

Linear bearings, units and shafts catalogue



3.7 Precision shafts

Ewellix precision shafts can be supplied either as solid or hollow shafts. Solid shafts are available in all dimensions required to fit Ewellix linear ball bearings. Hollow shafts have a minimum outer diameter of 12 mm. They are induction hardened and ground. Ewellix shafts have exceptionally high dimensional stability and are designed for long service life.

For special applications, solid shafts of stainless steel or hard chromium plated shafts with a layer thickness from 10 - 15 µm can be supplied.

Surface finish

All Ewellix precision steel shafts have a maximum surface roughness of $R_a = 0,3 \mu\text{m}$.

Materials

The shaft material differs with the shaft type, as indicated in table below.

Shaft type		Material	Hardness
			HRC
Solid shaft			
LJM	high-grade steel	1.1213 (Cf53) ¹⁾	60 - 64
LJMR	stainless steel	1.4112 (X90CrMoV18) ¹⁾	52 - 56
LJMS	stainless steel	1.4034 (X46Cr13) ¹⁾	52 - 56
Solid shaft, hard chromium plated			
LJMH	high-grade steel	1.1213 (Cf53) ¹⁾	60 - 64
Hollow shaft			
LJT	high-grade steel	1.3505 (100Cr6) ¹⁾	60 - 64

¹⁾ or equal

The table with hardness depths shows minimum values. In reality the hardness depth may also be greater than indicated in the table and this may have an influence on the machinability of the shafts. The ends of uncut shafts in production length may deviate in hardness and dimensional accuracy.



Tolerances

All Ewellix precision shafts without coating are supplied in tolerance h6 as standard. Hard chromium plated shafts LJMH are supplied in tolerance h7. The accuracy of dimensions and form of these shafts can be found on page 97. There may be slight deviations from the values provided in the tables for sections of the shaft that have been annealed. Shafts cut to length have a length tolerance according to the adjacent table.

Shafts with radial holes

Radial holes are needed if a shaft has to be mounted onto a shaft support. The radial holes may be either positioned to fit Ewellix shaft supports (suffix ESSC 6) or as specified by the customer (suffix ESSC 7). The values for thread size and depth provided in the adjacent table must be adhered to when customising shafts. Ewellix shafts with radial holes are not annealed at the drilling position. The thread is cut in the hardened and ground shaft to avoid any changes in hardness or dimensional accuracy.

Jointed shafts

Ewellix can supply jointed shafts on request. Screwed joints are recommended for unsupported shafts. Plug and socket joints are used with supported shafts. Ewellix takes care for accurately machined joints, e.g. regarding concentricity, as they are vital for smooth transitions at the joints.

A customer drawing with details and defined joint positions is necessary to handle a request or order.

NOTE for customised solutions:

The length of the shaft and the position of the supports should be determined so that any bending of the shaft does not cause a gap at the joint. When drilling radial holes for the supports, drill as close as possible to the joint.

Corrosion protection, packaging

Ewellix precision shafts are treated with a rust inhibiting preservative that must be removed before the shafts are installed. Depending on size and quantity, precision shafts are supplied in cardboard or wooden boxes that offer maximum protection during transport.

Please contact us for special freight or storage conditions, e.g. overseas.

Hardness depths of shafts

Shaft diameter > mm	≤	Hardness depth min.
3	10	0,4
10	18	0,6
18	30	0,9
30	50	1,5
50	80	2,2

Length tolerances for shafts

Nominal length > mm	≤	Deviation
10	2 000	± 1,5
2 000	4 000	± 2
4 000	8 000	± 3

Maximum length of precision shafts

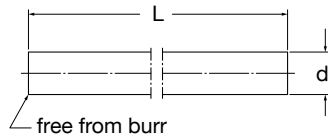
Shaft diameter mm	Maximum length ¹⁾				
	LJM	LJMR	LJMS	LJMH	LJT
3 ²⁾	1 000	300	-	-	-
4 ²⁾	3 000	3 000	-	-	-
5	3 000	3 000	-	3 000	-
6	3 000	3 000	3 000	3 000	-
8	3 000	3 000	3 000	3 000	-
10	3 000	3 000	3 000	3 000	-
12	6 000	6 000	6 000	6 000	6 000
14	6 000	6 000	6 000	6 000	-
16	6 000	6 000	6 000	6 000	6 000
20	6 000	6 000	6 000	6 000	6 000
25	6 000	6 000	6 000	6 000	6 000
30	6 000	6 000	6 000	6 000	6 000
40	6 000	6 000	6 000	6 000	6 000
50	6 000	6 000	6 000	6 000	6 000
60	6 000	6 000	6 000	6 000	6 000
80	6 000			6 000	6 000

