Precision shafts

SKF precision shafts (→ **fig** 20) can be supplied either as solid or hollow shafts. The solid shafts are available in all dimensions required to fit SKF linear ball bearings; the hollow shafts have a minimum outside diameter of 16 mm.

They are induction hardened and ground (see table on next page). SKF shafts have exceptionally high dimensional stability and long service life.

Yet at the end of shafts of normal production length, deviations of hardness and dimensional stability can occur.

For special applications, solid shafts of stainless steel or hard chromium plated shafts having a chromium layer approximately 10 µm thick can be supplied. When using stainless steel shafts, it must be taken into account that the surface is not as hard as that of shafts made of high-grade steel. The case depth may also be greater than indicated in **Table** 5 and this may have an influence on the machinability of the shafts.

Because of the benefits they offer, SKF precision shafts are not only used in combination with SKF linear ball bearings for linear guides, but also for other purposes, for instance axles or column sleeves.

Tolerances

SKF precision steel shafts are available as standard with a diameter machined to tolerance h6 or h7. Other tolerances on request. Shafts cut to special lengths have a length tolerance to DIN 7168 “medium”. The relevant values are given in **Table** 4.

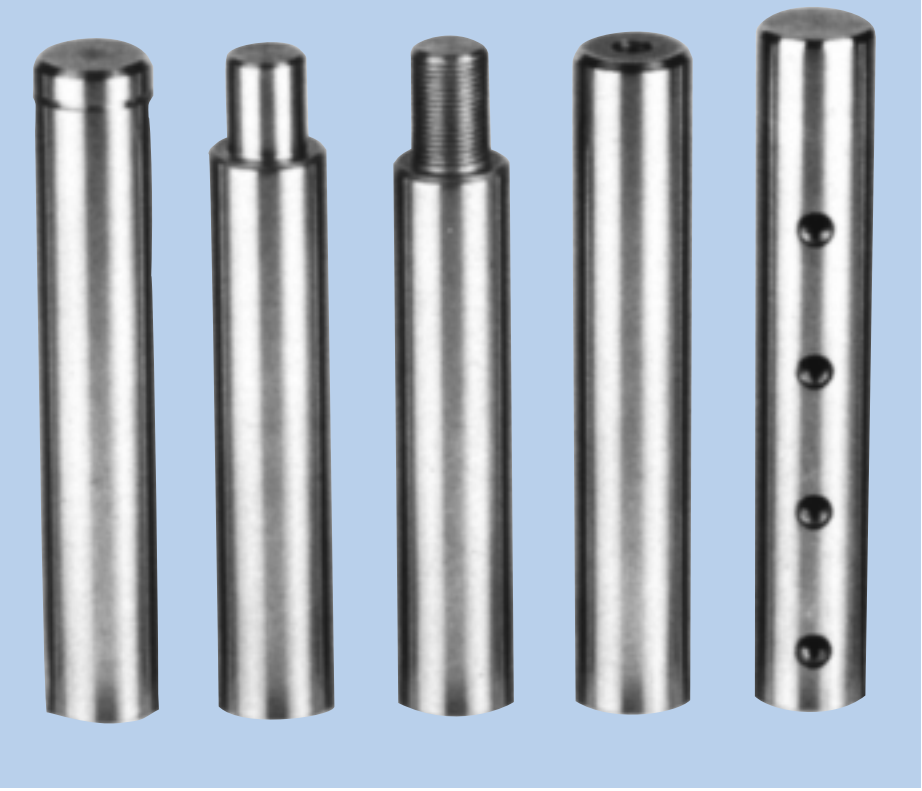
Shafts with radial holes

For linear guides requiring support, shafts with threaded radial holes are needed. These can be supplied by SKF. The radial holes can be positioned either in a way that they accommodate SKF shaft supports or as specified in the customer drawing.

Composite shafts

Composite shafts can be supplied to customer drawings, either with screwed joints or with “plug and socket” joints, depending on the application.

Fig 20



Length tolerances for shafts to DIN 7168, medium series.

