

# Ball Splines Overview

## Guideline for Products

- Max. 40% Price Reduction (compared with products of part number)
- Specified in 1 mm increments, short lead time.
- A wide variety of shaft end configurations

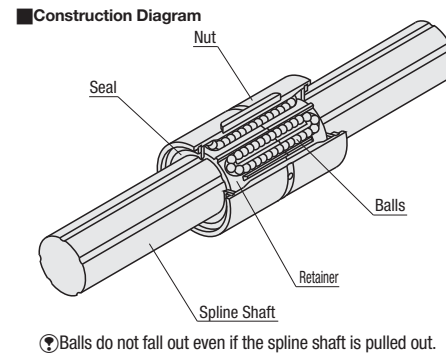
**68,10 EUR~**  
**10th day shipping**  
**9 Shapes (Alteration is available)**

## Structure

Ball spline is a linear motion mechanism with infinite linear motion travels of a nut on a spline shaft. It can bear radial loads and rotational torque simultaneously due to the structure where balls within a nut roll smoothly.

## Features

- Capable of highly accurate linear motion**  
Applying preload makes ball splines capable of highly accurate linear motion.
- Capable of transmission of torque**  
Rotary motion of balls on grooves of spline shaft makes ball spline capable of linear motion while transmitting torque.
- Capable of changing into compact design**  
Ability to transmit torque makes ball spline capable of guiding by single shaft.
- High load capability and long life**  
High load capacity and long running life due to presence of grooves of splines on the surface where loads are applied.



## Comparison of Characteristics with Other Linear Motion Mechanism

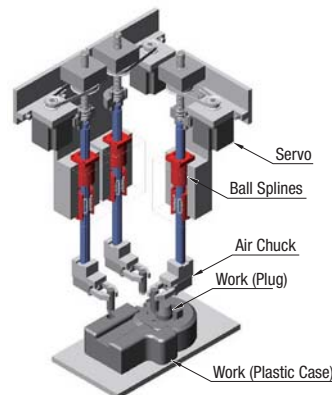
Ball splines are used in many machine applications requiring linear motion and rotary motion for space saving, cost, and weight advantages.

Linear Motion Mechanism	Ball Splines	Linear Bushings	Linear Guides
Radial Load	○	△	○
Rotational torque	○	X	X
Cost	○	○	△
Mass	○	○	△

## Application Examples

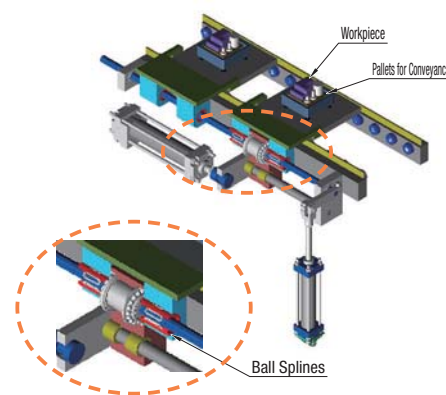
### 1 Pick and Place Application

For linear and rotational motions of each axis are needed in space-savings, ball splines capable of linear motion and torque transmission are effective.



### 2 Work Transfer Mechanism

Space saving designs are made possible by a Ball Spline capable of torque transmitting and guiding in a single shaft package.



## Accuracy

**■ Spline Shaft: Raceway Twist Tolerance (Max.)** Unit: μm

Material	Tolerance
1.3505/100Cr6	13
1.4125/X105CrMo17	33

Spline groove twist is measured at an arbitrary 100mm section of the effective shaft length. If the length to be evaluated is longer or shorter than 100mm, proportionally add or subtract from the standard values in the table.

Reference: Supporting portion is the part to mount the bearing and support the spline shaft.

Rotational Clearance		Tolerance (max) of accuracies against spline shaft supporting portions		Spline Shaft						
No.	Standard Preload	No.	(1) Spline Portion Perpendicularity of End Face of the Shafts	(2) Flange face Perpendicularity	Full Length	(3) Max. radial runout of spline nut outer surface against spline shaft supporting axis	No. 6 + 8	No. 10	No. 13 + 16	No. 20 + 25 + 30
6	-2~+1	6	9	11	~ 200	46 (72)	36 (59)	34 (56)	32	
8		8			201~ 315	89	54 (83)	45 (71)	39	
10	-3~+1	10	11	13	316~ 400	126	68 (103)	53 (83)	44	
13		13			401~ 500	163	82	62	50	
16	-4~+2	16	13	16	501~ 630	-	102	75	57	
20		20			631~ 800	-	-	-	68	
25	-4~+2	25	13	16	801~ 1000	-	-	-	83	
30		30			1001~ 1150	-	-	-	102	

Ⓞ Values in ( ) are for 1.4125/X105CrMo17.

## Calculation of Life Span

### Running Life

**- Radial Load**

$$L = \left( \frac{ft \cdot fh \cdot fp}{fw} \cdot \frac{Cr}{F} \right)^3 \cdot L_0$$

**- Torque Load**

$$L = \left( \frac{ft \cdot fh \cdot Ct}{fw} \cdot \frac{Cr}{T} \right)^3 \cdot L_0$$

**L:** Running Life (km)  
**Cr:** Basic Dynamic Radial Load Rating (N)  
**Ct:** Basic Dynamic Torque (Nm)  
**F:** Applied Radial Load (N)  
**T:** Applied Torque (Nm)  
**L0:** Rated Life (50km)

### Life Hours

$$L_h = \frac{10^6 \cdot L}{120 \cdot St \cdot n}$$

**Lh:** Running Time (hr)  
**L:** Running Life (km)  
**St:** Stroke Length (mm)  
**n:** Reciprocating cycles per Minute (cpm)

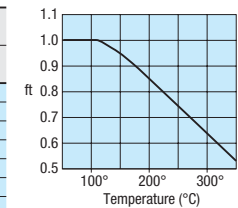
Ⓞ For values and factors, see below.

### Load Rating

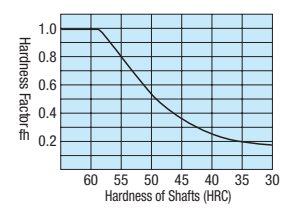
No.	Basic Rated Torque		Basic Load Rating		Allowable Static Moment	
	Dynamic Ct Nm	Static Cot Nm	Dynamic C kN	Static Co kN	M01 Nm	M02 Nm
6	3.8	7	1.2	2.1	5	36
8	4.8	8.7	1.2	2.1	5	36
10	19	34	3.8	6.9	26	181
13	28	52	4.6	8.3	36	251
16	51	93	6.2	11.1	56	386
20	85	154	8.5	15.3	83	611
25	193	348	15.4	27.7	173	1248
30	272	490	18.5	33.3	212	1581

Ⓞ Allowable static moment M01, M02

### Temperature Factor (ft)



### Hardness Factor (fh)



### Load Factor (fw)

Conditions of Use	Load Factor (fw)
Minimal vibrations / shocks, Low speed 15m/min. or less	1.0~1.2
Some vibrations / shocks, Medium speed 60m/min. or less	1.2~2.0
Significant vibrations / shocks, High speed over 60m/min.	2.0~3.5

## Operating Environment

### Lubrication

Ball splines are shipped greased. Administer lubrication maintenance as needed.

### Operating Temp.

Plastic components are used in ball spline assemblies. Avoid usage in high temperature environments, keep below 80°C.

## Installation Precautions

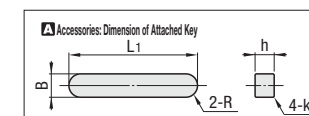
### Shaft Fits

An H7 tolerance is recommended for mating bores for the spline nuts.

### Dimension of Key (Included)

No.	B	Tolerance μm	h	Tolerance μm	L1	R
6	2.5	+16	2.5	0	10.5	1.25
8					10.5	
10	3	+6	3	-25	17 (14)	1.5
13					17 (14)	
16	3.5	+24	3.5	0	18 (18)	1.75
20					29	
25	4	+12	4	-30	33	2.0
30					42	

Ⓞ Values in ( ) are for 1.4125/X105CrMo17.

