Block Type Linear Ball Spline

LSB

Points

● **Block type for easy mounting**

1 The screw holes for mounting are provided on the slide unit, so that it can be easily mounted to the machine or device using bolts.

● **Stainless steel selections for excellent corrosion resistance**

2 Products made of stainless steel are highly resistance to corrosion, so that they are suitable for applications where rust prevention oil is not preferred, such as in a cleanroom environment.

Identification Number and Specification

Example of an identification number

The specification of LSB series is indicated by the identification number. Indicate the identification number, consisting of a model code, dimensions, a part code, a material code, a preload symbol, a classification symbol, an interchangeable code, and a supplemental code for each specification to apply.

Interchangeable specification	1	2	3	4	5	6	7	8	9	10
Single slide unit	LSB		10	C1		SL	T1		S1	/U
Single spline shaft	LSB		10		R200	SL		H	S1	
Assembled set	LSB		10	C1	R200	SL	T1	H	S1	/U

1 **Model** — Model code Page Ⅱ－133

2 **Spline shaft shape** — Model code Page Ⅱ－133

3 **Size** — Dimensions Page Ⅱ－133

4 **Number of slide units** — Part code Page Ⅱ－133

5 **Spline shaft length** — Part code Page Ⅱ－133

6 **Material type** — Material code Page Ⅱ－133

7 **Preload amount** — Preload symbol Page Ⅱ－134

8 **Accuracy class** — Classification symbol Page Ⅱ－134

9 **Interchangeable** — Interchangeable code Page Ⅱ－136

10 **Special specification** — Supplemental code Page Ⅱ－136

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Identification Number and Specification —Model · Spline Shaft Shape · Size · Slide Unit · Number of Slide Unit · Spline Shaft Length · Material Type · Preload Amount · Accuracy Class—

1 Model

Block Type Linear Ball Spline (LSB series) : LSB

For applicable models and sizes, see Table 1.

2 Spline shaft shape

Solid shaft	: No symbol	For applicable models and sizes, see Table 1.
Hollow shaft	: T	

3 Size

6, 8, 10, 13, 16, 20, 25 — For applicable models and sizes, see Table 1.

4 Number of slide units

: C○ — For an assembled set, indicates the number of slide units assembled on a spline shaft. For a single slide unit, only "C1" is specified.

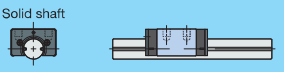
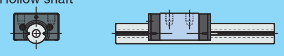
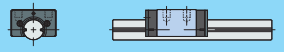
5 Spline shaft length

: R○ — The spline shaft length is indicated in mm. For standard and maximum lengths, see the dimension table.

6 Material type

High carbon steel made	: No symbol	For applicable models and sizes, see Table 1.
Stainless steel made	: SL	

Table 1 Models and sizes of LSB series

Material	Shape	Model	Size						
			6	8	10	13	16	20	25
High carbon steel made	Solid shaft 	LSB	○(1)	○(1)	○(1)	○	○	○	○
	Hollow shaft 	LSBT	○(1)	○(1)	○(1)	○	○	○	○
Stainless steel made	Solid shaft 	LSB···SL	○	○	○	–	–	–	–

Note (1) Slide units of size 6, 8, and 10 series are stainless steel-made only. When high carbon steel-made is specified for an assembled set, only the spline shaft will be high carbon steel-made.

Remark: The LSB series are all interchangeable specification. Non-interchangeable specification is not available.

7 Preload amount

Standard	: No symbol	Specify this item for an assembled set or a single slide unit. For details of the preload amount, see Table 2. For applicable preload types, see Table 3.
Light preload	: T1	

Table 2 Preload amount

Item / Preload type	Preload symbol	Preload amount N	Operational conditions
Standard	(No symbol)	0(1)	· Light and precise motion
Light preload	T_1	0.02 C_0	· Almost no vibrations · Load is evenly balanced · Light and precise motion

Note (1) Indicates zero or minimal amount of preload.

Remark: C_0 indicates the basic static load rating.