Table 4

Nominal length		Deviation
over	incl.	
mm	mm	
–	120	± 0.3
120	400	± 0.5
400	1000	± 0.8
1000	2000	± 1.2
2000	4000	± 2
4000	8000	± 3

Case depth of SKF shafts.

Table 5

Shaft diameter		Case depth
over	incl.	min
mm		mm
–	10	0.5
10	18	0.8
18	30	1.2
30	50	1.5
50	80	2.2
80	100	3.0

Accurately centred trunnions and sockets guarantee smooth transitions at the butt joint. To ensure correct assembly, the relative positions of the shaft sections and of the shaft ends are marked. Composite shafts should be fastened to a support at the butt joints, particularly when these are of the “plug and socket” type. The radial holes should be positioned as closely to the joint as possible and the shaft length selected in a way that bending of the shaft will not result in a gap forming at the joint.

SKF precision steel shafts are available as shown in **Tables 6 and 7**.

Table 6

Designation	Type
LJM	Precision shaft, steel Ck53/Cf53, 60-64HRC, h6
LJMH	Hard chromium plated precision shaft, steel Ck53/Cf53, min. 60HRC, h7
LJMR	Precision shaft, corrosion resistant, X90CrMoV18, 54-58HRC, h6
LJMS	Precision shaft, corrosion resistant, X46Cr13, 54-58HRC, h6
LJT	Hollow shaft, high-grade steel, C60, 60-66HRC, h6

Table 7

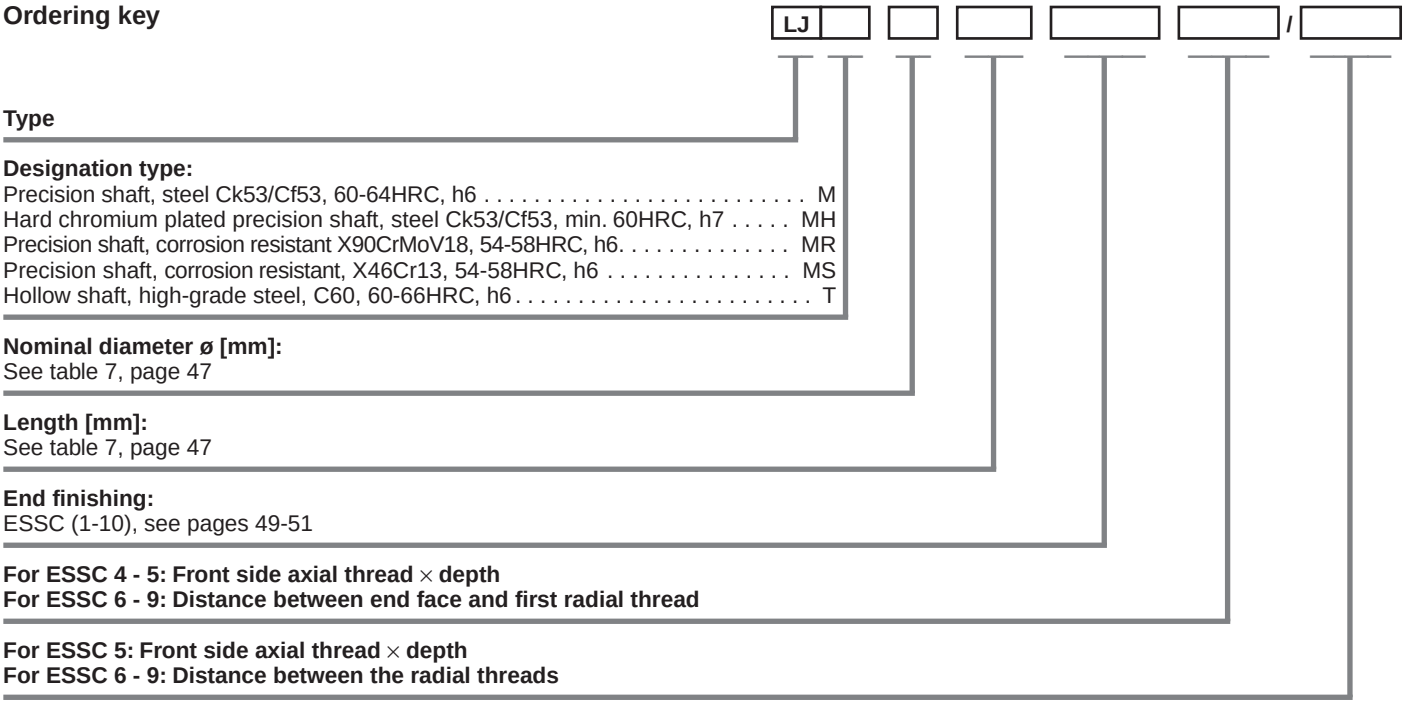
Shaft diameter	Standard length*			
	LJM	LJMH	LJMR LJMS	LJT
mm	mm			
3/4**	100			
	200			
	300			
	400			
	500			
5	2800 - 4100			
6	2800 - 4100			
8	2800 - 4100	3500 - 4100	3500 - 4100	
10	2800 - 4100	3500 - 4100	3500 - 4100	
12	5100 - 6200	5100 - 6200	3500 - 4100	
14	5100 - 6200	5100 - 6200		
16	5100 - 6200	5100 - 6200	3500 - 4100	5100 - 6200
20	5100 - 6200	5100 - 6200	3500 - 4100	5100 - 6200
25	5100 - 6200	5100 - 6200	3500 - 4100	5100 - 6200
30	5100 - 6200	5100 - 6200	3500 - 4100	5100 - 6200
40	5100 - 6200	5100 - 6200	3500 - 4100	5100 - 6200
50	5100 - 6200	5100 - 6200	on request	5100 - 6200
60	5100 - 6200	5100 - 6200	on request	on request
80	5100 - 6200	5100 - 6200	on request	on request

