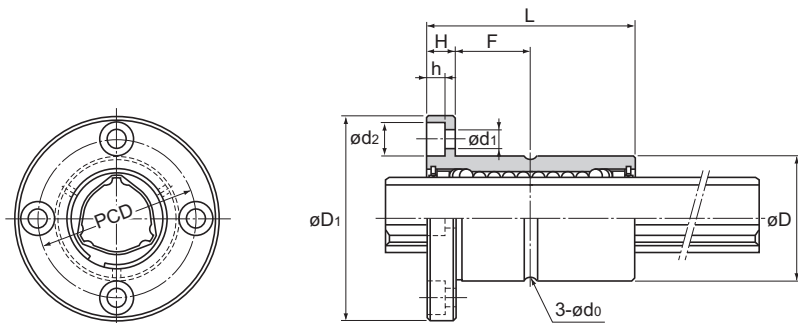
	Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
	C_T N·m	C_{OT} N·m	C kN	C_0 kN	$M_{A,1}^1$ N·m	$M_{A,2}^2$ N·m	Spline nut kg	Spline shaft kg/m
	90.2	213	9.4	20.1	103	632	0.17	1.8
	176	381	14.9	28.7	171	1,060	0.29	2.7
	312	657	22.5	41.4	295	1,740	0.5	3.8
	696	1,420	37.1	66.9	586	3,540	1.1	6.8
	1,290	2,500	55.1	94.1	941	5,610	1.9	10.6
	1,870	3,830	66.2	121	1,300	8,280	3.3	15.6
	3,000	6,090	90.8	164	2,080	11,800	3.8	21.3
	4,740	9,550	119	213	3,180	17,300	6.1	32
	6,460	14,400	137	271	4,410	25,400	10.4	45
	8,380	19,400	148	306	5,490	32,400	12.9	69.5
	13,900	32,200	196	405	8,060	55,400	28	116.6

¹ $M_{A,1}$ indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

² $M_{A,2}$ indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.

Note: For details on the maximum lengths of ball spline shafts by accuracy, please see **A3-123**.

Model LBF (Medium-Load Type)



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

○: Indicates model numbers able to handle high temperatures (with metal retainers, the operating temperature is up to 100°C).

(Example) LBF20 A CL+500L H

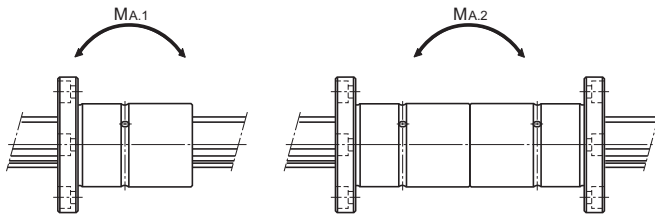
High temperature symbol

●: Indicates model numbers for which felt seals are available (see **A3-128**).
A felt seal cannot be attached to ball spline models using metal retainers.

Model number coding

2	LBF20	DD	CL	+900L	P	K
Model No.		Symbol for clearance in the rotational direction ²		Accuracy symbol ³		Symbol for spline shaft ⁴
Number of spline nuts on one shaft (no symbol for one nut)		Contamination protection accessory symbol ¹		Overall spline shaft length ⁵ (in mm)		

¹ See **A3-128**. ² See **A3-32**. ³ See **A3-37**. ⁴ See **A3-71**. ⁵ See **A3-123**.