Table 3 Application of preload

Size	Preload type (preload symbol)	
	Standard (No symbol)	Light preload (T_1)
6	○	–
8	○	○
10	○	○
13	○	○
16	○	○
20	○	○
25	○	○

8 Accuracy class

Ordinary	: No symbol	Specify this item for an assembled set or a single spline shaft. For details of accuracy class, see Fig. 1, Table 4 and Table 5.
High	: H	

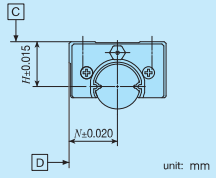


Fig. 1 Accuracy

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

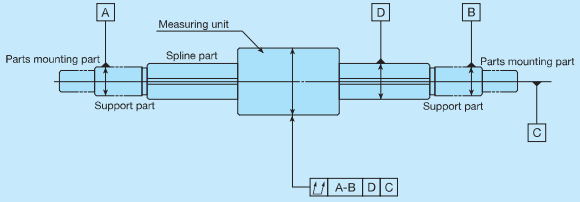
Table 4 Twist of grooves with respect to effective length of the spline part

unit: μm

Accuracy class	Ordinary (No symbol)	High (H)
Allowable value	33	13

Remark: The values can be applied to 100 mm of the effective length of the spline at any position.

Table 5 Allowable values of total radial runout of spline shaft axial line

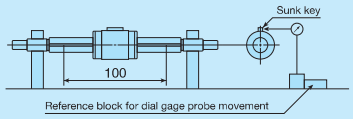
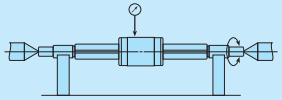


unit: μm

Overall length of spline shaft mm		Size 6, 8 Ordinary (No symbol)	6, 8 High (H)	10, 13 Ordinary (No symbol)	10, 13 High (H)	16, 20 Ordinary (No symbol)	16, 20 High (H)	25 Ordinary (No symbol)	25 High (H)
–	200	72	46	59	36	56	34	53	32
200	315	133	89	83	54	71	45	58	39
315	400	185	126	103	68	83	53	70	44
400	500	236	163	123	82	95	62	78	50
500	630	–	–	151	102	112	75	88	57
630	800	–	–	190	130	137	92	103	68
800	1 000	–	–	–	–	170	115	124	83
1 000	1 250	–	–	–	–	–	–	151	102

Remark: Applied to all models of the same size.

Table 6 Measuring methods of accuracy

Item	Measuring method	Illustration of measuring method
Twist of grooves with respect to effective length of the spline part (see Table 4)	While supporting the spline shaft fixed, apply a unidirectional torsion moment load to the measuring unit, place the dial gage probe vertically to the spline shaft on the side face of the sunk key attached on the external cylinder, and measure the deflection when the external cylinder and the dial gage probe are moved 100 mm in the axial direction at any position on the effective length of the spline shaft. However, the dial gage probe should be applied as near as possible to the outer peripheral face of the external cylinder.	
Total radial runout of axial line of spline shaft (See Table 5)	While supporting the spline shaft at its support part or at both centers, place a dial gage probe on the outer peripheral face of the measuring unit and measure the deflection from one rotation of the spline shaft at several positions in the axial direction to obtain the maximum value.	

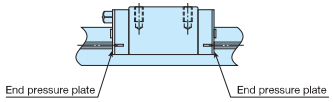
9 Interchangeable	S1 specification S2 specification	: S1 : S2	Assemble a spline shaft and a slide unit with the same interchangeable code. Performance and accuracy of "S1" and "S2" are the same.
10 Special specification	/N, /U		For applicable special specifications, see Table 7.

Table 7 Application of special specifications (Single slide unit and assembled set)

Special specification	Supplemental code	Size 6	8	10	13	16	20	25
No seal	/N	○	○	○	○	○	○	○
Under seal	/U	○	○	○	○	○	○	○

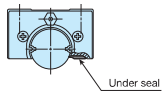
Remark: The combination of no seal (supplemental code/N) and under seal (supplemental code/U) is not available.

No seal /N



End seals at both ends of the slide unit can be replaced with end pressure plates, which do not come in contact with the spline shaft, to reduce frictional resistance.
This specification is not effective for dust protection.

Under seal /U



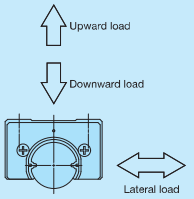
The seal is attached to the bottom of the slide unit to prevent foreign substances from entering from underneath.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Load Direction and Load Rating

The LSB series must be used with its load rating corrected in accordance to the load direction. The basic dynamic load rating and basic static load rating shown in the dimension table should be corrected to values in Table 8.

Table 8 Load ratings corrected for load direction



Load rating and load direction / Size	Basic dynamic load rating			Basic static load rating		
	Load direction			Load direction		
	Downward	Upward	Lateral	Downward	Upward	Lateral
6~20	C	C	$0.84C$	C_0	C_0	$0.84C_0$
25	C	C	C	C_0	C_0	C_0

Identification Number and Quantity for Ordering

To order an assembled set of LSB series, please specify the number of sets based on the number of spline shafts. For slide unit or single spline shafts, please specify the number of units.

