Precision shafts

SKF precision shafts (**fig. 8**) 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, please note 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 are available 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.

Fig. 8



Table 4

Nominal length		Deviation
over	incl.	
mm		
–	120	±0,3
120	400	±0,5
400	1 000	±0,8
1 000	2 000	±1,2
2 000	4 000	±2
4 000	8 000	±3

Length tolerances for shafts to DIN/ISO 2768 medium class

Table 5

Shaft diameter		Hardness depth
over	incl.	min.
mm		
-	10	0,5
10	18	0,8
18	30	1,2
30	50	1,5
50	80	2,2
80	100	3

Case hardening of SKF shafts

N.B.:
In addition to this catalogue, all product brochures are available on **www.skf.com** *as PDF files.*



Publication nr. 4182 EN

Composite shafts

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

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.

Materials

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

SKF precision shafts are made from the non-alloyed high-grade steels Cf53 (Material No.1.1213), Ck53 (Material No.1.1210), Ck60 (Material No.1.1221) and 100Cr6 (Material No.12067).

The surface hardness is between approximately 60 and 64 HRC. The solid shafts of stainless steel are made from the steel X90CrMoV18 (Material No.1.4112) or X46Cr13 (Material No.1.4034). In this case the surface hardness lies between approximately 52 and 56 HRC.

Shafts made from other materials can be supplied to special order.

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, 52-56HRC, h6/h7
LJMS	Precision shaft, corrosion resistant, X46Cr13, 52-56HRC, h6/h7
LJT	Hollow shaft, high-grade steel, Ck60 or 100Cr6, 60-66HRC, h6/h7

Table 7

Standard length of the shafts[1] Shaft diameter	Dimensions Maximal length[2]				
	LJM[3]	LJMH[3]	LJMS[3]	LJMR[3]	LJT[3]
mm					
3[4]				200	
4[4]				200	
5	3 900	2 000	1 000	3 800	
6	3 900	3 900	3 900	3 800	
8	3 900	3 900	3 900	3 800	
10	6 200	6 200	3 900	3 800	
12	6 200	6 200	4 900	6 200	6 200
14	6 200	6 200	4 900	6 200	6 200
16	6 200	6 200	4 900	6 200	6 200
20	6 200	6 200	4 900	6 200	6 200
25	6 200	6 200	4 900	6 200	6 200
30	6 200	6 200	4 900	6 200	6 200
40	6 200	6 200	4 900	6 200	6 200
50	6 200	6 200	4 900	6 200	6 200
60	6 200	6 200	4 900	6 200	6 200
80	6 200	6 200		6 200	6 200

[1] Different diameters and length on request
[2] Length tolerance ±10 % (based on maximum shaft length)
[3] For details see page 51/52
[4] Only available as ESSC 2

Standard shaft lengths

Ordering key

LJ						/	

Type

Designation type:

Precision shaft, steel Ck53/Cf53, 60-64HRC, h6	M
Hard chromium plated precision shaft, steel Ck53/Cf53, min. 60HRC, h7	MH
Precision shaft, corrosion resistant X90CrMoV18, 52-56HRC, h6/h7	MR
Precision shaft, corrosion resistant, X46Cr13, 52-56HRC, h6/h7	MS
Hollow shaft, high-grade steel, Ck60 or 100Cr6, 60-66HRC, h6/h7	T

Nominal diameter Ø (mm):
See table 7, page 46

Length (mm):
See table 7, page 46

End finishing:
ESSC (1-10), see pages 48-50

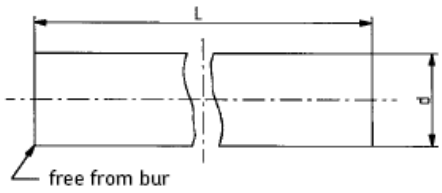
For ESSC 4 - 5: Front side axial thread × depth
For ESSC 6 - 9: Distance between end face and first radial thread

For ESSC 5: Front side axial thread × depth
For ESSC 6 - 9: Distance between the radial threads

Example 1:	LJ	MR	40	1200	ESSC1			
Example 2:	LJ	MR	40	1200	ESSC2			
Example 3:	LJ	MR	40	1200	ESSC3			
Example 4:	LJ	MR	40	1200	ESSC4	M14×40		
Example 5:	LJ	MR	40	1200	ESSC5	M14×40	/	M16×50
Example 6:	LJ	MR	40	1200	ESSC6			
Example 7:	LJ	MR	40	1200	ESSC7	125	/	250
Example 8:	LJ	MR	40	1200	ESSC8			
Example 9:	LJ	MR	40	1200	ESSC9	125	/	250
Example 10:	LJ	MR	40	1200	ESSC10			

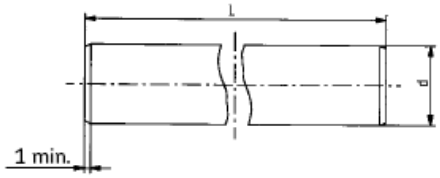
ESSC 1

Cut, without chamfer, only deburred
Length tolerance according to ISO 2768 medium class



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 3 000 mm



ESSC 4

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

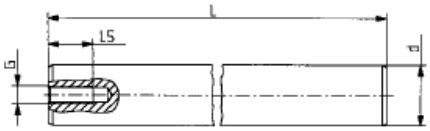
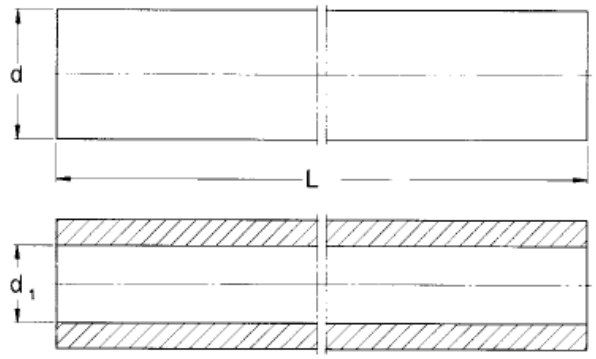