Unit: mm

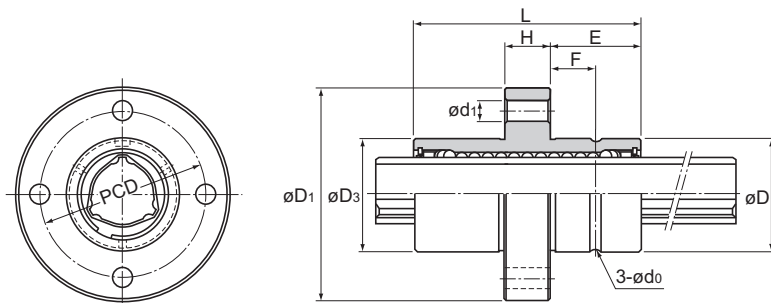
Mounting hole $d_1 \times d_2 \times h$		Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
		C_T N·m	C_{DT} N·m	C kN	C_D kN	$M_{A.1}^1$ N·m	$M_{A.2}^2$ N·m	Spline nut kg	Spline shaft kg/m
	4.5×8×4.4	30.4	74.5	4.4	8.4	25.4	185	0.11	1
	4.5×8×4.4	74.5	160	7.8	14.9	60.2	408	0.2	1.8
	5.5×9.5×5.4	154	307	13	23.5	118	760	0.36	2.7
	6.6×11×6.5	273	538	19.3	33.8	203	1,270	0.6	3.8
	9×14×8.6	599	1,140	31.9	53.4	387	2,640	1.2	6.8
	11×17.5×11	1,100	1,940	46.6	73	594	4,050	1.9	10.6
	11×17.5×11	1,870	3,830	66.2	121	1,300	8,280	3.5	15.6
	14×20×13	2,190	3,800	66.4	102	895	6,530	3.6	21.3
	16×23×15.2	3,620	6,360	90.5	141	2,000	12,600	6.2	32
	18×26×17.5	5,910	12,600	126	237	3,460	20,600	11	45

¹ $M_{A.1}$ indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

² $M_{A.2}$ indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.

Note: For details on the maximum lengths of ball spline shafts by accuracy, please see **A3-123**.

Model LBR



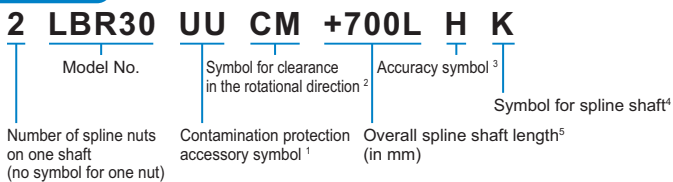
Model No.	Spline nut dimensions								
	Outer diameter		Outer diameter D ₃	Length		Flange diameter D ₁	H	E	PCD
	D	Tolerance		L	Tolerance				
LBR 15	25	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	25.35	40	$\begin{matrix} 0 \\ -0.2 \end{matrix}$	45.4	9	15.5	34
○● LBR 20	30	$\begin{matrix} 0 \\ -0.016 \end{matrix}$	30.35	60	$\begin{matrix} 0 \\ -0.3 \end{matrix}$	56.4	12	24	44
○● LBR 25	40		40.35	70		70.4	14	28	54
○● LBR 30	45		45.4	80		75.4	16	32	61
○● LBR 40	60	$\begin{matrix} 0 \\ -0.019 \end{matrix}$	60.4	100		96.4	18	41	78
○● LBR 50	75	75.4	112	112.4		20	46	94	
○ LBR 60	90	$\begin{matrix} 0 \\ -0.022 \end{matrix}$	90.5	127		134.5	22	52.5	112
○● LBR 70	95		95.6	135	140.6	24	55.5	117	
○● LBR 85	120		120.6	155	170.6	26	64.5	146	
○● LBR 100	140	$\begin{matrix} 0 \\ -0.025 \end{matrix}$	140.6	175	$\begin{matrix} 0 \\ -0.4 \end{matrix}$	198.6	34	70.5	170

○: Indicates model numbers able to handle high temperatures (with metal retainers, the operating temperature is up to 100°C).
(Example) LBR40 A CM+600L H

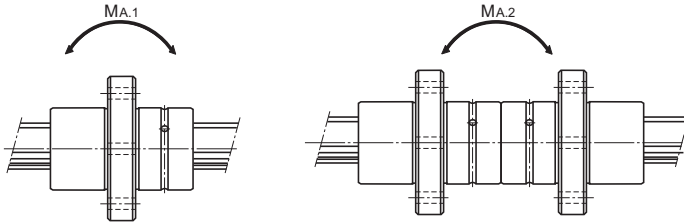
High temperature symbol

●: Indicates model numbers for which felt seals are available (see **A3-128**).
A felt seal cannot be attached to ball spline models using metal retainers.