¹⁾ Length tolerance ±10 % (based on maximum shaft length). Maximum length < production length. Both ends are cut, this means no deviation of hardness or dimensional accuracy.

²⁾ Only available as ESSC 2, see **next page**

Shafting standard – ESSC

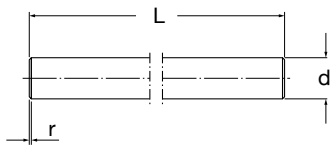
Ewellix offers different standards to specify how both ends of the shaft should look. The choice has to be mentioned in the ordering key. For example, the designation for a shaft with 20 mm diameter cut to a length of 1,5 m and with chamfers is LJM 20x1 500 ESSC2. The standard ESSC 10 is for shafts machined according to the customer drawing.



ESSC 1

cut with deburring

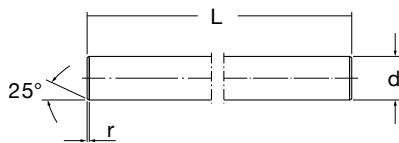
- length tolerance \hookrightarrow page 89



ESSC 2

cut with chamfer

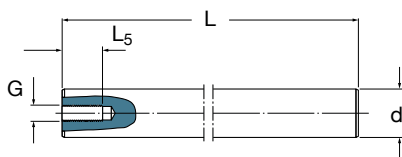
- length tolerance \hookrightarrow page 89
- chamfer with value r to be at least 1 mm



ESSC 3

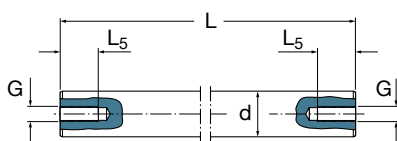
front surface machined to 90° and chamfer with 25°

- length tolerance \pm 0,1 mm up to 3 000 mm total length
- defined chamfer with minimum value r as defined on page 92



ESSC 4

as ESSC 3
+ one axial hole

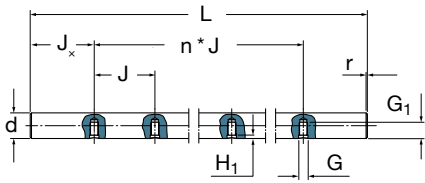


ESSC 5

as ESSC 3
+ two axial holes

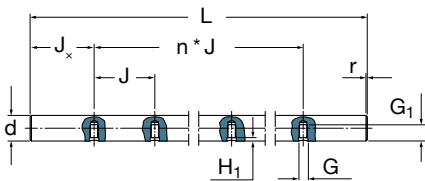
Dimensions of front side threads for ESSC 4, 5

d mm	G -	L5 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



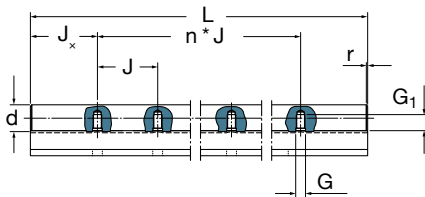
ESSC 6

- as ESSC 2
- + radial holes for shaft support LRCB (↳ chapter 3.6.6)
- + first radial hole at $J_x = J/2$
- + H_1 according to hardness depth



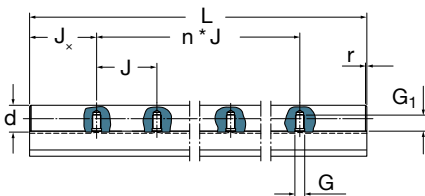
ESSC 7

- as ESSC 2
- + radial holes
- + dimension J_x and J according to customer specification
- + H_1 according to hardness depth



ESSC 8

- as ESSC 6
- + shaft mounted on shaft support with mounting holes LRCB (↳ chapter 3.6.6)

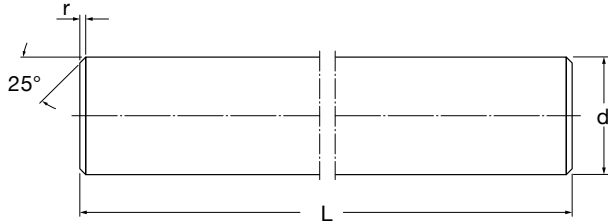


ESSC 9

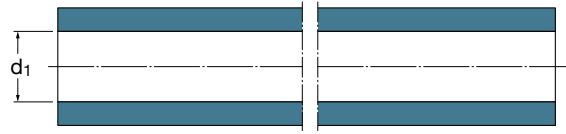
- as ESSC 6
- + shaft mounted on shaft support without mounting holes LRCC (↳ chapter 3.6.6)

Dimensions of radial threads for ESSC 6, 7, 8, 9					
d mm	Thread -	G mm	G_1	J	J_x
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

Precision shafts



Picture shows solid shaft with shafting standard ESSC 3



Picture shows hollow shaft with shafting standard ESSC 1

Dimensions			Mass		Moment of inertia		Cross sectional area		Designation ¹⁾					
d	d ₁	r ³⁾	Solid shaft	Hollow shaft	Solid shaft	Hollow shaft	Solid shaft	Hollow shaft	Solid shaft			Hollow shaft		
									high-grade steel	stainless steel ²⁾	stainless steel ²⁾	high-grade steel and hard chromium plated	high-grade steel	
mm			kg/m		cm ⁴		mm ²		1.1213 or equal	1.4112 or equal	1.4034 or equal	1.1213 or equal	1.3505 or equal	
3	—	0,4	0,06	—	0,0004	—	7,1	—	LJM 3	LJMR 3				
4	—	0,4	0,1	—	0,0013	—	12,6	—	LJM 4	LJMR 4				
5	—	0,8	0,15	—	0,0031	—	19,6	—	LJM 5	LJMR 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	0,1	113	101	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 ⁴⁾	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 ⁴⁾	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	

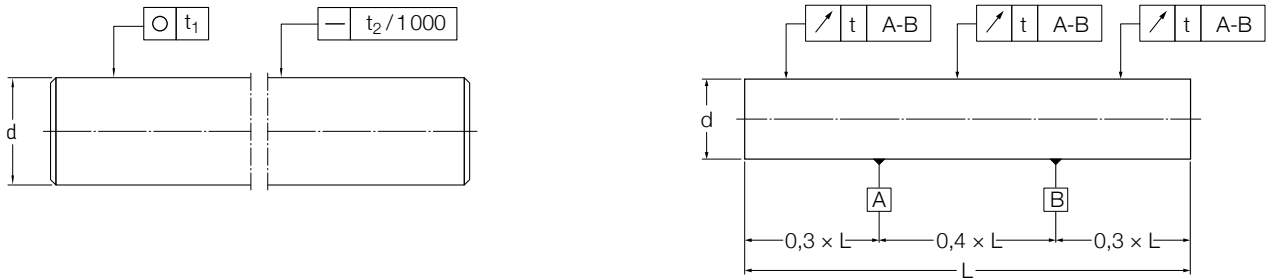
¹⁾ Delivery time of shafts on request

²⁾ Basic load ratings are valid for bearing steel and stainless steel variants. They must be reduced with stainless steel shafts only

³⁾ The values r given in that table represent the minimum values of r.