* Different diameters and lengths on request
** Only available as ESSC 2

Standard shaft lengths

2 Guiding systems
Precision shafts

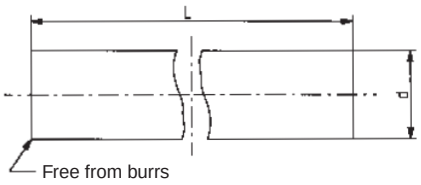
Ordering key



Example 1:	LJ MR	40	1200	ESSC 1			
Example 2:	LJ MR	40	1200	ESSC 2			
Example 3:	LJ MR	40	1200	ESSC 3			
Example 4:	LJ MR	40	1200	ESSC 4	M14×40		
Example 5:	LJ MR	40	1200	ESSC 5	M14×40	/	M16×50
Example 6:	LJ MR	40	1200	ESSC 6	100	/	200
Example 7:	LJ MR	40	1200	ESSC 7	125	/	250
Example 8:	LJ MR	40	1200	ESSC 8	100	/	200
Example 9:	LJ MR	40	1200	ESSC 9	125	/	250
Example 10:	LJ MR	40	1200	ESSC 10			

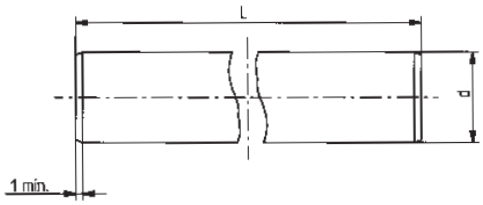
ESSC 1

Cut, without chamfer, only deburred
Length tolerance according to
DIN 7168 medium range



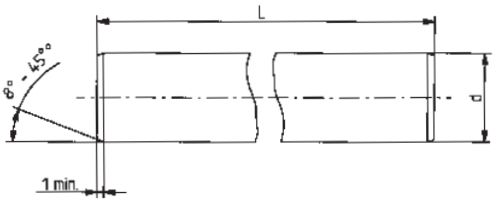
ESSC 2

Cut, with chamfer
Length tolerance as ESSC 1



ESSC 3

Cut, 25° machined chamfer, end faces cut at right angles for limited length tolerance or chamfered according to customer specification
Length tolerance +/– 0.1 mm to a total length of 3000 mm



ESSC 4

Cut, 25° machined chamfer, end faces cut at right angles, one front-side (axial) hole
Length tolerance as ESSC 3
(see Table 8)

