



NEW

Miniature Ball Spline

LTS / LT-X

Compact design (volume comparison: 80% of conventional THK product)

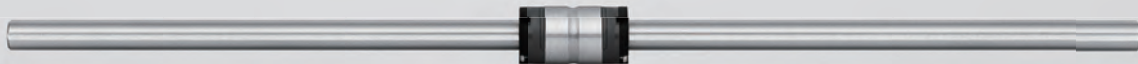
Stable, smooth motion

Corrosion resistant Martensite stainless steel

Spline shaft diameter $\phi 4$, $\phi 5$, $\phi 6$, and $\phi 8$



LTS5 Actual Size



LT4X Actual Size

For details, visit THK at www.thk.com

*Product information is updated regularly on the THK website.

Miniature Ball Spline

Achieves Compact Design, High Rigidity, and Long Life

Miniature Ball Spline LTS/LT-X uses a new circulation method employing end caps and four rows of circular arc grooves (raceways) to enable stable and smooth motion with a small rolling resistance fluctuation.

Compact

The new circulation method used in LTS/LT-X makes it significantly more compact than THK's conventional LT. Because the LT-X nut has the same outer diameter and length as THK linear bushing model LM, the linear bushing can be replaced with a miniature ball spline LT-X.



High Rigidity

For a given nut size, an LT-X one spline shaft size larger or an LTS two sizes larger can be used instead of the conventional LT, for significantly improved rigidity.

Smooth Motion (Small Rolling Resistance Fluctuation)

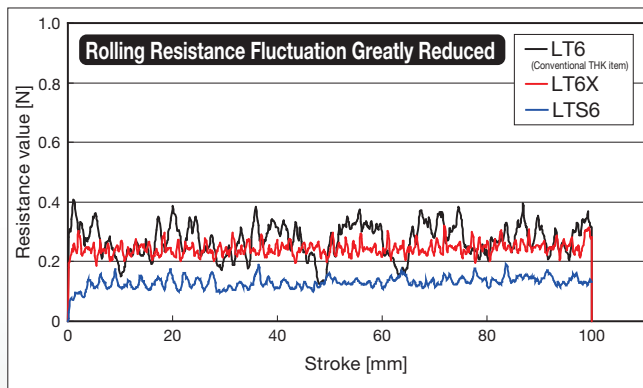
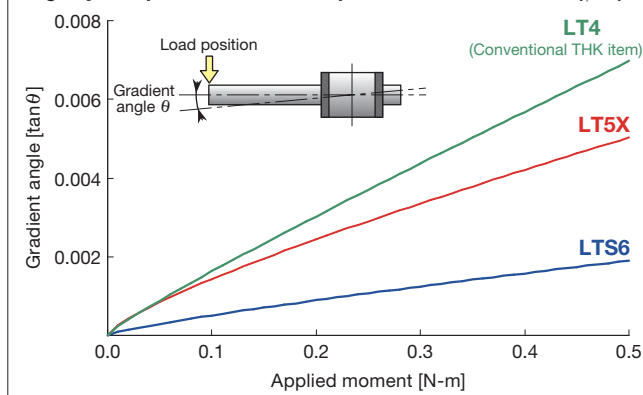
The new circulation method used in LTS/LT-X achieves more stable and smoother motion than THK's conventional LT.

Item	Description
Model No.	LT6/LT6X/LTS6
Speed	10mm/s
Lubricant	AFF Grease

Corrosion Resistant

LTS and LT-X use martensitic stainless steel for the spline nut, spline shaft, and balls, so it is corrosion resistant and an optimal choice for clean environments.

Rigidity Comparison with Same Spline Nut Outer Diameter ($\phi 10$)



Miniature Ball Spline

Achieves a Substantially More Compact Design.

More compact spline nut dimensions for the same shaft diameter.
Larger shaft diameter for the same spline nut dimensions.

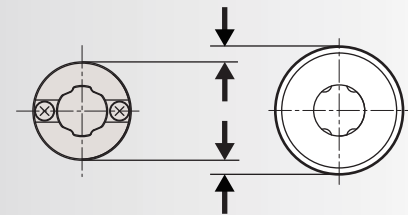
LT-X

(Comparison with THK's conventional LT)



LTS

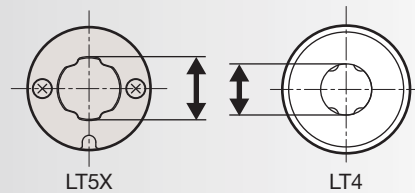
(Comparison with THK's conventional LT)



LT4X

LT4

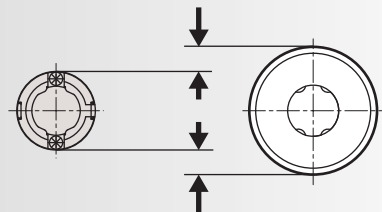
Spline shaft diameter	Spline nut dimensions	
	LT-X	LT
4	8	10
5	10	12
6	12	14



LT5X

LT4

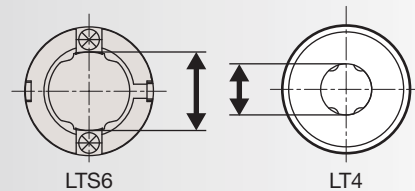
Spline nut dimensions	Spline shaft diameter	
	LT-X	LT
8	4	-
10	5	4
12	6	5
14	-	6



LTS4

LT4

Spline shaft diameter	Spline nut dimensions	
	LTS	LT
4	6.5	10
5	8	12
6	10	14
8	13	16



LTS6

LT4

Spline nut dimensions	Spline shaft diameter	
	LTS	LT
6.5	4	-
8	5	-
10	6	4
12	-	5
13	8	-

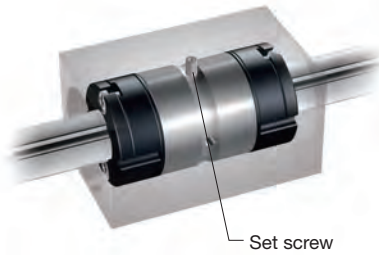
Mounting method (LT-X)

When fitting the spline nut and housing together for Miniature Ball Spline model LT-X, it is recommended that they be loose fitting to avoid deformation of the spline nut.

Housing Inner-diameter Tolerance	General conditions	H6
	If the accuracy does not need to be very high	H7

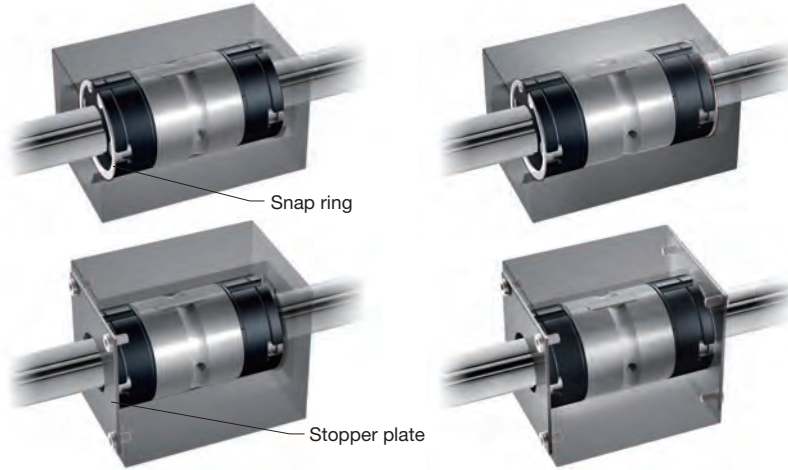
Mount Miniature Ball Spline model LT-X using the keyway on the nut (countersunk portion on LT4X). Also, the same as with THK's conventional Linear Bushing, mounting can also be carried out using a snap ring or stopper plate.

Model LT4X Housing



When mounting model LT4X, use M2 screws with thread lock, turning so they lightly contact the nut. To prevent deformation of the spline nut, avoid tightening the screws.

Mounting with snap ring and with stopper plate



Both ends of Miniature Ball Spline model LT-X's spline nut are resin end caps. Avoid applying excessive loads, as striking or strongly pushing may damage the caps. When using adhesive, contact THK for details.

Mounting method (LTS)

The method for mounting LTS is the same as described above for LT-X, except for the set screw. Contact THK for details on how to prevent rotation.

Accuracy Standards

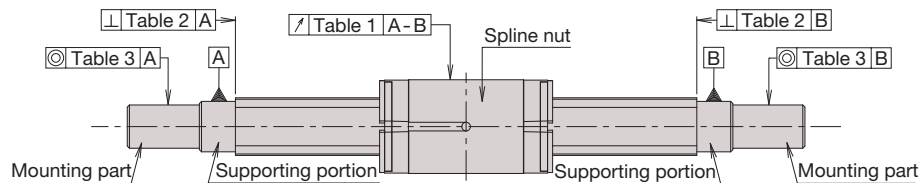


Table 1 Runout of the Spline Nut Circumference in Relation to the Support of the Spline Shaft

Overall spline shaft length [mm]	Runout (MAX) [μm]			
	Normal grade (No symbol)	High accuracy grade (H)	Precision Grade (P)	
-	200 or less	72	46	26
Above 200	315 or less	133	89	57
Above 315	400 or less	171	114	-
Above 400	500 or less	214	-	-

Table 2 Perpendicularity of the Spline Shaft End Face in Relation to the Support of the Spline Shaft

Perpendicularity (MAX) [μm]		
Normal grade (No symbol)	High accuracy grade (H)	Precision Grade (P)
22	9	6

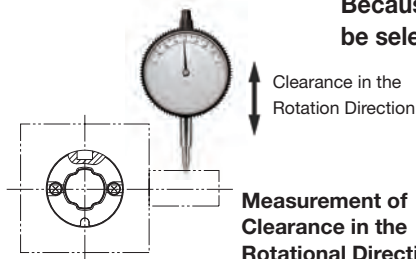
Table 3 Concentricity of the Part-mounting in Relation to the Support of the Spline Shaft

Concentricity (MAX) [μm]		
Normal grade (No symbol)	High accuracy grade (H)	Precision Grade (P)
33	14	8

Clearance in the Rotation Direction

With the Ball Spline, the clearance in the rotation direction is standardized as the sum of clearances in the circumferential direction.

Because clearance values are standardized per each shaft diameter, clearances can be selected to match usage conditions.



Measurement of Clearance in the Rotational Direction

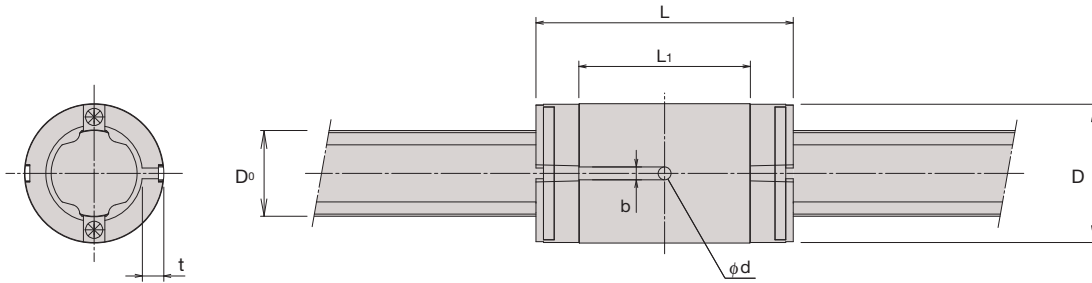
Table 4 Clearance in the rotation direction for LTS [μm]

Model No.	Normal Clearance	Clearance CL
LTS4	-0.4 to +0.4	-0.8 to -0.4
LTS5	-0.8 to +0.8	-1.3 to -0.8
LTS6	-1.0 to +1.0	-1.5 to -1.0
LTS8	-1.2 to +1.2	-1.8 to -1.2

Table 5 Clearance in the rotation direction for LT-X [μm]

Model No.	Normal Clearance	Clearance CL
LT4X	-2 to +1	-6 to -2
LT5X/XL	-2 to +1	-6 to -2
LT6X/XL	-2 to +1	-6 to -2

Dimensional Table for Model LTS



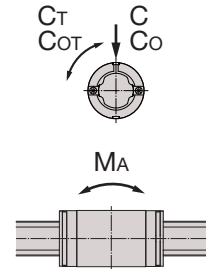
Unit: mm

Model No.	Spline shaft diameter D _{h7}	Spline nut dimensions							Basic Load Rating		Permissible moment M _A [N·m]	Basic torque rating		Nut mass [g]
		Outer diameter		Length		Pin hole			C [N]	C ₀ [N]		C _T [N·m]	C _{0T} [N·m]	
		D	Tolerance	L ⁰ _{-0.2}	L ₁	d H8	b ^{+0.1} ₀	t						
LTS4	4	6.5	⁰ _{-0.009}	14.2	9.4	1	1	1.2	336	701	1.042	0.384	0.802	1.46
LTS5	5	8	⁰ _{-0.009}	14.6	8.6	1	1	1.4	667	1095	1.634	0.976	1.602	2.04
LTS6	6	10	⁰ _{-0.009}	19	12	1.2	1.2	1.9	1061	1752	3.434	1.862	3.076	4.68
LTS8	8	13	⁰ _{-0.011}	24	16	1.2	1.2	2.4	1500	2387	6.191	6.451	10.262	10.26



Precautions To Be Taken if an Eccentric Load Is Applied

By incorporating four rows of raceways, LTS offers greatly enhanced performance with regard to eccentric loads (moment and torque) when compared to THK's conventional Linear Bushing LM. However, under heavy eccentric loads poor operation or premature failure may result. Avoid applying excessive eccentric loads.



Maximum Manufactured Lengths for Model LTS Spline Shaft

Maximum Manufactured Lengths for Model LTS Spline Shaft

Model No.	Shaft diameter D _{h7}	Mass [g/m]	Maximum manufactured lengths [mm]		
			Normal grade (No symbol)	High accuracy grade (H)	Precision grade (P)
LTS4	4	96	200	150	100
LTS5	5	149	250	200	100
LTS6	6	215	315	250	200
LTS8	8	376	500	400	315

Material: equivalent to SUS440C
Hardness: 58 to 64 HRC

Model number coding

2

LTS6

CL

+100L

H

Model No.

Symbol for clearance in the rotational direction

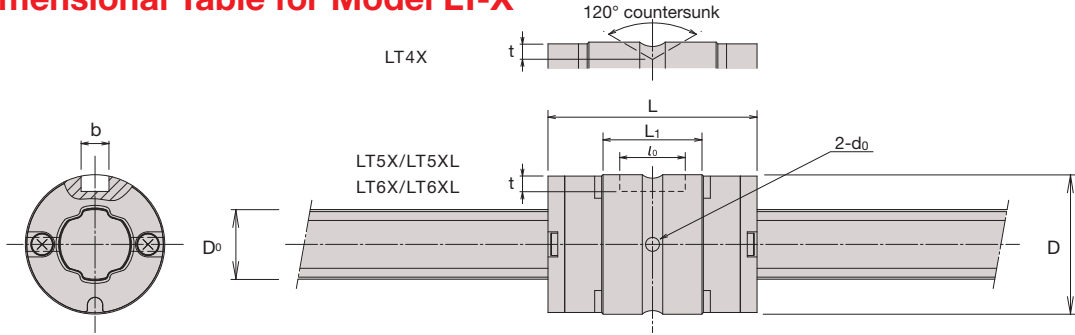
Accuracy symbol

Number of spline nuts on one shaft (no symbol for one nut)

Overall spline shaft length (in mm)

Also available are products with a specified clearance between spline shaft and spline nut, preload products (0 or less clearance), inclusion of specified grease (comes standard with THK-AFF grease fed and anti-rust oil applied), and considerations such as surface treatment (THK AP-C treatment, THK AP-CF treatment, THK AP-HC treatment). Contact THK for details.

Dimensional Table for Model LT-X



Unit: mm

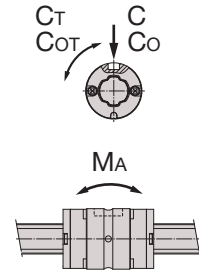
Model No.	Spline shaft diameter D _{h7}	Spline nut dimensions							Greasing hole d ₀	Basic Load Rating		Permissible moment M _A [N-m]	Basic torque rating		Mass [g]
		Outer diameter		Length		Keyway				C [N]	C ₀ [N]		C _T [N-m]	C _{0T} [N-m]	
		D	Tolerance	L ⁻¹	L ₁	b H8	t	l ₀							
LT4X	4	8	⁰ -0.009	14.4 (12.0)	7.5	-	1	-	1	420	700	0.84	0.49	0.82	2.4
LT5X	5	10	⁰ -0.009	15 (13.6)	7.3	2	1.2	4.7	1	560	850	1.04	0.82	1.25	3.7
LT5XL		10		26 (24.6)	18.3	2	1.2	4.7	1	1090	2190	6.11	1.59	3.20	8.4
LT6X	6	12	⁰ -0.011	19 (17.6)	10.2	2	1.2	6	1	980	1580	2.85	1.73	2.77	7.2
LT6XL		12		30 (28.6)	21.2	2	1.2	6	1	1600	3150	10.6	2.81	5.54	13.9

*1: Spline nut length L is length with contamination protection accessory UU mounted. Values in () are appropriate dimensions without contamination protection accessory UU.



Precautions To Be Taken if an Eccentric Load Is Applied

By incorporating four rows of raceways, LT-X offers greatly enhanced performance with regard to eccentric loads (moment and torque) when compared to THK's conventional Linear Bushing LM. However, under heavy eccentric loads poor operation or premature failure may result. Avoid applying excessive eccentric loads.



Maximum Manufactured Lengths for Model LT-X Spline Shaft

Maximum Manufactured Lengths for Model LT-X Spline Shaft

Model No.	Shaft diameter D _{h7}	Mass [g/m]	Maximum manufactured lengths [mm]		
			Normal grade (No symbol)	High accuracy grade (H)	Precision grade (P)
LT4X	4	95	200	150	100
LT5X/XL	5	150	250	200	100
LT6X/XL	6	220	315	250	200

Material: equivalent to SUS440C
Hardness: 58 to 64 HRC

Model number coding

2

LT6X

UU

CL

+100L

H

Model No.

Contamination protection accessory symbol

Symbol for clearance in the rotational direction

Accuracy symbol

Number of spline nuts on one shaft (no symbol for one nut)

Overall spline shaft length (in mm)

Also available are products with a specified clearance between spline shaft and spline nut, preload products (0 or less clearance), inclusion of specified grease (comes standard with THK-AFF grease fed and anti-rust oil applied), and considerations such as surface treatment (THK AP-C treatment, THK AP-CF treatment, THK AP-HC treatment). Contact THK for details.

THK Miniature Ball Spline LTS/LT-X

Precautions on use

●The Spline Nut and the Spline Shaft

- Do not remove the spline nut from the spline shaft unless it is necessary. If reinstalling the spline nut onto the spline shaft after inevitably removing the nut, align the ball position in the spline nut with the groove position of the spline shaft, and gradually insert the spline shaft straight into the spline nut. If the spline shaft is tilted when it is inserted, balls may fall out or the circulation part may be damaged.
- If the spline shaft gets stuck halfway while being inserted into the nut, do not force the shaft into the nut, but pull it out once, recheck the ball position and the groove position of the spline shaft, then gradually insert the shaft straight into the nut.
- After inserting the spline shaft into the spline nut, check whether the spline nut or the spline shaft smoothly moves. If the spline shaft was forcibly inserted, functional loss may have occurred even if the product looks intact.

●Handling

- Do not disassemble the parts. Doing so may cause dust to enter the product or degrade the assembly accuracy.
- Tilting the spline nut or the spline shaft when they are assembled may cause it to fall by its own weight.
- Dropping or hitting the Miniature Ball Spline may damage it. Subjecting the product to impact may cause functional loss even if the product looks intact.

●Lubrication

- Thoroughly remove anti-rust oil and feed a lubricant before using the product.
- Do not mix lubricants of different physical properties.
- In locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, normal lubricants may not be used. Contact THK for details.
- When planning to use a special lubricant, contact THK before using it.
- When adopting oil lubrication, the lubricant may not be distributed throughout the product depending on the mounting orientation of nut. Contact THK for details.
- Lubrication interval varies according to the conditions. Contact THK for details.

●Precautions on Use

- Entrance of foreign material may damage the ball circulation part or cause functional loss. Prevent foreign material, such as dust and cutting chips, from entering the product.
- When planning to use the product in an environment where the coolant penetrates into the spline nut, it may disrupt the function of the product depending on the type of the coolant. Contact THK for details.
- Do not use the product at a temperature above 80°C. Contact THK if you desire to use the product at a temperature above 80°C.
- If foreign material, such as dust or cutting chips, adheres to the product, replenish the lubricant after cleaning the product. For the type of the cleaning fluid to be used, contact THK.
- When using the product in locations exposed to constant vibrations or in special environments such as clean rooms, vacuum and low/high temperature, contact THK in advance.
- Removing the spline nut from the spline shaft then reinstalling it onto the shaft may cause balls to fall. Take much care in handling the product.

●Storage

- When storing the Miniature Ball Spline, enclose it in a package designated by THK and store it in a horizontal orientation while avoiding high temperature, low temperature and high humidity.

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