Model number coding



¹ See **A3-128**. ² See **A3-32**. ³ See **A3-37**. ⁴ See **A3-71**. ⁵ See **A3-123**.



Unit: mm

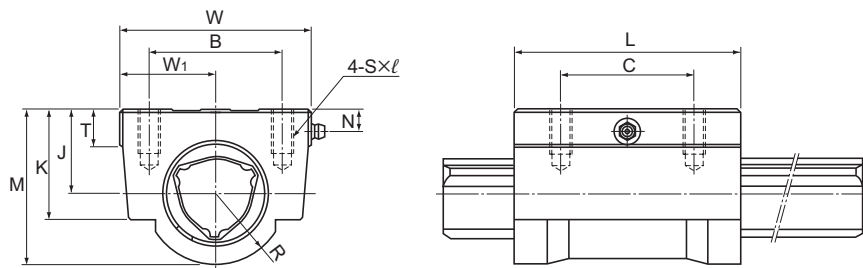
				Basic torque rating		Basic load rating (radial)		Static permissible moment		Mass	
Mounting hole	F	Lubrication hole	C_T N·m	C_{DT} N·m	C kN	C_0 kN	$M_{A.1}^1$ N·m	$M_{A.2}^2$ N·m	Spline nut kg	Spline shaft kg/m	
d_1		d_0									
4.5	7.5	2	30.4	74.5	4.4	8.4	25.4	185	0.14	1	
5.5	12	2	90.2	213	9.4	20.1	103	632	0.33	1.8	
5.5	14	2	176	381	14.9	28.7	171	1,060	0.54	2.7	
6.6	16	3	312	657	22.5	41.4	295	1,740	0.9	3.8	
9	20.5	3	696	1,420	37.1	66.9	586	3,540	1.7	6.8	
11	23	4	1,290	2,500	55.1	94.1	941	5,610	2.7	10.6	
11	26	4	1,870	3,830	66.2	121	1,300	8,280	3.7	15.6	
14	27	4	3,000	6,090	90.8	164	2,080	11,800	6	21.3	
16	32	5	4,740	9,550	119	213	3,180	17,300	8.3	32	
18	35	5	6,460	14,400	137	271	4,410	25,400	14.2	45	

¹ $M_{A.1}$ indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

² $M_{A.2}$ indicates the permissible moment value in the axial direction when two spline nuts in close contact with each other are used, as shown in the figure above.

Notes: For details on the maximum lengths of ball spline shafts by accuracy, please see **A3-123**.

Model LBH



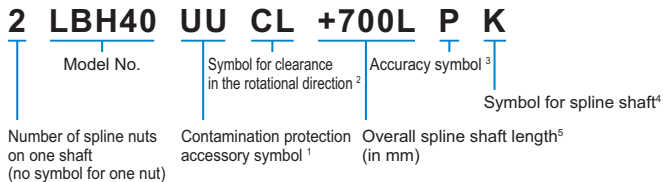
Model No.	Spline nut dimensions									
	Height M	Width W	Length L	B	C	S × l	J ±0.15	W ₁ ±0.15	T	K
○ LBH 15	29	34	43	26	26	M4 × 10	15	17	6	20
○● LBH 20	38	48	62	35	35	M6 × 12	20	24	7	26
○● LBH 25	47	60	73	40	40	M8 × 16	25	30	9.8	32.4
○● LBH 30	56	70	83	50	50	M8 × 16	30	35	11.8	38.6
○● LBH 40	70	86	102	60	60	M10 × 20	38	43	15	50
○● LBH 50	88	100	115	75	75	M12 × 25	48	50	18	63

○: Indicates model numbers able to handle high temperatures (with metal retainers, the operating temperature is up to 100°C).
(Example) LBH30 A CM+600L H

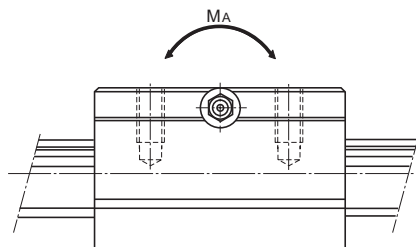
└ High temperature symbol

●: Indicates model numbers for which felt seals are available (see **A3-128**).
A felt seal cannot be attached to ball spline models using metal retainers.

Model number coding



¹ See **A3-128**. ² See **A3-32**. ³ See **A3-37**. ⁴ See **A3-71**. ⁵ See **A3-123**.



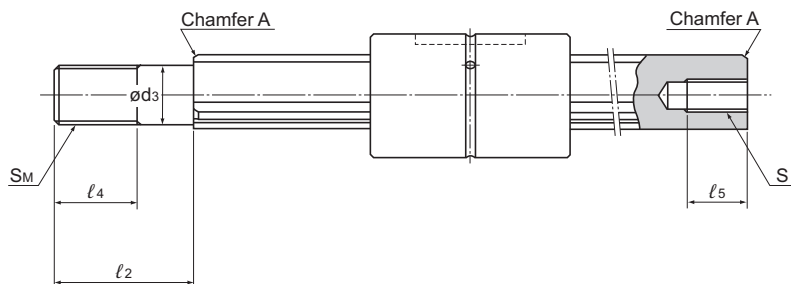
Unit: mm

				Basic torque rating		Basic load rating (radial)		Static permissible moment	Mass	
R	N	Grease nipple	C_T N·m	C_{OT} N·m	C kN	C_0 kN	M_A^1 N·m		Spline nut kg	Spline shaft kg/m
14	5	ø4 drive Nipple	30.4	74.5	4.4	8.4	25.4	0.23	1	
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	1.1	2.7	
26	8	A-M6F	312	657	22.5	41.4	295	1.73	3.8	
32	10	A-M6F	696	1,420	37.1	66.9	586	3.18	6.8	
40	13.5	A-PT1/8	1,290	2,500	55.1	94.1	941	5.1	10.6	

¹ M_A indicates the permissible moment value in the axial direction when a single spline nut is used, as shown in the figure above.

Note: For details on the maximum lengths of ball spline shafts by accuracy, please see **A3-123**.

Model LBS with Recommended Shaft End Shape



Unit: mm

Model No.	d_3	Tolerance	l_2	S_M	l_4	$S \times l_5$
LBS 15	10	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	23	M10×1.25	14	M6×10
LBS 20	14	$\begin{matrix} 0 \\ -0.018 \end{matrix}$	30	M14×1.5	18	M8×15
LBS 25	18		42	M18×1.5	25	M10×18
LBS 30	20	$\begin{matrix} 0 \\ -0.021 \end{matrix}$	46	M20×1.5	27	M12×20
LBS 40	30		70	M30×2	40	M18×30
LBS 50	36	$\begin{matrix} 0 \\ -0.025 \end{matrix}$	80	M36×3	46	M20×35

Note: For details of chamfer A, see **A3-72**.

Spline Shaft

Spline shafts are divided by shape into precision solid spline shafts, special spline shafts, and hollow spline shafts (type K), as described on **A3-59**.

Spline shafts can be produced with various shapes according to customer requests. Please provide a drawing of the desired shaft shape when asking for an estimate or placing an order.

Cross-Sectional Shape of the Spline Shaft

Table 2 shows the cross-sectional shape of a spline shaft. When the spline shaft ends need to be cylindrical, if possible, the width should not exceed the minor diameter (ϕd) value of the shaft.