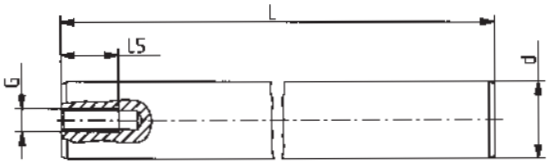


Table 8

Diameter	Thread	Depth
Ø	G	L_5
mm		
5		
8	M4	10
10	M4	10
12	M5	12.5
14	M5	12.5
16	M6	15
20	M8	20
25	M10	25
30	M10	25
40	M12	30
50	M16	40
60	M20	50
80	M24	60

2 Guiding systems
Precision shafts

ESSC 5

As ESSC 4 with two front side (axial) holes
(see Table 9)

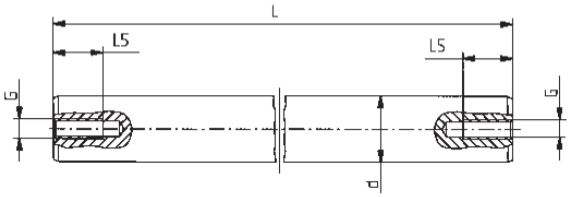


Table 9

Diameter	Thread	Depth
Ø	G	L_5
mm		
5		
8	M4	10
10	M4	10
12	M5	12.5
14	M5	12.5
16	M6	15
20	M8	20
25	M10	25
30	M10	25
40	M12	30
50	M16	40
60	M20	50
80	M24	60

ESSC 6

Cut and chamfered as ESSC 2
- with radial holes for LRCB
- first radial hole at Jx = J/2
- H_1 according to hardening depth

(see Table 10)

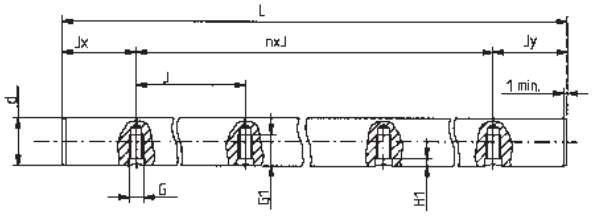


Table 10

Ø	Thread	G	G_1	J	J_X
mm		mm			
5	–	–	–	–	–
8	–	–	–	–	–
12	M4	5	8	75	37.5
16	M5	6	9.5	100	50
20	M6	7	13	100	50
25	M8	9	14	120	60
30	M10	11	18	150	75
40	M10	11	20	200	100
50	M12	13	23	200	100
60	M14	15	28	300	150
80	M16	16	33	300	150

ESSC 7

As ESSC 6
- radial holes with J and Jx according to customer specification

(see Table 11)

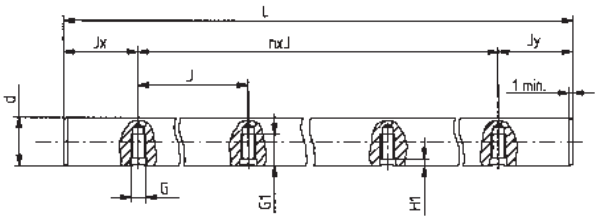


Table 11

Ø	Thread	G	G_1	J	J_X
mm		mm			
5	–	–	–	–	–
8	–	–	–	–	–
12	M4	5	8	–	–
16	M5	6	9.5	–	–
20	M6	7	13	–	–
25	M8	9	14	–	–
30	M10	11	18	–	–
40	M10	11	20	–	–
50	M12	13	23	–	–
60	M14	15	28	–	–
80	M16	16	33	–	–

ESSC 8

Cut and chamfer as ESSC 2
- shaft mounted on LRCB
- first radial hole with Jx = J/2
- H_1 according to hardness depth

(see Table 12)