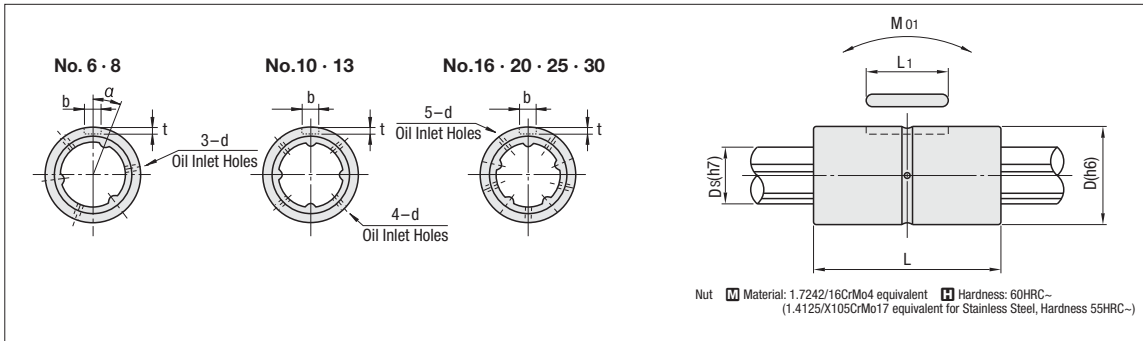




CAD Data

CAD Data

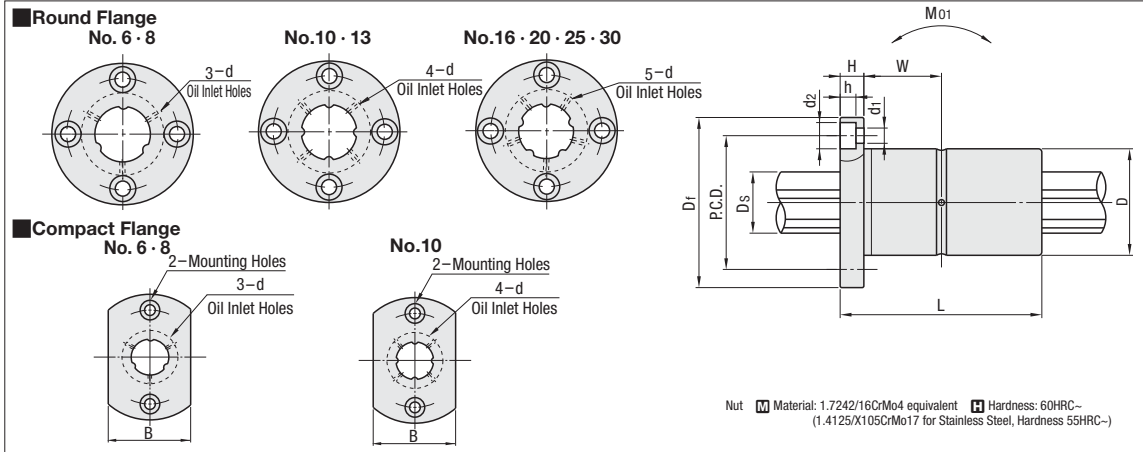
## Straight Nuts



No.	D (h6)	L	b	Tolerance $\mu\text{m}$	t+0.05 0	L1	d	Ds (h7)	$\alpha$	Cross Sectional Moment of Inertia $\text{mm}^4$	Mass (Reference)						
											Nut kg	Shaft kg/m					
6	14	25	2.5	+14 0	1.2	10.5	1.5	6	15°	6.2 x 10	0.23	0.23					
8	16	30	3										8	25°	1.97x10 <sup>2</sup>	0.39	0.39
10	21	40 (33)	3										10.4		5.57x10 <sup>2</sup>	0.06	0.65
13	24	44 (36)	3	+18 0	1.5	17(14)	1.5	13.4	-	1.55x10 <sup>3</sup>	0.07	1.11					
16	31	50	3.5										16.6		3.61x10 <sup>3</sup>	0.15	1.65
20	35	63	4										20.6		8.74x10 <sup>3</sup>	0.20	2.57
25	42	71	4										25.8		2.13x10 <sup>4</sup>	0.29	4.04
30	47	80	4										30.8		4.373x10 <sup>4</sup>	0.37	5.85

Purple letters denote dimensions changed from the previous products.

## Flanged Nuts



No.	D (h6)	L	Df	H	P.C.D.	d1	d2	h	W	d	B	Ds (h7)	Cross Sectional Moment of Inertia $\text{mm}^4$	Mass (Reference)	
														Nut kg	Shaft kg/m
6	14	25	30	6	22	3.5	6	3.1	6.5	1.5	18	6	6.2 x 10	0.03	0.23
8	16	32	32	7	24	4.5	8	4.4 (5.3)	14(8.5)	1.5	21	8	1.97x10 <sup>2</sup>	0.04	0.39
10	21	42 (41)	42 (41)	7 (8)	32 (30)	5.5	9.5	5.4	22.5	2	25	10.4	5.57x10 <sup>2</sup>	0.09	0.65
13	24	44 (36)	44 (45)	7 (8)	33 (34)	6.6	11	6.5	33 (34)	2.5	30.8	13.4	1.55x10 <sup>3</sup>	0.11	1.11
16	31	50	51	7	40			4.4	18			16.6	3.61x10 <sup>3</sup>	0.20	1.65
20	35	63	58	9	45			5.4	22.5			20.6	8.74x10 <sup>3</sup>	0.30	2.57
25	42	71	65	9	52			5.4	26.5			25.8	2.13x10 <sup>4</sup>	0.40	4.04
30	47	80	75	10	60			6.5	30			30.8	4.373x10 <sup>4</sup>	0.57	5.85

Purple letters denote dimensions changed from the previous products.

## Alteration Guide

### Dimensions of key grooves on shaft ends (P · Q)

P and Q	b	Tolerance (N9)	t	Tolerance
8 or 10	3	-0.004 -0.029	1.8	+0.1 0
12	4	0	2.5	
13-16	5	0 -0.030	3.0	
20	6	0	3.5	
25	8	0 -0.036	4.0	

### Dimensions of the retaining ring groove on shaft ends (P and Q)

P · Q	m	Tolerance	d	Tolerance	Applicable Retaining Ring
6	0	-0.012	0.7	+0.1	JIS E Type 5
8	0	-0.015	0.9	0	JIS E Type 6
10	0	-0.015	9.6	0 -0.09	JIS C Type 10
12	0	-0.018	11.5	0	JIS C Type 12
13	0	-0.018	12.4	0	JIS C Type 13
15	0	-0.018	14.3	-0.11	JIS C Type 15
16	0	-0.021	15.2	0	JIS C Type 16
20	0	-0.021	19	0	JIS C Type 20
25	0	-0.021	23.9	-0.21	JIS C Type 25

Some product specifications and model numbers have been revised, and re-introduced in order to realize price reductions.

## Standard Type



Standard Type	Spline Shaft Material 1.3505/100Cr6 or equivalent Nuts 1.7242/16CrMo4 or equivalent				1.4125/X105CrMo17 equivalent	
	Nut 1 pc.		Nut 2 pcs.		Nut 1 pc.	
	L Dimension Selectable	L Dimension Configurable	L Dimension Selectable	L Dimension Configurable	L Dimension Selectable	L Dimension Configurable
With Straight Nut	BSSS	BHSS	BSS2S	BHS2S	BESKSS	BASKSS
With Round Flange Nut	BSSM	BHSM	BSS2M	BHS2M	BESKFS	BASKFS
With Compact Flange Nut	BSSN	BHSN	BSS2N	BHS2N	-	-

Accuracy P310 Dimension details of included nut P311

## Standard L Dimension Selectable Type

Part Number	L Selectable										D		
	Type	No.											
BSSS	*6	150*	200*	300	400							6	
BSSM	*8	150*	200*	300	400							8	
BSSN	*10	150	200*	300*	400	500	600					10.4	
BSS2S	13	150	200*	300*	400	500	600					13.4	
BSS2M	16	150	200*	300*	400	500	600					16.6	
BSS2N	20	150	200	300	400	500	600	700				20.6	
BESKSS	25	150	200	300	400	500	600	700	800	900		25.8	
BASKFS	30	150	200	300	400	500	600	700	800	900	1000	1150	30.8

\*Only \* marked sizes are available for BHSN and BHS2N.

Only \* marked sizes are available for BESKSS and BASKFS.

## Standard L Dimension Configurable

Part Number	L 1mm Increment				D
	Type	No.	1-Nut Type	2-Nut Type	
BHSS	*6	60~400 (200)	60~400		6
BHSM	*8	60~400 (200)	60~400		8
BHSN	*10	60~600 (350)	90~600		10.4
BHS2S	13	60~600 (350)	100~600		13.4
BHS2M	16	70~600 (350)	110~600		16.6
BHS2N	20	80~700	130~700		20.6
BASKSS	25	90~900	150~900		25.8
BASKFS	30	100~1150	170~1150		30.8

\*Only \* marked sizes are available for BHSN and BHS2N.

Max. L dimension of BASKSS and BASKFS is ( ).



Part Number	€ Unit Price											Part Number	€ Unit Price															
	Type	No.	L150	L200	L300	L400	L500	L600	L700	L800	L900		L1000	L1150	Type	No.	Min. L -150	L151 -200	L201 -300	L301 -400	L401 -500	L501 -600	L601 -700	L701 -800	L801 -900	L901 -1000	L1001 -1150	
BSSS BSS2S	6													BHSS BHS2S	6													
	8														8													
	10														10													
	13														13													
	16														16													
	20														20													
BSSM BSS2M	6													BHSM BHS2M	6													
	8														8													
	10														10													
	13														13													
	16														16													
	20														20													
BSSN BSS2N	6													BHSN BHS2N	6													
	8														8													
	10														10													

Part Number	€ Unit Price			Part Number	€ Unit Price						Additional Price for 2-Nut Type						
	Type	No.	L150		L200	L300	Type	No.	Min.L-100	L101-150	L151-200	L201-250	L251-300	L301-350	No.	Straight Nuts	Round Flange Nuts
BESKSS	6				BASKSS	6							6				
	8					8								8			
	10					10								10			
	13					13								13			
	16					16								16			
BESKFS	6				BASKFS	6							20				
	8					8								25			
	10					10								30			
	13					13											
	16					16											

Order Example

Part Number - L

BSSS8 - 300

BHS2M10 - 555

Days to Ship **10 Days**

Please request a quotation for 5 or more identical pieces.

Notices about lead times: These products are not available for delivery on Saturday, Sunday and public holiday.



# Ball Splines

-Both Ends Female Thread Type · One End Female Thread Type-

Part Number & Spec. Change Printed in Purple

CAD Data

Some product specifications and model numbers have been revised, and re-introduced in order to realize price reductions.

**Both Ends Female Thread** **RoHS**

**One End Female Thread**

Both Ends Female Thread Type	Spline Shaft 1.3505 or equivalent Nuts 1.7242 or equivalent Hardness: 58HRC-		1.4125 or equivalent Nuts 1.7242 or equivalent Hardness: 58HRC-		One End Female Thread Type	Spline Shaft 1.3505/100Cr6 or equivalent Nuts 1.7242 or equivalent Hardness: 58HRC-	
	Nut 1 pc.	Nut 2 pcs.	Nut 1 pc.	Nut 1 pc.			
With Straight Nut	BSHS	BSH2S	-	-	With Straight Nut	BSFS	-
With Round Flange Nut	BSHM	BSH2M	BASBFS	-	With Round Flange Nut	BSFM	-
With Compact Flange Nut	BSHN	BSH2N	-	-	With Compact Flange Nut	BSFN	-

Accuracy P.310 Dimension details of included nut P.311 Annealed range P.315

**Both Ends Female Thread**

Part Number Type	No.	L 1mm Increment		M (Coarse) · N (Coarse) Selectable				D
		1-Nut Type	2-Nut Type	3	4	5	6	
BSHS	*8	60-400	60-400	3	4			8
BSHM	*10	60-600	90-600	3	4	5		10.4
BSHN	13	60-600 (350)	100-600			5	6	13.4
BSH2S	16	70-600 (350)	110-600	6	8			16.6
BSH2M	20	80-700	130-700	6	8	10		20.6
BSH2N	25	90-900	150-900	6	8	10	12	25.8
BASBFS	30	100-1150	170-1150	8	10	12		30.8

BASBFS is applicable to only No.13 and 16, and max. of L dimension is ( ). Only \* marked sizes are available for BSHN and BSH2N.

**One End Female Thread**

Part Number Type	No.	L 1mm Increment		M (Coarse Thread) Selectable				D
		1-Nut Type		3	4	5	6	
BSFS	*8	60-400		3	4			8
BSFM	*10	60-600		3	4	5		10.4
BSFN	13	60-600				5	6	13.4
	16	70-600		6	8			16.6
	20	80-700		6	8	10		20.6
	25	90-900		6	8	10	12	25.8
	30	100-1150		8	10	12		30.8

Only \* marked sizes are available for BSFN.

Order Example: Part Number - L - M - N Days to Ship 13 Days

Example: BSHS8 - 270 - M4 - N4 Days to Ship 13 Days

BSFS10 - 350 - M5

Please request a quotation for 5 or more identical pieces.

Notices about lead times: These products are not available for delivery on Saturday, Sunday and public holiday.

**Price**

Part Number Type	No.	€ Unit Price										
		Min. L	L151	L201	L301	L401	L501	L601	L701	L801	L901	L1001
BSHS	8	-150	-200	-300	-400	-500	-600	-700	-800	-900	-1000	-1150
BSH2S	10											
BSHM	13											
BSH2M	16											
BSHN	20											
BSH2N	25											
BASBFS	30											

**Price**

Part Number Type	No.	€ Unit Price										
		Min. L	L151	L201	L301	L401	L501	L601	L701	L801	L901	L1001
BSFS	8	-150	-200	-300	-400	-500	-600	-700	-800	-900	-1000	-1150
BSFM	10											
BSFN	13											
	16											
	20											
	25											
	30											

**Standard € Unit Price**

Part Number Type	No.	Min. L-150	L151-200	L201-250	L251-300	L301-350
BASBFS	13					
	16					

**Additional € Price for 2-Nut Type**

No.	Straight Nuts	Round Flange Nuts	Compact Flange Nuts
8			
10			
13			
16			
20			
25			
30			

Alterations Part Number - L - M - N - (SC · FC · NTW)

Example: BSHN10 - 270 - M5 - N5 - SC15

Alterations	Wrench Flats	Set Screw Flat	Additional Spline Nuts
	Code	SC	FC
Spec.	Adds a wrench flat. = 1mm Increment SC+ $\epsilon$ 1≤L SC=0 or SC≥1	Adds a set screw flat. (Ordering Code) FC10-48 Specify FC and A in 1mm incr. FC≤3xD 1.5xD<FC FC≤L/2 A=0 or A≥2	Additional nuts (from one to two) BSFS · BSFM Available for BSFN only.
Price Adder	7,00	6,00	refer to the left.

When selecting multiple alteration additions, more than 2mm is needed between each feature to be added.



# Ball Splines

-Both End Stepped Type · One End Stepped Type-

Part Number & Spec. Change Printed in Purple

CAD Data

Some product specifications and model numbers have been revised, and re-introduced in order to realize price reductions.

**Both Ends Stepped Type** **RoHS**

**One End Stepped Type**

Both Ends Stepped Type	Spline Shaft 1.3505 or equivalent Nuts 1.7242 or equivalent Hardness: 58HRC-		One End Stepped Type	Spline Shaft 1.3505 or equivalent Nuts 1.7242 or equivalent Hardness: 58HRC-	
	Nut 1 pc.	Nut 2 pcs.		Nut 1 pc.	Nut 2 pcs.
With Straight Nut	BSJS	-	With Straight Nut	BSDS	BSD2S
With Round Flange Nut	BSJM	-	With Round Flange Nut	BSDM	BSD2M
With Compact Flange Nut	BSJN	-	With Compact Flange Nut	BSDN	BSD2N

Accuracy P.310 Dimension details of included nut P.311 Annealed range P.315

**Both Ends Stepped Type**

Part Number Type	No.	L 1mm Increment		F / E	P / Q Selectable	D	(Y)	
		1-Nut Type	2-Nut Type				1-Nut Type min-max	2-Nut Type min-max
BSJS	*8	60-400			5 6	8	56-396	
BSJM	*10	60-600		2≤F≤P×4 2≤E≤Q×4	5 6 8	10.4	56-596	
BSJN	13	60-600			5 6 8 10	13.4	56-596	
	16	70-600			5 6 8 10 12 13	16.6	66-596	
	20	80-700			8 10 12 13 15 16	20.6	76-696	
	25	90-900			8 10 12 13 15 16 20	25.8	86-896	
	30	100-1150			10 12 13 15 16 20 25	30.8	96-1146	

Only \* marked sizes are available for BSJN.

**One End Stepped Type**

Part Number Type	No.	L 1mm Increment		F	P Selectable	D	(Y)	
		1-Nut Type	2-Nut Type				1-Nut Type min-max	2-Nut Type min-max
BSDS	*8	60-400			5 6	8	58-398	
BSDM	*10	60-600		2≤F≤P×4	5 6 8	10.4	58-598	88-598
BSDN	13	60-600			5 6 8 10	13.4	58-598	98-598
BSD2S	16	70-600			5 6 8 10 12 13	16.6	68-598	108-598
BSD2M	20	80-700			8 10 12 13 15 16	20.6	78-698	128-698
BSD2N	25	90-900			8 10 12 13 15 16 20	25.8	88-898	148-898
	30	100-1150			10 12 13 15 16 20 25	30.8	98-1148	168-1148

Only \* marked sizes are available for BHDN and BSD2N.

Order Example: Part Number - L - F - E - P - Q Days to Ship 13 Days

Example: BSJS8 - 300 - F30 - E20 - P6 - Q5 Days to Ship 13 Days

BSDN10 - 300 - F20 - P6

Please request a quotation for 5 or more identical pieces.

Notices about lead times: These products are not available for delivery on Saturday, Sunday and public holiday.

**Price**

Part Number Type	No.	€ Unit Price										
		Min. L	L151	L201	L301	L401	L501	L601	L701	L801	L901	L1001
BSJS	8	-150	-200	-300	-400	-500	-600	-700	-800	-900	-1000	-1150
BSJM	10											
BSJN	13											
	16											
	20											
	25											
	30											

**Price**

Part Number Type	No.	€ Unit Price										
		Min. L	L151	L201	L301	L401	L501	L601	L701	L801	L901	L1001
BSDS	8	-150	-200	-300	-400	-500	-600	-700	-800	-900	-1000	-1150
BSD2S	10											
BSDM	13											
BSD2M	16											
BSDN	20											
BSD2N	25											
	30											

**Additional € Price for 2-Nut Type**

No.	Straight Nuts	Round Flange Nuts	Compact Flange Nuts
8			
10			
13			
16			
20			
25			
30			

Alterations	Wrench Flats	Set Screw Flat	Retaining Ring Groove	Keyway on Shaft End	Tapping	Additional spline nuts
	Code	SC	FC	TA · TB	PKC · QKC	MC
Spec.	Adds a wrench flat. = 1mm Increment SC+ $\epsilon$ 1≤Y SC=0 or SC≥1	Adds a set screw flat. (Ordering Code) FC10-48 Specify FC and A in 1mm incr. FC≤3xD When 1.5xD<FC, FC≤Y/2 A=0 or A≥2	Adds retaining ring grooves. (Ordering Code) TA10-TB10 TA, TB= 1mm Increment P, Q≥6 4≤TA, TB<F / E / 2	Adds a keyway on the shaft end face. (Ordering Code) PKC10 (QKC10) Type PKC / QKC P, Q≥8 4≤F (1)-1 For keyway details, refer to P.311	Machines tapped hole on the right end face. One End Stepped Type Applicable to one end stepped type only.	Additional nuts (from one to two) BSJS · BSJM Available for BSJN only.
Price Adder	7,00	6,00	14,00	14,00	6,00	Refer to the left

When selecting multiple alteration additions, more than 2mm is needed between each feature to be added.





# Miniature Ball Bearing Guide Sets

-Compact Type-

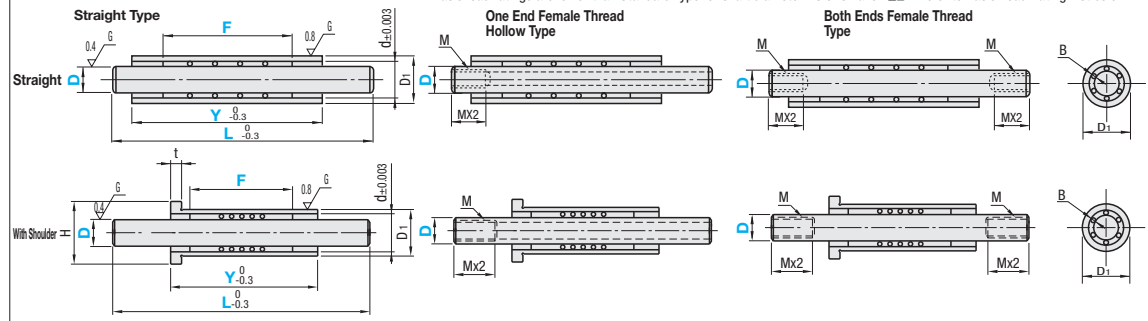
CAD Data



Bushing	Shafts			Shafts Bushing	Material		Hardness	
	Straight	One End Female Thread Hollow	Both Ends Female Thread		Steel balls Retainer	Steel balls	Shafts Bushing	Steel balls
Straight Type	BYZ	BYA	BYY	1.3505/100C6	CW614N/ CuZn39Pb3 (Applicable to RoHS)	1.3505/100C6	58HRC-	58HRC-
With Shoulder Type	SSBYZ	SSBYA	SSBYH	1.4125/X105C/Mo17		1.4125/X105C/Mo17	58HRC-	58HRC-
	BYHZ	BYHA	BYHY	1.3505/100C6		1.3505/100C6	58HRC-	58HRC-
	SSBYHZ	SSBYHA	SSBYHY	1.4125/X105C/Mo17		1.4125/X105C/Mo17	58HRC-	58HRC-

### Features of Compact Type

- The O.D. is 1~2mm smaller compared to the Standard Type using the same diameter shaft, contributing to space savings.
- Basic load ratings are lower than Standard Type for shaft diameter D8 or smaller. Refer to Basic Load Rating List below.



Part Number	Type	D	Shaft Dia. Tol.	L		Y	F	D1	T	H	d	M (Coarse Thread)	B
				One End Female Thread Hollow	Both Ends Female Thread								
	Straight	(2)	0	30-50	Selectable	10 15 20	Selectable	5	2.5	7	3.2	-	0.6
	One End Female Thread Hollow	(3)	-0.005	40-70	Selectable	10 15 20	Selectable	6	0	8	4.2	-	0.6
	Both Ends Female Thread	(4)	-0.005	40-90	Selectable	10 20 30	Selectable	7	-0.006	9	5.2	M3	0.6
		(5)	-0.005	40-90	Selectable	10 20 30	Selectable	8	0	10	6.2	M3	0.6
		(6)	-0.005	40-90	Selectable	10 20 30	Selectable	9	0	11	7.2	M4	0.6
		(7)	-0.005	40-90	Selectable	10 20 30	Selectable	10	0	12	8.2	M4	0.6
		(8)	-0.005	40-150	Selectable	20 30 40	Selectable	11	0	13	9.2	M4	1.0
		(9)	-0.005	40-150	Selectable	20 30 40	Selectable	12	0	14	10.2	M5	1.0
		(10)	-0.005	40-150	Selectable	20 30 40	Selectable	13	0	16	12	M6	1.0

⊕ Sizes in ( ) are applicable to BYZ, BYHZ, SSBYZ and SSBYHZ only. ⊕ Ball retainer travels 1/2 the distance of the bushing (or the shaft) stroke. 1/2

**Price** **Quantity Discount Price** (Round down to one Cent.) P87

Quantity	1-9	10-14	15-19	20-49
Rate	€ Unit Price	5%	10%	18%

⊕ For orders larger than indicated quantity, please request a quotation.

**Order Example** Part Number - L - Y - F

Example: BYZ5 - 72 - 20 - 15

**Days to Ship** 8 Days

**Express A** 5,00 EUR/ piece P88

⊕ A Express Charge of 13.50 EUR for 3 or more identical pieces.

**Basic Load Rating List**

D	F	Basic Load Rating Co (Static) N
2	10	15.0
	15	24.4
	20	33.7
3	10	16.3
	15	26.5
	20	36.7
4	10	21.1
	15	34.3
	20	47.5
5	10	26.1
	15	42.4
	20	58.7
6	15	43.2
	20	59.8
	30	83.1
8	20	59.0
	30	81.6
	40	113.4
10	20	147.7
	30	221.5
	40	307.7
12	20	187.4
	30	281.1
	40	390.5

**€ Unit Price**

D	Y	€ Unit Price											
		BYZ	BYHZ	SSBYZ	SSBYHZ	BYA	BYHA	SSBYA	SSBYHA	BYY	BYHY	SSBYY	SSBYHY
10	10												
	20												
	30												
12	20												
	30												
	40												

# Miniature Ball Bearing Guide Sets

-Standard Type-

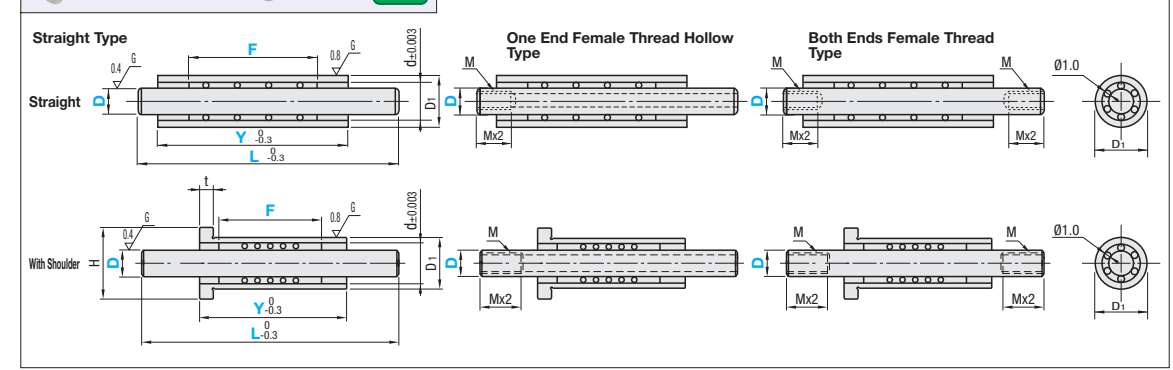
CAD Data



Bushing	Shafts			Shafts Bushing	Material		Hardness	
	Straight	One End Female Thread Hollow	Both Ends Female Thread		Steel balls Retainer	Steel balls	Shafts Bushing	Steel balls
Straight Type	BGZ	BGA	BGY	1.3505/100C6	CW614N/ CuZn39Pb3 (Applicable to RoHS)	1.3505/100C6	58HRC-	58HRC-
With Shoulder Type	SSBGZ	SSBGA	SSBGY	1.4125/X105C/Mo17		1.4125/X105C/Mo17	58HRC-	58HRC-
	BGHZ	BGHA	BGHY	1.3505/100C6		1.3505/100C6	58HRC-	58HRC-
	SSBGHZ	SSBGHA	SSBGHY	1.4125/X105C/Mo17		1.4125/X105C/Mo17	58HRC-	58HRC-

### Features of Miniature Ball Bearing Guide

- Motion mechanism utilizing rolling balls, capable of linear and rotary motion.
- The bearing balls and the rolling surface are in point contact relationship enabling low friction rolling motion.



Part Number	Type	D	Shaft Dia. Tol.	L		Y	F	D1	T	H	d	M (Coarse Thread)	B
				Straight One End Female Thread Hollow	Both Ends Female Thread								
	Straight	(3)	0	40-70	Selectable	10 20 30	Selectable	7	2.5	9	5	-	0.6
	One End Female Thread Hollow	(4)	-0.005	40-90	Selectable	10 20 30	Selectable	8	0	10	6	-	0.6
	Both Ends Female Thread	(5)	-0.005	40-90	Selectable	10 20 30	Selectable	9	-0.006	12	7	M3	0.6
		(6)	-0.005	40-90	Selectable	10 20 30	Selectable	10	0	13	8	M3	0.6
		(7)	-0.005	40-90	Selectable	10 20 30	Selectable	11	0	14	9	M4	0.6
		(8)	-0.005	40-90	Selectable	10 20 30	Selectable	12	0	16	10	M4	0.6
		(9)	-0.005	40-150	Selectable	20 30 40	Selectable	13	0	18	12	M5	1.0
		(10)	-0.005	40-150	Selectable	20 30 40	Selectable	14	0	20	14	M6	1.0

⊕ Sizes in ( ) are applicable to BGZ, BGHZ, SSBGZ and SSBGHZ only. ⊕ Ball retainer travels 1/2 the distance of the bushing (or the shaft) stroke. 1/2

**Price** **Quantity Discount Price** (Round down to one Cent.) P87

Quantity	1-9	10-14	15-19	20-49
Rate	€ Unit Price	5%	10%	18%

⊕ Please request a quotation for orders of 50 or more identical pieces (except BGZ, BGA, AVBGHZ and BGHA).

**Order Example** Part Number - L - Y - F

Example: BGZ5 - 72 - 20 - 15

**Days to Ship** 8 Days

**Express A** 5,00 EUR/ piece P88

⊕ A Express Charge of 13.50 EUR for 3 or more identical pieces.

**Basic Load Rating List**

D	F	Basic Load Rating Co (Static) N
3	10	30.4
	15	50.7
	20	71
4	10	40.4
	15	67.3
	20	87.5
5	10	50.7
	15	84.5
	20	109.9
6	15	101.5
	20	113.2
	30	182.9
8	15	105.1
	20	126.1
	30	189.2
10	20	147.7
	30	221.5
	40	307.7
12	20	187.4
	30	281.1
	40	390.5

**€ Unit Price**

D	Y	€ Unit Price											
		BGZ	BGHZ	SSBGZ	SSBGHZ	BGA	BGHA	SSBGA	SSBGHA	BGY	BGHY	SSBGY	SSBGHY
10	10												
	20												
	30												
12	20												
	30												
	40												

# Miniature Ball Bearing Guides Sets / Shafts for Miniature Ball Bearing Guides -With Retaining Ring- -Straight-

CAD Data

**Miniature Ball Bearing Guide Sets -With Retaining Ring-** **RoHS**

**Parts** **Material** **Hardness**

Shafts	1.3505/100Cr6	58HRC~	Ball Retainer	CW614N/CuZn39Pb3	58HRC~
Bushing	1.3505/100Cr6	58HRC~	Steel balls	1.3505/100Cr6	58HRC~
			Retaining Ring	Spring Steel	44HRC~

Retaining rings are assembled into BGSTZ, BGSTA to prevent ball retainer from falling out.

Type	D	Shaft Dia. Tol.	L 1mm Increment	Y	F	D1 Outer Dia. Tol.	M (Coarse Thread)	d	Max. Stroke mm	Standard € Unit Price						
										BGSTZ			BGSTA			
BGSTZ BGSTA	5	0 -0.005	40-90	17	6	10	0 -0.006	M3	7	13						
	6			19	7	11										
	8			25	8	13										
	10			30	10	16	0 -0.011	M4	10	24						
	12		40-150	32	11	18		M5	12	30						
								M6	14	32						

**Shafts for Miniature Ball Bearing Guides -Straight-** **RoHS**

Type	Material	Hardness
Linear Bushings Straight	BGZP 1.3505/100Cr6	58HRC~
	SSBGZP 1.4125/X105CrMo17	56HRC~
Hollow Shaft	BGBP 1.3505/100Cr6	58HRC~

Linear Bushings Straight Type: BGZP, SSBGZP

Hollow Shaft Type: BGBP

Type	D	Shaft Dia. Tol.	L 1mm Increment	d	€ Unit Price									
					BGZP			SSBGZP			BGBP			
BGZP SSBGZP BGBP	2	0 -0.005	30-50	2.5										
	3													
	4		40-70											
	5													
	6		40-90											
	8													
	10	40-150		3.3										
	12			4.2										
				5										

**Order Example** Part Number - L  
BGZP5 - 72

**Days to Ship** 8 Days Express A 5,00 EUR/piece P. 88

**Price** **Quantity Discount Price** (Round down to one Cent.) P. 87

Quantity	1-9	10-14	15-19	20-49
Rate	€ Unit Price	5%	10%	18%

Please request a quotation for orders of 50 or more identical pieces (except BGZP).

**Accuracy Standard-**

- (1) L Dimension Tolerance:  $L \leq 120 \Rightarrow \pm 0.3$ ,  $L \geq 121 \Rightarrow \pm 0.5$
- (2) Circularity of Part D: 0.004 or less
- (3) Concentricity of D and P: 00.1 or less
- (4) Thickness Variations of Hollow:  $D \geq 8 \Rightarrow 0.4$  or less, Deviation Value=A-B

# Shafts for Miniature Ball Bearing Guides -One End Machined - Both Ends Machined

CAD Data

**One End Machined** **RoHS**

Type	Material	Hardness
One End Female Thread	BGDP 1.3505/100Cr6	58HRC~
Thread	SSBGDP 1.4125/X105CrMo17	56HRC~
One End Female Thread Hollow	BGAP 1.3505/100Cr6	58HRC~
Thread Hollow	SSBGAP 1.4125/X105CrMo17	56HRC~
One End Male Thread	BGEP 1.3505/100Cr6	58HRC~

Type	D	Shaft Dia. Tol.	L 1mm Increment	F	B	M (Coarse Thread)	d	€ Unit Price											
								BGDP			BGEP			SSBGDP			BGAP		
BGDP SSBGDP BGEP SSBGAP BGAP	5	0 -0.005	40-90	4	6	M3	2.5												
	6																		
	8																		
	10																		
	12		40-150	5	10	M5	4.2												
				12	M6	5													

**Both Ends Machined** **RoHS**

Type	Material	Hardness
Both Ends Female Thread	BGFP 1.3505/100Cr6	58HRC~
	SSBGFP 1.4125/X105CrMo17	56HRC~
Both Ends Female Thread Hollow	BGCP 1.3505/100Cr6	58HRC~
One End Male Thread, One End Female Thread	BGHP 1.3505/100Cr6	58HRC~

Type	D	Shaft Dia. Tol.	L Selectable	F	B	M (Coarse Thread)	d	€ Unit Price						
								BGFP BGHP		BGCP		SSBGFP		
BGFP SSBGFP BGCP BGHP	5	0 -0.005	40 50 60 70 80 90	4	6	M3	2.5							
	6													
	8													
	10													
	12		40 50 60 70 80 90 100	5	10	M5	4.2							
				12	M6	5								

**Order Example** Part Number - L  
BGDP5 - 70

**Days to Ship** 8 Days Express A 5,00 EUR/piece P. 88

**Price** **Quantity Discount Price** (Round down to one Cent.) P. 87

Quantity	1-9	10-14	15-19	20-49
Rate	€ Unit Price	5%	10%	18%


Please request a quotation for orders of 50 or more identical pieces (except BGAP).



# Miniature Ball Guide Bushings

-Compact / Standard-

CAD Data



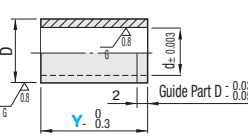
**RoHS**

Type				Material	Hardness
Compact Type		Standard Type			
Straight Type	Shoulder Type	Straight Type	Shoulder Type		
BYB	BYH	BGB	BGH	1.3505/100Cr6	58HRC~
SSBYB	SSBYH	SSBGB	SSBGH	1.4125/X105CrMo17	56HRC~

Use Ball Slider Compact Type (BYS, SSBYS) with Compact Type; Ball Sliders Standard Type (BGS, SSBGS, SSBPS) with Standard Type.  
Loctite is recommended to fix bushings.

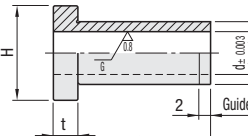
**Compact Type**

(Straight Type) **BYB SSBYB**



Guide Part D:  $-0.03 / -0.05$

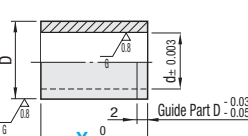
(Shoulder Type) **BYH SSBYH**



Guide Part D:  $-0.03 / -0.05$

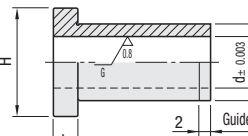
**Standard Type**

**BGB SSBGB**



Guide Part D:  $-0.03 / -0.05$

**BGH SSBGH**



Guide Part D:  $-0.03 / -0.05$

**Compact Type**

Part Number	Type	No.	Y Selectable	D Outer Diameter Tolerance	T	H	d	€ Unit Price					
BYB SSBYB BYH SSBYH	2	10	15	0 -0.006	2.5	7	3.2	BYB	SSBYB	BYH	SSBYH		
			20										
			30										
	4	10	20										
			30										
	5	10	20										
			30										
	6	20	30	40	0 -0.011	11	7.2						
	8	20	30	40	0 -0.011	13	9.2						
	10	30	40	50	0 -0.011	16	12						
12	30	40	50	0 -0.011	18	14							

**Order Example**

Part Number - Y

BYB5 - 20

SSBYH10 - 40

BGB5 - 20

BGH10 - 40

**8 Days**

Express A 2,00 EUR/ piece P88

A Express Charge of 5,40 EUR for 3 or more identical pieces.

**Price**

Quantity Discount Price (Round down to one Cent) P87

Quantity	1-9	10-14	15-19	20-49
Rate	€ Unit Price	5%	10%	18%

Please request a quotation for orders of 50 or more identical pieces (except BGB - BGH)

**Standard Type**

Part Number	Type	No.	Y Selectable	D Outer Diameter Tolerance	T	H	d	W	B	D <sub>1</sub>	€ Unit Price				
BGB SSBGB BGH SSBGH	3	10	15	0 -0.006	2.5	9	5				BGB	SSBGB	BGH	SSBGH	
			20												
			30												
	4	10	20												
			30												
	5	10	20												
			30												
	6	20	30	40	0 -0.011	13	8								
	8	20	30	40	0 -0.011	14	10								
	10	30	40	50	0 -0.011	18	12								
12	30	40	50	0 -0.011	20	14									

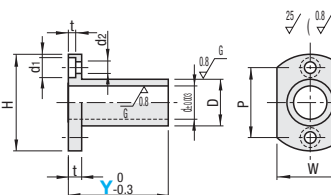
# Bushings for Miniature Ball Bearing Guides / Ball Sliders

-Compact / Standard-

CAD Data

**Flanged Type**

**BGHT** (Mounting Hole)

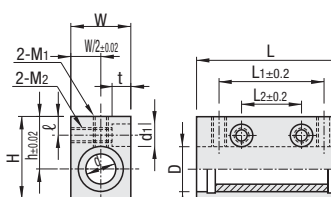


**RoHS**

Material: 1.3505/100Cr6 Hardness: 58HRC~

**Linear Bushings with Housing Units**

**BGVH** (BGB Built-in Bushings)

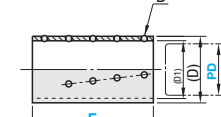


**RoHS**

Material: Aluminum Alloy Surface Treatment: Clear Anodize

**Ball Sliders Compact Type**

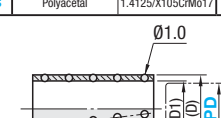
Type	Material	Hardness
Ball Retainer	Steel balls	Steel balls
BYB	CW614N/CuZn39Pb3	1.3505/100Cr6 58HRC~
SSBYB	(Compliant with RoHS)	1.4125/X105CrMo17 56HRC~



**RoHS**

**Ball Sliders Standard Type**

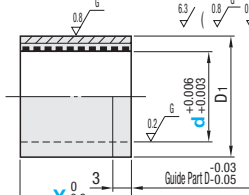
Type	Material	Hardness
Ball Retainer	Steel balls	Steel balls
BGS	CW614N/CuZn39Pb3	1.3505/100Cr6 58HRC~
SSBGS	(Applicable to RoHS)	1.4125/X105CrMo17 56HRC~
SSBPS	Polyacetal	1.4125/X105CrMo17 56HRC~



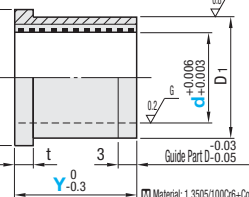
**RoHS**

**Oil Free Bushings**

**BGMS** (Straight)



**BGMH** (Shoulder)



**RoHS**

Material: 1.3505/100Cr6+ Copper Alloy MoS<sub>2</sub> (Embedded) Hardness: 45HRC~  
Loctite is recommended to fix oil free bushings.

Part Number	Type	No.	Y Selectable	D Outer Diameter Tolerance	H	W	P	T	d	d <sub>1</sub>	d <sub>2</sub>	t	€ Unit Price
BGHT		5	20	0 -0.006	10	25	16	17	7	6	3.5	2.2	
			30										
			40										
			40										
			40										
10		10	30	0 -0.011	14	29	20	21	12	7.5	4.5	3	
			40										
			50										
			50										

Use in combination with Ball Sliders Standard Type (BGS, SSBGS, SSBPS).

Part Number	Type	No.	S	h	W	H	L	D	L <sub>1</sub>	L <sub>2</sub>	ℓ	M <sub>1</sub>	M <sub>2</sub>	d	d <sub>1</sub> x <sub>t</sub>	€ Unit Price		
BGVH		5	20	13	15	20	30	10	20	10	28	16	M4	M4	7	6x5 (For M3 screws)		
			30															
		6	30	14	16	22	40	11	28	16	36	24	5	M4	M4		8	
			40															
		8	30	14	16	22	40	12	28	16	36	24	5	M5	M5		12	
			40															
		10	40	16	20	26	50	16	36	24	44	30	6	M6	M5		14	
			50															
		12	40	19	26	32	50	18	36	24	44	30	6	M6	M5		14	
			50															

Use in combination with Ball Sliders Standard Type (BGS, SSBGS, SSBPS).

Part Number	Type	F Selectable	(D)	(D <sub>1</sub> )	B	€ Unit Price		
BYB SSBYB		10	15	20	0.6	2	3.1	2.1
						3	4.1	3.1
						4	5.1	4.1
						5	6.1	5.1
						6	7.1	6.1
						8	9.1	8.1
						10	11.8	10.2
						12	13.8	12.2

Use in combination with Bushings for Miniature Ball Bearing Guides Compact Type (BYB, SSBYB, BYH, SSBYH).

Part Number	Type	F Selectable	(D)	(D <sub>1</sub> )	€ Unit Price		
BGS SSBGS SSBPS		10	15	20	3	4.8	3.2
					4	5.8	4.2
					5	6.8	5.2
					6	7.8	6.2
					8	9.8	8.2
					10	11.8	10.2
					12	13.8	12.2

Only PD in ( ) are available for SSBPS.  
Use in combination with Bushings for Miniature Ball Bearing Guides Standard Type (BGB, SSBGB, BGH, SSBGH, BGVH and BGMH).  
Polyacetal type is superior in anti-corrosion performance compared to brass (CW614N/CuZn39Pb3) and best for use in environments where corrosion is not desirable.

Part Number	Type	d	Y Selectable	D <sub>1</sub> Outer Diameter Tolerance	T	H	€ Unit Price	
BGMS BGMH		8	12	0 -0.011	3	15	BGMS	BGMH
			15					
			20					
			25					

**Order Example**

Part Number - Y, F, S

BGHT5 - 20

BGVH10 - 40

BGS5 - 15

BGMS8 - 12

**8 Days**

Express A 2,00 EUR/ piece P88

A Express Charge of 5,40 EUR for 3 or more identical pieces.

**Price**

Quantity Discount Price (Round down to one Cent) P87

Quantity	1-9	10-14	15-19	20-49
Rate	€ Unit Price	5%	10%	18%

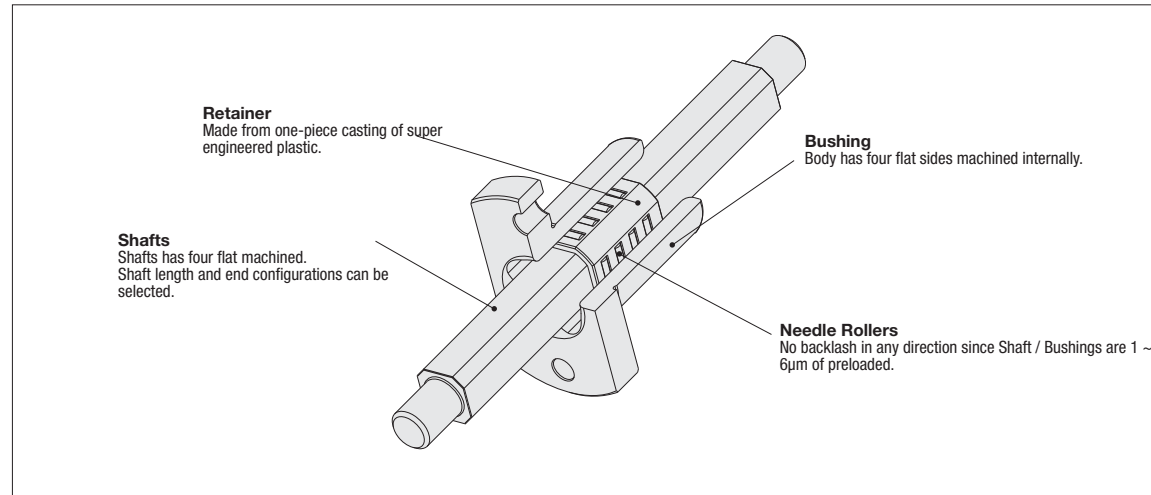
Please request a quotation for orders of 50 or more identical pieces (except BGS)

# High Rigidity Needle Guide Sets

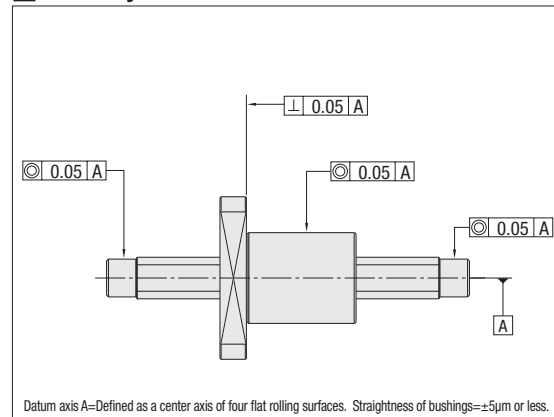
## -Overview-

### Features

High accuracy needle rollers are arranged in four directions against the square shafts. Shafts / Bushings are designed to be 1 ~ 6µm preloaded. Widely used in parts of semiconductor, liquid crystal manufacturing equipment and inspection device, lift / slide stages, robotic systems, press machines and transfer mechanism as the guide with high rigidity, straightness and high speed. Capable of torque loading without rotation due to square cross section with low yawing and pitching, maintaining smooth rotation and stable accuracy.

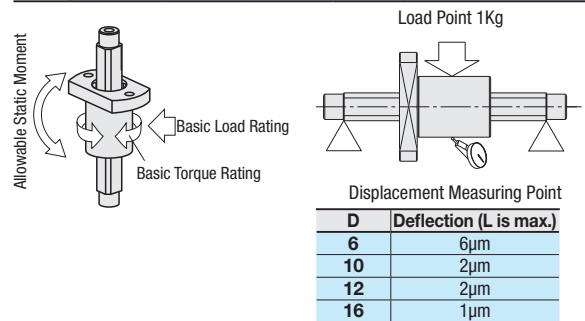


### Accuracy Standards

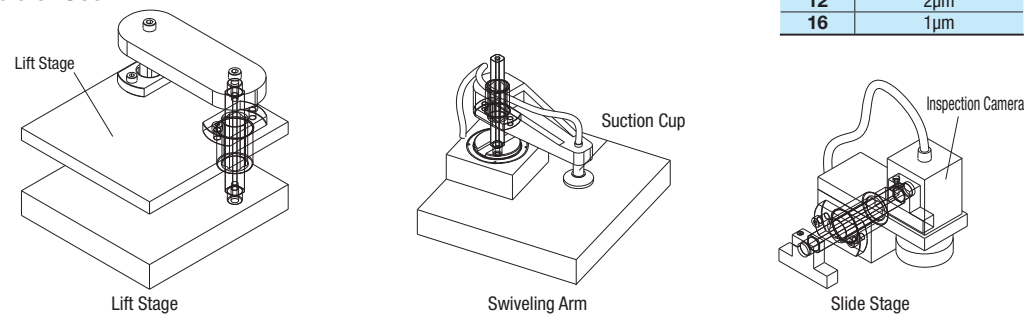


### Load Rating Chart

D	Basic Rated Torque		Basic Load Rating		Allowable Static Moment Mo (N·m)
	CT Dynamic (N·m)	CoT Static (N·m)	C Dynamic (kN)	Co Static (kN)	
6	12.3	21.0	3.4	5.0	10.6
10	48.7	84.4	6.8	10.0	23.0
12	91.3	162.9	11.9	17.4	76.4
16	115.7	212.0	11.9	17.4	83.6



### Example of Use

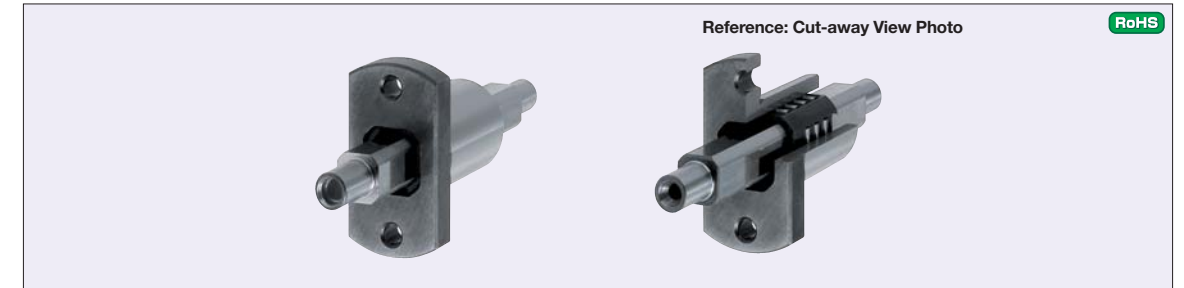


### Cautions

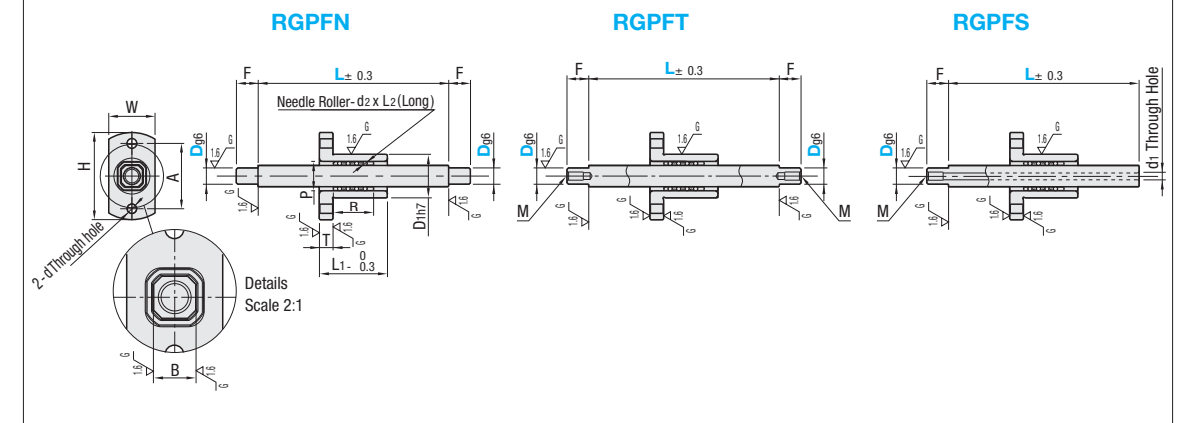
- Administer lubrication maintenance as needed.
- When designing, position the bushing where the retainer does not fall out from the bushing at stroke ends.
- As the preload is still applied when inserting retainers, assemble and fit carefully in order not to apply any off-center insertion force as that may cause the damage to the retainers as well as damages on the rolling surfaces.
- Protect it with covers if any foreign objects or dust may adhere to the rolling surfaces.
- Avoid using in high temperature environments, keep below 80°C.
- Do not cold shrink fit the bushings and shafts.
- Residual austenite will transform into martensite and will expand inner / outer dimension of bushings and shafts, rendering them unusable.

# High Rigidity Needle Guide Sets

CAD Data



Type	Shaft / Bushing		Retainer	Needle Rollers		Ambient Operating Temp.
	Material	Hardness	Material	Material	Hardness	
RGPFN RGPFT RGPFS	1.3505/100Cr6	58HRC~	Polyacetal	1.3505/100Cr6	54HRC~	-20~80°C



Part Number	Type	Dg6	L 10mm Increment	Effective Stroke (Reciprocating)	Shafts				Bushing				Retainer							
					F	B	d1	M	D1	L1	T	H	W	P	d	A	R	d2	L2 (Length)	Needle Quantity
RGPFN RGPFT RGPFS	6	-0.004 -0.012	50~70	20	8	7.8	2.5	M3x6	16	25	5	32	17	10.8	3.4	24	15	1.5	4.8	16
	10	-0.005 -0.014	60~80	30	8	11.0	4.2	M5x10	24	36	7	43	25	15.0	4.5	33	19	2	4.8	20
	12	-0.006 -0.017	90~120	40	10	14.6	5	M6x12	31	50	7	50	32	18.6	5.5	40	30	2	6.8	24
16			100~130	50	10	18.9	6.8	M8x16	32	60	7	55	33	22.9	6.6	43	33	2	6.8	24



Part Number - L  
RGPFN10 - 60



10 Days

Part Number	Type	D	L 10mm Increment	€ Unit Price	Volume Discount
				Qty. 1~10	11~19
RGPFN	6	50~70			
	10	60~80			
	12	90~120			
	16	100~130			
RGPFT	6	50~70			
	10	60~80			
	12	90~120			
	16	100~130			
RGPFS	6	50~70			
	10	60~80			
	12	90~120			
	16	100~130			

For orders larger than indicated quantity, please request a quotation.