Single slide unit

(When 2 units are needed)

Example of identification number indication

LSB 13 C1 T1 S○ /U

Please specify S1 or S2.

Only C1 can be specified.

Order quantity: 2units

Single spline shaft

(When 1 unit is needed)

Example of identification number indication

LSB 13 R200 H S○

Please specify S1 or S2.

Order quantity: 1unit

Assembled set

(When 1 set is needed)

Example of identification number indication

LSB 13 C2 R200 T1 H S○ /U

Please specify S1 or S2.

Order quantity: 1set

Moment of Inertia of Sectional Area and Section Coefficient of Spline Shaft

Table 9 Moment of inertia of sectional area and section coefficient of spline shaft

Identification number	Moment of inertia of sectional area mm⁴		Section coefficient mm³	
	Solid shaft	Hollow shaft	Solid shaft	Hollow shaft
6	55	54	19	19
8	170	170	44	43
10	440	420	90	87
13	1 220	1 160	190	180
16	2 830	2 630	360	340
20	7 110	6 620	730	680
25	17 600	15 100	1 440	1 230

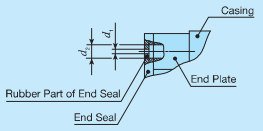
Lubrication

Lithium-soap base grease (MULTEMP PS No.2 [KYODO YUSHI CO., LTD.]) is pre-packed in LSB series.
The LSB series has grease nipple or oil hole as indicated in Table 10 and Table 11. For supply nozzle applicable to each grease nipple and dedicated supplying equipment (miniature greaser) applicable to oil holes, see Table 13 and Table 14.

Table 10 Parts for lubrication

Size	Grease nipple type	Applicable supply nozzle type
6, 8, 10	Oil hole	Miniature greaser
13, 16, 20	A-M3	A-5120V A-5240V
25	A-M4	B-5120V B-5240V

Table 11 Oil hole specifications



Size	d_1	d_2
6, 8	0.5	1.2
10		1.5

Table 12 Dimensions and shape of grease nipple

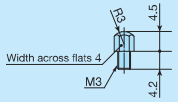
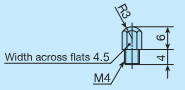
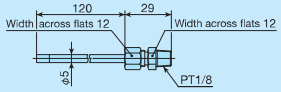
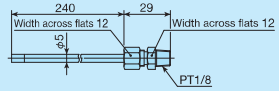
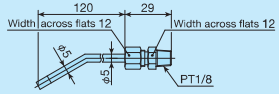
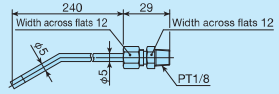
Model	Dimensions and shape
A-M3	
A-M4	

Table 13 Miniature greaser

Identification number	Grease name	Amount	Outside diameter of grease feed needle
MG10/MT2	MULTEMP PS No.2 [KYODO YUSHI CO., LTD.]	10ml	ϕ1mm
MG10/CG2	IKO Low Dust-Generation Grease for Clean Environment CG2		
MG2.5/EP2	Alvania EP Grease 2 [SHOWA SHELL SEKIYU K. K.]	2.5ml	
MG2.5/CG2	IKO Low Dust-Generation Grease for Clean Environment CG2		
MG2.5/CGL	IKO Low Dust-Generation Grease for Clean Environment CGL		
MG2.5/AF2	IKO Anti-Fretting Corrosion Grease AF2		

Table 14 Types and dimensions of supply nozzle

Model	Dimensions and shape
A-5120V	
A-5240V	
B-5120V	
B-5240V	

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Dust Protection

The slide units of LSB series are equipped with end seals as standard for dust protection. However, if large amount of contaminant or dust are floating, or if large particles of foreign substances such as chips or sand may adhere to the spline shaft, it is recommended to attach a protective cover to the linear motion mechanism.