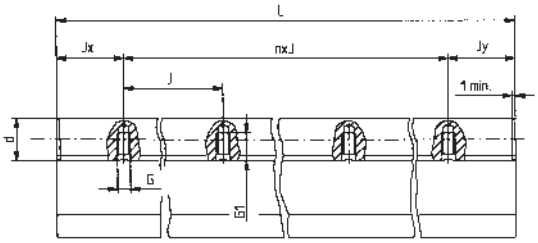


Table 12

Ø	Thread	G	G_1	J	J_X
mm		mm			
5	–	–	–	–	–
8	–	–	–	–	–
12	M4	5	8	75	37.5
16	M5	6	9.5	100	50
20	M6	7	13	100	50
25	M8	9	14	120	60
30	M10	11	18	150	75
40	M10	11	20	200	100
50	M12	13	23	200	100
60	M14	15	28	300	150
80	M16	16	33	300	150

ESSC 9

As ESSC 8
- shaft mounted on LRCC
- radial holes with J and Jx according to customer specification

(see Table 13)

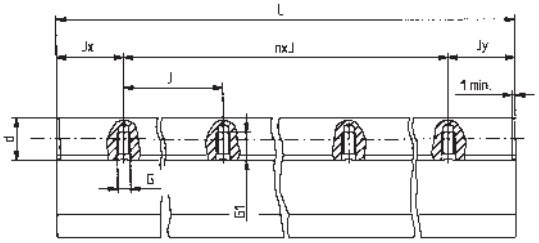


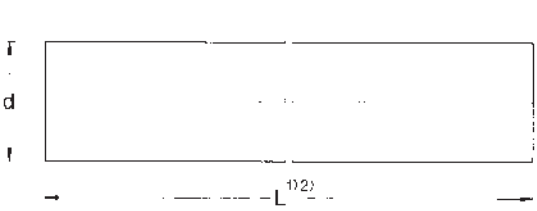
Table 13

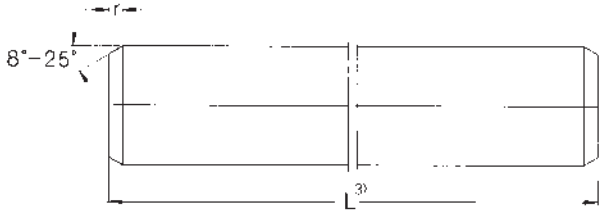
Ø	Thread	G	G_1	J	J_X
mm		mm			
5	–	–	–	–	–
8	–	–	–	–	–
12	M4	5	8	–	–
16	M5	6	9.5	–	–
20	M6	7	13	–	–
25	M8	9	14	–	–
30	M10	11	18	–	–
40	M10	11	20	–	–
50	M12	13	23	–	–
60	M14	15	28	–	–
80	M16	16	33	–	–

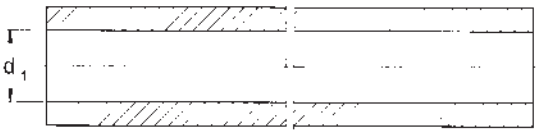
ESSC 10

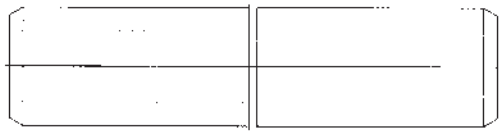
Shaft according to customer specification
- manufacture only according to customer drawing

2 Guiding systems
Precision shafts









Standard designs
Designs for fixed length without chamfer

Designs for fixed length with chamfer

Table 14 shows basic data for the various models for the precision shafts.