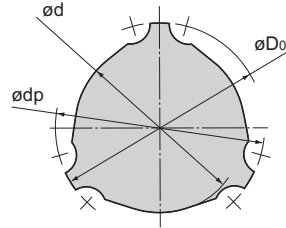


Table 2: Cross-Sectional Shape of the Spline Shaft

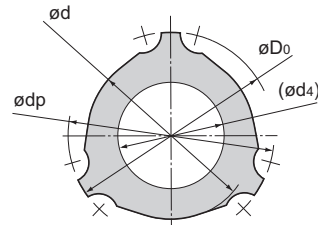
Unit: mm

Nominal shaft diameter	15	20	25	30	40	50	60	70	85	100	120	150
Minor diameter ϕd	11.7	15.3	19.5	22.5	31	39	46.5	54.5	67	81	101	130
Major diameter ϕD_0	14.5	19.7	24.5	29.6	39.8	49.5	60	70	84	99	117	147
Ball center-to-center diameter ϕdp	15	20	25	30	40	50	60	70	85	100	120	150
Mass (kg/m)	1	1.8	2.7	3.8	6.8	10.6	15.6	21.3	32	45	69.5	116.6

Note: The minor diameter ϕd must be a value at which no groove is left after machining.

Hole Shape of the Standard Hollow Spline Shaft

Table 3 shows the hole shape of the standard hollow type spline shaft. Use this table when a requirement such as piping, wiring, air ventilation, or weight reduction needs to be met.



Type K

Table 3: Cross-Sectional Shape of the Standard Hollow Type Spline Shaft

Unit: mm

Nominal shaft diameter	20	25	30	40	50	60	70	85	100	120	150
Minor diameter ϕd	15.3	19.5	22.5	31	39	46.5	54.5	67	81	101	130
Major diameter ϕD_0	19.7	24.5	29.6	39.8	49.5	60	70	84	99	117	147
Ball center-to-center diameter ϕdp	20	25	30	40	50	60	70	85	100	120	150
Hole diameter (ϕd_4)	6	8	12	18	24	30	35	45	56	60	80
Mass (kg/m)	1.6	2.3	2.9	4.9	7	10	13.7	19.5	25.7	47.3	77.1

Note: The minor diameter ϕd must be a value at which no groove is left after machining.

Chamfering of the Spline Shaft Ends

To facilitate the insertion of the spline shaft into a spline nut, the shaft ends are normally chamfered with the dimensions indicated below unless otherwise specified.

● Chamfer A

If the spline shaft ends are stepped, tapped, or drilled as in Fig. 2, they are machined with the Chamfer A dimensions indicated in Table 4.

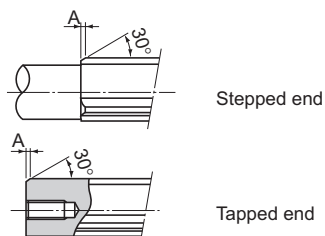


Fig. 2: Chamfer A

● Chamfer B

If either end of the spline shaft is not used, such as for cantilever support, it is machined with the chamfer B dimensions indicated in Table 4.

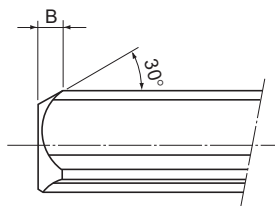


Fig. 3: Chamfer B

Table 4: Chamfer 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	1	1.5	2.5	3	3.5	5	6.5	7	7	7.5	8
Chamfer B	3.5	4.5	5.5	7	8.5	10	13	15	16	17	17	18

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

Length of the Incompletely Ground Area of a Special Spline Shaft

If any part of the spline shaft is thicker than the minor diameter (ϕd), incompletely ground spline grooves with rounded inside corners will be left by the grinding process. The relationship between the flange diameter (ϕdf) and the length of incomplete splines (S) is shown in Table 5.

(This table does not apply to overall length of 1,500 mm or greater. Contact THK for details.)