⁴⁾ d₁ can deviate from the given value. Please enquire if necessary

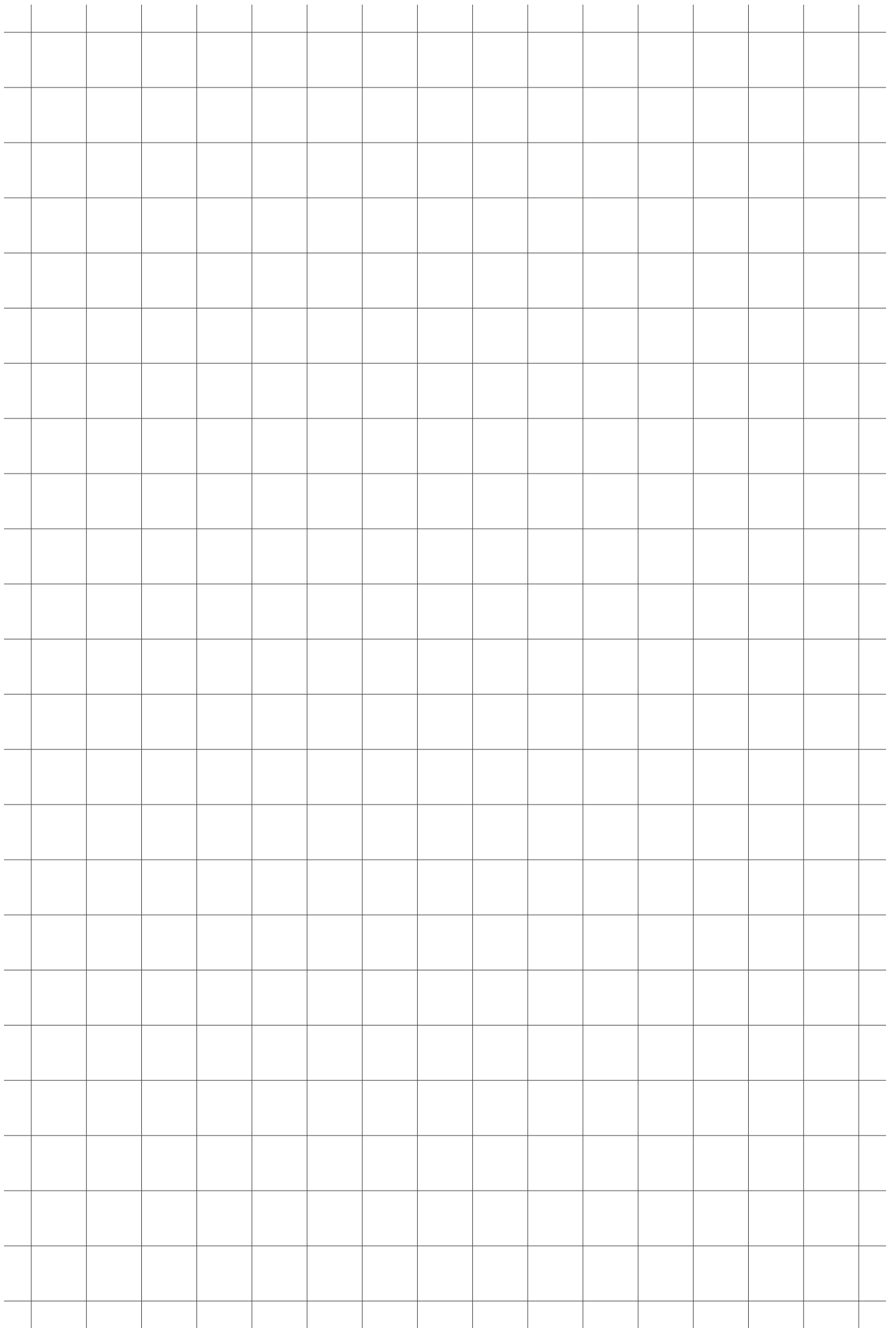
Precision shafts of high-grade steel



Measuring principle of straightness

Shaft Nominal diameter d mm	Accuracy of dimension and form									
	Shafts in tolerance h6 ¹⁾					Shafts in tolerance h7				
	Diameter deviation		Roundness	Cylindricity	Straightness	Diameter deviation		Roundness	Cylindricity	Straightness
	high	low	t ₁	t ₂	t ₃	high	low	t ₁	t ₂	t ₃
	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⁾ All precision shafts without coating are supplied in tolerance h6 as standard. Higher precision on request. Hard chromium plated shafts LJMh only in h7.





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