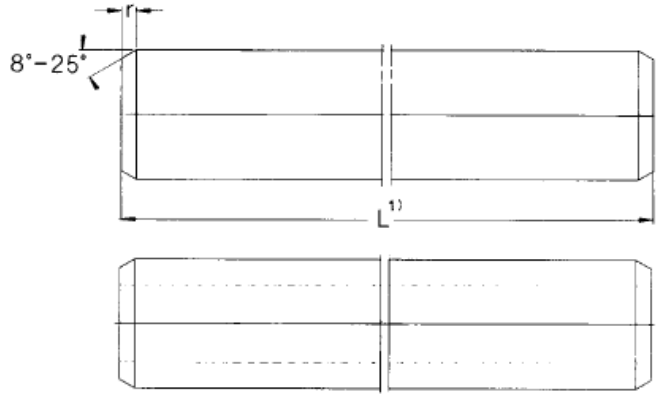
Table 8

Diameter Ø	Thread G	Depth L_5
mm		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

Standard designs for fixed length without chamfer



Standard designs for fixed length with chamfer

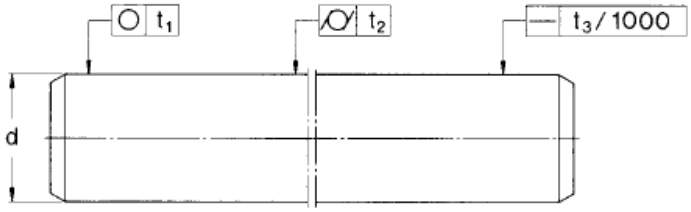


[1] Shafts cut to special length with chamfered ends. The length tolerance of these shafts corresponds to LJM 20×1 500 ESSC2 medium class.
The designation for a shaft with 20 mm diameter cut to a length of 1,5 m is, for example, LJM 20×1 500 ESSC2.

Basic data for the various models for the precision shafts

Dimensions			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		Solid shafts with high grade steel hard chromium plated	Hollow shaft high grade steel
d	d_1	r_{min}							Cf53/Ck53	X90CrMoV18	X46Cr13	Cf53/Ck53	Ck60/100Cr6
mm			kg/m		cm^4		mm^2						
3	–	0,4	0,06	–	0,0004	–	7,1	–	–	LJMR 3	–	–	–
4	–	0,4	0,1	–	0,0013	–	12,6	–	–	LJMR 4	–	–	–
5	–	0,8	0,15	–	0,0031	–	19,6	–	LJM 5	LJMR 5	LJMS 5	LJMH 5	–
6	–	0,8	0,22	–	0,0064	–	28,3	–	LJM 6	LJMR 6	LJMS 6	LJMH 6	–
8	–	0,8	0,39	–	0,02	–	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	4	1	0,89	0,79	0,102	–	113	–	LJM 12	LJMR 12	LJMS 12	LJMH 12	LJT 12
14	–	1	1,21	–	0,189	–	154	–	LJM 14	LJMR 14	LJMS 14	LJMH 14	–
16	7	1	1,58	1,28	0,322	0,31	201	163	LJM 16	LJMR 16	LJMS 16	LJMH 16	LJT 16
20	14	1,5	2,47	1,25	0,785	0,597	314	160	LJM 20	LJMR 20	LJMS 20	LJMH 20	LJT 20
25	16	1,5	3,86	2,35	1,92	1,64	491	305	LJM 25	LJMR 25	LJMS 25	LJMH 25	LJT 25
30	18	1,5	5,55	3,5	3,98	3,46	707	453	LJM 30	LJMR 30	LJMS 30	LJMH 30	LJT 30
40	28	2	9,86	4,99	12,6	9,96	1 260	685	LJM 40	LJMR 40	LJMS 40	LJMH 40	LJT 40
50	30	2	15,4	9,91	30,7	27,7	1 960	1 350	LJM 50	LJMR 50	LJMS 50	LJMH 50	LJT 50
60	36	2,5	22,2	14,2	63,6	57,1	2 830	1 920	LJM 60	LJMR 60	LJMS 60	LJMH 60	LJT 60
80	57	2,5	39,5	19,43	201	153	5 030	2 565	LJM 80	–	–	LJMH 80	LJT 80

Attention:
d_1 can deviate from the value quoted.
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.



Basic data for the various models for the precision shafts of high-grade steel

Shaft	Accuracy of dimension and form Shafts to tolerance h6					Shafts to tolerance h7				
Nominal diameter	Diameter deviation		Roundness	Circularity	Straightness[1]	Diameter deviation		Roundness	Circularity	Straightness[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	150	0	–10	4	6	150
4	0	–8	4	5	150	0	–12	5	8	150
5	0	–8	4	5	150	0	–12	5	8	150
6	0	–8	4	5	150	0	–12	5	8	150
8	0	–9	4	6	120	0	–15	6	9	120
10	0	–9	5	7	120	0	–15	7	10	120
12	0	–11	5	8	100	0	–18	8	11	100
14	0	–11	5	8	100	0	–18	8	11	100
16	0	–11	5	8	100	0	–18	8	11	100
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.