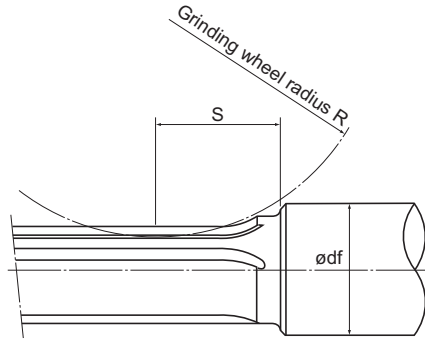


Table 5: Length of Incomplete Spline Area: S

Unit: mm

Flange diameter ϕdf	15	20	25	30	35	40	50	60	80	100	120	140	160	180	200
Nominal shaft diameter	15	20	25	30	35	40	50	60	80	100	120	140	160	180	200
15	32	42	49	55	60	—	—	—	—	—	—	—	—	—	—
20	—	35	43	51	57	62	—	—	—	—	—	—	—	—	—
25	—	—	51	64	74	82	97	—	—	—	—	—	—	—	—
30	—	—	—	54	67	76	92	105	—	—	—	—	—	—	—
40	—	—	—	—	—	59	80	95	119	—	—	—	—	—	—
50	—	—	—	—	—	—	63	83	110	131	—	—	—	—	—
60	—	—	—	—	—	—	—	66	100	123	140	—	—	—	—
70	—	—	—	—	—	—	—	—	89	115	134	150	—	—	—
85	—	—	—	—	—	—	—	—	61	98	122	140	—	—	—
100	—	—	—	—	—	—	—	—	—	78	108	130	147	—	—
120	—	—	—	—	—	—	—	—	—	—	81	111	133	150	—
150	—	—	—	—	—	—	—	—	—	—	—	64	101	125	144

Note: This table does not apply to overall lengths of 1,500 mm or greater. Contact THK for details.

Accessories

Ball spline models LBS and LBST are provided with a standard key as indicated in Table 6.

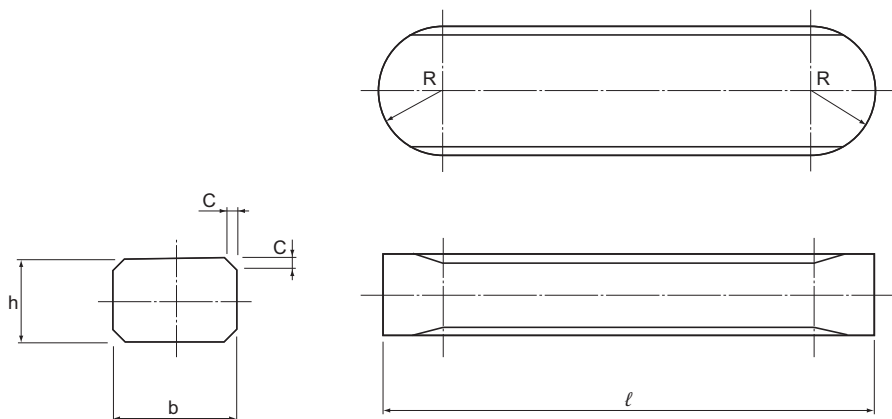


Table 6: Standard Keys for Models LBS and LBST

Unit: mm

Nominal shaft diameter	Width		Height		Length		R	C
	b	Tolerance (p7)	h	Tolerance (h9)	ℓ	Tolerance (h12)		
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	7	41	3.5				
LBS 40 LBST 40	10	+0.030 +0.015	8	0 -0.036	55	0 -0.300	5	
LBS 50 LBST 50	15		10		60		7.5	
LBST 60 LBS 70 LBST 70	18	+0.036 +0.018	12	0 -0.043	68	0 -0.400	9	1.2
LBS 85 LBST 85	20		13		80		14	
LBS 100 LBST 100	28	+0.043 +0.022	18	0 -0.052	93	0 -0.400	14	
LBST 120	28		18		123		14	
LBST 150	32	+0.051 +0.026	20	0 -0.052	157	0 -0.400	16	2