Precaution for Use

❶ Mounting surface, reference mounting surface and typical mounting structure

When mounting the LSB, properly align the reference mounting surface D of the slide unit with the reference mounting surface of the table and fix it. (See Fig. 2)
Outside diameter surface of the spline shaft, reference mounting surface D and mounting surface C are precisely ground. Machining the mounting surface of the table and bed, such as machine or device, to high accuracy and mounting them properly will ensure stable linear motion with high accuracy.
Reference mounting surface of the slide unit is the opposite side of the IKO mark. (See Fig. 3)

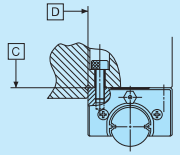


Fig. 2 Reference mounting surface and typical mounting structure

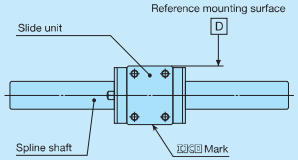


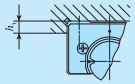
Fig. 3 Reference mounting surface

❷ Shoulder height of reference mounting surface

For the opposite corner of the mating reference mounting, it is recommended to have relieved fillet as indicated in Fig. 4. Recommended value for the shoulder height on the mating side is indicated in Table 15.

Fig. 4 Corner of the mating reference mounting

Table 15 Shoulder height



unit: mm

Size	Shoulder height
6	2
8	2.5
10	3
13	3.5
16	4
20	5
25	6

❸ Additional machining of spline shaft end

The spline shaft is hardened by induction hardening. When additional machining on the shaft end is needed, make sure that the maximum diameter of the shaft end machining part does not exceed the dimension d_1 in the dimension table.
Spline shafts with special shaft end shapes can be prepared upon request. Contact IKO for further information.

❹ Multiple slide units used in close proximity

When using multiple slide units in close proximity, greater load may be applied than the calculated value depending on the accuracy of the mounting surfaces and reference mounting surfaces of the machine or device. In such cases, allowance for greater applied load than the calculated value should be made.
In addition, special products with variation between H and N dimensions aligned can be prepared upon request. Contact IKO for further information.

❺ Operating temperature

The maximum operating temperature is 120°C and temperature up to 100°C is allowed for continuous operation. When the temperature exceeds 100°C, contact IKO.

❻ When mounting multiple assembled sets at the same time

Assemble a slide unit and a spline shaft with the same interchangeable code ("S1" or "S2").

❼ Assembly of slide unit on spline shaft

When inserting a slide unit to the spline shaft, handle with care not to pry open the shaft and drop the balls.

❽ Tightening torque for fixing screw

Typical tightening torque for mounting of the LSB series to the steel mating member material is indicated in Table 16. When vibration and shock of the machine or device are large, fluctuating load is large, or moment load is applied, fix it by using the torque 1.2 to 1.5 times larger than the value indicated in the table as necessary. If the mating member material is cast iron or aluminum alloy, reduce the tightening torque depending on the strength characteristics of the mating member material.

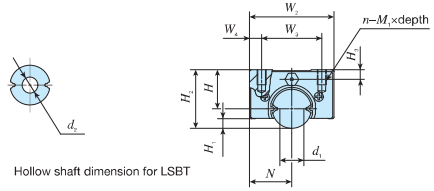
Table 16 Tightening torque for fixing screw

Bolt size	Tightening torque N・m	
	High carbon steel-made screw	Stainless steel-made screw
M2×0.4	0.50	0.31
M3×0.5	1.8	1.1
M4×0.7	4.1	–
M5×0.8	8.0	–
M6×1	13.6	–

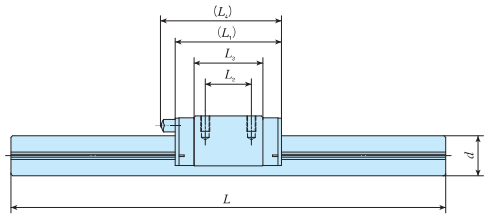
Note (1) The tightening torque is calculated based on strength division 12.9 and property division A2-70.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Shape	LSB
Size	6 8 10 13 16 20 25