Table 14

Dimension			Mass		Moment of inertia		Cross sectional area		Designations				
			Solid shaft	Hollow shaft	Solid shaft	Hollow shaft	Solid shaft	Hollow shaft	Solid shaft of precision steel	Solid shaft of stainless steel X90CrMoV18	X46Cr13	Solid shaft with high grade steel chromium plated	Hollow shaft high grade steel
d	d_1	r_{min}											
mm			kg/m		cm^4		mm^2						
3	–	0.4	0.06	–	0.0004	–	7.1	–	LJM 3				
4	–	0.4	0.1	–	0.0013	–	12.6	–	LJM 4				
5	–	0.8	0.15	–	0.0031	–	19.6	–	LJM 5				
6		0.8	0.22	–	0.0064	–	28.3	–	LJM 6				
8	–	0.8	0.39	–	0.020	–	50.3	–	LJM 8	LJMR 8	LJMS 8	LJMH 8	
10	–	0.8	0.62	–	0.049	–	78.5	–	LJM 10	LJMR 10	LJMS 10	LJMH 10	
12	–	1	0.89	–	0.102	–	113	–	LJM 12	LJMR 12	LJMS 12	LJMH 12	
14	–	1	1.21	–	0.189	–	154	–	LJM 14			LJMH 14	
16	7	1	1.57	1.28	0.322	0.310	201	163	LJM 16	LJMR 16	LJMS 16	LJMH 16	LJT 16
20	12	1.5	2.45	1.26	0.785	0.597	314	160	LJM 20	LJMR 20	LJMS 20	LJMH 20	LJT 20
25	14	1.5	3.83	2.40	1.92	1.64	491	305	LJM 25	LJMR 25	LJMS 25	LJMH 25	LJT 25
30	19	1.5	5.51	3.55	3.98	3.46	707	453	LJM 30	LJMR 30	LJMS 30	LJMH 30	LJT 30
40	26	2	9.80	5.40	12.6	9.96	1260	685	LJM 40	LJMR 40	LJMS 40	LJMH 40	LJT 40
50	35	2	15.3	10.6	30.7	27.7	1960	1350	LJM 50	LJMR 50	LJMS 50	LJMH 50	LJT 50
60	36	2.5	22.1	15.1	63.6	57.1	2830	1920	LJM 60			LJMH 60	LJT 60
80	53	2.5	39.2	20.1	201	153	5030	2565	LJM 80			LJMH 80	LJT 80

Attention:
d_1 can deviate from the value quoted. Please enquire if necessary.
Different shaft diameters and types on request.
The static load capacity has to be decreased by 8% and the dynamic load capacity by 18% when using the non-rusting types (HV6) in conjunction with precision steel shafts made of stainless steel.

Shafts cut to special length with flat turned ends. The length tolerance of these shafts corresponds to DIN 7168, medium. The designation for a shaft with 20 mm diameter cut to a length of 1.5 m is, for example, LJM 20×1500.

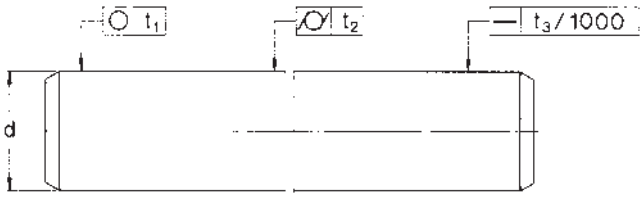


Table 15 shows basic data for the various models for the precision shafts of high-grade steel.

Table 15

Shaft	**Accuracy of dimension and form**									
Nominal diameter	Shafts to tolerance h6 Diameter deviation		Circularity	Cylindricity	Straight-ness[1)]	Shafts to tolerance h7 Diameter deviation		Circularity	Cylindricity	Straight-ness[1)]
d	high	low	t_1	t_2	t_3	high	low	t_1	t_2	t_3
mm	µm									
3	0	– 6	3	4	300	0	– 10	4	6	300
4	0	– 8	4	5	300	0	– 12	5	8	300
5	0	– 8	4	5	300	0	– 12	5	8	300
6	0	– 8	4	5	300	0	– 12	5	8	300
8	0	– 9	4	6	300	0	– 15	6	9	300
10	0	– 9	5	7	300	0	– 15	7	10	300
12	0	– 11	5	8	200	0	– 18	8	11	200
14	0	– 11	5	8	200	0	– 18	8	11	200
16	0	– 11	5	8	200	0	– 18	8	11	200
20	0	– 13	6	9	100	0	– 21	9	13	100
25	0	– 13	6	9	100	0	– 21	9	13	100
30	0	– 13	6	9	100	0	– 21	9	13	100
40	0	– 16	7	11	100	0	– 25	11	16	100
50	0	– 16	7	11	100	0	– 25	11	16	100
60	0	– 19	8	13	100	0	– 30	13	19	100
80	0	– 19	8	13	100	0	– 30	13	19	100

[1)] Shafts with straightness 50 mm/1000 mm to order