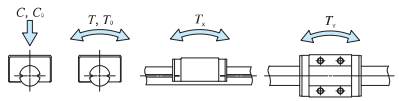
Hollow shaft dimension for LSBT



Identification number	Interchangeable	Mass (Ref.) g: Slide unit	Mass (Ref.) g: Spline shaft (per 100 mm)	Dimensions of assembly mm: H	H_1	H_2	N	Dimensions of slide unit mm: W_2	W_3	W_4	L_1	L_2	L_3	L_4	$n-M_1\times$ depth	H_3	Spline shaft dimensions and tolerances mm: d	Dim. d tolerance(1)	d_1(2)	d_2	L(3)	Maximum length	Basic dynamic (4) load rating C N	Basic static (4) load rating C_0 N	Dynamic (4) torque rating T N·m	Static (4) torque rating T_0 N·m	Static moment rating (4) T_X N·m	Static moment rating (4) T_Y N·m
LSB 6	○	7.6	21.2	6	1.1	9	6.5	13	8	2.5	20	—	12.5	—	2—M2× 3	1.5	6	$^{0}_{-0.012}$	3.7	—	150 200	300	675	1 090	2.0	3.3	2.3 / 13.6	1.9 / 11.4
LSBT 6	○		18.8																	2								
LSB 6···SL	○		21.2																	—			540	875	1.6	2.6	1.8 / 10.9	1.5 / 9.1
LSB 8	○	18	37.6	8	1.3	12	9	18	12	3	25	8	15.6	—	4—M3× 3	1.5	8	$^{0}_{-0.015}$	5	—	150 200 250	500	1 340	1 890	5.4	7.6	4.7 / 30.2	3.9 / 25.4
LSBT 8	○		32.1																	3		400						
LSB 8···SL	○		37.6																	—		500	1 070	1 510	4.3	6.1	3.7 / 24.2	3.1 / 20.3
LSB 10	○	34	59.7	10	1.9	15	10.5	21	15	3	31	10	21.2	—	4—M3× 4	2.5	10	$^{0}_{-0.015}$	6.9	—	200 300	600	1 810	2 760	9.1	13.8	9.1 / 53.0	7.6 / 44.5
LSBT 10	○		49.8																	4								
LSB 10···SL	○		59.7																	—			1 450	2 200	7.3	11.0	7.3 / 42.4	6.1 / 35.6
LSB 13	○	62	100	13	3.2	19.5	14	28	20	4	35	15	22.4	40	4—M3× 5	3.2	13	$^{0}_{-0.018}$	9	—	200 300 400	800	3 330	4 290	21.7	27.9	15.4 / 96.3	12.9 / 80.8
LSBT 13	○		77.9																	6								
LSB 16	○	112	152	16	4.2	24	16.5	33	25	4	43	20	28.8	48	4—M4× 6	4	16	$^{0}_{-0.018}$	11.4	—	200 300 400	1 000	4 980	6 490	39.9	51.9	29.7 / 176	24.9 / 148
LSBT 16	○		113																	8								
LSB 20	○	215	240	20	5.8	30	20	40	30	5	53	25	37.3	58	4—M5×10	5	20	$^{0}_{-0.021}$	15	—	300 400 500 600	1 000	6 670	9 080	66.7	90.8	52.7 / 299	44.2 / 251
LSBT 20	○		178																	10								
LSB 25	○	403	376	25	6	37.5	26	52	40	6	67	30	41.8	70	4—M6×12	6	25	$^{0}_{-0.021}$	19.3	—	300 400 500 600 800	1 200	10 500	13 400	136	175	95.6 / 566	95.6 / 566
LSBT 25	○		237																	15								

Notes (1) This does not apply to hollow shaft (LSBT).
(2) d_1 represents the maximum diameter for end machining.
(3) Represents standard length. We can produce other than the standard length, please specify the length of spline shaft by indicating the length in mm with the identification number.
(4) The direction of basic dynamic load rating (C), basic static load rating (C_0), dynamic torque rating (T), static torque rating and static moment rating (T_0, T_X, T_Y) are shown in the sketches below.
The upper values of T_X and T_Y are for one slide unit and the lower values are for two slide units in close contact.

Remarks 1. Block type Linear Ball Spline are all interchangeable specification.
2. LSB 6, LSBT 6, LSB 6···SL, LSB 8, LSBT 8, LSB 8···SL, LSB 10, LSBT 10, and LSB 10···SL are provided with oil holes.
The specifications of grease nipple and oil hole are shown in Table 11 and Table 12 on page Ⅱ-138.



Example of identification number of assembled set

Model code		Dimensions	Part code		Material code	Preload symbol	Classification symbol	Interchangeable code	Supplemental code
LSB		10	C2	R300	SL	T1	H	S1	/N
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

① Model: LSB

② Spline shaft shape

No symbol	Solid shaft
T	Hollow shaft

③ Size: 6, 8, 10, 13, 16, 20, 25

④ Number of slide units (2 pcs.)

⑤ Length of spline shaft (300 mm)

⑥ Material type

No symbol	High carbon steel made
SL	Stainless steel made

⑦ Preload amount

No symbol	Standard
T1	Light preload

⑧ Accuracy class

No symbol	Ordinary
H	High

⑨ Interchangeable

S1	S1 specification
S2	S2 specification

⑩ Special specification: N, U

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch