HYDRAULICALLY ACTUATED GUIDING AND CLAMPING SLEEVES

SPIETH

- **AUTOMATIC CLAMPING FEATURE WITH CONTROLLED GUIDE CLEARANCE**

SPIETH

PATENTED

1.0 APPLICATION:

SPIETH Hydraulic Guiding and Clamping Sleeves guide and automatically clamp machine components such as quills, guide bars, clamp and support posts on automatic mechanisms and machines.

The standard series has been designed for reciprocating motions.

Upon request, we also furnish special guiding and clamping sleeves for both reciprocating and rotary motions.

2.0 CONSTRUCTION:

SPIETH Hydraulic Guiding and Clamping Sleeves are made of alloy steel, are hardened and precision ground. Standard concentricity is within .0005″. For extreme precision requirements, concentricity of .0002″ is also available. The unique design of the sleeves incorporates the hydrodynamic principle of lubrication: thus, when reciprocating the guide bar, the lubricant is wedged between the guide surfaces, creating a lubricant film and avoiding metal-to-metal contact. Wear on the mating guide surfaces is minimized and special lining is normally not required. For applications with little or no lubrication, SPIETH Guiding and Clamping Sleeves may be lined with bronze or plastic.

3.0 FUNCTIONAL CHARACTERISTICS:

By compressing the Guiding and Clamping Sleeve axially, it expands the outside diameter and contracts the inside diameter (axial compression of .001″ results in about .0001″ diametrical contraction).

3.1 IN RELAXED MODE

Note the exaggerated clearance "C" between quill, SPIETH Sleeve, housing, and retainer when no preload is applied (See Fig. 1)

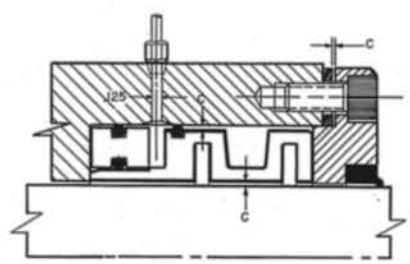


Fig. 1

3.2 IN PRELOADED MODE

Guide clearance "GC" between quill and guide sleeve may be reduced independently from manufacturing tolerances of adjacent parts by changing the spacer width "X". Note the clearance of the housing and outer diameter of the sleeve is first eliminated before the inner diameter of the sleeve contracts. (See Fig. 2)

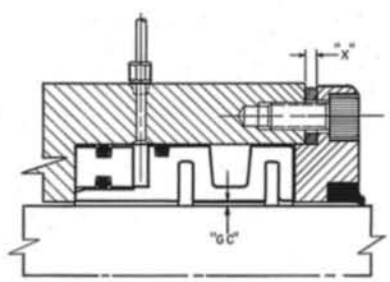


Fig. 2

3.3 IN CLAMPED MODE

Full linear and circumferential contact between clamping sleeve, quill housing, and quill is established. This method provides a solid shrink fit metal-to-metal connection and ascertains the highest degree of rigidity and stiffness between quill and housing. (See Fig. 3) Relief clearance "RC" will not diminish under hydraulic pressure.

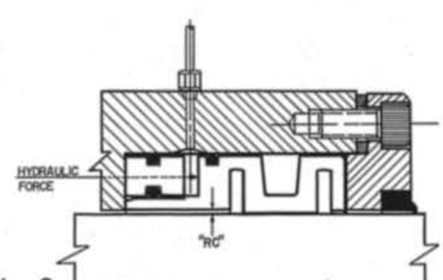


Fig. 3

4.0 ADVANTAGES:

SPIETH Guiding and Clamping Sleeves —

- 4.1 Offer a simple solution to automatic guiding and clamping applications.
- 4.2 Can be adjusted to obtain the most suitable guide clearance.
- 4.3 Clamp rigidly on the entire circumference of the inside and outside diameter, across keyways, racks, splines.
- 4.4 Clamp the mating components axially in any position without complicated support mechanisms.
- 4.5 Maintain accurate location and concentricity between clamping and unclamping cycles.
- 4.6 Relax to their original set guide clearance at zero hydraulic pressure.
- 4.7 Compensate for slight out-of-roundness of mating components.
- 4.8 Hold high axial thrust, radial load, and torque with a high degree of concentricity and stiffness.
- 4.9 Can be adjusted to compensate for wear.
- 4.10 Can be applied for automatic guide clearance variation by changing hydraulic pressure.
  - 4.101 Normal guide clearance for drilling, tapping, counterboring and reaming.
  - 4.102 Reduced guide clearance for boring and bumpfacing.
  - 4.103 Zero guide clearance in clamping mode for milling or facing.

5.0 TYPES OF SPIETH HYDRAULIC GUIDING AND CLAMPING SLEEVES:

5.1 SPK - SPL SPIETH Standard Hydraulic Guiding and Clamping Sleeve Sets, as tabulated in the table, incorporate the highest clamping capacities. However, during the clamping process, they will drag the bar by .002" to .005" in the direction of hydraulic pressure actuation in the case of an SPK assembly. This feature is generally favored on clamp posts because it intensifies the clamping force. The amount and direction of drag in an SPL and E assembly cannot be determined. (See 5.102 Note)

5.2 DPK - DPL SPIETH Dragfree Guiding and Clamping Sleeve Sets with zero drag are mainly used on support posts or quills where accurate positioning must be maintained while clamping. Dragfree sleeves yield about 50% holding capacity of standard sleeves.

5.3 SCK - SCL SPIETH Coated Standard Guiding and Clamping Sleeve Sets are similar to SPK-SPL except that they are lined with bronze or plastic and are recommended when lubrication is not always guaranteed.

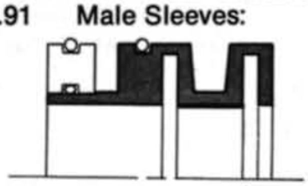
5.4 DCK - DCL SPIETH Coated Dragfree Guiding and Clamping Sleeve Sets are similar to DPK-DPL but with the bronze or plastic lining.

5.5 ESKK - ESKL SPIETH Extended Guiding and Clamping Sleeve Sets, type "E", are applied when a greater distance between the clamping sleeves is desired for a longer "Wheelbase". Hydraulic spacers in increments of 2" are standard. Special lengths are available upon request.

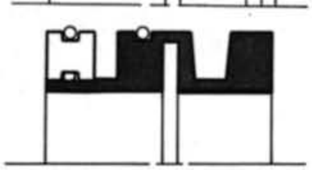
5.6 EDKK - EDKL Similar function to 5.2 (DPL) except for extended length.
5.7 ESCK - ESCL Similar function to 5.3 (SCL) except for extended length.
5.8 EDCK - EDCL Similar function to 5.4 (DCL) except for extended length.

5.9 INDIVIDUAL COMPONENTS FOR SHORT "K" AND LONG "L" STYLE HYDRAULIC GUIDING AND CLAMPING SLEEVE SETS:

5.91 Male Sleeves:

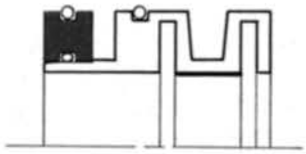


SP Standard Sleeve non-coated
SC Standard Sleeve coated (shown)



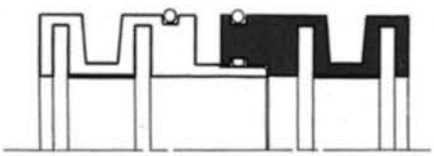
DP Dragfree Sleeve non-coated
DC Dragfree Sleeve coated (shown)

5.92 Pressure Ring:

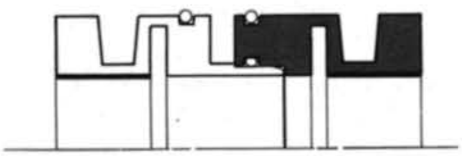


SK Hydraulic pressure ring (used on type "K" only)

5.93 Female Sleeves:



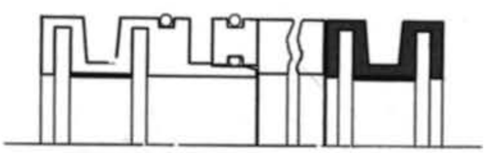
SL Standard Sleeve non-coated
SCL Standard Sleeve coated (shown)



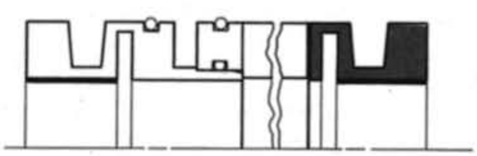
DL Dragfree Sleeve non-coated
DCL Dragfree Sleeve coated (shown)

5.10 INDIVIDUAL COMPONENTS FOR EXTENDED TYPE "E" HYDRAULIC GUIDING AND CLAMPING SLEEVE SETS.

5.101 Plain Short "K" Guiding and Clamping Sleeves:

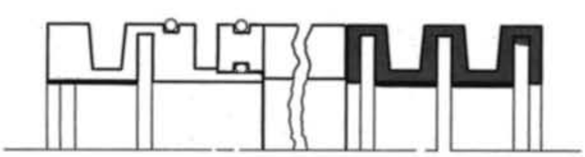


SKK Standard Short Sleeve non-coated
SCK Standard Short Sleeve coated (shown)



DKK Dragfree Short Sleeve non-coated
DCK Dragfree Short Sleeve coated (shown)

5.102 Plain Long "L" Guiding and Clamping Sleeves:



SKL Standard Long Sleeve non-coated
SCL Standard Long Sleeve coated (shown)

NOTE: Dragfree Long Sleeves are not available. Long type "L" Hydraulic Guiding and Clamping Sleeve Sets may be arranged to drag in one specified direction only by selecting standard and dragfree sleeves in proper order.

6.0 DESIGN CONSIDERATIONS:

6.1 ECONOMY:

6.11 SPK Hydraulic Guiding and Clamping Sleeve Sets are most economical if holding forces and clamping lengths are within the chart values F_t and T_t.

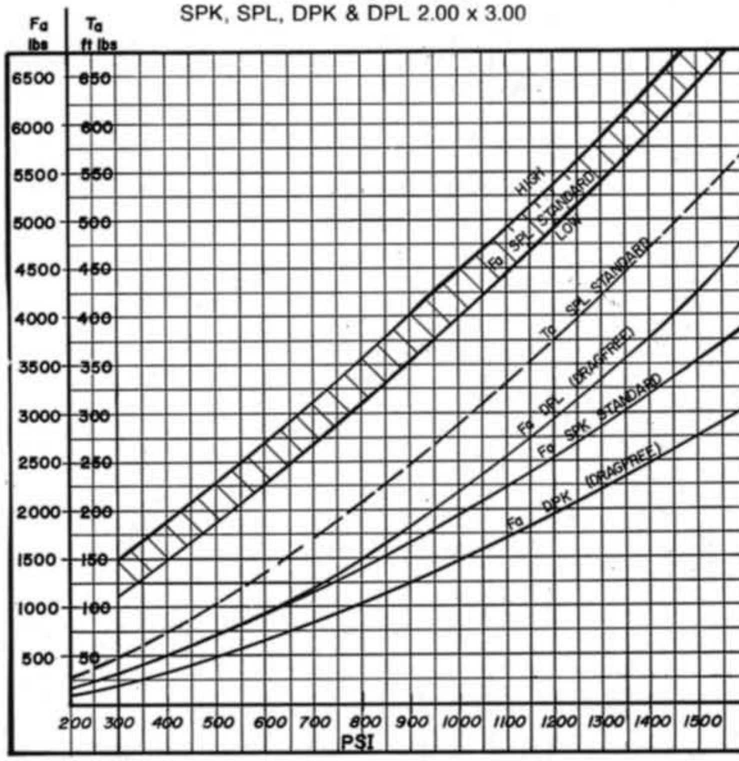
6.12 SPL Sets offer higher holding forces and better ratios of bearing length to diameter.

6.13 Extended Hydraulic Guiding and Clamping Sleeve Sets, type "E" with hydraulic spacer rings, position the sleeves farther apart for a better "Wheelbase".

6.2 HOLDING ABILITY:

6.21 SPIETH Hydraulic Guiding and Clamping Sleeve Sets have been designed to operate at a maximum pressure of 1500 PSI. The chart values are based on 1000 PSI. An increase in hydraulic pressure results in increased holding force.

Actual holding forces of
SPK, SPL, DPK & DPL 2.00 x 3.00



This diagram of holding forces was plotted from actual test data. (10) different SPL sets were tested giving a high and low curve. All other SPIETH Hydraulic Guiding and Clamping Sleeves are proportionate to the above table.

6.22 Calculation of forces at different hydraulic pressures:

6.221 If the applied hydraulic pressure (PSI) differs from 1000 PSI, the holding forces may be approximated by the following formula:

F_a — Holding Force actual [lbs.]
F_t — Holding Force table [lbs.]
T_a — Torque actual [ft. lbs.]
T_t — Torque table [ft. lbs.]

Axial Holding Force $F_a = \frac{F_t \times PSI}{1000}$ [lbs.]

or

Holding Torque $T_a = \frac{T_t \times PSI}{1000}$ [ft. lbs.]

6.23 The relationship of F_t and T_t is established by the formula: $F_t = \frac{24 \times T_t}{d}$ [lbs.]

6.24 Dragfree sleeves generate holding forces of about 50% of the table values of standard sleeves.

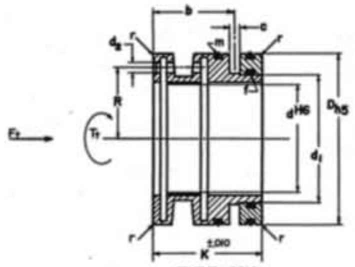
6.25 Hydraulic "start-up" pressure needed to contract the sleeves is about 50-200 PSI depending on sleeve size and guide clearance.

6.251 Sleeves used for automatic locating at zero clearance should not be actuated at less than 200 PSI.

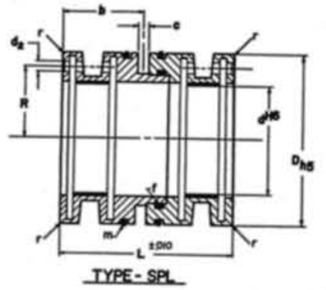
6.252 Sleeves used for clamping should not be actuated with less than 300 PSI.

6.26 If the required holding forces cannot be obtained by larger sleeve sizes or longer sleeve assemblies, special sleeves with back-up "O" rings may be furnished in conjunction with intensifiers in order to raise the hydraulic pressure to a maximum of 3000 PSI.

NOTE: When making Sleeve selection, keep in mind that peak load requirements must be below table values.



TYPE- SPK



TYPE- SPL

EXAMPLES FOR ORDERING GUIDING AND CLAMPING SLEEVES

SLEEVE d = 2.000" dia. for 2.00" shaft dia.
D = 3.000" dia. for 3.00" housing bore
K = 1.885 for min. housing length 1.88"

ORDER SPK 2.00" x 3.00"

SLEEVE d = 2.500" dia. for 2.50" shaft dia.
D = 3.750" dia. for 3.75" housing bore
L = 3.500" for min. housing length of 1.88"

ORDER SPL 2.50" x 3.75"

"O" Ring # 2-238-N552-9
2-232-N552-9

TYPE	— DIMENSIONS —											
SPK, SPL, ESKK or ESKL	dH6	Dh5	K	L	EK (min.)	EL (min.)	K1	L1	L2 (min.)	b	c	r (max)
1 1.00- 1.88	1.000	1.875	1.55	2.50	4.50	5.07	.86	1.43	2.09	1.08	.19	
1 1.25- 2.25	1.250	2.250	1.55	2.50	4.50	5.07	.86	1.43	2.09	1.13	.19	
1 1.50- 2.50	1.500	2.500	1.89	3.00	5.00	5.71	1.07	1.77	2.05	1.36	.19	
1.75- 2.75	1.750	2.750	1.89	3.00	5.00	5.71	1.07	1.77	2.05	1.36	.19	.03
1 2.00- 3.00	2.000	3.000	1.89	3.00	5.00	5.71	1.07	1.77	2.05	1.41	.19	
2.25- 3.25	2.250	3.250	2.30	3.50	5.50	6.32	1.29	2.11	1.91	1.66	.19	
1 2.50- 3.75	2.500	3.750	2.30	3.50	5.50	6.32	1.29	2.11	1.91	1.66	.25	
3.00- 4.25	3.000	4.250	2.30	3.50	5.50	6.32	1.29	2.11	1.91	1.70	.25	
3.50- 4.88	3.500	4.875	2.53	4.00	6.00	6.91	1.42	2.33	2.05	1.86	.25	
4.00- 5.50	4.000	5.500	2.81	4.50	6.50	7.51	1.52	2.53	2.17	2.06	.25	
4.50- 6.25	4.500	6.250	3.15	5.00	7.00	8.19	1.81	3.00	2.04	2.33	.25	
5.00- 6.88	5.000	6.875	3.49	5.50	7.50	8.81	1.93	3.24	2.08	2.56	.25	.05
5.50- 7.63	5.500	7.625	3.87	6.00	8.00	9.42	2.05	3.47	2.08	2.81	.25	
6.00- 8.13	6.000	8.125	4.10	6.50	8.50	10.00	2.37	3.87	2.04	3.00	.25	
6.50- 8.75	6.500	8.750	4.35	7.00	9.00	10.76	2.54	4.30	2.11	3.25	.25	
7.00- 9.25	7.000	9.250	4.35	7.00	9.00	10.76	2.54	4.30	2.11	3.25	.25	
7.50- 9.75	7.500	9.750	4.35	7.00	9.00	10.76	2.54	4.30	2.11	3.25	.25	
1 8.00-10.25	8.000	10.250	4.35	7.00	9.00	10.76	2.54	4.30	2.11	3.25	.25	.07
8.50-10.75	8.500	10.750	4.35	7.00	9.00	10.76	2.54	4.30	2.11	3.25	.25	
9.00-11.25	9.000	11.250	4.35	7.00	9.00	10.76	2.54	4.30	2.11	3.25	.25	
9.50-12.00	9.500	12.000	4.50	7.25	9.50	11.47	2.76	4.73	2.24	3.38	.25	
10.00-12.50	10.000	12.500	4.50	7.25	9.50	11.47	2.76	4.73	2.24	3.38	.25	
12.00-14.50	12.000	14.500	4.50	7.25	9.50	11.47	2.76	4.73	2.24	3.38	.25	
14.00-16.50	14.000	16.500	4.73	7.75	10.00	12.01	2.99	5.00	2.29	3.62	.25	.09
15.00-17.50	15.000	17.500	4.73	7.75	10.00	12.01	2.99	5.00	2.29	3.62	.25	
16.00-18.50	16.000	18.500	4.73	7.75	10.00	12.01	2.99	5.00	2.29	3.62	.25	
18.00-20.50	18.000	20.500	4.73	7.75	10.00	12.01	2.99	5.00	2.29	3.62	.25	
20.00-22.50	20.000	22.500	5.00	8.50	10.50	12.82	3.40	5.72	2.10	3.80	.25	.11
22.00-24.50	22.000	24.500	5.00	8.50	10.50	12.82	3.40	5.72	2.10	3.80	.25	
24.00-26.50	24.000	26.500	5.00	8.50	10.50	12.82	3.40	5.72	2.10	3.80	.25	

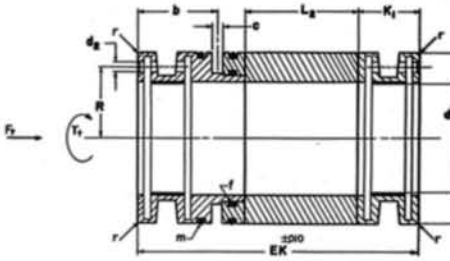
1. Holding Force data is from actual test results. Data for all other Guiding and Clamping Sleeves has been calculated proportionately.
2. "g6" I.S.O. Tolerance

NOTE: Peak load requirements should fall below table values.

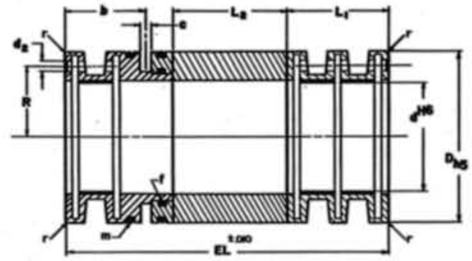
SPECIFICATIONS AND DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE

*LIMITS ARE BASED ON ISO STANDARDS (INCREASED TOLERANCE RANGE TO H7/h6 WILL DECREASE TRANSMISSABLE LOAD BY 10%)

SPECIAL OR LARGER SIZES AVAILABLE UPON REQUEST



TYPE - ESKK



TYPE - ESKL

EXAMPLES FOR ORDERING GUIDING AND CLAMPING SLEEVES

SLEEVE d = 6.000" dia. for 6.00" dia. shaft
D = 8.125" dia. for 8.13" dia. housing bore
EK = 8.500" for a min. housing length of 8.50"

ORDER ESKK 6.00" x 8.13"

SLEEVE d = 14.000" dia. for 14.00" dia. shaft
D = 16.500" dia. for 16.50" dia. housing bore
EL = 11.470" for a min. housing length of 11.47"

ORDER ESKL 14.00" x 16.50"

"O" Ring # 2-461-N552-9
2-457-N552-9

— DIMENSIONS —			STATIC HOLDING FORCE @ 1000 PSI						*TOLERANCES OF MATING COMPONENTS		PARKER "O" RING #		
			SPK		SPL-ESKK		ESKL		SHAFT DIA.	HUB BORE	2-XXX-	N552-9	
d1	R	d2	Tt Ft-Lbs.	Ft Lbs.	Tt Ft-Lbs.	Ft Lbs.	Tt Ft-Lbs.	Ft Lbs.	g5	H6	M	F	t max
1.250	.719	3/16	25	650	50	1,300	60	1,625	-.0003 -.0007	+.0006 -.0000	031	026	
1.500	.875	3/16	45	900	90	1,800	110	2,250	-.0004 -.0008	+.0007 -.0000	034	029	
1.750	1.000	3/16	90	1,500	180	3,000	225	3,750	-.0004 -.0008	+.0007 -.0000	141	132	
2.000	1.125	3/16	115	1,650	230	3,200	285	4,000	-.0004 -.0008	+.0007 -.0000	145	136	.10
2.250	1.250	3/16	150	1,800	300	3,600	375	4,500	-.0004 -.0009	+.0007 -.0000	149	140	
2.500	1.375	3/16	185	2,000	370	4,000	460	5,000	-.0004 -.0009	+.0009 -.0000	234	230	
2.750	1.563	3/16	225	2,200	450	4,400	560	5,500	-.0004 -.0009	+.0009 -.0000	238	232	
3.250	1.813	3/16	310	2,500	620	5,000	775	6,250	-.0004 -.0009	+.0009 -.0000	242	236	
3.750	2.094	3/16	465	3,200	930	6,400	1,160	8,000	-.0005 -.0011	+.0010 -.0000	247	240	
4.250	2.375	3/16	665	4,000	1,330	8,000	1,660	10,000	-.0005 -.0011	+.0010 -.0000	252	244	
4.875	2.688	3/16	935	5,000	1,870	10,000	2,335	12,500	-.0005 -.0011	+.0010 -.0000	258	249	
5.375	2.969	3/16	1,250	6,000	2,500	12,000	3,125	15,000	-.0006 -.0013	+.0010 -.0000	363	356	
6.000	3.281	3/16	1,600	7,000	3,200	14,000	4,000	17,500	-.0006 -.0013	+.0012 -.0000	366	361	.15
6.500	3.531	3/16	2,000	8,000	4,000	16,000	5,000	20,000	-.0006 -.0013	+.0012 -.0000	368	363	
7.000	3.813	1/4	2,515	9,300	5,030	18,600	6,285	23,250	-.0006 -.0013	+.0012 -.0000	268	262	
7.500	4.063	1/4	2,915	10,000	5,830	20,000	7,285	25,000	-.0006 -.0013	+.0012 -.0000	270	264	
8.000	4.313	1/4	3,280	10,500	6,560	21,000	8,200	26,250	-.0006 -.0014	+.0012 -.0000	272	266	
8.500	4.563	1/4	3,665	11,000	7,330	22,000	9,160	27,500	-.0006 -.0014	+.0012 -.0000	274	268	
9.000	4.813	1/4	4,070	11,500	8,140	23,000	10,175	28,750	-.0006 -.0014	+.0012 -.0000	275	270	.20
9.500	5.063	1/4	4,500	12,000	9,000	24,000	11,250	30,000	-.0006 -.0014	+.0012 -.0000	276	272	
10.000	5.375	5/16	5,540	14,000	11,080	28,000	13,850	35,000	-.0006 -.0014	+.0012 -.0000	452	449	
10.500	5.625	5/16	6,665	16,000	13,330	32,000	16,660	40,000	-.0008 -.0017	+.0014 -.0000	453	450	
12.500	6.625	5/16	9,000	18,000	18,000	36,000	22,500	45,000	-.0008 -.0017	+.0014 -.0000	457	454	
14.500	7.625	5/16	11,665	20,000	23,330	40,000	29,125	50,000	-.0010 -.0020	+.0016 -.0000	461	457	.30
15.500	8.125	5/16	13,750	22,000	27,500	44,000	34,375	55,000	-.0010 -.0020	+.0016 -.0000	463	459	
16.500	8.625	5/16	16,000	24,000	32,000	48,000	40,000	60,000	-.0012 -.0022	+.0016 -.0000	465	461	
18.500	9.625	5/16	18,500	26,000	39,000	52,000	48,750	65,000	-.0012 -.0022	+.0017 -.0000	469	466	
21.000	10.625	5/16	23,330	28,000	46,660	56,000	58,325	70,000	2 -.0009 -.0026	+.0017 -.0000	471	470	
23.000	11.625	5/16	27,500	30,000	55,000	60,000	68,750	75,000	2 -.0009 -.0026	+.0017 -.0000	473	472	
25.000	12.625	5/16	32,000	32,000	64,000	64,000	80,000	80,000	2 -.0009 -.0026	+.0020 -.0000	475	474	

1. Holding Force data is from actual test results. Data for all other Guiding and Clamping Sleeves has been calculated proportionately.
2. "g6" I.S.O. Tolerance

NOTE: Peak load requirements should fall below table values.

SPECIFICATIONS AND DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE

*LIMITS ARE BASED ON ISO STANDARDS (INCREASED TOLERANCE RANGE TO H7/h6 WILL DECREASE TRANSMISSIBLE LOAD BY 10%)

SPECIAL OR LARGER SIZES AVAILABLE UPON REQUEST

6.3 CONDITION OF MATING PARTS:

6.31 Customer Shaft And Bore Condition:

6.311 Bore diameter tolerance must be according to I.S.O. "H6" or "H7".

6.312 Shaft diameter tolerance must be according to I.S.O. "g5" or "g6". (For tolerance values see tables.)

6.313 Shafts should be hardened to Rc 32 minimum

6.314 Increase in the tolerance field to "H7/g6" will result in a decrease in holding forces of approximately 10%, while a further increase to "H7/g7" results in a decrease of approximately 20%.

6.315 For accurate applications, retainer contact surfaces and spacers must be parallel within .0005". Contact shoulders must be square to bore within .0001" per inch of bore diameter.

6.316 For non-critical applications standard tolerances may be deviated from, but consultation with the factory is recommended.

6.317 Surface finish on bores and shafts should be between 32 and 63 micro finish wherever the "O" ring will pass.

6.318 If oil pressure inlet is not located at the highest point of the pressure chamber, an air bleed hole should be provided there.

6.319 Chamfer on bore permits assembly without pinching "O" ring. (See Fig. 4)

6.320 When "O" ring must be pushed over cross-drilled port, the hole should be deburred and polished or under cut. (See Figs. 5a & 5b)

CHAMFER ANGLE 10° - 20°

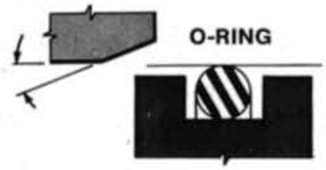


Fig. 4

CHAMFER HOLE JUNCTION

Fig. 5a

OR

UNDERCUT BORE

(PREFERRED)

Fig. 5b

6.321 Hub thickness and wall thickness on hollow shafts "W" is calculated by the following formula:

Steel: W = .6 x (D-d) [in.]

Cast Iron: W = (D-d) [in.]
d = Inside diameter of sleeve
D = Outside diameter of sleeve

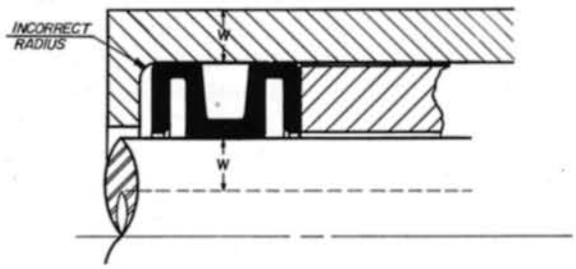


Fig. 6

6.322 Insufficient wall thicknesses will cause excessive expansion of the hub or contraction of the hollow shaft resulting in a reduction in holding forces. Hub and quill wall thickness may be increased or possibly decreased depending on the operating pressure. Guiding and clamping sleeves clamping on thin quill walls might influence the bearing play.

6.323 Radii or reliefs "t" on contact shoulders must comply with engineering data.

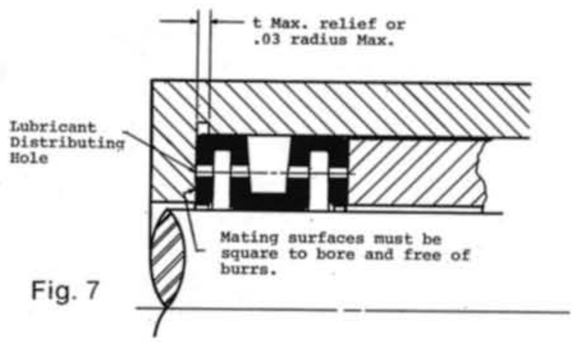


Fig. 7

6.324 In order to avoid excessive friction, interconnecting hydraulic spacer on "E" series must have a loose slide fit.

6.325 Retainer thickness and bolt size must be sufficient in order to avoid deflection in the clamped mode to prevent any reduction in clamping force.

NOTE: We invite you to furnish a sketch or layout indicating your design specifications. We will submit recommendations and application sketches to help attain an optimum design.

6.4 LUBRICATION:

6.41 On fast cycling mechanisms, apply lube oil to the sliding surfaces.

6.42 On general purpose mechanisms, fill the sleeve chambers on I.D. and O.D. with Moly grease. Exerted oil from the pressure chamber adds lubrication so that the guiding and clamping sleeves are practically greased for life. Cross holes interconnect I.D. and O.D. grooves of sleeves for grease distribution.

7.0 ASSEMBLY INSTRUCTIONS FOR SPIETH HYDRAULIC GUIDING AND CLAMPING SLEEVES:

7.1 SURFACE PREPARATION:

- 7.11 Clean and degrease sleeves and mating surfaces thoroughly.
- 7.12 Check diameters of bore and quill to insure they conform to the specified table tolerances.
- 7.13 Hone or polish housing bore to the specified tolerance and to a surface finish of 63 micro finish where "O" ring will pass.
- 7.14 Deburr and polish porthole to prevent shearing of "O" rings. Caution must be taken to avoid making chamfer too big so that it extends over "O" ring which in turn could cause leakage.
- 7.15 Grind or polish lead-in angle or chamfer .080 x 15°.
- 7.16 Machine shoulders and other contact surfaces square to bore and parallel to each other.

7.2 GUIDE CLEARANCE ADJUSTMENT OF SLEEVES:

- 7.21 Grease sleeves and "O" rings.
- 7.22 Install sleeves into housing bore by using hand pressure or light tapping with a plastic hammer. Hydraulic spacers should slide easily to minimize friction.
- 7.23 Install quill or bar carefully avoiding cocking or jamming.
- 7.24 Retainer assembly with spacer:
  - 7.241 Mount retainer without spacer.
  - 7.242 Tighten retainer screws evenly and diagonally until shaft clearance is eliminated and a proper guide fit is established.
  - 7.243 Measure average distance "X" between retainer and housing and grind spacer to that dimension.
  - 7.244 Assemble spacer with retainer and bolt retainer solidly against spacer and housing.
- 7.25 Retainer assembly without spacer:
  - 7.251 Machine retainer with .08" fitting stock.
  - 7.252 Tighten retainer locking screws evenly and diagonally to desired guide fit of quill or guide bar.
  - 7.253 Measure gap "X" between retainer flange surface and housing.
  - 7.254 Machine gap "X" off the retainer pilot face, making sure that face "C" is parallel to face "D".
  - 7.255 Reassemble retainer and tighten clamping screws to make solid contact with surface "B" (See Fig. 8)

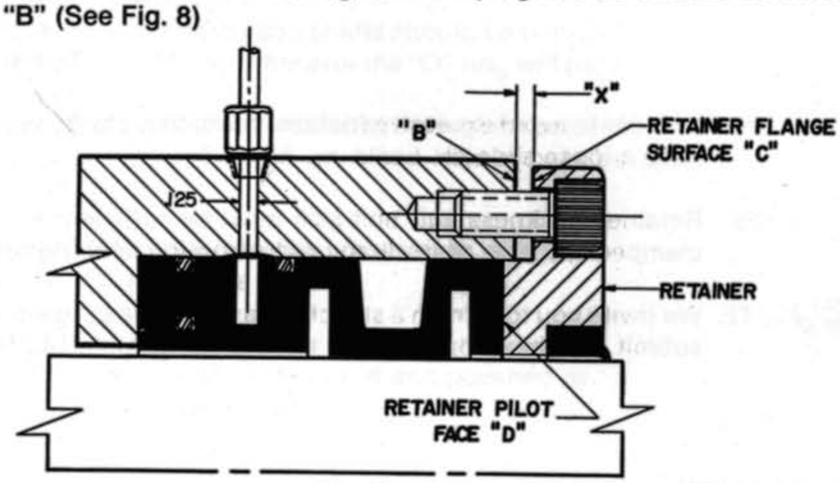


Fig. 8

7.3 IMPORTANT REMINDERS:

- 7.31 ALWAYS clean, deburr and grease mating surfaces prior to assembly.
- 7.32 ALWAYS pack sleeve chambers with Moly grease prior to assembly.
- 7.33 NEVER force components onto shaft or into bore!
- 7.34 Be CAREFUL not to damage "O" rings during assembly.
- 7.35 ALWAYS bleed hydraulic lines before actuation!
- 7.36 NEVER increase hydraulic pressure beyond 1500 PSI unless sleeves are designed for high pressurization!

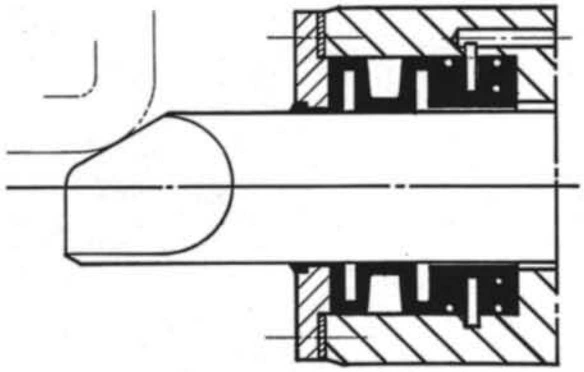


Fig. 9

SPK Hydraulic Guiding and Clamping Sleeve Set for automatic locking of a wedge plunger installed in a milling fixture for supporting thrust and traverse load.

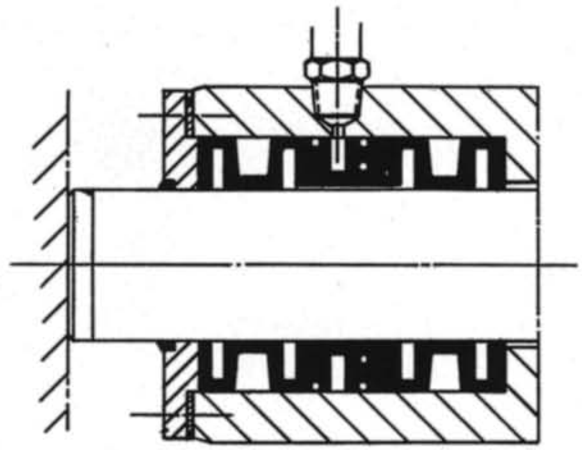


Fig. 10

SPL Hydraulic Guiding and Clamping Sleeve set for automatic locking of a support plunger installed in a precision boring fixture.

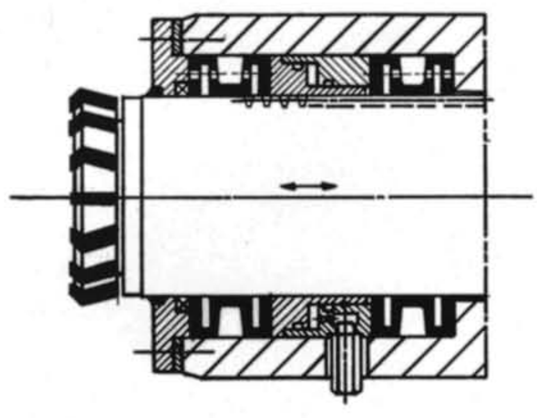


Fig. 11

Plain Guiding and Clamping Sleeves actuated by a ring cylinder for automatic clamping of a milling quill.

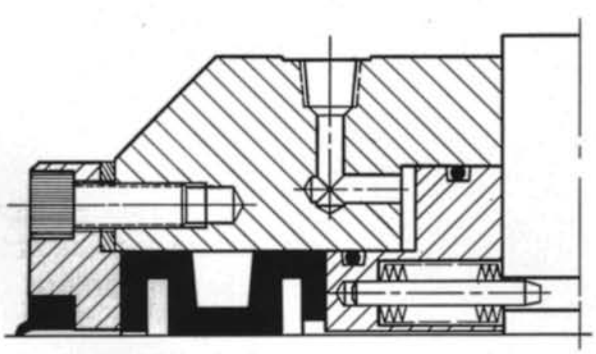


Fig. 12

Safety Clamping is accomplished by several Belleville Spring Sets spaced equally in the hydraulic piston ring. Unclamping by hydraulic pressurization. In case of hydraulic failure, the component will be clamped automatically.

NOTE: For other applications, see SPIETH Clamping Sleeve catalog SN 01.00/0078, page 11.

Our application engineers will gladly assist you in the design of your machine tools and tooling applications.

The SPIETH Family
Of Shaft Connectors & Guides

Spieth Hydraulically Actuated Guide and Clamping Sleeves for automatic and concentric clamping of quills, shafts, etc.

Spieth Clamping Sleeves provide keyless, shrink-fit connections.

Spieth precision Adjustable Locknuts provide vise-like locking without washers and keys.

Spieth Adjustable Hydrodynamic Guide Bushings provide accurate guiding, adjustable guide clearance, hydrodynamic lubrication effect. Linear and rotary applications.

Spieth Hydrodynamic Expansion Gibs reduce the cost of machining and scraping, reduce vibration and chatter, and compensate for minor machining inaccuracies on machine slides.

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ADJUSTABLE HYDRODYNAMIC GUIDE BUSHINGS

SPIETH

• WITH CONTROLLED GUIDE CLEARANCE

SPIETH

PATENTED

1.0 Application

SPIETH ADJUSTABLE HYDRODYNAMIC GUIDE BUSHINGS are applied for optimum guiding of axially or roto-axially moving machine components on round column axles, quills, boring bars, and similar round ways. The cylindrical shape of the bushings allow for simple machining of the mating parts, thus reducing cost by straight boring or reaming. Grinding or scraping is seldom required.

2.0 Construction

The SPIETH ADJUSTABLE HYDRODYNAMIC GUIDE BUSHING is made of high-quality bearing bronze. The bore and the outer diameter are accurately machined. Bore tolerance is ISO H6; O.D. tolerance is h5. Surface finish on the bore is between 16 and 32 micro inches. The series FSK-FSL adjustable bushings have built-in socket head cap screws. A radial hole at one end of the outside diameter will accept a roll or dowel pin used to orient the bushing if so required for repetitive assembly and disassembly. Internal and external predetermined grooves are required for the function of the bearing adjustment and also act as a reservoir for the lubricant. This unique design allows for precise initial adjustment of bearing play and subsequent wear adjustment when needed during the life of the bushing. The individual grooves are interconnected with an axial oil distribution hole on bushing Type FDK-FDL. On Type FSK-FSL, the axial screw holes are also used to distribute the lubricant.

3.0 Function

When the bushing is axially compressed, either by a retainer or by a number of built-in screws, the clearance on the outer diameter will be reduced and the bushing will lock itself in place. Additional axial tightening will reduce the clearance on the inner diameter until a proper fit is established. The bushing adjusts concentrically; therefore, grinding or scraping is not generally required. The axial force deflects the edges of the bearing lands slightly upward, forming a wedge ring. This feature allows for a hydrodynamic lubrication effect when the bushing is moved axially on the round way and lubricant is present. Good quality machine oil is recommended for higher speed. The viscosity should be selected according to the application. For low speed, grease is sufficient. The ratio between axial compression and diametrical reduction on the inner diameter is about 10-1. Thus, .010″ compression of the bushing will reduce the inner diameter by .001″.

4.0 Advantages

4.1 Easy bearing-play adjustment to suit requirements and to compensate for wear.
4.2 Hydrodynamic lubrication feature reduces friction and wear.
4.3 Simple machining for mating parts.
4.4 High degree of accuracy without expensive hand scraping and fitting.
4.5 Economical for precision-round sliding mechanisms.
4.6 Type FSK-FSL bushings allow for minor error corrections in bore alignment or in center distance alignment by discriminately tightening the adjustment screws.

5.0 Mating Components

5.1 Bore: The bore is to be machined cylindrical and round to ISO H6 tolerance and should have a maximum surface finish of 125 micro-inches. If an orientation pin is used, the end milled groove in the housing must be long enough to allow for free compression of the bushing. For accurate function of Type FDK-FDL bushings, and to avoid cocking the bushing, all mating faces must be square to the bore.
5.2 Shaft: The shaft is to be machined cylindrical and round to ISO tolerance g5 and should have a surface finish of 16 micro-inches.

6.0 **Assembly and Guide Clearance Adjustment**

6.1 Type FDK-FDL (figure 1)

6.11 Insert bushing (1) into the housing (2) using hand pressure or light tapping. Note that the orienting pin (6), if needed, must be freely movable in the groove.

6.12 Mount retainer (5) without fitting spacer (3) and lightly tighten bolts.

6.13 Insert shaft

6.14 Tighten retainer bolts evenly and crosswise until the bearing play is sufficiently reduced.

6.15 Measure carefully the gap between retainer and housing.

6.16 Remove retainer

6.17 Regrind spacer (3) to the desired thickness. (Thickness of spacer equals the measured gap plus .001 to .005″, depending on bushing diameter). Note that .010″ of axial compression will reduce the inner bushing diameter about .001″.

6.18 Assemble spacer (3) and retainer (5) and tighten bolts.

6.19 Recheck desired guide clearance. If necessary, correct by machining spacer or retainer. Watch parallelism.

6.20 Compensate for wear by regrinding the spacer (3).

6.2 Type FSK-FSL (figure 2)

6.21 Assemble bushing (1) in the housing (2) and tighten the adjustment screws evenly and crosswise until the bushing is fixed in the housing. Use the same amount of turn on each screw (about 30 degrees). Note that for free axial bushing movement, the orienting pin (if needed) must not bottom out in the groove.

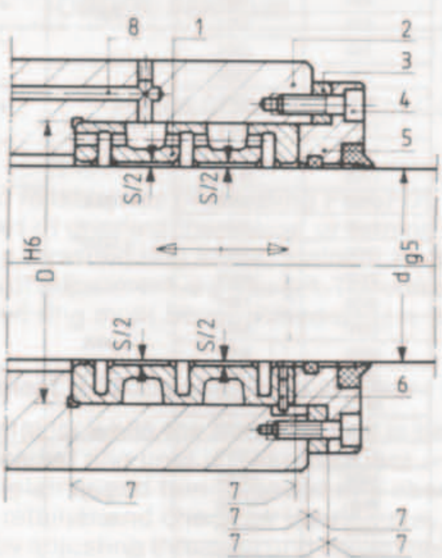
6.22 Blue the surface of the shaft and insert into the bushing. Procede to tighten the screws as mentioned above until the shaft moves hard (check for bearing pattern).

6.23 Mark the position of the screw heads for subsequent final bearing adjustment. Rotate and push the shaft in and out to print the bearing pattern on the bushing bore. Remove the shaft and check the bearing pattern in the bore.

6.24 Loosen screws about ¼ turn to increase the bore diameter.

6.25 Reinsert the shaft and adjust the desired bearing clearance as mentioned above. If the bearing pattern is uneven, tighten the screws that need to be tightened and recheck. The bearing clearance is usually greater than the fit for establishing the bearing pattern. The marked portion of the screws will therefore not be reached. Note: Since each mating component has slightly different actual dimensions within the tolerance field, the adjustment for each bushing will differ. Therefore, recommendations for a specific screw torque cannot be given.

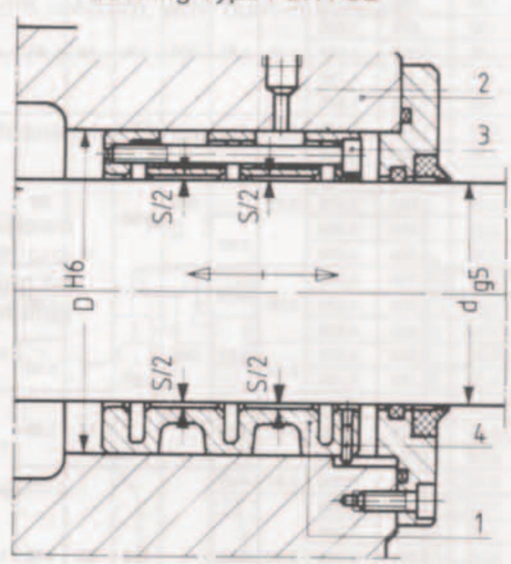
Figure 1:
Guiding with
Bushing Type FDK-FDL



1. Guide Bushing
2. Housing
3. Spacer
4. Retainer Screws
5. Retainer
6. Orienting Pin (if needed)
7. Surfaces to be machined; square to the bore.
8. Lube Hole
9. Shaft

S Guide Clearance

Figure 2:
Guiding with
Bushing Type FSK-FSL



1. Guide Bushing
2. Housing
3. Adjustment Screw
4. Orienting Pin (if needed)
5. Lube Hole

S Guide Clearance

SPIETH

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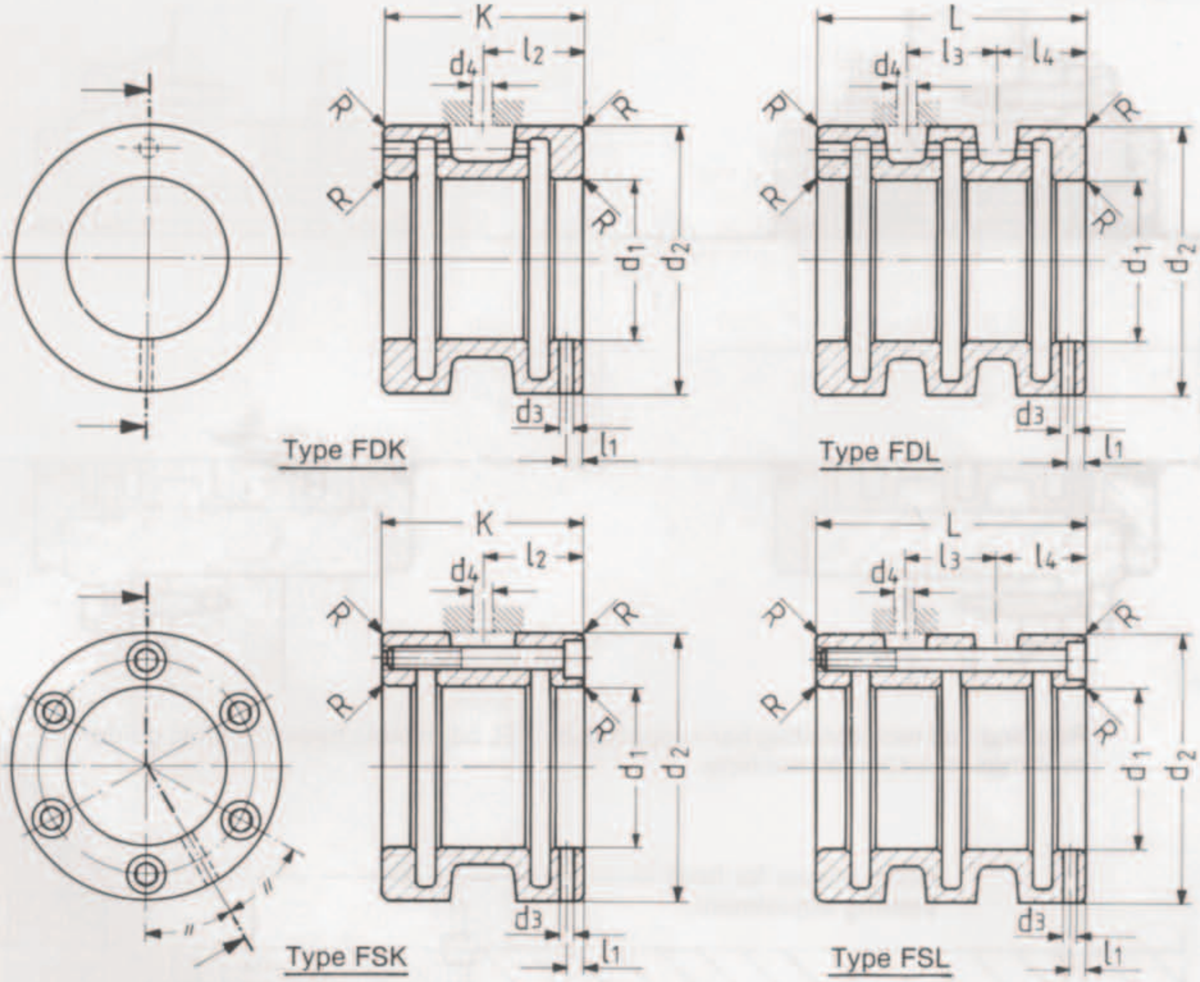
CATALOG NUMBER FDK FDL / FSK FSL	METRIC SERIES d₁ H6	d₂ h5	K	L	R	d₃ H7	l₁	l₂	l₃	l₄	Dimensions in mm d₄ max.	SOCKET HEAD CAP SCREWS FSK/FSL	Q'Y	ALLOWABLE RADIAL LOAD (LBS.) FDK / FSK	FDL / FSL	TOLERANCE OF MATING PARTS SHAFT DIA. in 1/1000's g5	HUB BORE in 1/1000's H6
20 - 37	20	37												400	800	−7 −16	+16 −0
25 - 42	25	42	30	46	0.8	3	2.5	15	15	16	6			500	1000	−7 −16	+16 −0
30 - 47	30	47										M4		650	1300	−7 −16	+16 −0
35 - 55	35	55												1200	2000	−9 −20	+19 −0
40 - 62	40	62												1350	2300	−9 −20	+19 −0
45 - 68	45	68		62					20	22	10			1500	2600	−9 −20	+19 −0
50 - 72	50	72	42		1			21						1700	2900	−9 −20	+19 −0
55 - 80	55	80												1900	3700	−10 −23	+19 −0
60 - 85	60	85		68		4	3.5		21.5	25	12			2050	4000	−10 −23	+22 −0
65 - 90	65	90										M5		2800	4500	−10 −23	+22 −0
70 - 100	70	100												2700	5600	−10 −23	+22 −0
75 - 105	75	105	48	78				24	24	30	14		6	2900	6000	−10 −23	+22 −0
80 - 110	80	110												3100	6500	−10 −23	+22 −0
85 - 120	85	120												4700	8000	−12 −27	+22 −0
90 - 125	90	125	60	92	1.5		4.5	30	28.5	35				4900	8500	−12 −27	+25 −0
95 - 130	95	130				5								5200	9000	−12 −27	+25 −0
100 - 140	100	140	66	102			5.5	33	31.5	39		M6		5800	10500	-12 −27	+25 −0
110 - 150	110	150									16			6400	11500	−12 −27	+25 −0
120 - 165	120	165	72	114				36	36	42				7700	13700	−12 −27	+25 −0
130 - 180	130	180				6	6							9200	16000	−14 −32	+25 −0
140 - 190	140	190	78	124	2			39	39	46			8	10000	18000	−14 −32	+25 −0
150 - 200	150	200										M8		11000	20000	−14 −32	+29 −0

CATALOG NUMBER FDK FDL / FSK FSL	INCH SERIES d₁ H6	d₂ h5	K	L	R	d₃ H7	l₁	l₂	l₃	l₄	d₄ max.	SOCKET HEAD CAP SCREWS FSK/FSL	Q'Y	ALLOWABLE RADIAL LOAD (LBS.) FDK / FSK	FDL / FSL	TOLERANCE OF MATING PARTS SHAFT DIAMETER g5	HUB BORE H6
.75 - 1.38	.750	1.375												400	750		
.88 - 1.50	.875	1.500												450	900	−.0003 −.0007	+.0006
1.00 - 1.63	1.000	1.625	1.22	1.81	.020	.125	.10	.61	.63	.59	.25			550	1050		
1.13 - 1.75	1.125	1.750										8-32		700	1300		−.0000
1.25 - 1.88	1.250	1.875												800	1500		
1.38 - 2.13	1.375	2.125												1000	1800	−.0004	+.0007
1.50 - 2.38	1.500	2.375												1100	2000	−.0008	
1.75 - 2.75	1.750	2.750		2.44					.90	.77	.39			1400	2500		−.0000
2.00 - 2.88	2.000	2.875	1.75		.040			.88						1700	3100		
2.25 - 3.25	2.250	3.250				.156								2100	3700	−.0004	
2.50 - 3.50	2.500	3.500		2.69			.13		1.00	.84		10-32	6	2400	4500		+.0009
2.75 - 4.00	2.750	4.000									.50			2800	5300	−.0009	
3.00 - 4.25	3.000	4.250	2.00	3.06				1.00	1.14	.96				3300	6200		−.0000
3.25 - 4.50	3.250	4.500												3900	7200		
3.50 - 4.88	3.500	4.875		3.63	.060				1.33	1.15				4500	8200	−.0005	
3.75 - 5.13	3.750	5.125	2.38			.187		1.19						5200	9200		
4.00 - 5.50	4.000	5.500									.63	¼-20		5800	10500	−.0011	+.0010
4.25 - 5.75	4.250	5.750	2.50	4.00			.15	1.25		1.25				6500	11500		−.0000
4.50 - 6.00	4.500	6.000							1.56					7000	12700		
4.75 - 6.50	4.750	6.500	2.81	4.50				1.40		1.47				7700	13800		
5.00 - 7.00	5.000	7.000												8400	15000		
5.50 - 7.50	5.500	7.500												9600	17200	−.0006	
6.00 - 8.00	6.000	8.000	3.13	5.13		.250	.25	1.56	1.75	1.69		5/16-18	8	10800	19600	−.0013	
6.50 - 8.50	6.500	8.500												11800	21200		
7.00 - 9.00	7.000	9.000			.080									12800	22900		+.0012
7.50 - 9.50	7.500	9.500												13800	24700		−.0000
8.00 - 10.25	8.000	10.250									.68		10	14800	26400	−.0006	
8.50 - 10.75	8.500	10.750										3/8-16		15800	28100	−.0014	
9.00 - 11.25	9.000	11.250	3.50	6.00		.312	.31	1.75	2.00	2.00				16800	29800		
9.50 - 11.75	9.500	11.750											12	17800	31600		
10.00 - 12.25	10.000	12.250												18800	33300	−.0008 −.0017	

SPECIFICATIONS AND DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE. LARGER OR SPECIAL SIZES AVAILABLE UPON REQUEST.



ORDER EXAMPLE:
To order Guide Bushing dl = 60mm, d2 = 85mm, and K = 42mm, with built-in screws,
ORDER: FSK 60.85

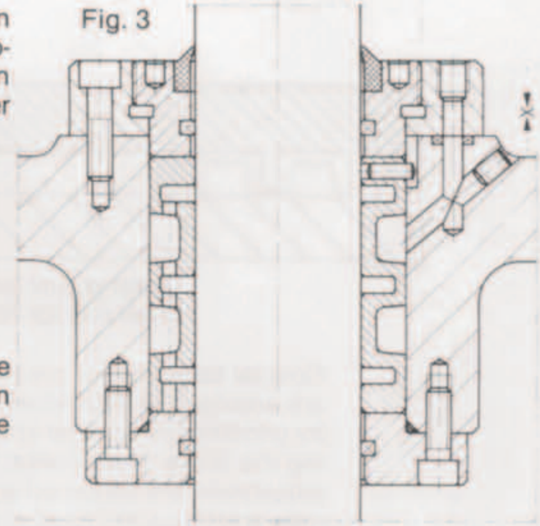
Figure 3: Adjustment of Guide Clearance by Means of a Threaded Retainer:

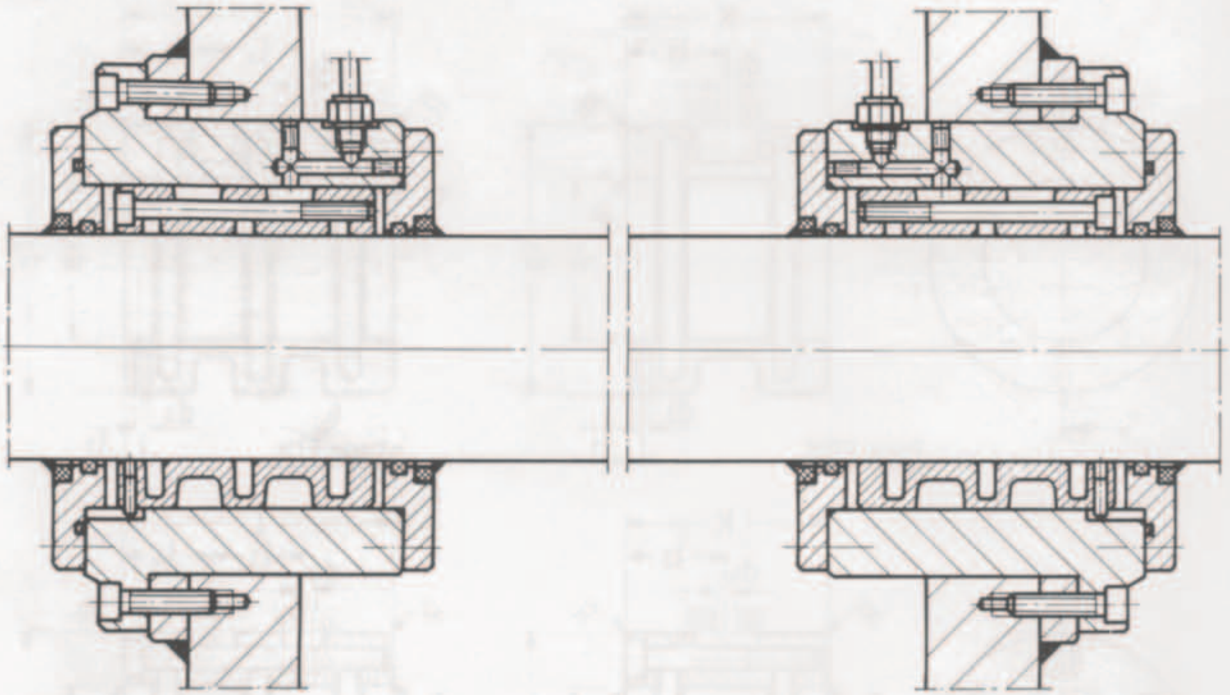
A quick and reliable way of adusting FDK-FDL Guide Bushings is shown here. Instead of grinding the spacer or turning the retainer to obtain proper fitting, a threaded ring in the retainer can be adjusted. Depending on size, 2-3mm of adjustment is sufficient. The contact surfaces on the retainer and threaded ring must be machined square to the housing bore.

The adjustment is accomplished as follows:

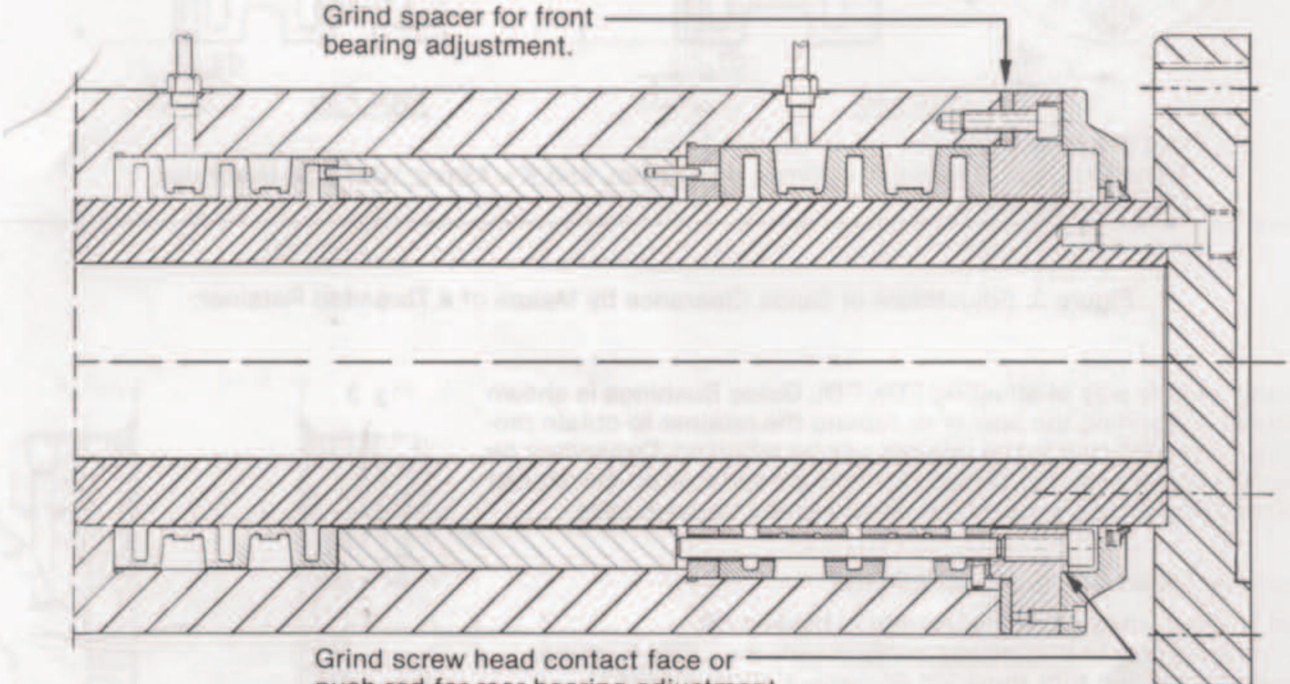
1. Install retainer while the threaded ring is backed off.
2. Turn threaded ring until it makes contact with the guide bushing.
3. Loosen retainer and turn threaded ring about .010″ inward.
4. Tighten retainer and check for bearing play.
5. Repeat by adjusting threaded ring inward until desired guide clearance is read. Note: To avoid misadjustment (due to high surface friction on the threaded ring), loosen the retainer when adjusting the guide clearance of the threaded ring.

Fig. 3

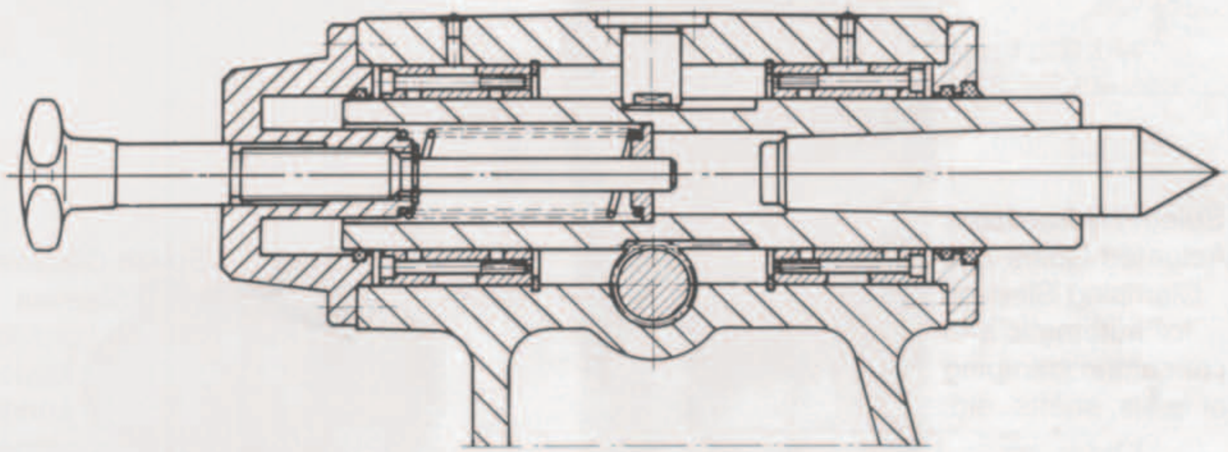




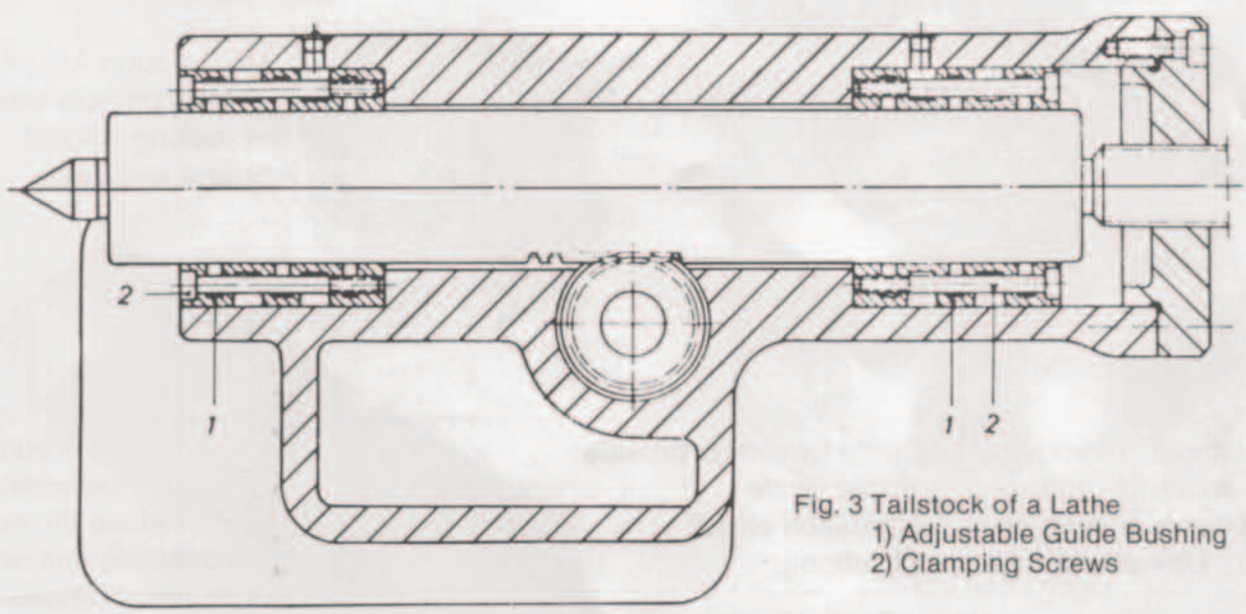
Rotating and reciprocating bar supported by FSL adjustable hydrodynamic guide bushings in a special machine.



Special tailstock for precision grinder: two FDL Hydrodynamic Bronze Bushings are arranged for individual bearing adjustment. While the front bushing is adjusted by grinding the retainer spacer, the rear bearing is independently adjusted by grinding the screw head contact face of the retainer. The heads of the (6) socket head cap screws are tightened against the retainer to prevent uneven adjustment. (6) push rods and (6) socket head cap screws must have the same length to guarantee equal pressure on the center bearing spacer.



Precision grinding machine tailstock with FSK Adjustable Hydrodynamic Guide Bushings.



Precision lathe tailstock with FSL Adjustable Hydrodynamic Guide Bushings.

The SPIETH Family
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Spieth Hydraulically Actuated Guide and Clamping Sleeves for automatic and concentric clamping of quills, shafts, etc.

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SPIETH Hydrodynamic Radial-Slide-Bearings

Series GLM

Works Standard SN 03.01

Content

Page

1. General

In modern and powerful machines the importance of the spindle bearing is increasing. Solutions for these tasks are offered by roller bearings as well as by slide bearings. Increasing demands for long tool life as well as for surface performance, shape accuracy, and fabrication tolerances of the work pieces has been shown in the last years, that especially at hydrodynamic sectionalised surface slide bearings – with its caused by the lubricating film high damping properties and concentric accuracy – the smoothness as well as the insusceptibility to shock together with its high durability are characteristics which can barely be featured by roller bearings.

1.1. SPIETH Hydrodynamic Radial-Slide-Bearing

SPIETH-slide bearings are hydrodynamic lubricated adjustable sectionalised-surface radial slide bearings. The main use is in the field of mechanical engineering and especially for building machine tools with its complex requirements.

1.2. Hydrodynamic lubrication

Hydrodynamic lubrication means the stream caused by a running spindle in the with lubricant filled wedged shaped gap of a slide bearing. This stream cause liquid thrusts in the lubricant with the highest level of thrust short before the smallest gap in running direction. At correct arrangement of wedged shaped gap, spindle revolutions and oil viscosity the created liquid thrust is able to lift even high loaded spindles from the bearing surface. The effect is that the spindle is >>swimming<< above the lubricant layer.

1.3. Lubricant

Used for lubrication are mineral oils, mainly spindle oils. Their viscosity has to be chosen in dependence of the working conditions. For hydrodynamic lubricated slide bearings an adequate supply of oil is required for problem free running. The function of the lubricant hereby is not only to create the hydrodynamic thrust in the wedged shaped gap, it also has to transfer the friction heat out of the region of the slide surfaces.

1.4. Lubrication system

The most used lubrication systems are:
Splash lubrication, centrifuge lubrication and external lubrication

The external lubrication by a pump is the most secure and efficient lubrication system. Especially for high sliding speeds which need a high quantity of oil for cooling the external lubrication supply by a pump is absolutely necessary. For this lubrication system any spindle position can be allowed. There is only the need for sufficient pump pressure to negotiate circuit and duct resistance to ensure an adequate quantity of oil for the temperature equation. As said before, the carrying liquid thrust will be created by itself after the rotation of the spindle has started.

1.5. Sealing

Slide bearings are provided with gaskets to avoid the escape of the lubricant out of the inner system and also to protect the bearing system against penetration of dirt and humidity. The sealing system is dependent of the working conditions.

Contact or sliding gaskets are used for low and middle velocities. The wear and friction heat limits its use. The application area is up to the peripheral speed of 12 m/s.

Higher sliding speeds require non-contact gaskets such as a pressure-tight sealing thread, labyrinth sealing or an annular gap with a loose inserted bronze sliding ring. As in the annular gap a hydrodynamic thread will be created by the spinning spindle, which is higher than the regular pressure of the lubricant, no oil can escape while the spindle is running. All non-contact sealing have a little amount of leaking oil as long as the spindle is not running. As this is known, this can be absorbed and returned to the lubricant tank.

2. Adjustable SPIETH Radial-Slide-Bearing

2.1. Use and preferences

This hydrodynamic sectionalised radial slide bearing is used wherever optimum bearing play and highest running smoothness is requested and a sufficient lubrication supply is ensured. High and low frequencies are allowed as same as both directions.

As the optimum bearing play can be set and readjusted, no longsome adaptation between bearing and spindle are necessary. It is sufficient if the seating of the spindle and the bore in the housing are machined cylindrical according to an ISO-Tolerance.

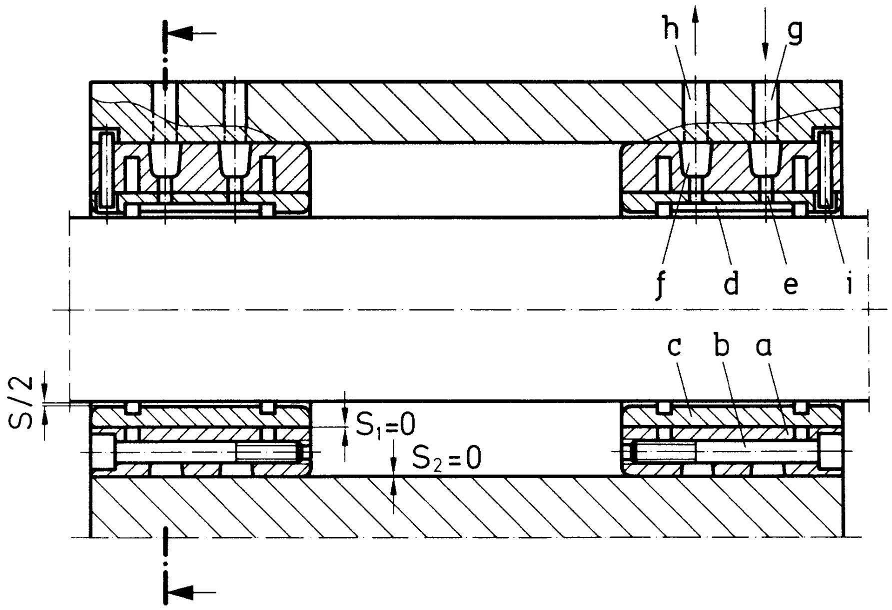
This adjustable bearing type is today successful used wherever best surface quality, and shape accuracy has to be machined. The GLM is used for spindle bearing in grinding-machines, lathes, precise drilling or as counter bearing of milling arbor and boring bars. For this machinery there are for example grind and work piece spindles with a GLM bearing in use to realize a concentricity of less than 0,4 μm.

One of the most underestimated advantages of the Type GLM bearing is the damping effect of the hydrodynamic bearing system. The high absorbability of the hydrodynamic guidance is very useful for machining processes where high frequencies can occur due to the high durability of the static elements.

2.2. Layout and function

The SPIETH hydrodynamic radial slide bearings have a meander formed profiled steel hull (a) with integrated clamping screws (b) and a bearing bush made out of bearing bronze (c).

The bearings are configured in a way, that after tightening the clamping screws first the mounting play (S_1 + S_2) will be eliminated. After this the radial strangling of the inner bearing bush will start. This strangling will be in a parallel direction to the axis. It is possible to set any requested bearing play or adjustment without any scraping.



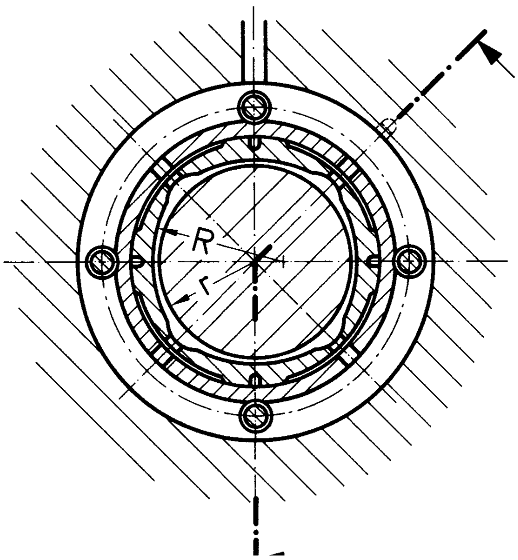


Fig. 3:

a	iron hull
b	clamping screws
c	bushing
d	lubrication flute
e	lubrication hole
f	outer cut-in
g	lubrication inlet
h	lubrication outlet
i	cylindrical pin
S	bearing play
S_1	mounting play
S_2	mounting play
r	shaft-radius
R	slide-radius

The inner bushing has some axial lubrication flutes (d) which are connected with the outer cut-in (f) in the steel hull by radial lubrication holes (e). By this arrangement the bushing is connected with the lubrication inlet (g) and outlet (h) in the housing bore.

The lubrication flutes are dividing the bushing bore in a few sliding surfaces. During the adjustment of bearing play, these sliding surfaces are changing their original radius in the way, that there will arise a wedge crack between sliding surface and spindle. The tightest point of this wedge crack will be in the middle of the sliding surface and will expand in both directions to the lubrication flutes. SPIETH hydrodynamic radial slide bearings are independent of the rotation direction of the spindle as the lubricant can flow under the developed pressure in the squeezed wedge crack and can thereby lift the spindle from the bearing sliding surface. Due to physical rules, the hydrodynamic lubrication process is all round the spindle and therefore centring the spindle unavoidable.

The radial orientation of the bearing in the housing bore will be realized by a cylindrical pin (i) which will fit in a flute to be machined in the housing.

2.3. Execution

The meander formed steel hull working as an adjustment element is made out of special steel and not hardened. The bushing is made out of high grade bearing bronze. This material was chosen for high security reasons and due to its emergency running properties as during the short period of start-up and run-out the lubrication layer may be interrupted and a metal contact between spindle and bearing sliding surface may occur.

The outer diameter of the bearing is grinded according to the tolerance h5; the bore is machined to F6. As the bearing is machined under compressed conditions, a control measurement of the bore is not possible in its untensioned delivery state.

The mounted clamping screws shall be tightened by using a wrench according to ISO 2936.

2.4. Connecting Components

2.4.1. Housing

The housing bore has to be machined cylindrically according to the tolerance H6. The radial orientation of the bearing is done by a cylindrical pin of the bearing, aligned in a flute to be machined in the housing. Normally the orientation is chosen in a way, that the direction of the bearing load is about 6° before one of the sliding surface centre out of the rotation direction.

The lubrication supply has to be done in a way, that the lubricant can be feed into the outer cut-in of the steel hull of the bearing. The lubricant return circuit will be dependent of the working conditions through the second outer cut-in and/or through outpouring side wards as leak oil. Return circuit and leak oil will be conveyed to the reservoir. For horizontal spindles it may be practical to install the supply and return from the top. At vertical spindles the supply should be beneath, the return above.

2.4.2. Spindle

For an accurate concentricity the spindle contact surface has to be done cylindrically according to tolerance g5. Recommended quality of the spindle is a surface roughness of 0,4 – 0,63 µm best realized by smooth grinding. The material of the spindle is dependent of the requirements. For high operational demands the spindle should be case hardened (≈ HRC 64) or nitrogen hardened (≈ HV 8500 N/mm^2).

Regarding to the for bearing play adjustment necessary control of contact pattern we recommend following for using two bearings with the same size:
The diameter of the first to insert spindle-bearing seat should be machined with a reduction of IT3. The result will be that passing the second bearing during dismounting will not smear the visible areas of a die spotting.

2.5. Mounting and adjustment of play

To inform every first time user detailed, every delivery is equipped with an extensive instruction. Further instructions are available under request.

Basic requirement for proper bearing function is an accurate cleaning of all lubrication-conveying holes, and lines. Left over from fabrication or other particles are removed best by pressure flushing with heated (warm) low viscosity machine oil.

2.5.1. Dismantling of clamping screws, greasing of thread and contact surface of screw head. Screw the screws back on place until contact of screw head contact face, but do not tighten more to avoid pretension.

2.5.2. Insert the radial-plain-bearing into the housing, pay attention that the orientation pin must not come to rest axially against the groove in the housing. Tighten the clamping screws evenly crosswise until the radial-plain-bearing is seated firmly in the housing. Even actuation of the clamping screws can be achieved by tightening in each case by a certain angular amount (e.g.30°).

2.5.3. Insert the spindle into the borehole of the radial-plain-bearing. Adjust on each spindle end a micrometer for concentricity. Pay attention that the radial play, cause by radial movements, is measured in the direction of the clamping screws and as near as possible to the radial-plain-bearing.

2.5.4. Reduce bearing play on both bearings by tightening the clamping screws crosswise until the play is 0,01 mm bigger than the wanted movement play. After each tightening sequence hit the spindle a few times lightly with a rubber mallet in the direction of the clamping screws. It could happen, that the bearing play will increase by this treatment, but this is intended.

2.5.5. As the bearing play is now 0,01 mm bigger than the wanted movement play, remove the spindle and apply a coating of inking paste. To assess the contact pattern by the left ink impression, the coating of the inking paste has to be kept real thin.

2.5.6. Reinsert the spindle into the radial-plain-bearing and generate a contact pattern by radial and axial movements of the spindle. Remove the spindle and assess the ink impressions left.

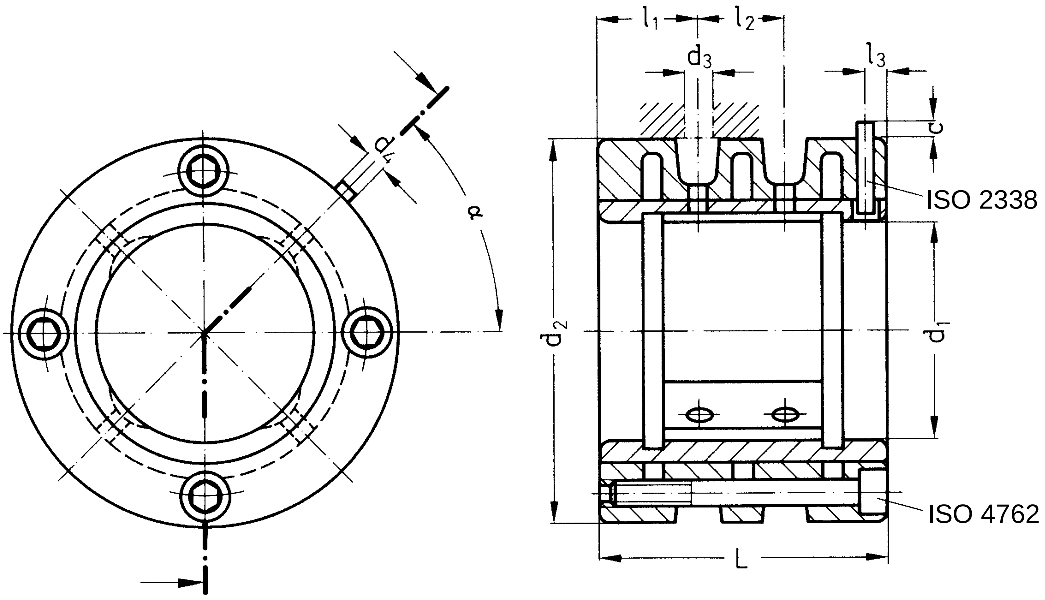
2.5.7. If the contact pattern in the radial-plain-bearing is equally at all sliding sections, the final movement play can be set by tightening the clamping screws as described above.

If the contact pattern is uneven, the clamping screws shall be tightened individually depending on the ink impressions. This could result in a one-sided adjustment.

If the movement play was set too closed, all screws have to be loosened until play is 0,01 – 0,02 mm bigger. The play has to be set again as described above.

The complete adjusting range correspond approx. the basic tolerance field IT 10 based on the spindle diameter.

3. Table of dimensions for Radial-Slide-Bearing Series GLM



Designation of an adjustable hydrodynamic radial slide bearing with
d_1 = 40 mm, d_2 = 65 mm, and L = 45 mm:

Radial slide bearing GLM 40 · 65

<table>
<tr><th rowspan="3">Code</th><th colspan="6">dimensions in mm</th><th colspan="4">cylindrical pin ISO 2338 -</th><th colspan="2">clamping screws</th></tr>
<tr><th>d_1</th><th>d_2</th><th>L</th><th>l_1</th><th>l_2</th><th>d_3</th><th>d_4</th><th>c</th><th>l_3</th><th>α</th><th>dimensions</th><th>n</th></tr>
<tr><th>F6 1)</th><th>h5</th><th></th><th></th><th></th><th>max</th><th>mm</th><th>mm</th><th>mm</th><th>°</th><th>ISO 4762 - 8.8</th><th>No.</th></tr>
<tr><td>GLM 30.55</td><td>30</td><td>55</td><td rowspan="2">40</td><td rowspan="2">13,8</td><td rowspan="2">12,5</td><td rowspan="2">4</td><td rowspan="4">2</td><td rowspan="4">2</td><td rowspan="4">3</td><td rowspan="4">45</td><td rowspan="2">M 4 x 35</td><td rowspan="4">4</td></tr>
<tr><td>GLM 35.60</td><td>35</td><td>60</td></tr>
<tr><td>GLM 40.65</td><td>40</td><td>65</td><td rowspan="2">45</td><td rowspan="2">15</td><td rowspan="2">15</td><td rowspan="2">6</td><td rowspan="2">M 4 x 40</td></tr>
<tr><td>GLM 45.70</td><td>45</td><td>70</td></tr>
<tr><td>GLM 50.80</td><td>50</td><td>80</td><td>52</td><td>17,8</td><td>16,5</td><td>6</td><td rowspan="3">3</td><td rowspan="3">2</td><td rowspan="3">4</td><td rowspan="4">45</td><td>M 5 x 45</td><td rowspan="4">4</td></tr>
<tr><td>GLM 55.85</td><td>55</td><td>85</td><td>56</td><td>18,8</td><td>18,5</td><td>8</td><td>M 5 x 50</td></tr>
<tr><td>GLM 60.90</td><td>60</td><td>90</td><td>62</td><td>20,3</td><td>21,5</td><td rowspan="2">10</td><td>M 5 x 55</td></tr>
<tr><td>GLM 65.100</td><td>65</td><td>100</td><td>68</td><td>23,5</td><td>21</td><td>4</td><td>3</td><td>6</td><td>M 6 x 60</td></tr>
<tr><td>GLM 70.105</td><td>70</td><td>105</td><td>72</td><td>24,5</td><td>23</td><td>10</td><td rowspan="4">4</td><td rowspan="4">3</td><td rowspan="4">6</td><td rowspan="4">45</td><td>M 6 x 65</td><td rowspan="4">4</td></tr>
<tr><td>GLM 75.110</td><td>75</td><td>110</td><td>78</td><td>26</td><td>26</td><td rowspan="3">15</td><td>M 6 x 70</td></tr>
<tr><td>GLM 80.115</td><td>80</td><td>115</td><td>82</td><td>27</td><td>28</td><td rowspan="2">M 6 x 75</td></tr>
<tr><td>GLM 85.120</td><td>85</td><td>120</td><td>85</td><td>27,8</td><td>29,5</td></tr>
<tr><td>GLM 90.125</td><td>90</td><td>125</td><td>90</td><td>29,8</td><td>30,5</td><td>15</td><td rowspan="4">4</td><td rowspan="4">3</td><td rowspan="4">6</td><td rowspan="4">45</td><td>M 6 x 80</td><td rowspan="4">4</td></tr>
<tr><td>GLM 95.130</td><td>95</td><td>130</td><td>95</td><td>31</td><td>33</td><td rowspan="3">20</td><td>M 6 x 85</td></tr>
<tr><td>GLM 100.135</td><td>100</td><td>135</td><td>100</td><td>32,3</td><td>35,5</td><td>M 6 x 90</td></tr>
<tr><td>GLM 110.160</td><td>110</td><td>160</td><td>110</td><td>34,8</td><td>40,5</td><td>M 8 x 100</td></tr>
<tr><td>GLM 120.170</td><td>120</td><td>170</td><td>120</td><td>38,5</td><td>43</td><td rowspan="3">25</td><td rowspan="3">4</td><td rowspan="3">3</td><td rowspan="3">7</td><td rowspan="3">30</td><td>M 8 x 110</td><td rowspan="3">6</td></tr>
<tr><td>GLM 130.180</td><td>130</td><td>180</td><td>130</td><td>41</td><td>48</td><td>M 8 x 120</td></tr>
<tr><td>GLM 140.190</td><td>140</td><td>190</td><td>140</td><td>43,5</td><td>53</td><td>M 8 x 130</td></tr>
</table>

1) see chapter 2.3.

subject to change without notice.

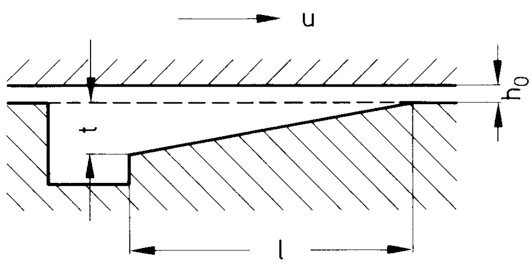
4. Calculation of Bearing

With the here presented method the designer is given the possibility to collect the for bearing definition needed but unknown values by graphic method. This method is easy and sufficient enough.

4.1. Ascertainment of load capacity (Nomogram I)

The SPIETH hydrodynamic radial slide bearing Type GLM has nearly wedge shaped retain fields in defined geometric dimensions. Therefore the load bearing capacity is according to technical literature:

$$F = C \cdot \eta \cdot u \cdot b \cdot \frac{l^2}{h_o^2}$$



b = supporting bearing width

The smallest operational lubrication gap is according to technical literature about the size of

$$h_o \approx 2\mu m$$

Due to this

$$h_o < t$$

can be ascertained and the load rating C displayed as:

$$C \approx 0{,}25 \cdot \frac{h_o}{t}$$

For the geometric of the GLM the load bearing capacity F can be calculated as:

$$\boxed{F \approx 30\eta \cdot u \cdot \frac{d^2}{h_o}}$$

and the average high loading pressure $\bar{p}$:

$$\bar{p} = \frac{F}{l \cdot b} \approx 150\eta \cdot u \cdot \frac{1}{h_o}$$

Nomogram I was compiled for the smallest lubrication gap occurring under operation $h_o \approx 2\mu m$; η is the dynamic viscosity under working temperatures.

4.2. Ascertainment of heating of the bearing (Nomogram II)

Out of the for wedge shaped retain field named relations

$$\mu \approx (0{,}5 \ldots 1) \cdot \frac{\eta \cdot u}{\bar{p} \cdot h_o}$$

there is the outcome of the friction coefficient

$$\mu \approx \frac{1}{200}$$

and the friction loss

$$P = \frac{1}{200} \cdot F \cdot u$$

In the diagram of Nomogram II are two overlapping cases displayed:

Case 1: heat emission at the bearing surface.
At an exothermic surface

$$A \approx 10 \cdot d^2$$

and the heat transmission number

$$\alpha = 20\left[\frac{W}{K \cdot m^2}\right]$$

the dissipation of friction loss at the bearing surface

$$P = \alpha \cdot A \cdot \Delta T_{air}$$

As a result of this, the high temperature of the bearing is

$$\Delta T_{air} \approx K_{air} \cdot \frac{P}{d^2} \; ;$$

whereby $K_{air} = 0{,}005\left[\frac{K \cdot m^2}{W}\right]$

In this case the high temperature will be ascertained with the diameter scale in the Nomogram II.

Case 2: heat emission to the coolant
At a supposed specific heat

$$c = 1900\left[\frac{Nm}{kg \cdot K}\right]$$

and a density of the coolant

$$\rho = 0{,}9 \cdot 10^3 \left[kg / m^3\right]$$

the dissipated friction loss by the quantity of coolant Q is

$$P = \rho \cdot c \cdot Q \cdot \Delta T_{oil}$$

As a result of this, the high temperature of the bearing is

$\Delta T_{oil} \approx K_{oil} \cdot \frac{P}{Q}$; whereby $K_{oil} \approx 0{,}03\left[\frac{K \cdot l}{W \cdot min}\right]$

The high temperature will be determined by the scale of the coolant quantity in the Nomogram.

4.3. Viscosity of standard lubricants

In the Nomogram III the dynamic viscosity η of some standard lubricants in dependency of the working temperature can be ascertained.

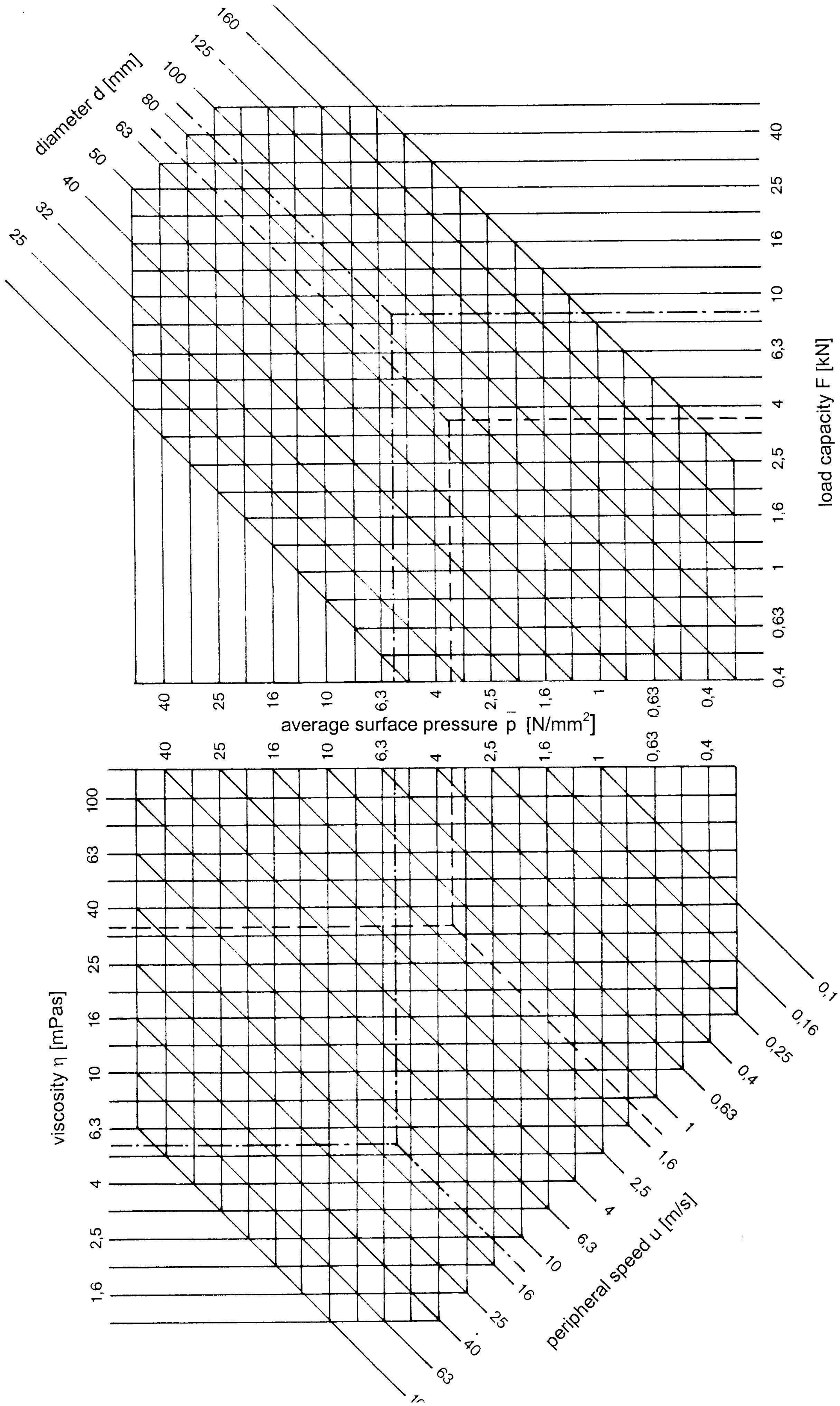
4.4. Standard values for bearing play

The bearing play is the resulting difference of the adjusted diameter of the bearing sliding surfaces and the diameter of the shaft. In the Nomogram IV there are standard values for the bearing play, graded in dependence of the bearing size and the allowed high temperature.

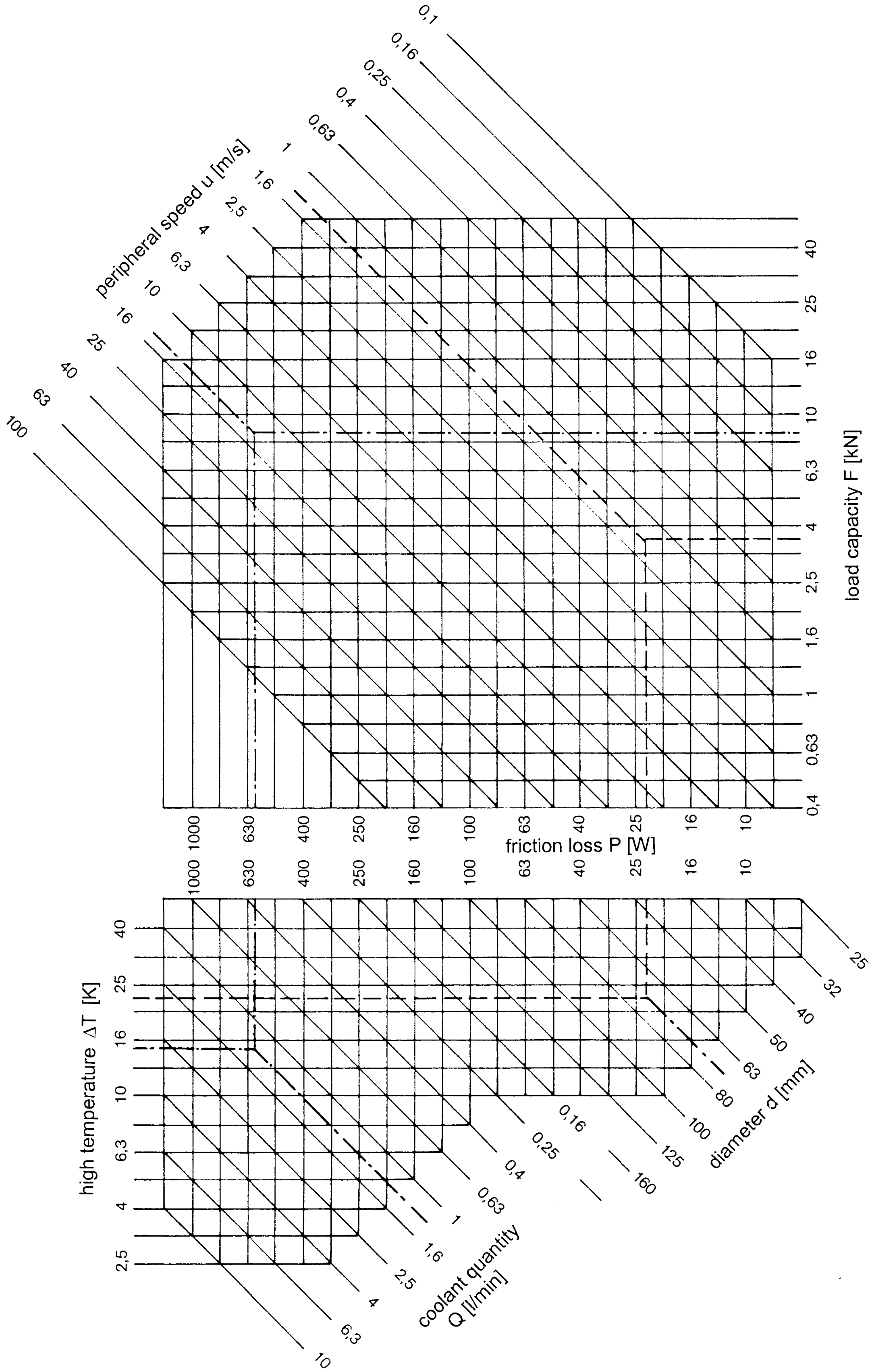
4.5. Calculation examples

Reading	description	code	dimensions	bearing	
				case 1 heat emission at the bearing surface	case 2 heat emission through the coolant
Nomogram I and II	diameter (spindle)	d	mm	70	90
	load capacity	F	kN	3,6	8,7
	revolutions per minute	n	1/min	355	2760
	peripheral speed	u	m/s	1,3	13
	average surface pressure	$\bar{p}$	N/mm^2	3,6	5,6
	working viscosity	η	$mPa \cdot s$	34	5,4
	high temperature	ΔT	K	22	15
	friction loss	P	W	22	590
	coolant quantity	Q	l/min	-	1,25
N'gr. III	working temperature	T	℃	42	35
	kinematical viscosity	υ	mm^2/s	134 at 20℃	10 at 20℃
N'gr. IV	bearing play standard value	S	µm	18,5	17

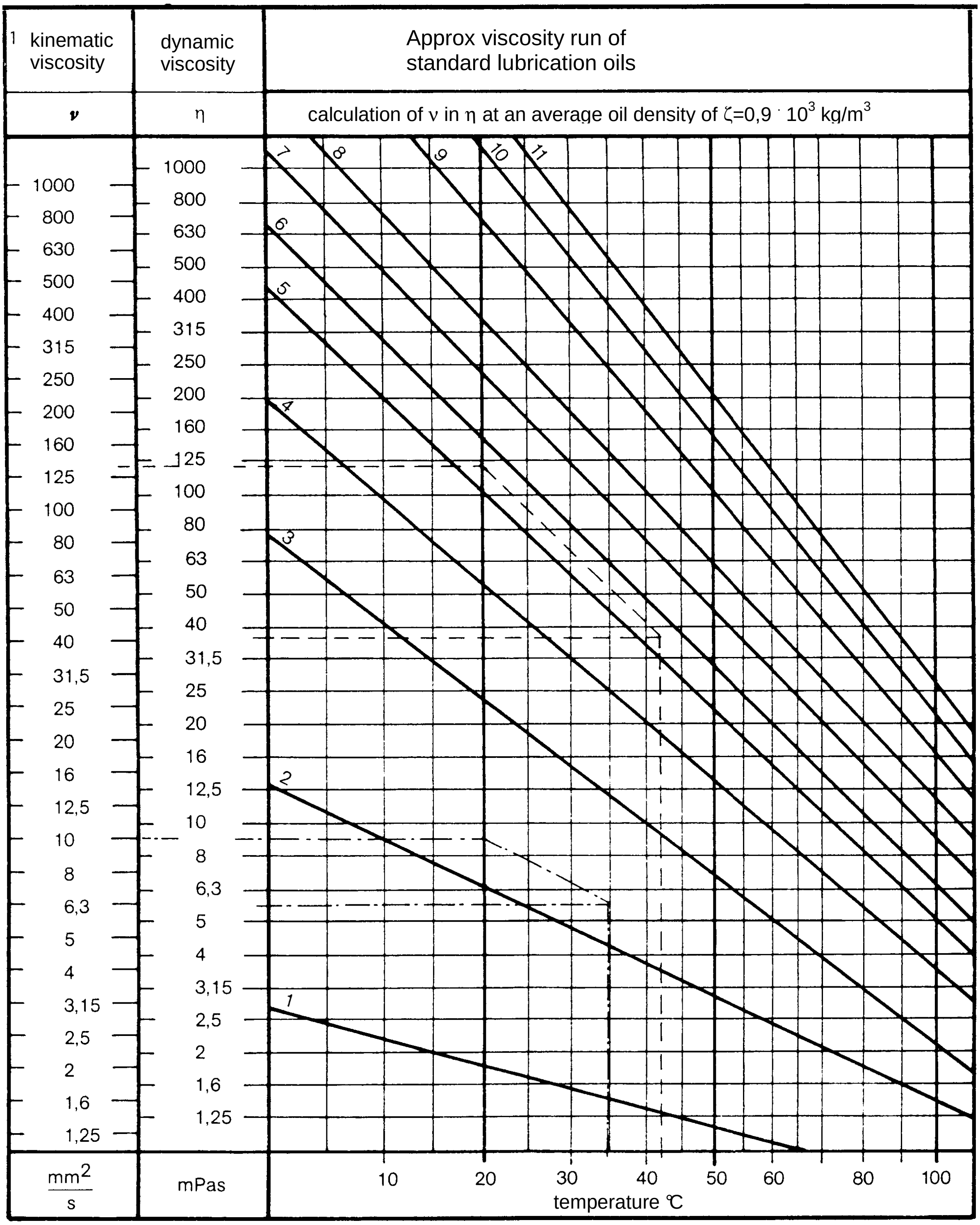
4.1.1. Nomogram I



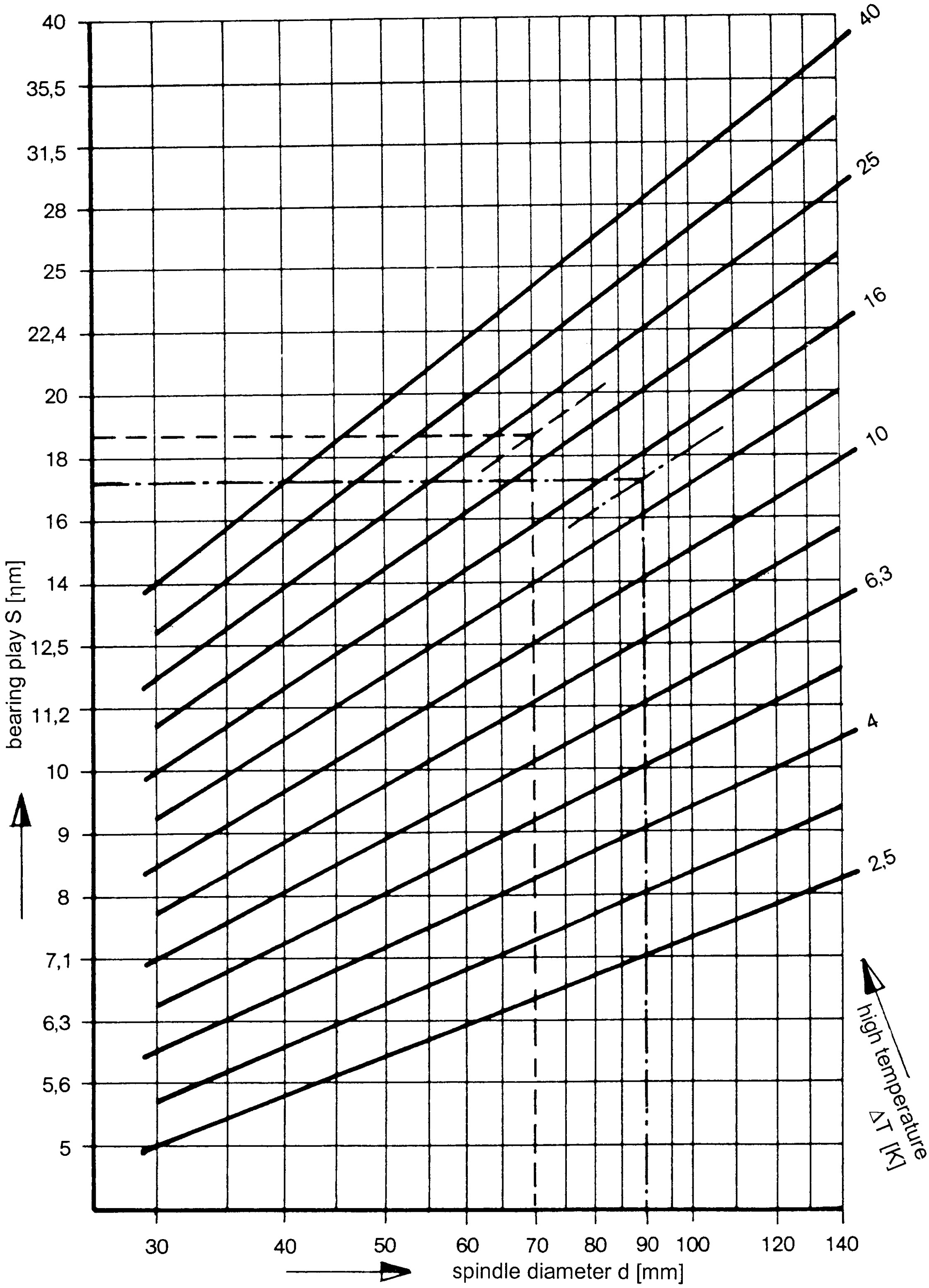
4.2.1. Nomogram II



4.3.1. Nomogram III



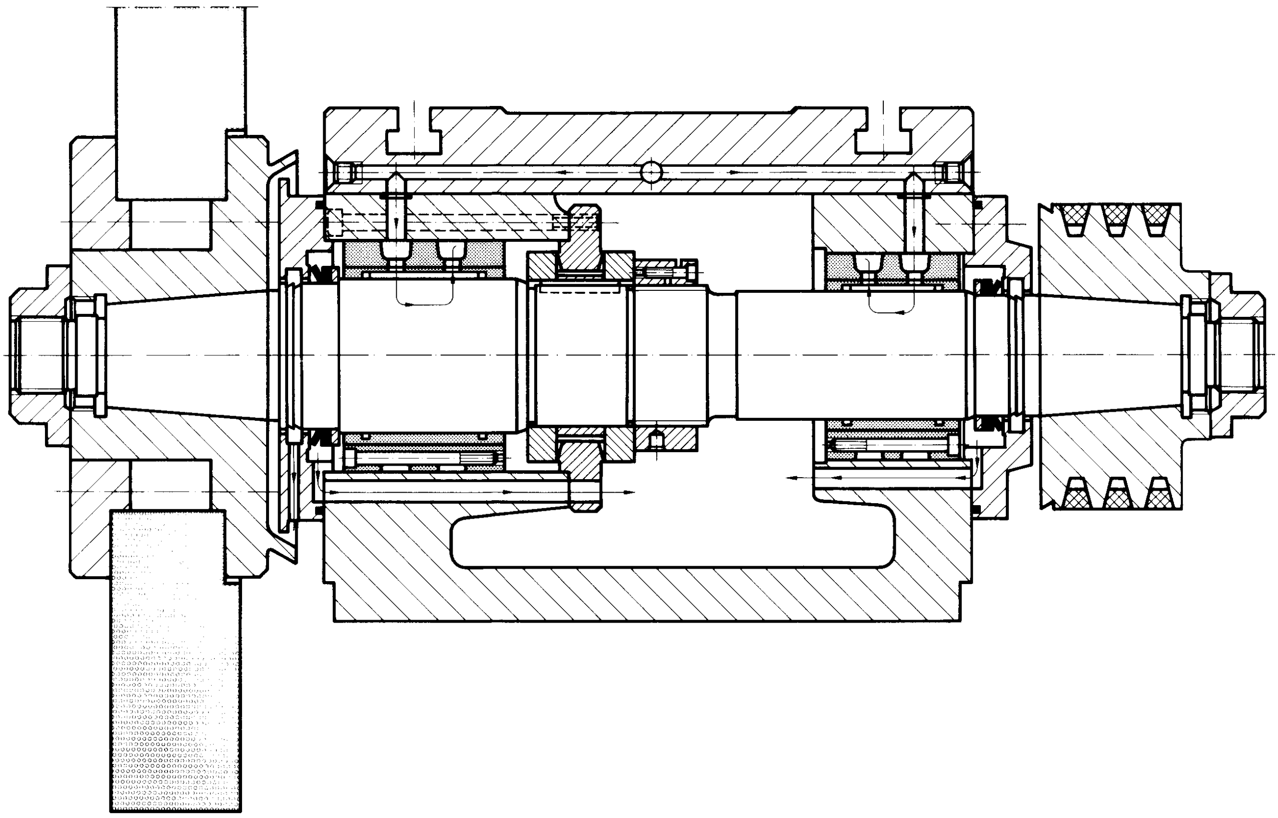
4.4.1. Nomogram IV



4.6. Legend

F	=	load capacity
η	=	dynamic viscosity at working temperature
u	=	peripheral speed
d	=	diameter (shaft)
$\bar{p}$	=	average surface pressure
P	=	friction loss
Q	=	coolant quantity
ΔT	=	high temperature (difference between working- and coolant supply temperature)
T	=	working temperature
ν	=	kinematical viscosity
s	=	bearing play

5. Assembly example



Headstock with open housing

The adjustable hydrodynamic sectionalised radial slide bearings GLM are mounted directly in the bores of the headstock. The axial guiding is placed between the GLM, adjusted for correct play and tightened with a SPIETH-Locknut against the spindle accretion. V-rings are used for sealing against oil loss.

SN 03.01 e 0409/0000/0409

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Our concept of precision also means that we are there wherever you need us – to provide the optimum service for all your requirements. Since time is money, Spieth guarantees prompt service, a high level of delivery availability backed up by technical expertise on the ground.

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Use our expertise to expand your catalogue of design solutions. Our dedicated sales engineers will be only too delighted to draw on their up-to-date product and industry knowledge in advising you on all aspects of efficient and economical mechanical components. Just give us a call.

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SPIETH
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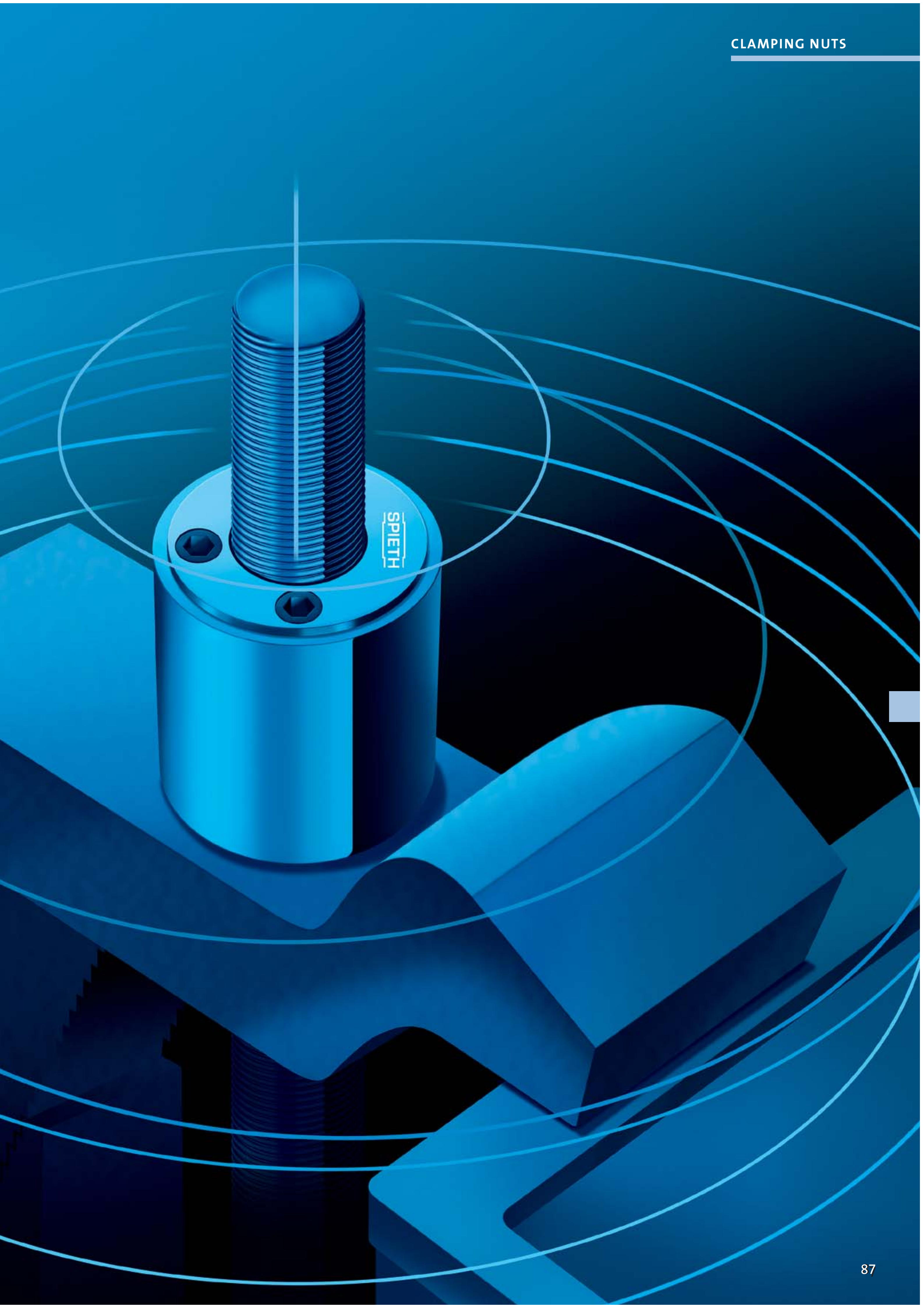
SN 0611 e/2011

SECURE ALL-ROUND CLAMPING FORCE

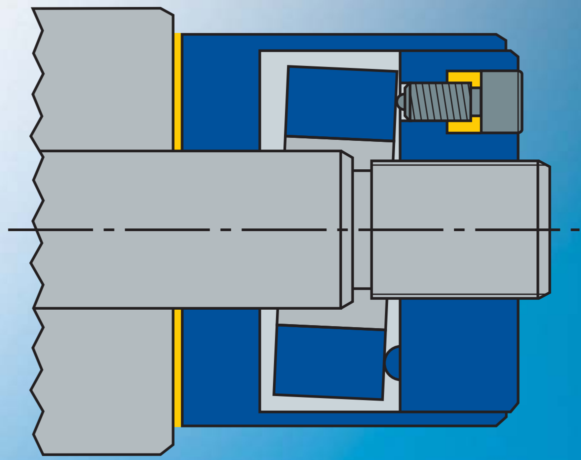
Spieth clamping nuts – an efficient principle. Clamping nuts are widely used in general mechanical and construction engineering applications as mechanical force-transmitting elements for executing reliable connections involving high axial forces with a low level of manual force. Clamping nuts are suitable for use on rotating spindles and can be clamped and released in rapid succession without difficulty.

Since no movement takes place at the end face and at the main thread of the clamping nut during the clamping process, this precludes the possibility of friction loss. Thanks to the Spieth design, these clamping nuts offer much greater efficiency than conventional nuts – along with an extended service life and resistance to temperature influences.

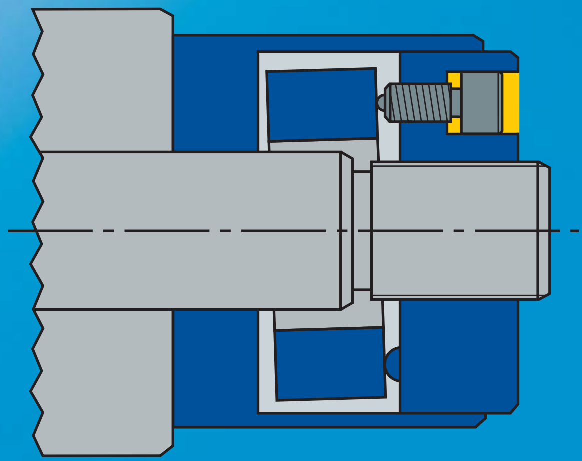


FUNCTIONAL PRINCIPLE

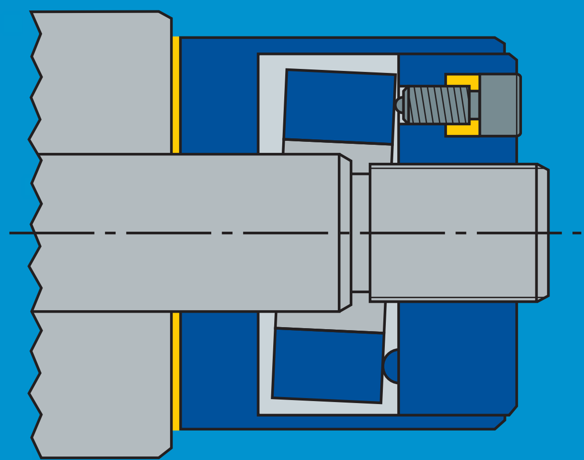
The principle is shown in a simplified diagram with enlarged clamping path.



Clamping nut screwed into place, light contact with end face is sufficient.



Clamping screw actuated: High axial forces have built up at the point of end face contact.



Clamping screw released: Original, light end-face contact is restored.

SPIETH **CLAMPING NUTS AM-GS**

BENEFITS

During the clamping process (tightening the clamping screw), no movement takes place at the end face and at the main thread of the clamping nut. This precludes the possibility of friction loss, thus eliminating the cause of the poor efficiency of conventional nuts. Only the clamping screw with its relatively small movement thread and the ball-bearing supports make some sliding movements. This results in high system efficiency. Combined with the double clamping force ratio, this enables reliable and user-friendly application of the clamping force.

The entirely mechanical structure of the clamping nut guarantees long durability and makes it virtually impervious to the influence of temperature.

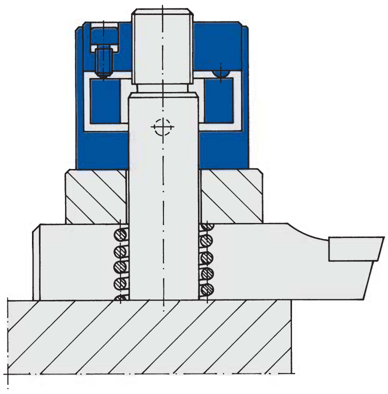
FIELDS OF APPLICATION

Series AM-GS clamping nuts are mechanical force-transmitting elements for use in general mechanical and construction engineering. They are of particular benefit for the execution of reliable connections involving high axial forces with a low level of manual force. They are designed to permit clamping and release in quick succession without difficulty. The clamping nut is suitable for use on rotating spindles.

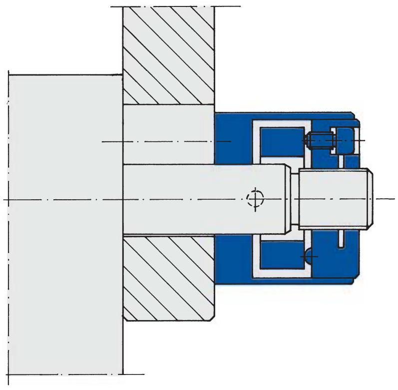
Series AM-GS

- High degree of efficiency, minimal tightening torque.
- Simple actuation.
- Can be used on rotating spindles.
- Capable of withstanding dynamic loads.
- High degree of axial pretension safely achievable.
- Designed with purely mechanical components.
- No hydraulics used, which means no leaks or sudden failures are possible.
- Excellent durability.

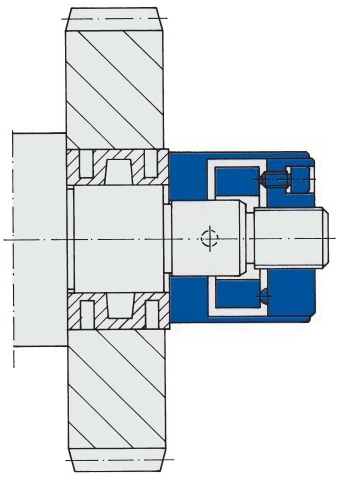
Clamping Nuts Series AM-GS



Example 1: Tool fixture
Typical arrangement of the clamping nut on a tool fixture.

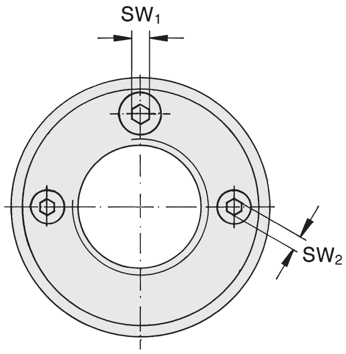


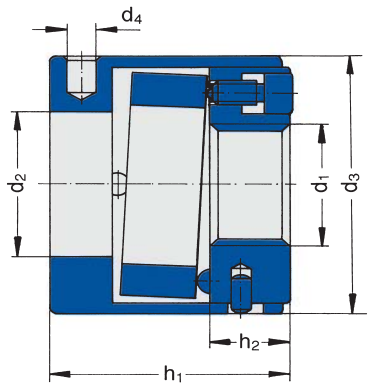
Example 2: Work piece fixture
The machine component must be reliably clamped here during the operational status, but must permit traversing for periodic set-up work. The clamping nut with thread fixation used here offers the advantage that its position remains fixed even when the nut is released.



Example 3: Gear fixture
Realised using a clamping set, tensioned by a clamping nut. The gear has to be changed or its peripheral position altered periodically. This can be conveniently and safely achieved using the clamping nut.

SPIETH CLAMPING NUTS SERIES **AM-GS**





Order No.	Dimensions in mm						Effective clamping force	Clamping screw		Lock screws	
	d_1	d_2	d_3	d_4	h_1	h_2	F	Width across flats SW_1	M_A	Width across flats SW_2	M_S
	ISO - 5H	H7					kN	mm	Nm	mm	Nm
AM 20.1,5 - GS	M20x1.5	22	52	6.9	56	26	30	6	20	5	8
AM 24.1,5 - GS	M24x1.5	27	55	6.9	56	26	30	6	20	5	8
AM 30.1,5 - GS	M30x1.5	32	69	9.2	78	31	50	8	35	6	15
AM 36.2 - GS	M36x2	40	78	9.2	82	31	50	8	35	6	15
AM 42.2 - GS	M42x2	50	88	11.5	88	36	75	10	55	6	15
AM 52.2 - GS	M52x2	60	100	11.5	92	36	75	10	55	6	15
AM 60.3 - GS	M60x3	70	118	14	102	40	85	12	70	8	20
AM 68.3 - GS	M68x3	80	130	16.2	112	46	100	14	80	10	30
AM 80.4 - GS	M80x4	100	152	16.2	122	46	100	14	80	10	30

Ensure that the clamping screw is in the correct starting position. Under no circumstances may the clamping screw be screwed in below the surface of the housing before the clamping sequence begins. Otherwise it is not possible to utilise the full clamping path of 2 mm.

Clamping

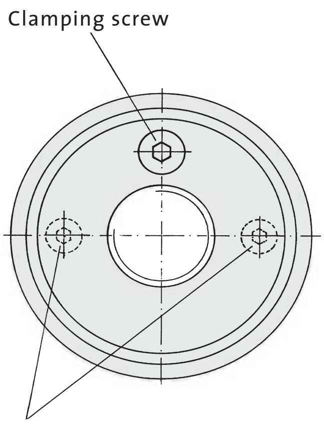
1. Screw the clamping nut manually until it makes contact with the end face (Fig. 1), Tighten the fixing screws and lock the clamping nut to the thread.
2. Tighten the clamping screw, observing the max. tightening torque. If a torque wrench is not available, the clamping screw may also be tightened using a screwdriver ISO 2936 (DIN 911) using normal manual force. If the clamping screw is tightened without a torque wrench, there is a tendency for the clamping force of the clamping nuts larger than M42 not to be fully utilised.

The clamping force of the nut is now fully effective. (Fig. 2)

Releasing

1. Turn the clamping screw back to the starting position. The clamped component is now released.
2. If the clamping nut is to be completely removed from the spindle, the thread lock screws must now be released. Then unscrew the clamping nut manually.

In exceptional circumstances, for example due to heavy soiling, it may be difficult to unscrew the clamping nut. In this case, utilize the radial boreholes around the outside diameter to insert a guide pin.



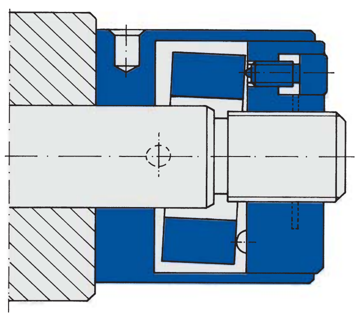


Fig. 1

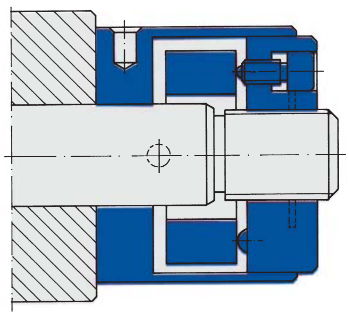


Fig. 2

DESIGN

All parts are made of steel. The thread ring, the tilting ring and the pressure ring are hardened and tempered.

The outside diameter, the borehole and the end face of the clamping nut are ground.

The modified clamping screw and the fixing screws are all cheese-head screws with a hexagon socket to ISO 4762 (DIN 912).

The metric thread d_1 is manufactured to tolerance class "fine" (tolerance zone 5H, DIN 13 parts 21 ... 25).

The locating bore d_2 of the pressure ring is manufactured to tolerance zone H7.

CONNECTING COMPONENTS

The metric bolt thread must normally be manufactured to tolerance class "medium" (tolerance zone 6g, DIN 13 parts 21 ... 25), for higher precision requirements (e.g. for arrangement on revolving spindles) to tolerance class "fine" (tolerance zone 4h, DIN 13 parts 21 ... 25).

If high accuracy of centring the clamping nut is required, the shank diameter for d_2 must be manufactured to tolerance zone h6.

EXPLANATIONS

For all clamping nuts, the maximum **clamping path of 2 mm** must be observed.

F: Max. effective clamping force with specified M_A.

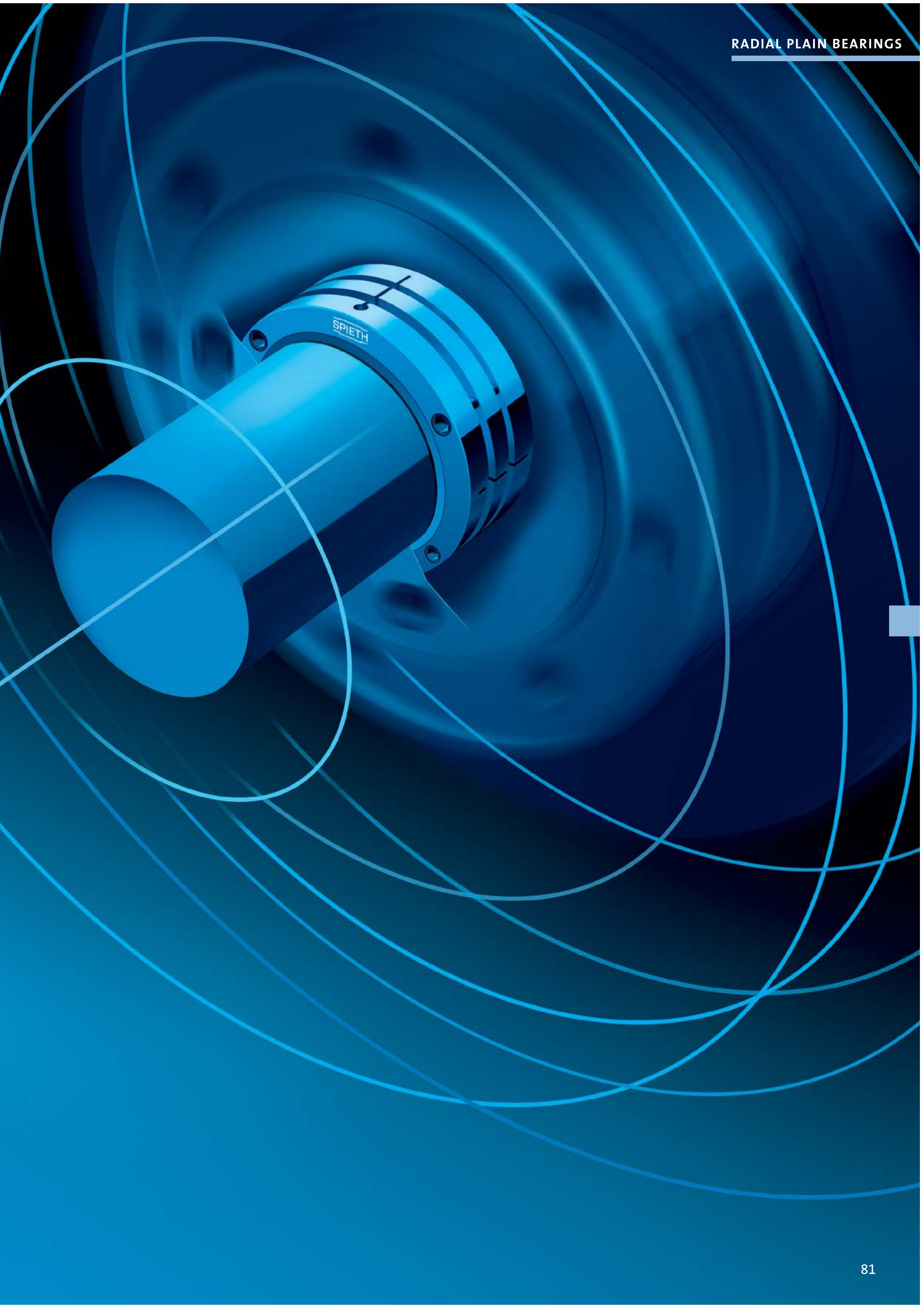
M_A: Max. permissible torque for clamping screw.

If a torque wrench is not available, the clamping screw may also be tightened using a screwdriver ISO 2936 (DIN 911) using normal manual force. In this case, however, there is a tendency for the clamping nuts in sizes ≥ AM 42x2 not to be fully utilised.

M_S: Tightening torque for fixing the thread (guideline value).

SAFELY SLIDING AND LIFTING

Spieth radial plain bearings – Hydrodynamic multilobe bearings with adjustable play.
When it comes to the implementation of spindle bearings in modern, powerful machines, roller bearings are increasingly being pushed to their limits and are being replaced by sliding bearings. Hydro-dynamically lubricated, adjustable multilobe radial plain bearings manufactured by Spieth play to their strengths in the field of mechanical engineering and in machine tool engineering in particular: They allow heavily loaded spindles to lift away from the bearing surface and float on the lubricant layer. This allows the increasing requirements in terms of surface quality, dimensional accuracy, manufacturing tolerance of the work piece as well as tool service life to be fulfilled. With the high level of damping achieved by the lubricant film along with their concentricity, they combine smooth running with shock resistance and long service life.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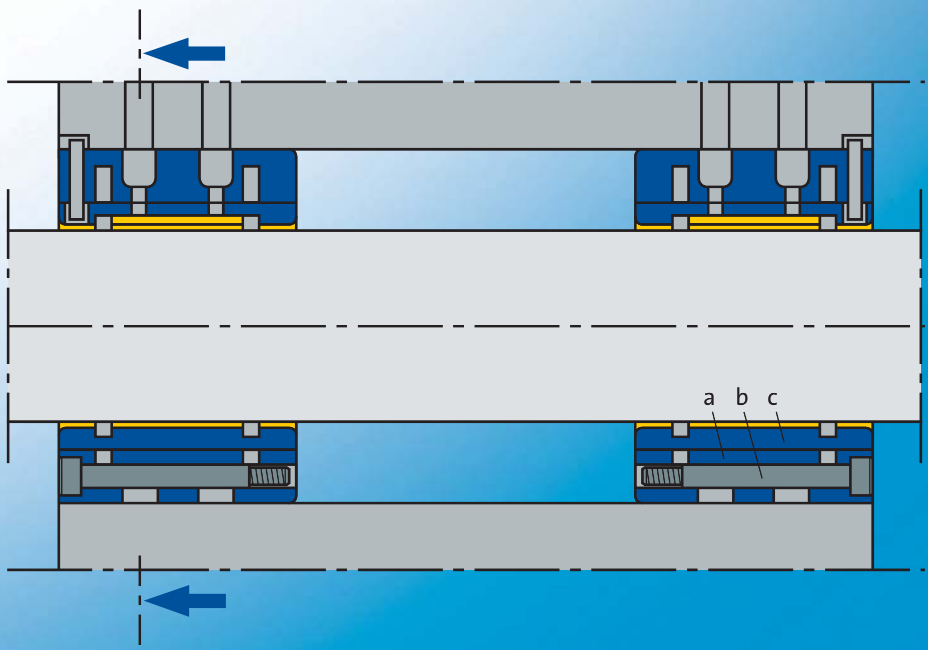
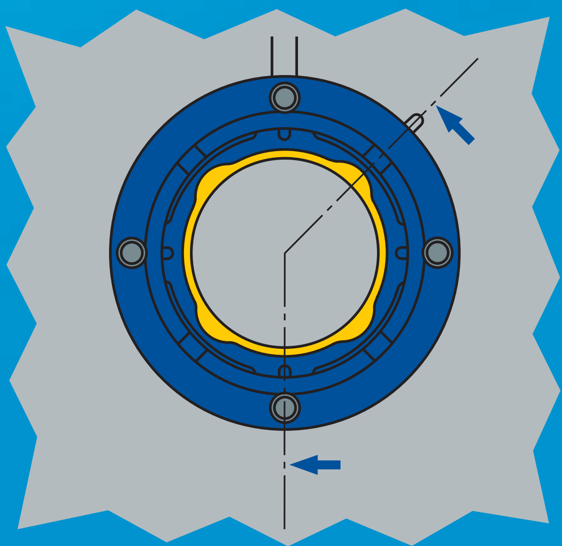
LAYOUT

a Meander-shaped profiled steel sleeve
b Clamping screw
c Bearing bush made of high-quality bearing bronze





SPIETH **RADIAL PLAIN BEARINGS**

We'll provide you with the perfect radial plain bearings for your application. We'll also make choosing easy – with expert advice from our specialists.

BENEFITS

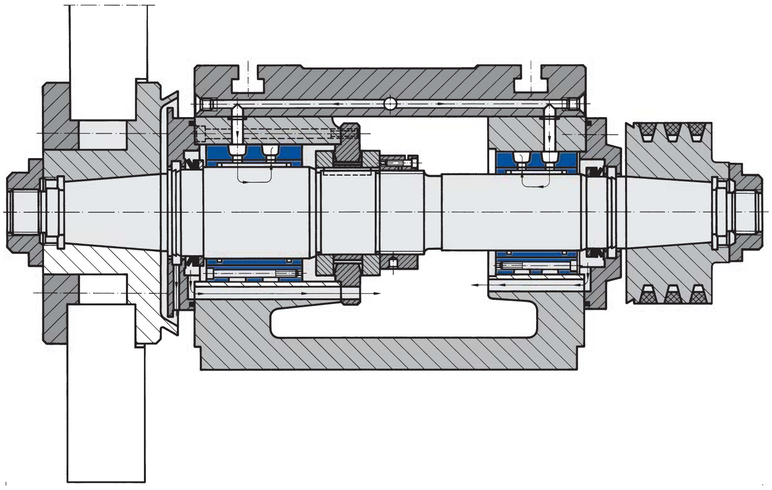
- Simple and precise adjustment of play.
- High degree of damping.
- High level of concentricity.
- Smooth running and shock resistant.
- Excellent emergency running properties.
- Suitable for low and high speeds.
- Independent of running direction.
- Connecting components simple to manufacture.
- Simple, quick assembly and dismantling.

FIELDS OF APPLICATION

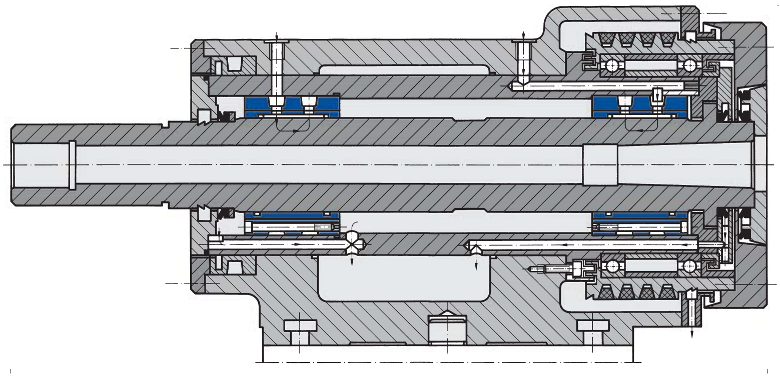
The hydro-dynamically lubricated, adjustable multilobe radial plain bearings are used primarily in the field of mechanical engineering. Thanks to their outstanding damping, concentricity and smooth running characteristics along with their long service life, multilobe slide bearings are an excellent choice for modern powerful machines with their ever-increasing requirements in terms of surface quality, dimensional accuracy and manufacturing tolerances of work pieces. One of the most important areas of application is in cylindrical grinding machines.

GLM hydro-dynamic radial plain bearing

ASSEMBLY EXAMPLES



Example 1: Headstock with open housing
The adjustable GLM radial plain bearings are mounted directly in the bores of the head-stock. The axial guiding is placed between the GLM, adjusted for correct play and tightened with a Spieth-Locknut against the spindle end. V-rings are used for sealing against oil loss.



Example 2: Work piece spindle head with bearing flange sleeve and closed housing
In this stable spindle head design, radial guid-ance is achieved using two GLM bearings mounted in the bearing flange sleeve.

Axial guidance is provided by a spindle collar, which is located on the working side outside the GLM bearing.

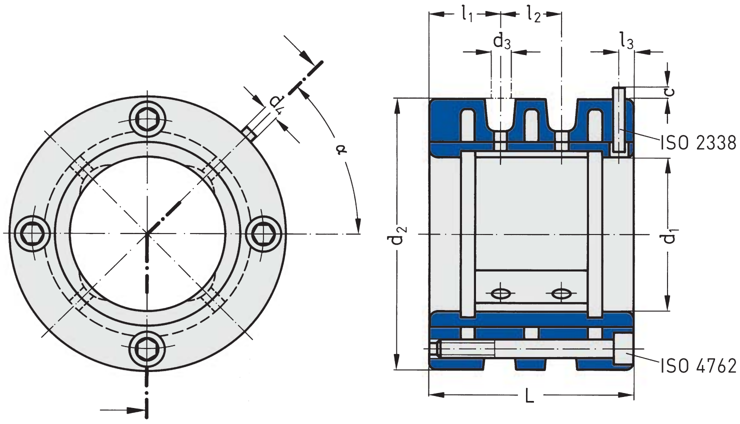
A Spieth clamping set is used to eliminate the assembly play between the housing borehole and bearing flange sleeve on the spindle drive side.

V-rings are provided to prevent oil loss.

NOTE

Detailed documents are available for down-load at: **www.spieth-me.de**

SPIETH RADIAL PLAIN BEARINGS SERIES **GLM**



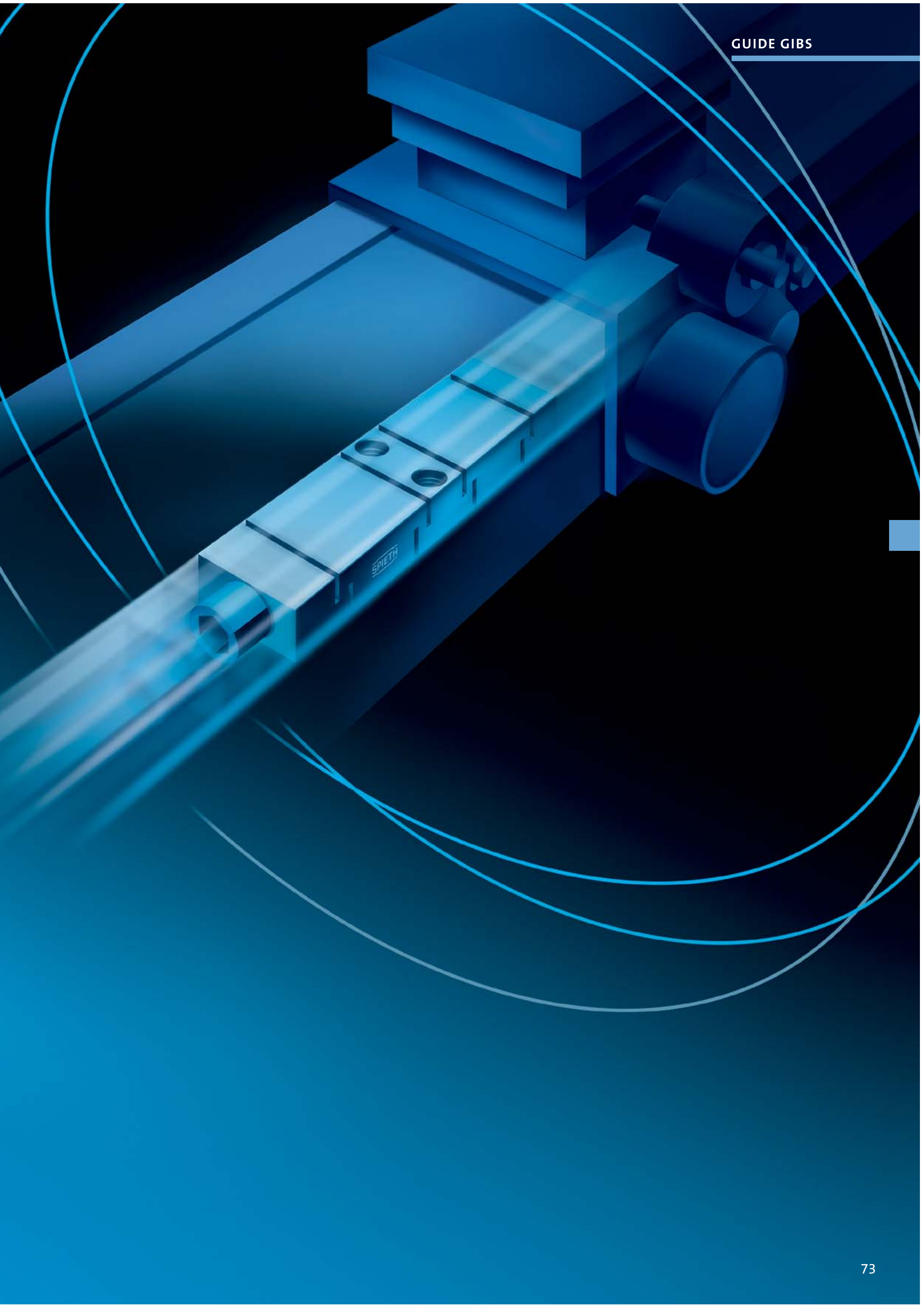
Order No.	Dimensions in mm						Cylindrical pin ISO 2338 – m6				Clamping screws	
	d_1 F6	d_2 h5	L	l_1	l_2	d_3 max	d_4 mm	c mm	l_3 mm	α °	Dimensions ISO 4762	No.
GLM 30.55	30	55	40	13.8	12.5	4	2	2	3	45	M4x35	4
GLM 35.60	35	60	40	13.8	12.5	4	2	2	3	45	M4x35	4
GLM 40.65	40	65	45	15	15	6	2	2	3	45	M4x40	4
GLM 45.70	45	70	45	15	15	6	2	2	3	45	M4x40	4
GLM 50.80	50	80	52	17.8	16.5	6	3	2	4	45	M5x45	4
GLM 55.85	55	85	56	18.8	18.5	8	3	2	4	45	M5x50	4
GLM 60.90	60	90	62	20.3	21.5	10	3	2	4	45	M5x55	4
GLM 65.100	65	100	68	23.5	21	10	4	3	6	45	M6x60	4
GLM 70.105	70	105	72	24.5	23	10	4	3	6	45	M6x65	4
GLM 75.110	75	110	78	26	26	15	4	3	6	45	M6x70	4
GLM 80.115	80	115	82	27	28	15	4	3	6	45	M6x75	4
GLM 85.120	85	120	85	27.8	29.5	15	4	3	6	45	M6x75	4
GLM 90.125	90	125	90	29.8	30.5	15	4	3	6	45	M6x80	4
GLM 95.130	95	130	95	31	33	20	4	3	6	45	M6x85	4
GLM 100.135	100	135	100	32.3	35.5	20	4	3	6	45	M6x90	4
GLM 110.160	110	160	110	34.8	40.5	20	4	3	6	45	M8x100	4
GLM 120.170	120	170	120	38.5	43	25	4	3	7	30	M8x110	6
GLM 130.180	130	180	130	41	48	25	4	3	7	30	M8x120	6
GLM 140.190	140	190	140	43.5	53	25	4	3	7	30	M8x130	6

THE REQUIRED GUIDANCE QUALITY: PRECISION

Spieth guide gibs – flat guides with adjustable play.

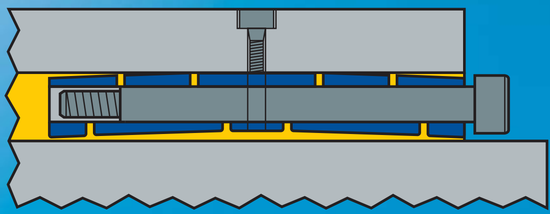
Wherever precision guides are configured without the occurrence of high forces in the fields of precision construction and mechanical engineering, guide gibs designed by Spieth are there to lend a guiding hand: They outperform the taper and pressure gibs used elsewhere.

That's because the flat linear guiding elements by Spieth combined the benefits of slideways, e.g. high damping, with minimal guide play that can be optimally adjusted during assembly.

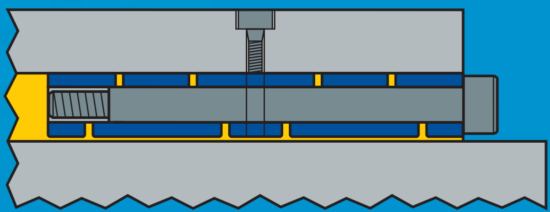

SPIETH

FUNCTIONAL PRINCIPLE

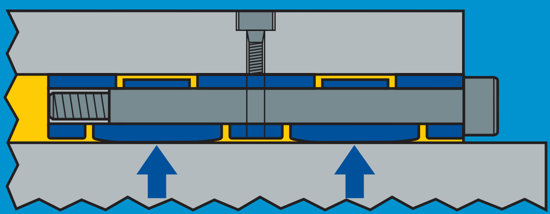
The principle is illustrated in a simplified diagram with enlarged play.



The guide gib is fastened to the machine body with the screws. In this phase, the "flying" ends of the guide gib are still not flush with the machine body.



The first pre-tensioning phase causes the ends of the guide gib to press flat against the machine body.



After further axial tensioning, the movement play between the guide block and the slideway is ideally adjusted.

SPIETH **GUIDE GIBS FLW**

At Spieth, you'll find the perfect guide gibs for your application. And you can rely on the expert advice of our specialists. The enhanced characteristics of the FLW series open up new possibilities for challenging linear guides.

FLW flat guides are ready-to-install machine elements that allow you to realise minimal guide play on your machines without the use of significant manual force. The process of designing and machining the contact surfaces on the surrounding components is straightforward, i.e. they are geometrically rectangular and parallel. Play is adjusted using a simple clamping screw, which is fitted on end face where it is easily accessible. This ensures that guide play can be corrected at any time if necessary.

BENEFITS

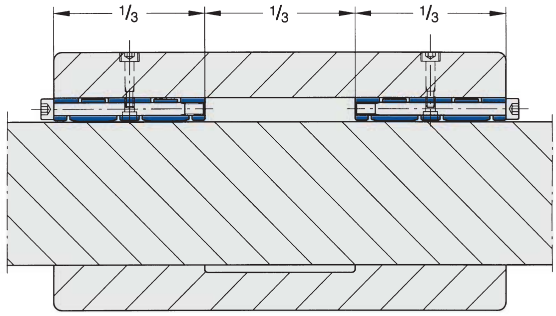
- Low-cost precision that's ready to install.
- High degree of damping.
- Minimum stick-slip effect.
- Cost-effective installation conditions.
- Guide play can be ideally adjusted and re-adjusted.
- Outstanding tribological characteristics.

FIELDS OF APPLICATION

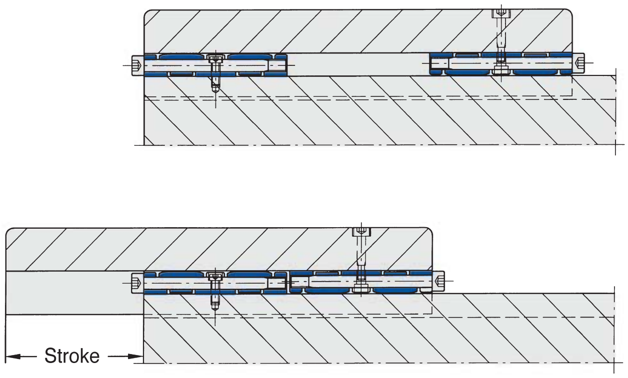
FLW guide gibs are flat linear guiding elements for all areas of precision mechanical and construction engineering. By using guide gibs, you can avoid the expense of producing your own flat guides or taper and pressure gibs and the painstaking process of integrating them into the required guiding area. On-site assembly or modifications are straightforward and adjustments can be made using a central screw. Based on their design, these guide gibs ideally suited for creating precision guides where the occurrence of high force must be avoided.

FLW guide gib, unhardened steel, with a tungsten carbide coating

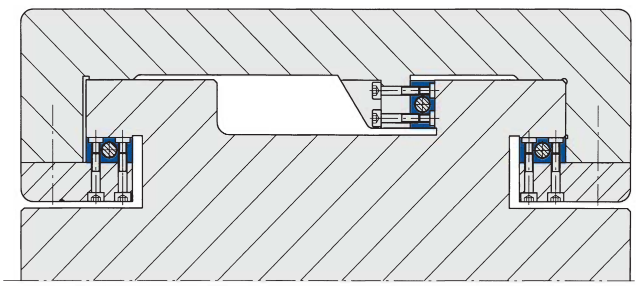
ASSEMBLY EXAMPLES



Example 1: Guide block
Standard arrangement of the guide gibs. In the case of a precisely executed guide, no stress occurs in the centre area of the guide block. This zone only exercises any effect when play exists (drawer effect).

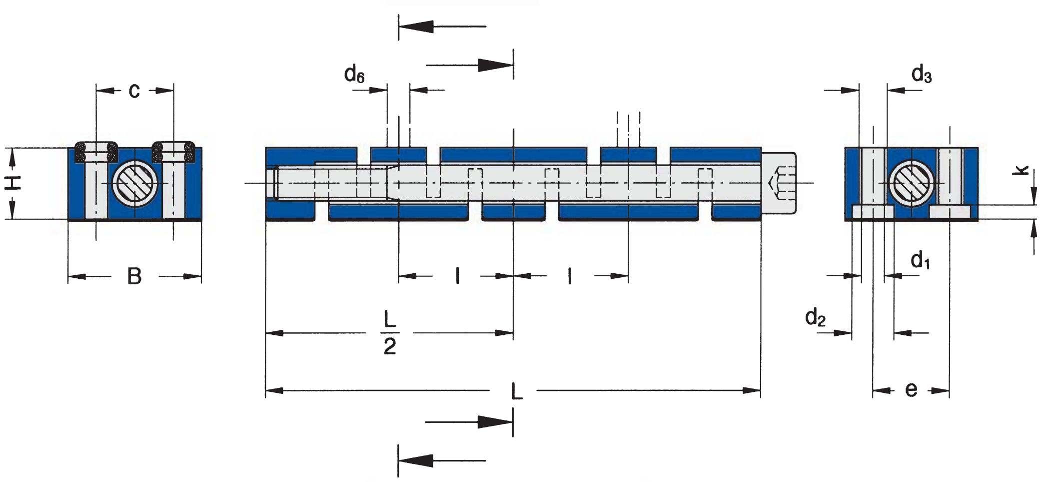


Example 2: Guide block with restricted length
If the length of the slideway is limited, it is possible to achieve an optimum guide basis in any guide block position by arranging one guide gib at the slideway and one guide gib at the guide block.



Example 3: Narrow bed guide
The ratio between the length and width of the guide (guide basis) should be as high as possible. To achieve this, the guide must be configured as a narrow bed guide in special cases.

SPIETH GUIDE GIBS SERIES **FLW**



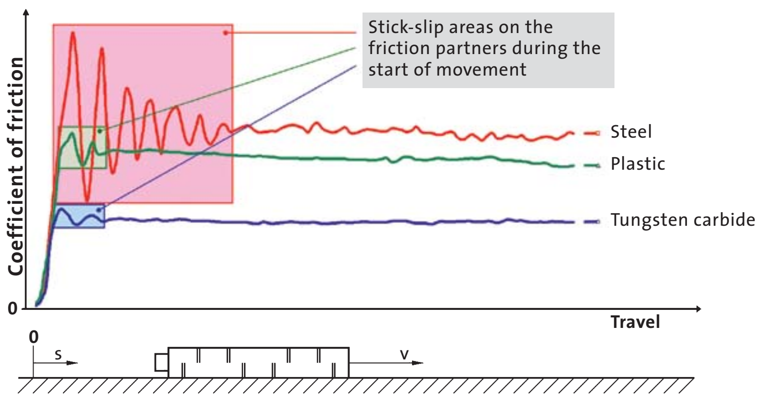
Order No.	Dimensions in mm								Clamping screws	Perm. load (Guideline values)	Lubricant supply in mm		
	H f6	B h11	L	d_1	d_2	d_3	e	k	ISO 4762	N	d_6	l +/−0.1	c +/−0.1
FLW 6[1)]	6	12	41	2.5	4.8	M 3	6.5	1.7	M3x40	900	-	-	-
FLW 8[1)]	8	14	56	2.5	4.8	M 3	8	1.7	M4x55	1900	-	-	-
FLW 10	10	18	66	3.3	5.9	M 4	10	2.2	M5x65	2800	2.5	15	10
FLW 12	12	20	76	3.3	5.9	M 4	11	2.2	M6x75	3600	2.5	17.5	11
FLW 12/1	12	20	110	3.3	5.9	M 4	11	2.2	M6x110	7000	2.5	26.5	11
FLW 15	15	25	100	4.3	7.4	M 5	15	3	M8x100	6000	2.5	22.2	15
FLW 15/1	15	30	150	6.8	10.4	M 8	18	4.5	M8x150	18000	2.5	34	18
FLW 20	20	35	200	6.8	10.4	M 8	22	4.5	M12x200	28000	3	44	22
FLW 26	26	45	250	8.4	13.5	M10	28	6	M16x250	45000	3	54	28

[1)] FLW 6 and FLW 8 without lubrication boreholes.

DESIGN

The guide gibs are made of steel (unhardened), ground parallel on all sides and coated with tungsten carbide. The integrated clamping screws are cheese-head screws to ISO 4762 (DIN 912), which are tightened with an ISO 2936 (DIN 911) screwdriver. The boreholes used to fasten the guide gibs are fitted with a thread and a recess for the screw head. This arrangement provides 2 different fixing options. The guide gibs are provided with lubricating boreholes and are characterised by a high level of wear resistance and favourable emergency running characteristics. Depending on the system, transverse grooves are provided to remove dirt.

Sliding properties of tungsten carbide compared



DETAILS

Fastening concept can be selected

Central adjustment of play

Lubrication boreholes incl. sealing rings

Coating for min. friction/wear

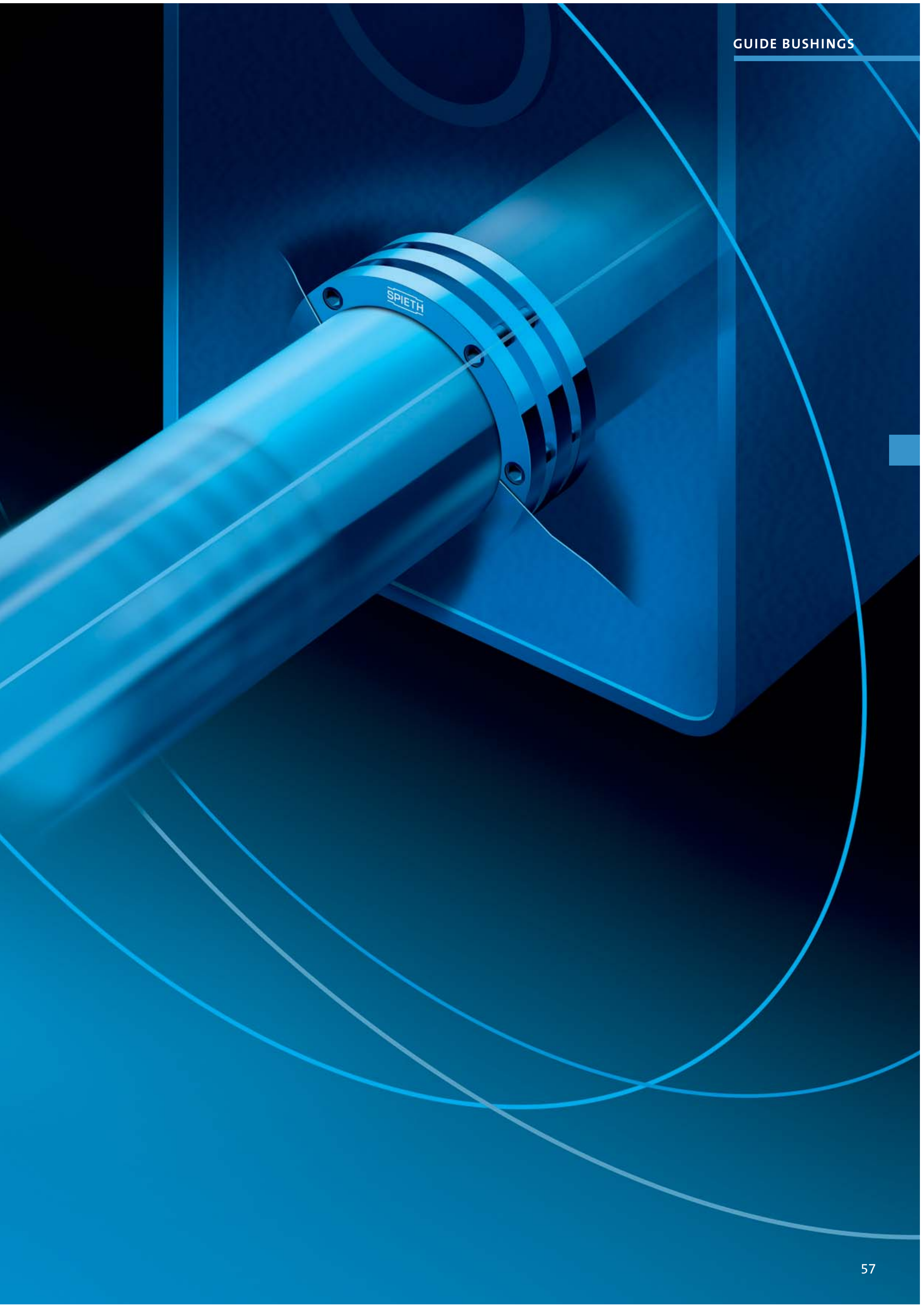
CONNECTING COMPONENTS

The mounting space for the guide gib between the slideway and the guide block must be designed to ISO tolerance H8. The recommended surface roughness for the contact surfaces Rz = 6.3 µm, for the sliding surfaces Rz = 2.5 µm. All functional surfaces must be rectangular or parallel.

The lubrication boreholes provided can be used to provide an optimum lubrication supply. Not all 4 boreholes must be used; depending on the mounting location, it is sufficient to supply the uppermost boreholes.

EXACT GUIDANCE –
IT'S ALL A MATTER OF ADJUSTMENT

Spieth guide bushings – round guiding and clamping elements with adjustable play.
Spieth guide bushings open up new dimensions for contemporary, efficient and economical machine designs incorporating high power densities and high levels of dynamic stress. That's because the simple to produce surrounding components can be manufactured to standard ISO tolerance levels. The required fine guidance play can be optimally adjusted during the mounting process. Minor geometrical errors in the surrounding components as well as operational influences such as increasing temperature can be taken into account – and play can easily be re-adjusted later on.


SPIETH

BENEFITS

- Low-cost, ready-to-mount guide and clamping bushing.
- Existing mating play ensures simple mounting even with large dimensions.
- Optimum guide play adjustment for any operating status.
- Metallic support between clamped sleeve and housing affords high radial rigidity.
- Provides typical high damping performance characteristics for slideways.
- Precise central play restriction and clamping of the sleeve or column.

Series FDK

Series FDL

Series FSK

Series FSL

FIELDS OF APPLICATION

Spieth guide bushings are round linear guiding elements for use in construction and mechanical engineering. The use of guiding bushes is called for wherever the benefits of slideways, such as high levels of damping combined with minimal guide play are required. As a result, guide bushings are successfully used on guide frames, cylindrical carriage guides, on tailstock sleeves, press rams etc. In addition to linear movement, simultaneous rotary movements are possible. However, due to the constraints imposed by lubrication technology, pure rotation such as that used for sliding bearings is not permitted. High acceleration values are possible, as long as an adequate supply of lubrication is ensured.

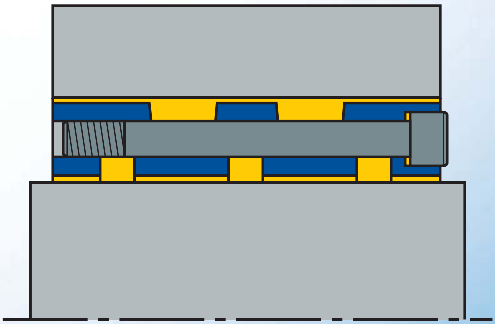
Series FAK/FAL guiding bushes are round linear guiding and clamping elements for precise sleeve or column guidance in applications where the sleeve/column also has to be clamped precisely and centrally in any position. This is required, for example, for sleeves on machine tools in which absolute freedom from play at standstill is called after positioning. The sequence of clamping and release can be repeated as often as required.

Series FAL

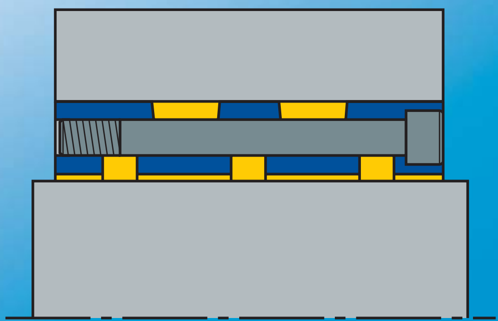
Series FAK

FUNCTIONAL PRINCIPLE

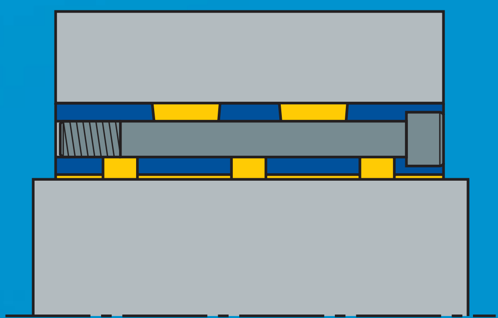
FDK/FDL, FSK/FSL



Connection with assembly play between the housing, guide bushing and centre sleeve.

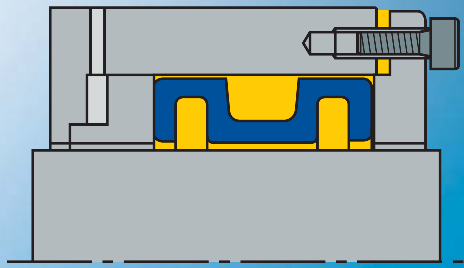


First phase of axial pre-stress: Mating play between housing and guide bushing eliminated, firm fit realized.

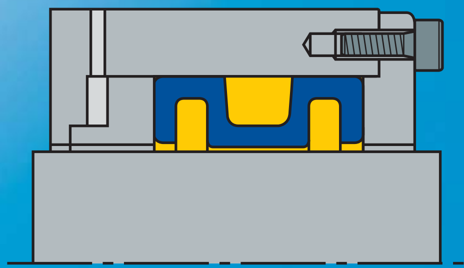


After further axial pre-stressing, the guide play between the guide bushing and sleeve is optimally adjusted.

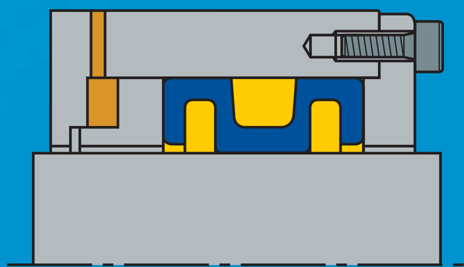
FAK/FAL



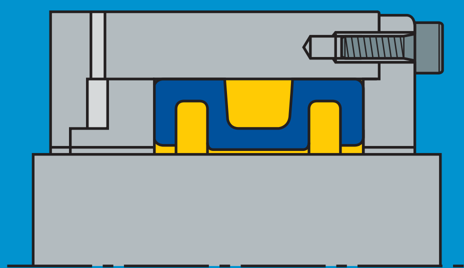
Mounting situation: Connection with assembly play between the housing, guide bushing and centre sleeve.



Guide play adjusted: The guide bushing fits firmly in the housing; guide play between guide bushing and sleeve is optimally adjusted.

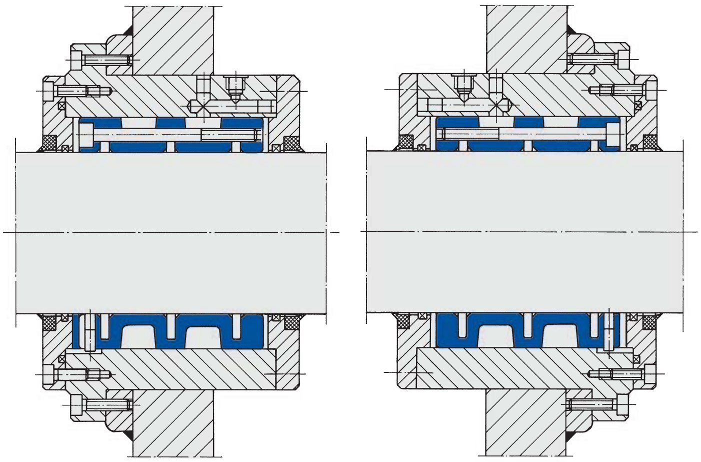


Sleeve clamped: Absolute freedom from play between the sleeve and housing due to tensioned guide bushing.

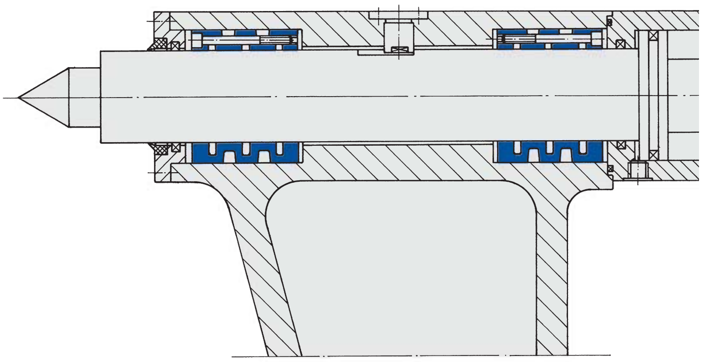


Sleeve released for free movement: The guide bushing has released the sleeve with the previously set degree of guide play.

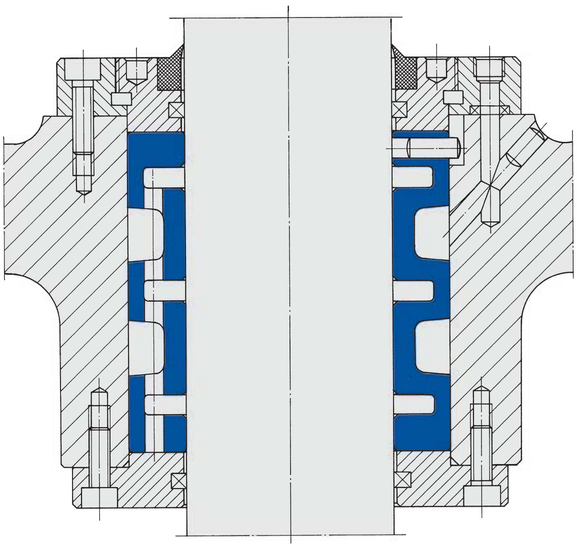
ASSEMBLY EXAMPLES



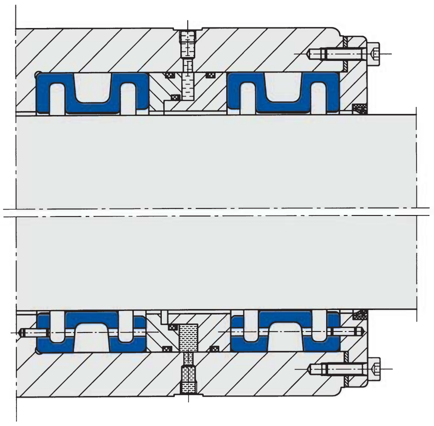
Example 1: Round guide
Due to the long guidance basis of the guide bushings on a welded machine column, particular attention must be paid to ensuring a precisely flush housing borehole.



Example 2: Sleeve guide
In a tailstock, minimal guide play can be achieved here during the installation process. Guide play readjustment is possible at any time. Grease lubrication with facility for occasional re-lubrication is sufficient here.

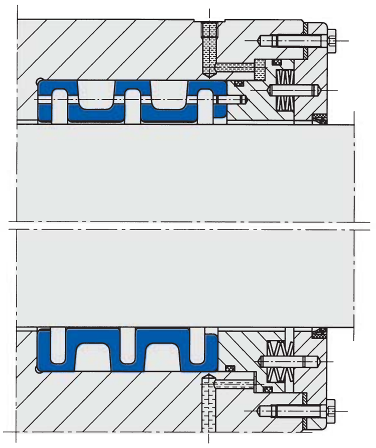


Example 3: Column guide
Guide play adjustment using threaded ring. A locating fit at the threaded ring ensures the necessary rectangular face contact at the guide bushing. The required feed path can be specified when the flange cover has not yet been tightened by turning the threaded ring. The guide bushing is then pre-stressed by tightening the screws at the flange cover.



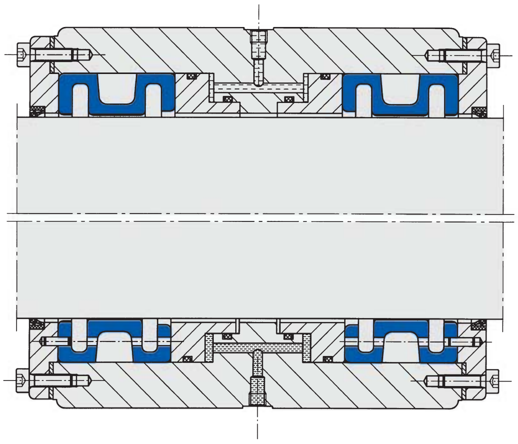
Example 4: Sleeve guidance and clamping

In this example, the working sleeve of a machine tool is precisely guided by two FAK series guide bushings. In the stationary working position of the sleeve or column, clamping using the spring-hardened guide bushing guarantees absolute freedom from play as well as a high degree of radial rigidity in the guide system.



Example 5: Safety clamping

Safety requirements (power failures, oil pressure drop) or economic considerations (long clamping and short release times) often call for a mechanically acting clamp. In this case, the FAL series guide bushing is clamped using banks of cup springs (lower half of the picture) and hydraulically released (upper half of the picture).



Example 6: Guide play compensation

In the arrangement shown here, an independent guide play setting is possible for each guide bushing. This allows the ever-present minimal influence of the different actual guide bushing dimensions and housing boreholes to be compensated. Where expedient for certain requirements, differing degrees of guide play can be set at the two guide bushings.

SPIETH **GUIDE BUSHINGS: THE RIGHT CHOICE**

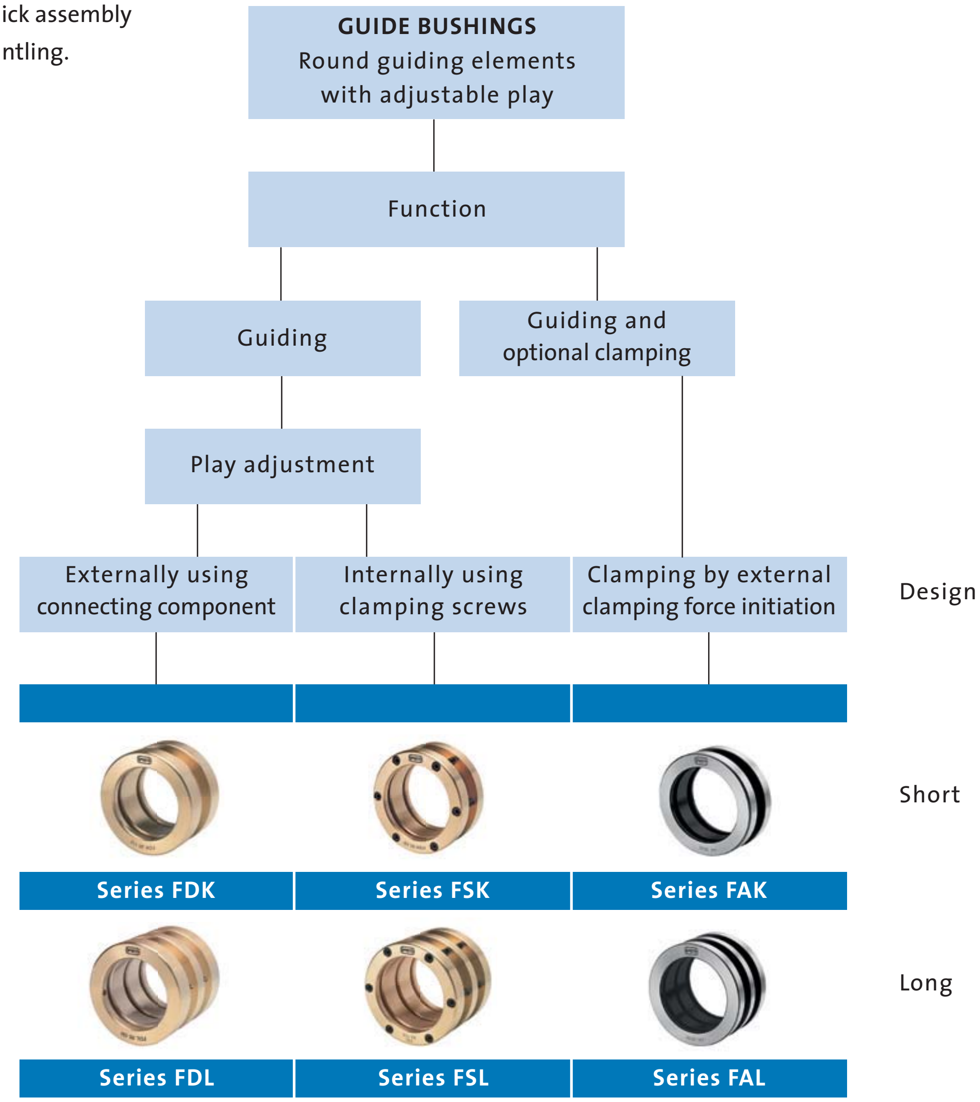
We'll provide you with the perfect guide bushings for your application. We'll also help you choose the right one – with expert advice from our specialists.

Series FDK/FDL and FSK/FSL

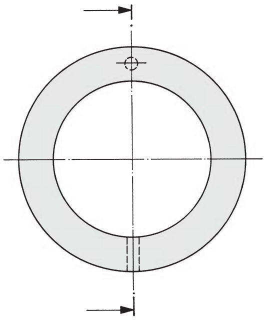
- Precision round guiding elements with adjustable play.
- Low-cost, ready-to-mount.
- Sliding friction in combination with minimum guide play possible.
- Adjustable during installation.
- Connecting components simple to manufacture.
- High degree of damping.
- Simple, quick assembly and dismantling.

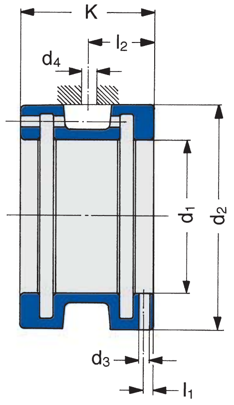
Series FAK/FAL

- Round guiding and clamping elements with precisely adjustable play.
- Low-cost, ready-to-mount.
- High degree of radial rigidity.
- High degree of damping.
- Simple, quick assembly and dismantling, even with large dimensions.

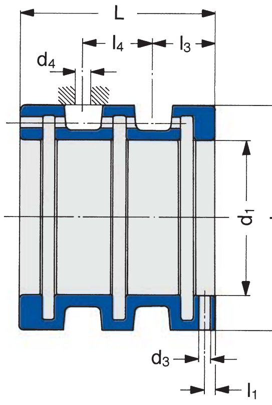


SPIETH GUIDE BUSHINGS SERIES **FDK/FDL**





Series FDK



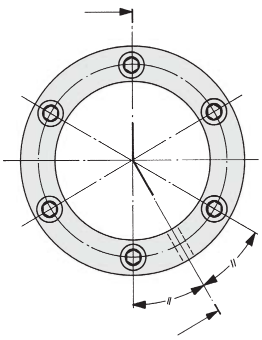
Series FDL

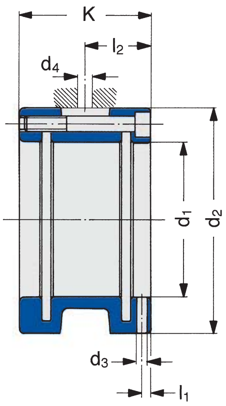
Order No.	Dimensions in mm										Perm. radial stress (Guideline values)	
FDK/FDL	d_1 H6 [1]	d_2 h5	K	L	d_3 H7	l_1	l_2	l_3	l_4	d_4 max.	FDK N	FDL N
20.37	20	37	30	46	3	2.5	15	15	16	6	1800	3600
25.42	25	42	30	46	3	2.5	15	15	16	6	2260	4500
30.47	30	47	30	46	3	2.5	15	15	16	6	2810	5720
35.55	35	55	42	62	4	3.5	21	20	22	10	5290	9070
40.62	40	62	42	62	4	3.5	21	20	22	10	6050	10370
45.68	45	68	42	62	4	3.5	21	20	22	10	6800	11660
50.72	50	72	42	62	4	3.5	21	20	22	10	7560	12960
55.80	55	80	42	68	4	3.5	21	21.5	25	12	8320	16630
60.85	60	85	42	68	4	3.5	21	21.5	25	12	9070	18140
65.90	65	90	42	68	4	3.5	21	21.5	25	12	9830	19660
70.100	70	100	48	78	4	3.5	24	24	30	14	12100	25200
75.105	75	105	48	78	4	3.5	24	24	30	14	12960	27000
80.110	80	110	48	78	4	3.5	24	24	30	14	13820	28800
85.120	85	120	60	92	5	4.5	30	28.5	35	16	20810	36110
90.125	90	125	60	92	5	4.5	30	28.5	35	16	22030	38230
95.130	95	130	60	92	5	4.5	30	28.5	35	16	23260	40360
100.140	100	140	66	102	5	5.5	33	31.5	39	16	25920	47520
110.150	110	150	66	102	5	5.5	33	31.5	39	16	28510	52270
120.165	120	165	72	114	6	6	36	36	42	16	34560	58750
130.180	130	180	78	124	6	6	39	39	46	16	41180	71140
140.190	140	190	78	124	6	6	39	39	46	16	44350	80640
150.200	150	200	78	124	6	6	39	39	46	16	47520	86400

[1] As the guide borehole is machined while the guide bushing is in a preloaded condition, control measurement of the guide bushing is not possible in its delivered, non-loaded state.

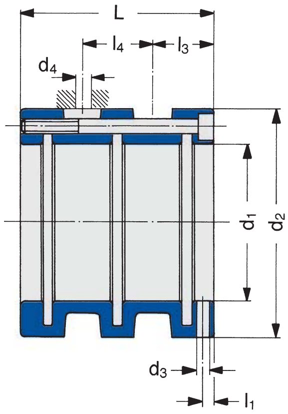
Designation of a guide bushing with d_1 = 40 mm, d_2 = 62 mm and K = 42 mm: Guide bushing **FDK 40.62**.

SPIETH GUIDE BUSHINGS SERIES **FSK/FSL**





Series FSK



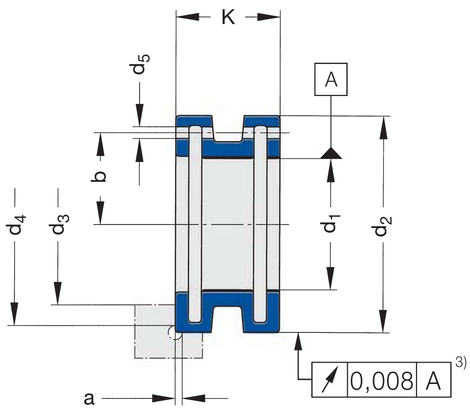
Series FSL

Order No.	Dimensions in mm										Clamping screws		Perm. radial stress (Guideline values)	
FSK/FSL	d_1 H6 [1)]	d_2 h5	K	L	d_3 H7	l_1	l_2	l_3	l_4	d_4	ISO 4762	No.	FSK N	FSL N
20.37	20	37	30	46	3	2.5	15	15	16	6	M4	4	1800	3600
25.42	25	42	30	46	3	2.5	15	15	16	6	M4	4	2260	4500
30.47	30	47	30	46	3	2.5	15	15	16	6	M4	6	2810	5720
35.55	35	55	42	62	4	3.5	21	20	22	10	M4	6	5290	9070
40.62	40	62	42	62	4	3.5	21	20	22	10	M4	6	6050	10370
45.68	45	68	42	62	4	3.5	21	20	22	10	M5	6	6800	11660
50.72	50	72	42	62	4	3.5	21	20	22	10	M5	6	7560	12960
55.80	55	80	42	68	4	3.5	21	21.5	25	12	M5	6	8320	16630
60.85	60	85	42	68	4	3.5	21	21.5	25	12	M5	6	9070	18140
65.90	65	90	42	68	4	3.5	21	21.5	25	12	M5	6	9830	19660
70.100	70	100	48	78	4	3.5	24	24	30	14	M5	6	12100	25200
75.105	75	105	48	78	4	3.5	24	24	30	14	M5	6	12960	27000
80.110	80	110	48	78	4	3.5	24	24	30	14	M5	6	13820	28800
85.120	85	120	60	92	5	4.5	30	28.5	35	16	M6	6	20810	36110
90.125	90	125	60	92	5	4.5	30	28.5	35	16	M6	6	22030	38230
95.130	95	130	60	92	5	4.5	30	28.5	35	16	M6	6	23260	40360
100.140	100	140	66	102	5	5.5	33	31.5	39	16	M6	6	25920	47520
110.150	110	150	66	102	5	5.5	33	31.5	39	16	M6	6	28510	52270
120.165	120	165	72	114	6	6	36	36	42	16	M6	8	34560	58750
130.180	130	180	78	124	6	6	39	39	46	16	M8	8	41180	71140
140.190	140	190	78	124	6	6	39	39	46	16	M8	8	44350	80640
150.200	150	200	78	124	6	6	39	39	46	16	M8	8	47520	86400

[1)] As the guide borehole is machined while the guide bushing is in a preloaded condition, control measurement of the guide bushing is not possible in its delivered, non-loaded state.

Designation of a guide bushing with integrate clamping screws, d_1 = 60 mm, d_2 = 85 mm and K = 42 mm: Guide bushing **FSK 60.85**.

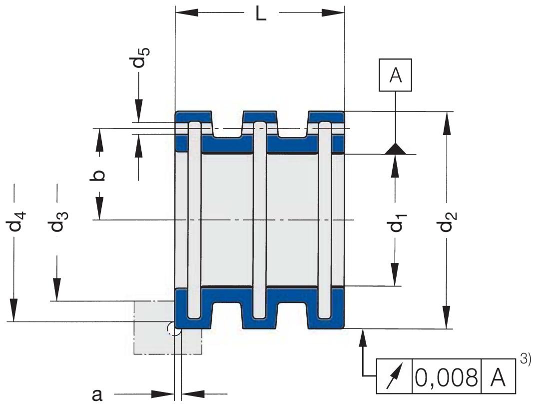
SPIETH GUIDE BUSHINGS SERIES **FAK**



Order No.	Dimensions in mm					Clamping initiation		Transmittable forces		Dim. connect. comp. in mm		
	d_1	d_2	K	Fixing hole		F_{max}	C_{min} 2)	M	Fa	d_3	d_4	a
	G6	h5		d_5	b	N	mm	Nm	N	max.	min.	max.
FAK 35.52	35	52	21	3.8	22	22900	0.4	100	5710	43	50	2.2
FAK 40.56	40	56	21	3.8	24	25900	0.4	131	6550	48	54	2.2
FAK 45.68	45	68	26	3.8	28	29800	0.4	180	8000	58	65	3
FAK 50.72	50	72	26	3.8	30	32900	0.4	221	8840	62	69	3
FAK 55.80	55	80	31	3.8	33	39300	0.5	295	10730	70	77	3
FAK 60.85	60	85	31	4.8	36	42200	0.5	352	11730	75	82	3
FAK 65.90	65	90	31	4.8	38	45100	0.5	421	12950	80	87	3
FAK 70.100	70	100	38	4.8	42	52500	0.5	546	15600	88	96	4
FAK 75.105	75	105	38	4.8	44	55600	0.5	619	16510	93	101	4
FAK 80.110	80	110	38	4.8	46	58700	0.5	709	17730	98	106	4
FAK 85.115	85	115	38	4.8	50	61800	0.6	793	18660	103	111	4
FAK 90.120	90	120	38	4.8	53	64800	0.6	909	20200	108	116	4
FAK 100.130	100	130	38	5.8	58	71000	0.6	1123	22460	118	126	4
FAK 110.140	110	140	38	5.8	63	77100	0.6	1342	24400	128	136	4
FAK 120.150	120	150	38	5.8	68	83300	0.6	1606	26770	138	146	4
FAK 130.160	130	160	38	5.8	73	89500	0.6	1869	30290	148	156	4
FAK 140.170	140	170	38	5.8	78	95700	0.6	2185	31210	158	166	4
FAK 150.180	150	180	38	5.8	83	101900	0.6	2491	33210	168	176	4

2) Design specification, not to be confused with actuation travel. For explanations, see p. 71.
3) d_2 > 80 mm = Concentricity to IT4

SPIETH GUIDE BUSHINGS SERIES **FAL**



Order No.	Dimensions in mm					Clamping initiation		Transmittable forces		Dim. connect. comp. in mm		
	d_1	d_2	L	Fixing hole		F_{max}	C_{min} [2]	M	Fa	d_3	d_4	a
	G6	h5		d_5	b	N	mm	Nm	N	max.	min.	max.
FAL 35.52	35	52	35	3.8	22	22900	0.6	149	8510	43	50	2.2
FAL 40.56	40	56	35	3.8	24	25900	0.6	195	9750	48	54	2.2
FAL 45.68	45	68	42	3.8	28	29800	0.6	261	11600	58	65	3
FAL 50.72	50	72	42	3.8	30	32900	0.6	321	12840	62	69	3
FAL 55.80	55	80	52	3.8	33	39300	0.8	427	15530	70	77	3
FAL 60.85	60	85	52	4.8	36	42200	0.8	506	16870	75	82	3
FAL 65.90	65	90	52	4.8	38	45100	0.8	600	18460	80	87	3
FAL 70.100	70	100	62	4.8	42	52500	0.8	770	22000	88	96	4
FAL 75.105	75	105	62	4.8	44	55600	0.8	874	23310	93	101	4
FAL 80.110	80	110	62	4.8	46	58700	0.8	995	24880	98	106	4
FAL 85.115	85	115	62	4.8	50	61800	0.9	1113	26190	103	111	4
FAL 90.120	90	120	62	4.8	53	64800	0.9	1234	27420	108	116	4
FAL 100.130	100	130	62	5.8	58	71000	0.9	1521	30420	118	126	4
FAL 110.140	110	140	62	5.8	63	77100	0.9	1817	33040	128	136	4
FAL 120.150	120	150	62	5.8	68	83300	0.9	2165	36080	138	146	4
FAL 130.160	130	160	62	5.8	73	89500	0.9	2520	38770	148	156	4
FAL 140.170	140	170	62	5.8	78	95700	0.9	2935	41930	158	166	4
FAL 150.180	150	180	62	5.8	83	101900	0.9	3349	44650	168	176	4

[2] Design specification, not to be confused with actuation travel. For explanations, see p. 71.
[3] d_2 > 80 mm = Concentricity to IT4

Application

Before mounting, all parts belonging to the round guide must be carefully cleaned and wet slightly using low viscosity machine oil.

Assembly of series FDK – FDL:

1. Insert the guide bushing in the housing borehole. If an orientation pin is fitted, this must not come to rest axially against the groove in the housing.
2. Mount the flange cover loosely without the shim ring and insert the sleeve.
3. Tighten the clamping screws in the flange cover evenly crosswise until loss of play in the centre sleeve is indicated by stiffer sliding action of the sleeve. Check the parallelism of the mounting gap for the shim ring and correct if necessary.
4. Gauge the mounting gap for the shim ring, remove the flange cover.
5. Adjust the height of the shim ring. Recommendation: measured mounting gap + approx. 0.02 mm for contact surface compression.
6. Mount the flange cover and the underneath shim ring, tighten the screws crosswise.
7. Check the guide play. If necessary, correct by reworking the shim ring (reducing guide play) or the flange cover (increasing guide play). Guideline value: 0.1 mm alteration of the height corresponds to ~ 0.01 mm alteration in diameter.

Assembly of series FSK – FSL:

1. Insert the guide bushing in the housing borehole. If an orientation pin is fitted, this must not come to rest axially against the groove in the housing.
2. Tighten the clamping screws in the flange cover evenly crosswise until the guide bushing is seated firmly in the housing. Even actuation of the clamping screws can be achieved by tightening in each case by a certain angular amount (e.g. 30°). Specifying a certain degree of torque for the clamping screws is a less suitable method of ensuring uniform guide play adjustment.
3. Insert the sleeve and continue tightening the clamping screws – as described above – until the desired loss of play is indicated by stiffer sliding action of the sleeve.
4. Remove the sleeve, apply a thin coating of inking paste and re-insert in the guide bushing to check the contact pattern.
5. Move the sleeve backwards and forwards with an oscillating motion, remove and inspect the ink impression left on the guide bushing.
6. Should the surface impression be incomplete, insert the sleeve again and tighten the screws in the sector, which is not making correct contact. Stop tightening when you notice the sleeve running more stiffly in the bushing.
7. After optimising the contact pattern, clean the sleeve and guide bushing borehole, oil and re-insert the sleeve.

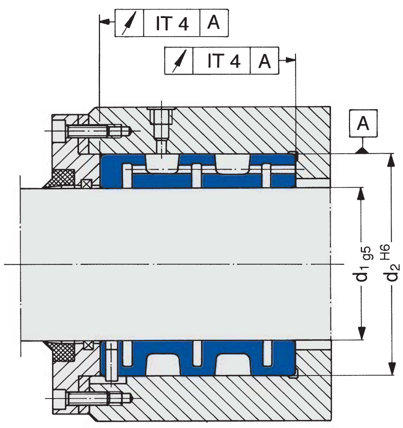


Fig. 1

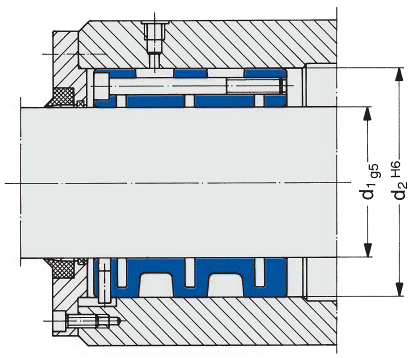


Fig. 2

APPLICATION

Assembly of series FAK – FAL:
The guide bushing may only be clamped if its borehole and outer surfaces are covered by the connecting components. Otherwise the guide bushing could be destroyed as a result of plastic deformation.

1. Insert the guide bushing and ring piston into the housing borehole without exerting force.
2. Mount the flange cover loosely without the shim ring and insert the sleeve.
3. Tighten the clamping screws in the flange cover evenly crosswise until loss of play in the centre sleeve is indicated by stiffer sliding action of the sleeve. Check the parallelism of the mounting gap for the shim ring and correct if necessary.
4. Gauge the mounting gap for the shim ring, remove the flange cover.
5. Adjust the height of the shim ring. Recommendation: Measure mounting gap + approx. 0.02 mm for contact surface compression.
6. Mount the flange cover and the underneath shim ring, tighten the screws crosswise.
7. Check the guide play. If necessary, correct by reworking the shim ring (reducing guide play) or the flange cover (increasing guide play).

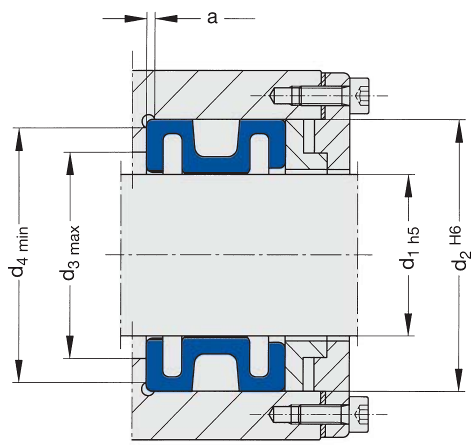


Fig. 3: Mounting assembly showing design of connecting components

Clamping
To obtain complete freedom from play between the sleeve and housing, the guide bushing is hydraulically clamped by the ring piston once it has been adjusted for optimum guide play. For further arrangements with mechanical or hydraulic clamping, see the assembly examples.

NOTE

The length of the guide bushing is reduced during the clamping process by a few tenths of a mm (depending on the size of the guide bushing, the clamping force and the actual dimensions of the connecting components) and in the process, it drags the part to be clamped in the clamping direction. If the guide bushings are arranged in pairs (e.g. Example 4, p. 62) with opposing clamping direction, this thrust effect is theoretically cancelled. However, due to minimal geometrical differences and changing coefficients of friction, even in this case a residual thrust in the range of hundredths of a mm can occur in an undetermined direction. As it is caused by the actual circumstances, this phenomenon is reproducible. FAK series guide bushings can be supplied as a special non-standard low-thrust version on request; but the retention force in this version only reaches 0.5 times that of the table values.

DESIGN

Series FDK/FDL, FSK/FSL
The guide bushings are made of high-grade bearing bronze. The guide borehole is precision turned to ISO tolerance H6, the outside diameter to ISO tolerance h5. As the guide borehole is machined while the guide bushing is in a pre-stressed condition, control measurement of the guide bushing is not possible in its delivered, non-stressed state. The radial borehole for fitting the cylindrical pin is machined to ISO tolerance H7. In the FDK/FDL series, lubricant is distributed to the various chambers by means of an additional borehole. In the FSK/FSL series, the space between the clamping screws and the through holes is used for this purpose. The lubricants used are predominantly mineral oils, whose viscosity is adjusted to the respective operating conditions.

For orientation, the guide bushings are equipped with a hole for a fixing pin (d_3). The necessary supply of lubrication is implemented by means of another borehole (d_4). The design of the housing must be adapted accordingly.

Series FAK/FAL
The guide bushings are manufactured from spring-hardened steel. The borehole has a plastic slide coating. The outside diameter is machined to ISO tolerance h5, the borehole to ISO tolerance G6. The maximum run-out of the borehole – outside diameter – end faces is 0.01 mm.

CLAMPING SCREWS

Clamping screws in series FSK/FSL are cheese-head screws with a hexagon socket ISO 4762 (DIN 912), which are tightened with an ISO 2936 (DIN 911) screwdriver.

CONNECTING COMPONENTS

The connecting components (housing borehole, shaft/sleeve) must be configured in such a way that the entire inside and outside surfaces of the guide bushing are covered at all times.

When series FDK/FDL and FAK/FAL guide bushings are used, all contact end faces of the connecting components, which represent functional surfaces, must be configured precisely at right angles to the axis.

Housing borehole
Manufacturing tolerance H6, concentricity and cylindricity within IT 3, surface roughness Rz max. 6.3 µm.

Sleeve on bronze bushes of series FDK/FDL, FSK/FSL
Manufacturing tolerance of the sleeve: g5, surface roughness R_z = 1µm. The quality of the round guide depends to a large degree on the cylindricity and the concentricity of the sleeve. Therefore, the minimum degree of geometrical error must be aimed for in this case. We recommend adhering to tolerance level IT 2 (ISO).

Shaft in steel bushings of series FAK/FAL
Manufacturing tolerance of the shaft: h5, concentricity and cylindricity within IT 3, surface roughness R_z max. 6.3 µm. We recommend the following experience value for the minimum housing wall thickness:
C 45 = 0.4 (D – d)
GG 25 = 0.7 (D – d)

TRANSMITTABLE FORCES

Series FAK/FAL
In conjunction with the lubrication, the plastic coating of the guide bushings ensures smooth-running, low-wear guidance. However, the good sliding properties of the bushing have a detrimental effect on the transmittable forces. Therefore the table values "transmittable forces" should only be regarded as non-binding guideline values.

F: Maximum permissible clamping force.

C: Required functional installation space
Spieth clamping sleeves must be clamped using the controlled application of force. The clamping force cannot be applied in relation to the clamping path. To prevent premature blocking, a "free" functional path "C" must be provided.

M: Transmittable torque at $F_a = 0$.

F_a: Transmittable axial force at M = 0.
The F_a values are calculated according to

$$F_a = 2000 \cdot \frac{M}{d_1} \text{ [N]}$$

M and F_a: If both torque and axial forces act on a guide bushing at the same time, check using the following formula whether the resulting torque Mr is transmittable:

$$M \geqq M_r = \sqrt{M_e^2 + \left(\frac{F_{ae} \cdot d_1}{2000}\right)^2} \text{ [Nm]}$$

If it is not possible to apply the clamping force F, the following formula is used for the approximate determination of the torque M_{red} which can be transmitted with the given clamping force $F_{giv.}$ (<F).

$$M_{red} = \frac{M\ (F_{giv.} - 0.05\ F)}{0.95\ F} \text{ [Nm]}$$

To ascertain the necessary clamping force for a transmittable torque $M_{red} < M$, an approximation is possible using the following formula:

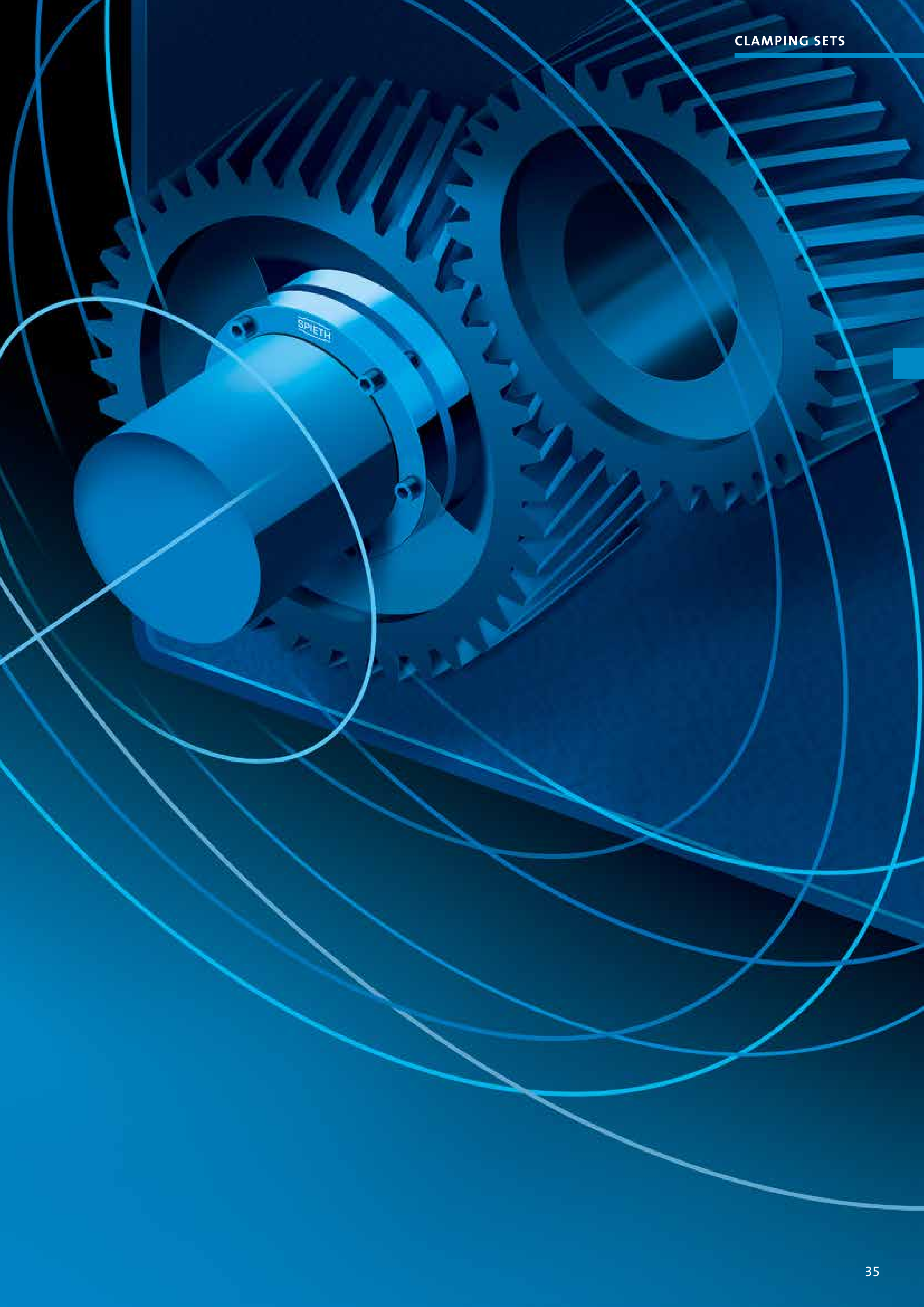
$$F_{req.} = \frac{M_{red} \cdot 0.95\ F}{M} + 0.05\ F \text{ [N]}$$

M	=	Transmittable torque (catalogue value) [Nm]
M_e	=	Required torque [Nm]
M_r	=	Resulting torque [Nm]
M_{red}	=	Reduced transmittable torque [Nm]
F	=	Max. perm. clamping force (catalogue value) [N]
F_{ae}	=	Required axial force [N]
$F_{req.}$	=	Required clamping force [N]
$F_{giv.}$	=	Given clamping force (<F) [N]
d_1	=	Shaft diameter [mm]

APPLYING ALL-ROUND PRESSURE WITH PRECISION

Spieth clamping sets – friction-locked shaft-hub connections.
Rising power densities. Increasing levels of dynamic stress. And the required function must be realised within increasingly restrictive cost parameters. The stringent demands of modern mechanical engineering can only be satisfied with high-quality shaft-hub connecting elements.

Spieth clamping sets apply uniform pressure. Without compromise. The are designed to be more accurate, precise, efficient, simpler to install and easier to service. The economical solution for modern machinery designs. Offering outstanding performance.


SPIETH

4 UNIQUE FEATURES – NUMEROUS BENEFITS

Precise
All functional surfaces that determine precision are machined to the finest geometrical and positional tolerances.

Single-piece design
Unlike tapered clamping sets, the single-piece steel body does not have any joints that could compromise tolerances. This ensures that the high degree of precision achieved in the manufacturing process can also be brought to bear in the relevant application.

Self-centering
When subjected to axial compression, the unique geometry of the absolutely symmetrical base body ensures uniform transverse contraction in the direction of the shaft and hub. The resulting centring effect is equivalent to that of the hydro-expansion principle, only much simpler, safer and stiffer.

Intelligent
Cylindrical clamping sets exert very low levels of wear on their connecting components. Significantly better clamping homogeneity at the contact surfaces eliminates any possibility of peak clamping force acting at specific points, which frequently lead to damage and installation problems. At the same time, the Spieth design in the tensioned state is equivalent to the combination of a knee lever and a spring compressed against a block, thus guaranteeing an extremely rigid connection. And when released, the cylindrical clamping set easily returns to its original shape.

BENEFITS TO YOU

Competitiveness through technological leadership – a strategy that calls for an economical increase in power density, efficiency and accuracy. Cylindrical clamping sets create the foundation for this.

Lower Resource Input
- Simple configuration of connecting components.
- Simple installation and dismantling of all components thanks to mating play.
- Minimum axial drag during clamping process.
- Clamping force initiation can be freely configured.
- Quick-release connection.

More Success
- High level of concentricity.
- Minimised vibrational excitation.
- High torque levels and axial forces.
- Suitable for alternating torsion.
- Axial and angular position freely adjustable.
- Preserves connecting components.
- Connection can be automated/switched.
- Re-usable.


Series DSM .. 1, DSM .. 2


Series DSM


Series DSL


Series DSK

FIELDS OF APPLICATION

Spieth clamping sets are friction-locked shaft-hub connections for all areas of mechanical engineering. They are used wherever high-quality and reliable connections perform key functional roles. At the same time, they are the ideal solution for applications with high levels of replacement and adjustment as well as for manual or automated clamping of sleeves, skids, pivoting heads or rotary tables.

APPLICATION EXAMPLES

- In machining, forming and cutting machine tools.
- In handling and automation equipment.
- In materials handling.
- In general drive engineering and transmissions.
- In packaging machinery.
- In fixture construction.
- In compressors and pumps.
- In printing presses and paper-making technology.
- In textile machines.
- In woodworking machines.
- In process engineering applications for mixing, crushing and centrifuging.
- For metrology, control and test engineering.
- In precision engineering and optical technology.

Series AK

Series IK

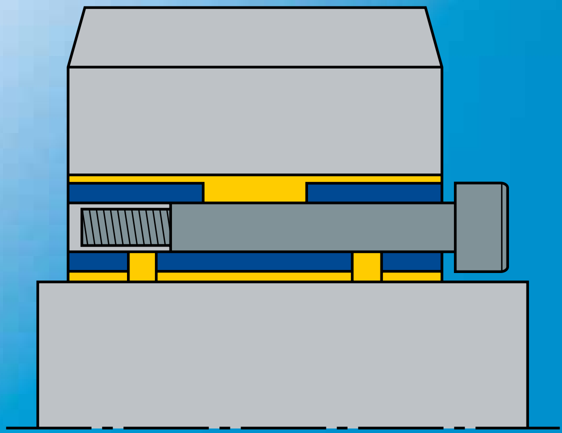
Series AL

Series IL

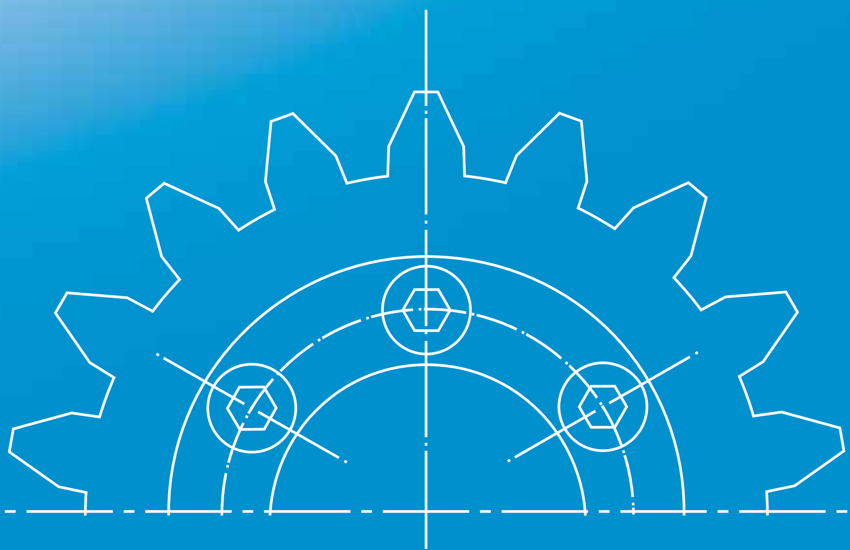
FUNCTIONAL PRINCIPLE

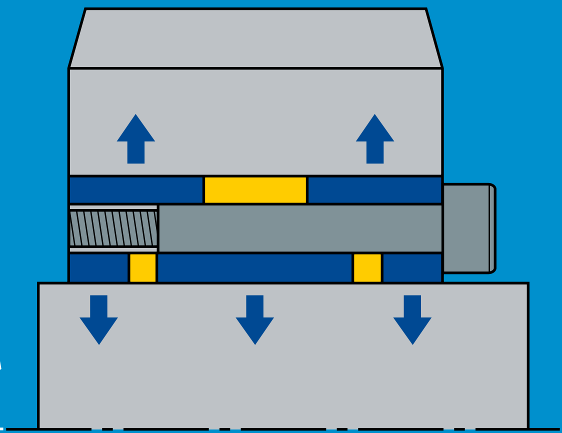
Shown here using a clamping set from series DSK with an integrated clamping screw.

The principle is illustrated in a simplified diagram with enlarged play.



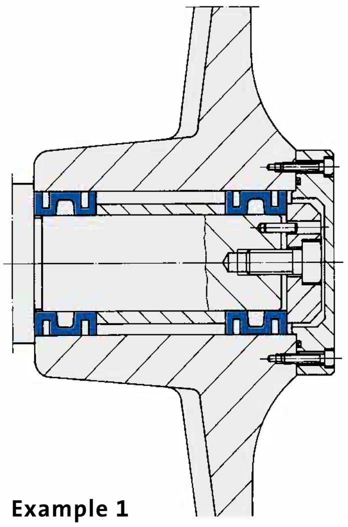
Clamping set released, easy installation or dismantling with mating play.





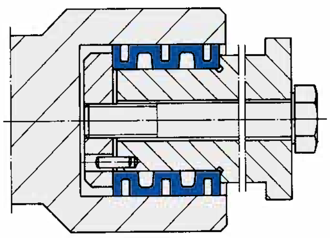
Clamping set clamped, connection is centred with a high load capacity. No lateral displacement during tightening. This ensures ultra-high precision centring and optimum concentricity.

ASSEMBLY EXAMPLES

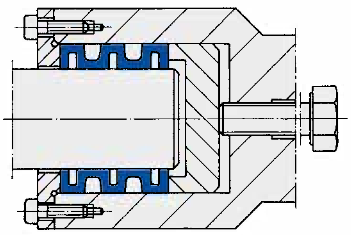


Example 1

Example 1: Blade wheel fixture
The clamping sleeves arranged over a wide basis exert a positive influence on run-out accuracy and rotating flexural stress of the shaft-hub fit. The degree of torque which can be transferred with two consecutively arranged clamping sleeves is approx. 30 % higher than when using a single clamping sleeve.

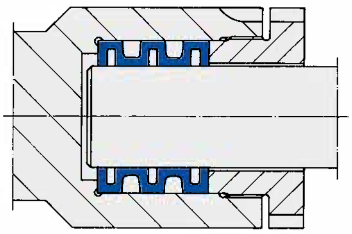


Example 2
Clamping force initiated by tension screw.

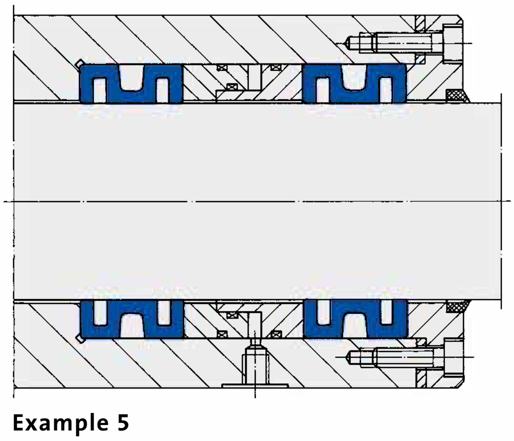


Example 3
Clamping force initiated by set screw.

Example 2–4: Plug-in connections
This shaft-hub connection is completely free of play and can be released an unlimited number of times. The tightening torque levels for clamping force initiating screws depend on the required clamping force for each individual clamping sleeve.

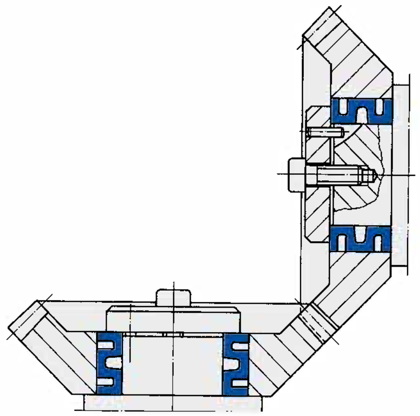


Example 4
Clamping force initiated by hollow screw.

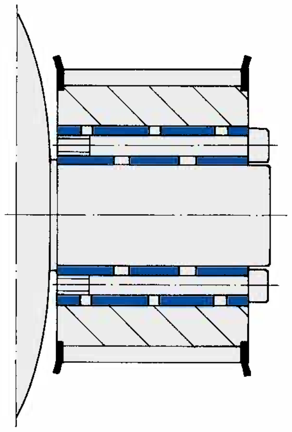


Example 5

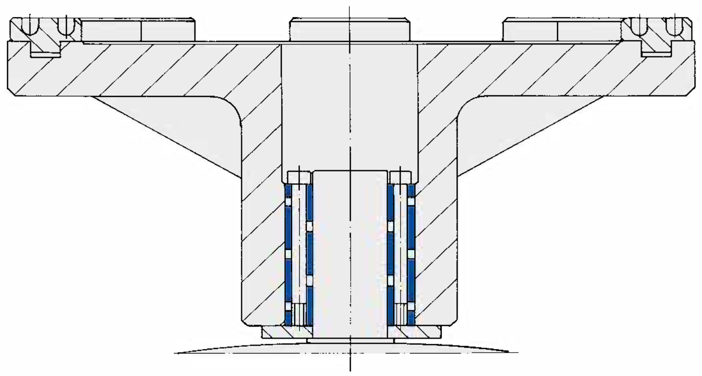
Example 5: Sleeve clamping
The sleeve is hydraulically tensioned and precisely centred. Free movement is immediately possible in the un-tensioned state. The axial thrust created during the clamping process with single arrangement of a clamping sleeve is theoretically balanced out in this case by forces working in opposition. In practice, however, in case of a freely located sleeve, allowance must be made for a slight residual thrust as it is not possible to create identical clamping conditions at the clamping sleeves.



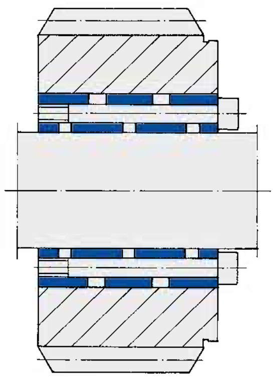
Example 6: Bevel wheel fixture
This connection is characterized by simple connecting components, a high degree of concentricity and absolute freedom from play.



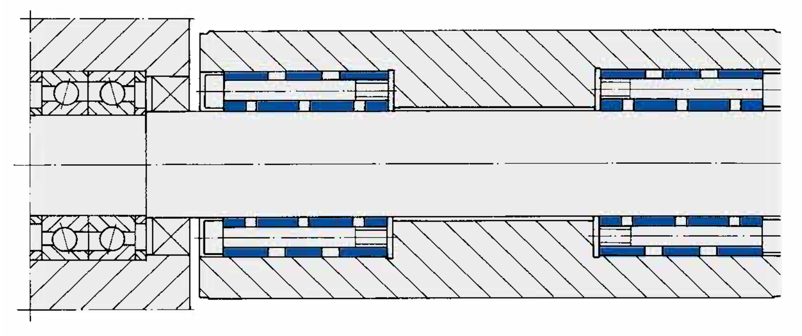
Example 7: Pulley fixture
The hub can be made of an aluminium alloy. Observe the minimum strength specification. High temperatures can impair retention force.



Example 8: Indexing plate
Indexing plate in alloy material at the shaft end of an indexing gear. Here, precise concentricity and run-out are vital.

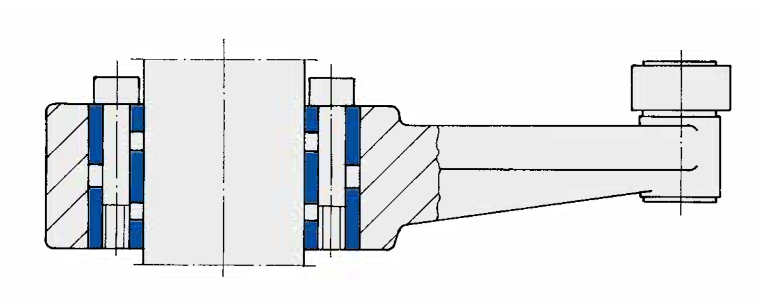


Example 9: Gear fixture
To satisfy the highest concentricity requirements, we recommend mounting a control facility on the gear to allow the concentricity to be checked and adjusted if necessary.



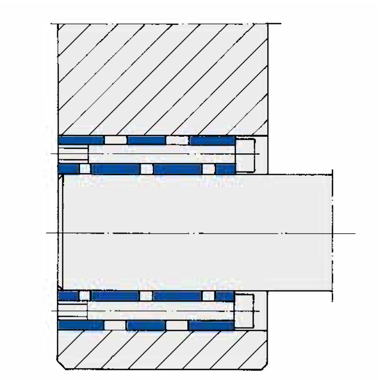
Example 10: Pressure roller fixture

Here, 2 long clamping sets are used to achieve high overall radial rigidity due to intensive tensioning of the shaft and hub. The pressure roller is exchanged by pulling the shaft out of the bearings.



Example 11: Rocker arm fixture

The peripheral and axial position can be ideally adjusted during assembly.



Example 12: Guide column

Fixture of a guide column in the machine body.

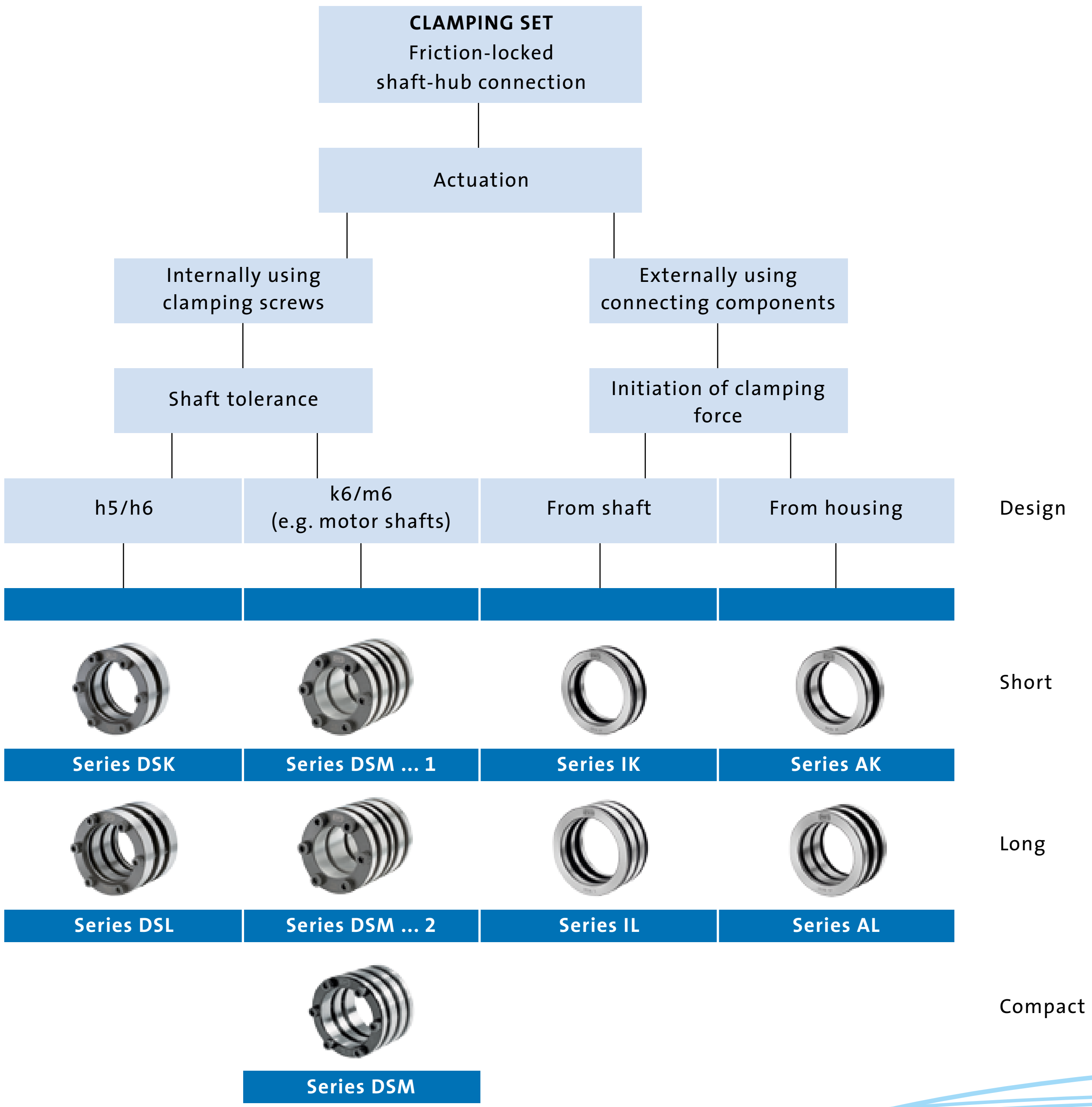
SPIETH **CLAMPING SETS: THE RIGHT CHOICE**

We'll provide you with the perfect clamping sets for your application. We'll also help you choose the right one – with expert advice from our specialists.

Series DSK, DSL
Ready-to-use friction-locked shaft-hub connection for quick and easy installation.

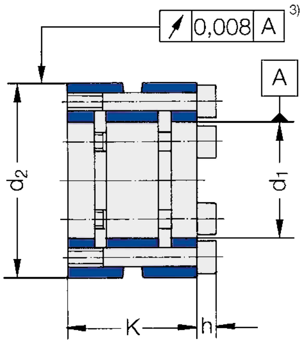
Series DSM
Ready-to-use friction-locked shaft-hub connection for use on motor shafts to DIN 748.

Series AK/IK and AL/IL
Friction-locked shaft-hub connection that can be automated. Clamping force initiation can be freely configured.



SPIETH CLAMPING SETS SERIES **DSK**

For shafts with h tolerance zone



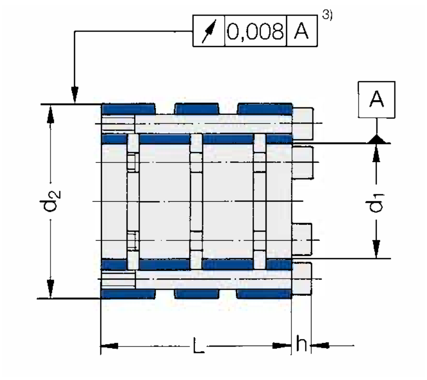
Order No.	Dimensions in mm			Clamping screws				Transmittable forces		Moment of inertia J
	d_1	d_2	K	ISO	h	M_A	No.	M or F_a		
	H6	h5		4762	mm	Nm		Nm	N	kg cm²
DSK 14.26	14	26	21	M3	3	2	6	36	5100	0.045
DSK 15.28	15	28	21	M3	3	2	6	44	5900	0.059
DSK 16.28	16	28	21	M3	3	2	6	43	5400	0.058
DSK 16.32	16	32	31	M4	4	5	6	71	8900	0.161
DSK 18.30	18	30	21	M3	3	2	6	53	5900	0.074
DSK 18.35	18	35	31	M4	4	5	6	96	10700	0.227
DSK 20.32	20	32	21	M3	3	2	6	62	6200	0.093
DSK 20.37	20	37	31	M4	4	5	6	100	10000	0.278
DSK 20.40	20	40	36	M5	5	7	6	130	13000	0.434
DSK 22.35	22	35	21	M3	3	2	6	75	6800	0.131
DSK 22.38	22	38	31	M4	4	5	6	100	9100	0.302
DSK 22.42	22	42	36	M5	5	10	6	210	19100	0.519
DSK 25.37	25	37	21	M3	3	2	6	85	6800	0.155
DSK 25.42	25	42	31	M4	4	5	6	140	11200	0.439
DSK 25.45	25	45	36	M5	5	10	6	260	20800	0.666
DSK 28.40	28	40	21	M3	3	2	6	98	7000	0.203
DSK 28.45	28	45	31	M4	4	5	6	170	12100	0.562
DSK 28.48	28	48	36	M5	5	10	6	300	21400	0.840
DSK 30.42	30	42	21	M3	3	2	6	110	7300	0.240
DSK 30.47	30	47	31	M4	4	5	6	190	12700	0.655
DSK 30.50	30	50	36	M5	5	10	6	340	22700	0.973
DSK 30·55	30	55	41	M6	6	13	6	390	26000	1.590
DSK 32.48	32	48	31	M4	4	5	6	180	11300	0.690
DSK 32.52	32	52	36	M5	5	10	6	360	22500	1.120
DSK 32.56	32	56	41	M6	6	13	6	410	25600	1.690
DSK 35.52	35	52	31	M4	4	5	6	230	13100	0.936
DSK 35.55	35	55	36	M5	5	10	6	420	24000	1.360
DSK 35.60	35	60	41	M6	6	17	6	630	36000	2.180
DSK 40.56	40	56	31	M4	4	5	6	240	12000	1.170
DSK 40·62	40	62	36	M5	5	10	6	540	27000	2.140
DSK 40.65	40	65	41	M6	6	17	6	750	37500	2.900
DSK 40.70	40	70	52	M8	8	25	6	830	41500	5.300
DSK 45.68	45	68	36	M5	5	10	6	640	28400	3.010
DSK 45.70	45	70	41	M6	6	17	6	860	38200	3.760
DSK 45.75	45	75	52	M8	8	25	6	950	42200	6.780
DSK 50.72	50	72	36	M5	5	10	6	750	30000	3.600

Order No.	Dimensions in mm			Clamping screws				Transmittable forces		Moment of inertia J
	d_1	d_2	K	ISO	h	M_A	No.	M or F_a		
	H6	h5		4762	mm	Nm		Nm	N	kg cm^2
DSK 50.75	50	75	41	M 6	6	17	6	1040	40800	4.780
DSK 50.80	50	80	52	M 8	8	40	6	1850	74000	8.520
DSK 55.80	55	80	41	M 6	6	17	6	1100	40000	5.980
DSK 55.85	55	85	52	M 8	8	40	6	2070	75400	10.500
DSK 60.85	60	85	41	M 6	6	17	6	1320	44000	7.360
DSK 60.90	60	90	52	M 8	8	40	6	2370	79000	12.900
DSK 65.90	65	90	41	M 6	6	17	6	1450	44600	8.950
DSK 65.95	65	95	52	M 8	8	40	6	2640	81400	15.500
DSK 70.100	70	100	52	M 8	8	40	6	2990	85400	18.500
DSK 75.105	75	105	52	M 8	8	40	6	3250	86700	21.900
DSK 80.110	80	110	52	M 8	8	40	6	3520	88000	25.600
DSK 85.120	85	120	57	M 8	8	40	6	3560	83800	40.300
DSK 90.120	90	120	52	M 8	8	40	7	4300	95500	35.200
DSK 95.125	95	125	52	M 8	8	40	8	4540	95600	40.700
DSK 100.130	100	130	52	M 8	8	40	8	4780	95600	46.300
DSK 110.140	110	140	52	M 8	8	40	10	6570	119500	60.200
DSK 120.150	120	150	52	M 8	8	40	10	7170	119500	75.200
DSK 130.160	130	160	52	M 8	8	40	10	7760	119500	92.500
DSK 140.170	140	170	52	M 8	8	40	10	8360	119500	112.000
DSK 150.180	150	180	52	M 8	8	40	10	8960	119500	134.000
DSK 160.190	160	190	52	M 8	8	40	12	11470	143300	162.000
DSK 170.200	170	200	52	M 8	8	40	12	12180	143300	190.000
DSK 180.210	180	210	52	M 8	8	40	12	12900	143300	221.000
DSK 190.230	190	230	62	M10	10	60	12	16650	175300	487.000
DSK 200.240	200	240	62	M10	10	60	12	17530	175300	588.000
DSK 210.250	210	250	62	M10	10	60	12	18400	175300	614.000
DSK 220.260	220	260	62	M10	10	60	12	19250	175300	639.000
DSK 230.270	230	270	62	M10	10	60	12	20160	175300	812.000
DSK 240.280	240	280	62	M10	10	60	12	21040	175300	984.000
DSK 250.300	250	300	72	M10	10	60	15	27390	219100	1580.000
DSK 260.310	260	310	72	M10	10	60	15	28480	219100	1760.000
DSK 270.320	270	320	72	M10	10	60	15	29580	219100	1950.000
DSK 280.330	280	330	72	M10	10	60	15	30670	219100	2150.000
DSK 290.340	290	340	72	M10	10	60	15	31770	219100	2360.000
DSK 300.350	300	350	72	M10	10	60	15	32860	219100	2590.000

[3] d2 > 80 mm = Concentricity to IT4

SPIETH CLAMPING SETS SERIES **DSL**

For shafts with h tolerance zone



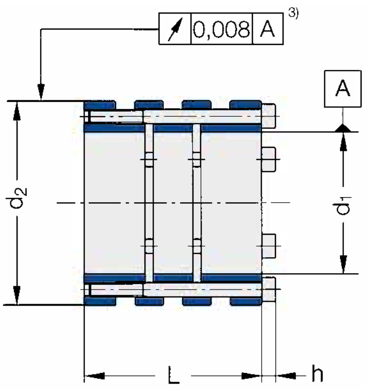
Order No.	Dimensions in mm			Clamping screws				Transmittable forces		Moment of inertia J
	d_1	d_2	L	ISO 4762	h	M_A	No.	M or F_a		
	H6	h5			mm	Nm		Nm	N	kg cm²
DSL 14.26	14	26	31	M3	3	2	6	60	8600	0.059
DSL 15.28	15	28	31	M3	3	2	6	66	8800	0.078
DSL 16.28	16	28	31	M3	3	2	6	73	9100	0.077
DSL 16.32	16	32	41	M4	4	5	6	130	16300	0.179
DSL 18.30	18	30	31	M3	3	2	6	86	9600	0.099
DSL 18.35	18	35	41	M4	4	5	6	160	17800	0.250
DSL 20.32	20	32	31	M3	3	2	6	100	10000	0.124
DSL 20.37	20	37	41	M4	4	5	6	180	18000	0.307
DSL 20.40	20	40	52	M5	5	7	6	170	17000	0.547
DSL 22.35	22	35	31	M3	3	2	6	110	10000	0.173
DSL 22.38	22	38	41	M4	4	5	6	180	16400	0.334
DSL 22.42	22	42	52	M5	5	10	6	260	23600	0.653
DSL 25.37	25	37	31	M3	3	2	6	140	11200	0.206
DSL 25.42	25	42	41	M4	4	5	6	250	20000	0.484
DSL 25.45	25	45	52	M5	5	10	6	320	25600	0.839
DSL 28.40	28	40	31	M3	3	2	6	160	11400	0.269
DSL 28.45	28	45	41	M4	4	5	6	280	20000	0.619
DSL 28.48	28	48	52	M5	5	10	6	370	26400	1.060
DSL 30.42	30	42	31	M3	3	2	6	180	12000	0.318
DSL 30.47	30	47	41	M4	4	5	6	320	21300	0.722
DSL 30.50	30	50	52	M5	5	10	6	410	27300	1.230
DSL 30·55	30	55	62	M6	6	13	6	430	28700	2.130
DSL 32.48	32	48	41	M4	4	5	6	340	21200	0.764
DSL 32.52	32	52	52	M5	5	10	6	440	27500	1.410
DSL 32.56	32	56	62	M6	6	13	6	460	28700	2.260
DSL 35.52	35	52	41	M4	4	5	6	400	22900	1.030
DSL 35.55	35	55	52	M5	5	10	6	520	29700	1.720
DSL 35.60	35	60	62	M6	6	17	6	700	40000	2.910
DSL 40.56	40	56	41	M4	4	5	6	470	23500	1.300
DSL 40·62	40	62	52	M5	5	10	6	620	31000	2.690
DSL 40.65	40	65	62	M6	6	17	6	830	41500	3.870
DSL 40.70	40	70	77	M8	8	25	6	900	45000	6.890
DSL 45.68	45	68	52	M5	5	10	6	720	32000	3.770
DSL 45.70	45	70	62	M6	6	17	6	960	42600	5.030
DSL 45.75	45	75	77	M8	8	25	6	1100	48900	8.810
DSL 50.72	50	72	52	M5	5	10	6	850	34000	4.520

Order No.	Dimensions in mm			Clamping screws				Transmittable forces		Moment of inertia J
	d_1	d_2	L	ISO	h	M_A	No.	M or F_a		
	H6	h5		4762	mm	Nm		Nm	N	kg cm²
DSL 50.75	50	75	62	M 6	6	17	6	1130	45200	6.400
DSL 50.80	50	80	77	M 8	8	40	6	1980	79200	11.100
DSL 55.80	55	80	62	M 6	6	17	6	1260	45900	8.000
DSL 55.85	55	85	77	M 8	8	40	6	2240	81500	13.700
DSL 60.85	60	85	62	M 6	6	17	6	1480	49400	9.850
DSL 60.90	60	90	77	M 8	8	40	6	2600	86600	16.700
DSL 65.90	65	90	62	M 6	6	17	6	1630	50100	12.000
DSL 65.95	65	95	77	M 8	8	40	6	2900	89300	20.100
DSL 70.100	70	100	77	M 8	8	40	6	3210	91800	24.000
DSL 75.105	75	105	77	M 8	8	40	6	3560	95000	28.400
DSL 80.110	80	110	77	M 8	8	40	6	3870	96800	33.200
DSL 85.120	85	120	92	M 8	8	40	6	3900	91800	60.200
DSL 90.120	90	120	77	M 8	8	40	7	6850	152200	48.100
DSL 95.125	95	125	77	M 8	8	40	8	7390	155600	55.700
DSL 100.130	100	130	77	M 8	8	40	8	7780	155600	63.300
DSL 110.140	110	140	77	M 8	8	40	10	10690	194500	82.300
DSL 120.150	120	150	77	M 8	8	40	10	11670	194500	103.000
DSL 130.160	130	160	77	M 8	8	40	10	12640	194500	126.000
DSL 140.170	140	170	77	M 8	8	40	10	13610	194500	153.000
DSL 150.180	150	180	77	M 8	8	40	10	14580	194500	184.000
DSL 160.190	160	190	77	M 8	8	40	12	18670	233400	221.000
DSL 170.200	170	200	77	M 8	8	40	12	19830	233400	260.000
DSL 180.210	180	210	77	M 8	8	40	12	21000	233400	302.000
DSL 190.230	190	230	92	M10	10	60	12	27110	285400	678.000
DSL 200.240	200	240	92	M10	10	60	12	28540	285400	777.000
DSL 210.250	210	250	92	M10	10	60	12	29960	285400	885.000
DSL 220.260	220	260	92	M10	10	60	12	31390	285400	1000.000
DSL 230.270	230	270	92	M10	10	60	12	32800	285400	1130.000
DSL 240.280	240	280	92	M10	10	60	12	34250	285400	1270.000
DSL 250.300	250	300	102	M10	10	60	15	44580	356700	2050.000
DSL 260.310	260	310	102	M10	10	60	15	46370	356700	2280.000
DSL 270.320	270	320	102	M10	10	60	15	48150	356700	2520.000
DSL 280.330	280	330	102	M10	10	60	15	49900	356700	2780.000
DSL 290.340	290	340	102	M10	10	60	15	51700	356700	3060.000
DSL 300.350	300	350	102	M10	10	60	15	53500	356700	3360.000

[3] d2 > 80 mm = Concentricity to IT4

SPIETH CLAMPING SETS SERIES **DSM**

For motor shafts to DIN 748 with k6/m6 tolerance zone



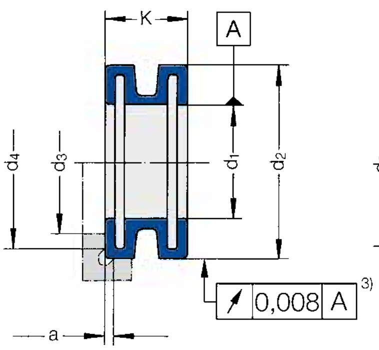
Order No.	Dimensions in mm			Clamping screws				Transmittable forces M or F_a		Moment of inertia J
	d_1	d_2 h5	L	ISO 4762	h mm	M_A Nm	No.	Nm	N	kg cm²
DSM 14.2	14	26	26	M3	3	2	4	50	7100	0.055
DSM 16.28	16	28	26	M3	3	2	6	66	8250	0.071
DSM 16.1	16	32	26	M4	4	5	6	95	11900	0.138
DSM 16.2	16	32	36	M4	4	5	6	130	16300	0.178
DSM 18.30	18	30	26	M3	3	2	6	92	10222	0.091
DSM 18.2	18	34	36	M4	4	5	6	160	17800	0.222
DSM 19.32	19	32	26	M3	3	2	6	100	10526	0.118
DSM 19.1	19	35	26	M4	4	5	6	130	13700	0.192
DSM 19.2	19	35	36	M4	4	5	6	200	21100	0.247
DSM 20.32	20	32	26	M3	3	2	6	108	10800	0.115
DSM 20.1	20	40	36	M5	5	10	5	190	19000	0.437
DSM 20.2	20	40	46	M5	5	10	5	240	24000	0.534
DSM 22.35	22	35	26	M3	3	2	6	122	11091	0.162
DSM 22.1	22	42	36	M5	5	10	5	220	20000	0.524
DSM 22.2	22	42	46	M5	5	10	5	290	26400	0.639
DSM 24.36	24	36	26	M3	3	2	6	145	12083	0.174
DSM 24.1	24	44	36	M5	5	10	5	260	21700	0.621
DSM 24.2	24	44	46	M5	5	10	5	360	30000	0.757
DSM 25.37	25	37	26	M3	3	2	6	184	14720	0.191
DSM 25.1	25	45	41	M5	5	10	6	280	22400	0.755
DSM 25.2	25	45	52	M5	5	10	6	450	35900	0.925
DSM 28.40	28	40	26	M3	3	2	6	205	14643	0.251
DSM 28.1	28	48	41	M5	5	10	6	320	22900	0.954
DSM 28.2	28	48	52	M5	5	10	6	550	39300	1.170
DSM 30.42	30	42	26	M3	3	2	6	220	14667	0.297
DSM 30.1	30	52	57	M6	6	17	5	690	46000	1.850
DSM 30.2	30	52	62	M6	6	17	5	710	47300	1.920
DSM 32.48	32	48	36	M4	4	5	6	365	22813	0.754
DSM 32.1	32	55	57	M6	6	17	5	770	48100	2.290
DSM 32.2	32	55	62	M6	6	17	5	800	50000	2.370
DSM 35.52	35	52	36	M4	4	5	6	400	22857	1.020
DSM 35.1	35	58	57	M6	6	17	6	1080	61700	2.790
DSM 35.2	35	58	62	M6	6	17	6	1120	63900	2.880
DSM 38.55	38	55	36	M4	4	5	6	435	22895	1.240
DSM 38.1	38	60	57	M6	6	17	6	1250	65800	3.080
DSM 38.2	38	60	62	M6	6	17	6	1300	68400	3.180

Order No.	Dimensions in mm			Clamping screws				Transmittable forces		Moment of inertia J
	d_1	d_2	L	ISO	h	M_A	No.	M or F_a		
		h5		4762	mm	Nm		Nm	N	kg cm^2
DSM 40.56	40	56	36	M4	4	5	6	455	22750	1.290
DSM 40.1	40	70	77	M8	8	40	5	1750	87500	7.800
DSM 40.2	40	70	92	M8	8	40	5	1800	90800	9.080
DSM 42.58	42	58	36	M4	4	5	6	480	22857	1.460
DSM 42.1	42	72	77	M8	8	40	5	1850	88100	8.630
DSM 42.2	42	72	92	M8	8	40	5	2000	95200	10.000
DSM 45.62	45	62	36	M4	4	5	6	510	22667	1.900
DSM 45.1	45	75	77	M8	8	40	5	2100	93300	10.000
DSM 45.2	45	75	92	M8	8	40	5	2250	101000	11.600
DSM 48.65	48	65	36	M4	4	5	6	545	22708	2.250
DSM 48.1	48	78	77	M8	8	40	5	2370	98800	11.500
DSM 48.2	48	78	92	M8	8	40	5	2600	108000	13.400
DSM 50.1	50	80	77	M8	8	40	6	2500	100000	12.600
DSM 50.2	50	80	92	M8	8	40	6	2700	109000	14.700
DSM 55.1	55	85	77	M8	8	40	6	2850	104000	15.600
DSM 55.2	55	85	92	M8	8	40	6	3100	113000	18.200
DSM 60.1	60	90	92	M8	8	40	6	3550	118000	22.300
DSM 60.2	60	90	122	M8	8	40	6	3550	118000	34.300
DSM 65.1	65	95	92	M8	8	40	6	4000	123000	26.900
DSM 65.2	65	95	122	M8	8	40	6	4000	123000	41.400
DSM 70.1	70	100	92	M8	8	40	6	4500	129000	30.000
DSM 70.2	70	100	122	M8	8	40	6	4500	129000	49.400
DSM 75.1	75	105	92	M8	8	40	7	5000	133000	38.100
DSM 75.2	75	105	122	M8	8	40	7	5000	133000	58.700
DSM 80.1	80	110	122	M8	8	40	8	6500	163000	69.000
DSM 85.1	85	115	122	M8	8	40	8	7150	168000	80.000

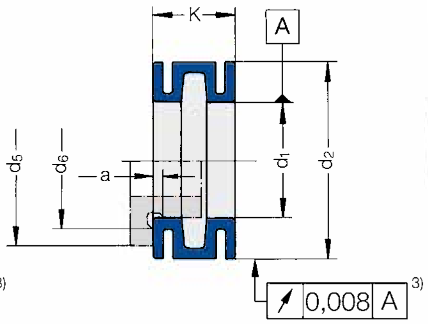
[3] d2 > 80 mm = Concentricity to IT4

SPIETH CLAMPING SLEEVES SERIES **AK/IK**

For shafts with h tolerance zone



Series AK



Series IK

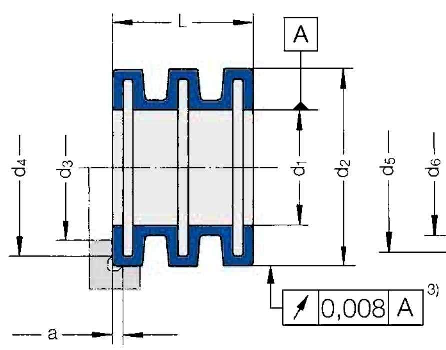
Designation of a clamping sleeve with initiation of clamping force from the shaft with d_1 = 28 mm, d_2 = 40 mm and K = 16 mm: **IK 28.40**.

Order No.	Dimensions in mm			Initiation of clamping force		Transmittable forces		Dimensions for connecting components in mm				
AK/IK	d_1 H6	d_2 h5	K	F_{max} [1] N	C_{min} [2] mm	M Nm	F_a N	d_3 max.	d_4 min.	d_5 min.	d_6 max.	a max.
8.12	8	12	12	10000	0.3	7	1750	9	10.8	11	9.2	1.5
10.15	10	15	12	11000	0.4	11	2200	11	13.8	14	11.2	1.5
12.18	12	18	12	11800	0.4	18	2950	13	16.8	17	13.2	1.5
14.20	14	20	12	13400	0.5	25	3620	15	18.8	19	15.2	1.5
15.22	15	22	12	13700	0.5	29	3840	16	20.8	21	16.2	1.5
16.22	16	22	12	14900	0.5	35	4320	17	20.8	21	17.2	1.5
18.25	18	25	12	15900	0.6	44	4930	19	23.8	24	19.2	1.5
20.32	20	32	16	20600	0.6	82	8240	24	30	28	22	1.7
22.35	22	35	16	21700	0.6	95	8680	27	33	30	24	1.7
25.37	25	37	16	24500	0.7	128	10290	29	35	33	27	1.7
28.40	28	40	16	26900	0.7	162	11570	32	38	36	30	1.7
30.42	30	42	16	28300	0.7	187	12450	34	40	38	32	1.7
32.48	32	48	21	32400	0.8	259	16200	40	46	40	34	2.2
35.52	35	52	21	34400	0.8	307	17540	43	50	44	37	2.2
40.56	40	56	21	38900	0.8	404	20230	48	54	49	42	2.2
45.68	45	68	26	44700	0.8	553	24590	58	65	55	48	3
50.72	50	72	26	49400	0.8	679	27170	62	69	60	53	3
55.80	55	80	31	59000	1.0	908	33040	70	77	65	58	3
60.85	60	85	31	63300	1.0	1082	36080	75	82	70	63	3
63.88	63	88	31	66000	1.0	1205	38280	78	85	73	66	3
65.90	65	90	31	67700	1.0	1298	39940	80	87	75	68	3
70.100	70	100	38	78800	1.0	1682	48070	88	96	82	74	4
75.105	75	105	38	83400	1.0	1907	50870	93	101	87	79	4
80.110	80	110	38	88100	1.1	2185	54620	98	106	92	84	4
85.115	85	115	38	92700	1.1	2442	57470	103	111	97	89	4
90.120	90	120	38	97200	1.1	2799	62200	108	116	102	94	4
95.125	95	125	38	101800	1.2	3139	66100	113	121	107	99	4
100.130	100	130	38	106500	1.3	3460	69200	118	126	112	104	4
110.140	110	140	38	115700	1.4	4136	75200	128	136	122	114	4
120.150	120	150	38	125000	1.4	4950	82500	138	146	132	124	4
125.155	125	155	38	129600	1.4	5343	85500	143	151	137	129	4
130.160	130	160	38	134300	1.5	5759	88 600	148	156	142	134	4
140.170	140	170	38	143500	1.5	6727	96100	158	166	152	144	4
150.180	150	180	38	152800	1.5	7672	102300	168	176	162	154	4

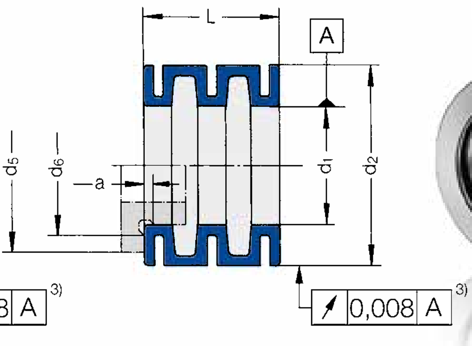
[1] Max. perm. clamping force. For automated operation, the clamping sleeve should be clamped with max. 0.75xF.
[2] Design specification, not to be confused with actuation travel. For explanations, see p. 55.
[3] d_2 > 80 mm = Concentricity to IT4

SPIETH CLAMPING SLEEVES SERIES **AL/IL**

For shafts with h tolerance zone



Series AL



Series IL

Designation of a clamping sleeve with initiation of clamping force from the housing with d_1 = 55 mm, d_2 = 80 mm and L = 52 mm: **AL 55.80**.

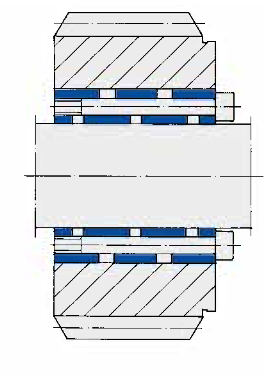
Order No.	Dimensions in mm			Initiation of clamping force		Transmittable forces		Dimensions for connecting components in mm				
AL/IL	d_1 H6	d_2 h5	L	F_{max} [1] N	C_{min} [2] mm	M Nm	F_a N	d_3 max.	d_4 min.	d_5 min.	d_6 max.	a max.
8.12	8	12	19	10000	0.5	12	3000	9	10.8	11	9.2	1.5
10.15	10	15	19	11000	0.6	21	4200	11	13.8	14	11.2	1.5
12.18	12	18	19	11800	0.7	35	5900	13	16.8	17	13.2	1.5
14.20	14	20	19	13400	0.8	49	6970	15	18.8	19	15.2	1.5
15.22	15	22	19	13700	0.8	54	7260	16	20.8	21	16.2	1.5
16.22	16	22	19	14900	0.8	64	8050	17	20.8	21	17.2	1.5
18.25	18	25	19	15900	0.9	80	8900	19	23.8	24	19.2	1.5
20.32	20	32	26	20600	0.9	124	12360	24	30	28	22	1.7
22.35	22	35	26	21700	0.9	143	13020	27	33	30	24	1.7
25.37	25	37	26	24500	1.1	190	15190	29	35	33	27	1.7
28.40	28	40	26	26900	1.1	237	16950	32	38	36	30	1.7
30.42	30	42	26	28300	1.1	272	18110	34	40	38	32	1.7
32.48	32	48	35	32400	1.2	389	24300	40	46	40	34	2.2
35.52	35	52	35	34400	1.2	457	26140	43	50	44	37	2.2
40.56	40	56	35	38900	1.2	599	29950	48	54	49	42	2.2
45.68	45	68	42	44700	1.2	804	35760	58	65	55	48	3
50.72	50	72	42	49400	1.2	988	39520	62	69	60	53	3
55.80	55	80	52	59000	1.5	1314	47790	70	77	65	58	3
60.85	60	85	52	63300	1.5	1557	51910	75	82	70	63	3
63.88	63	88	52	66000	1.5	1725	54780	78	85	73	66	3
65.90	65	90	52	67700	1.5	1848	56870	80	87	75	68	3
70.100	70	100	62	78800	1.5	2372	67770	88	96	82	74	4
75.105	75	105	62	83400	1.5	2690	71720	93	101	87	79	4
80.110	80	110	62	88100	1.6	3065	76650	98	106	92	84	4
85.115	85	115	62	92700	1.6	3427	80650	103	111	97	89	4
90.120	90	120	62	97200	1.6	3802	84500	108	116	102	94	4
95.125	95	125	62	101800	1.8	4251	89500	113	121	107	99	4
100.130	100	130	62	106500	2.0	4685	93700	118	126	112	104	4
110.140	110	140	62	115700	2.1	5599	101800	128	136	122	114	4
120.150	120	150	62	125000	2.1	6672	111200	138	146	132	124	4
125.155	125	155	62	129600	2.1	7206	115300	143	151	137	129	4
130.160	130	160	62	134300	2.2	7767	119500	148	156	142	134	4
140.170	140	170	62	143500	2.2	9037	129100	158	166	152	144	4
150.180	150	180	62	152800	2.2	10314	137520	168	176	162	154	4

[1] Max. perm. clamping force. For automated operation, the clamping sleeve should be clamped with max. 0.75xF.
[2] Design specification, not to be confused with actuation travel. For explanations, see p. 55.
[3] d_2 > 80 mm = Concentricity to IT4

GENERAL APPLICATION

The clamping sleeve may only be actuated when the bore and outside surface of the clamping sleeve are covered by the connecting components. Otherwise the clamping set could be destroyed as a result of plastic deformation.

APPLICATION USING SCREWS



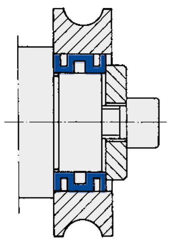
Assembly

1. Clean the clamping set, shaft and hub bore carefully and wet slightly with a low-viscosity machine oil.
2. Join the clamping set and connecting components without applying force.
3. Tighten the clamping screws evenly in diagonal order until the initial assembly play is eliminated. The play elimination phase is particularly important for ensuring good concentricity results.
4. Continue tightening evenly and gradually in diagonal sequence until you have applied full torque.
5. Finally, check the tightening torque all round.

Dismantling

1. Release the clamping screws gradually in diagonal sequence. Never completely unscrew one screw after the other. This would cause the last screw to be subjected to the total spring-back force exerted by the clamping sleeve and consequently to block. An attempt to release it can result in destruction of the hexagonal socket.
2. After releasing the clamp screws, all the components of the connection can be freely moved. After several assembly processes, an unfavourable alteration of the friction ratio between the head and contact surface of the clamping screws can take place. A stick-slip effect can occur during the tightening procedure, which results in jerky movement of the clamping screw. In this case, the contact surface of the screw head must be re-lubricated using a standard machine oil without additives.

APPLICATION WITHOUT SCREWS



Assembly

1. Clean the clamping sleeve, shaft and hub bore carefully and wet slightly with a low-viscosity machine oil.
2. Join the clamping sleeve and connecting components without applying force.
3. Initiate clamping force. The clamping sleeve deforms elastically and creates a friction-locked connection between the shaft and the housing bore.

Dismantling

1. Release the clamping force.
2. The clamping sleeve relaxes and resumes its original shape. All the parts are once again freely movable. Due to the many possible ways of initiating the clamping force, this description can only be formulated in general terms.

DESIGN

The clamping sets are manufactured from spring-hardened steel. The concentricity of the bore/outside diameter is accurate to 0.008 mm and from d_2 > 80 mm, concentricity to IT4.

The outside diameter is machined according to ISO tolerance h5. Depending on the design, the inside diameter is machined to ISO tolerance H6 or, for shaft ends, to DIN 748 (k6/m6).

Two different series (AK/AL and IK/IL) are offered to enable the different types of clamping force initiation. The AK/AL series sleeves are designed for use where the clamping force is initiated from the housing (Fig. 1). IK/IL series clamping sleeves are used in cases where clamping force is initiated from the shaft (Fig. 2).

However, of decisive importance is that the clamping force is applied to the end faces of the clamping sleeves in the area of diameter d_3 and d_4 or d_5 and d_6.

CONNECTING COMPONENTS

The cylindrical bore and outside surfaces of the clamping set must be completely covered by the connecting components. The shaft and bore must be machined cylindrically with a mean peak-to-valley height of Rz=2.5 ... 6.3 µm microns.

To ensure that the stress exerted on the hub or housing bore remains within the elastic range, we recommend the following minimum wall thickness:

Steel C 45	$= 0.6\ (d_2 - d_1)$
Aluminium alloys Minimum strength F 38	$= 1.0\ (d_2 - d_1)$
Grey cast iron GG 25 shrinkage-free casting	$= 1.0\ (d_2 - d_1)$

Hub bore
The following manufacturing tolerance applies for all series:
H7 (H6 for stringent concentricity requirements or a hydraulically operated clamp).

Shaft
Shafts must generally be manufactured to manufacturing tolerance h5 (max. perm. h6). As an exception when the DSM series is used, shafts must be manufactured to DIN 748 for motor shafts (up to dia.50 mm in k6 tolerance field, from dia.55 mm in m6 tolerance field).

Series AK/IK, AL/IL (without screws)
To permit simple configuration of the connecting components, however, projection of the clamping sleeve up to max. a (Fig. 1 and 2) can be tolerated.

Initiation of clamping force
The functional surfaces of the connecting components, which are used to initiate clamping force in the clamping sleeves, must be manufactured with a run-out accuracy of 0.01 mm or to IT4.

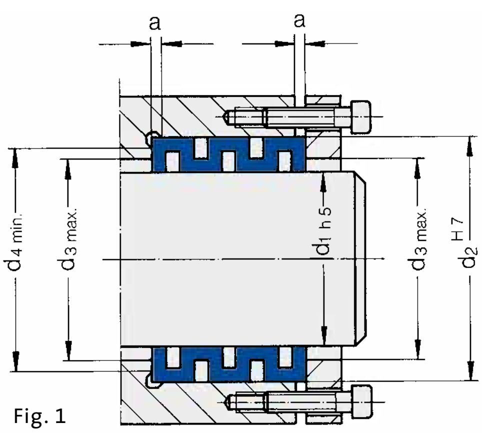


Fig. 1

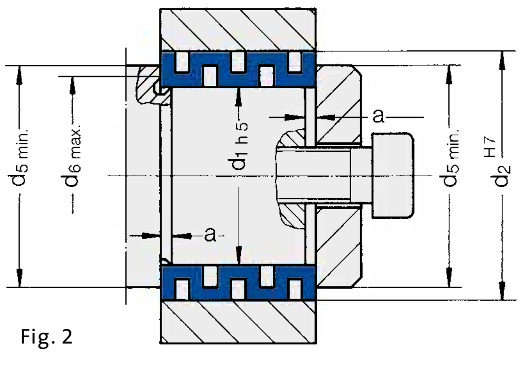


Fig. 2

CLAMPING SCREWS

Cheese-head screws with a hexagon socket ISO 4762 (DIN 912) with strength class 12.9 are used. As the power transmission of the clamping sleeves depends on the exerted clamping force, the clamping screws should be tightened using a torque wrench.

M_A: Tightening torque per clamping screw

TRANSMITTABLE FORCES

DSK/DSL/AK/IK/AL/IL

The specifications provided in the table apply to a bore tolerance of H7 and a shaft tolerance of h5 in the connecting components. For an h6 shaft, in the most unfavourable scenario, a reduction of transmittable forces of approx. 10 % may be expected.

DSM

The specifications provided in the table apply to a bore tolerance of H7 and a shaft tolerance to DIN 748 (k6/m6).

M: Transmittable torque at $F_a = 0$

The specified values were ascertained in a series of tests, in which the connecting components were made of C45steel, produced with the stipulated surface quality.

F_a: Transmittable axial force at M = 0

The F_a values are calculated according to

$$F_a = 2000 \cdot \frac{M}{d_1} \text{ [N]}$$

Subjection of the clamped connection to steady, pulsating, alternating or sudden stress has no impact provided that the occurring peak forces do not exceed the catalogue values. The risk of fretting corrosion is always a possibility in friction-locked connections subjected to alternating torsion or rotating bending stress. This phenomenon can complicate dismantling, and can be prevented by complying with the following instructions:

Perm. alternating torsion	$\tilde{T}_{perm.}$	$\leqq$ 0,6 M
Perm. rotating bending stress	$\tilde{M}_{b_{perm.}}$	$\leqq$ 0,3 M

M and F_a:

If both torque and axial forces act on a clamping set at the same time, check using the following formula whether the resulting torque Mr is transmittable.

$$M \geqq M_r = \sqrt{M_e^2 + \left(\frac{F_{ae} \cdot d_1}{2000}\right)^2} \text{ [Nm]}$$

M	=	Transmittable torque (catalogue value) [Nm]
M_e	=	Required torque [Nm]
M_r	=	Resulting torque [Nm]
F_{ae}	=	Required axial force [N]
d_1	=	Shaft diameter [mm]

TRANSMITTABLE FORCES

For series AK/IK, AL/IL only

F: Maximum permissible clamping force
To avoid the danger of fatigue failure and fretting corrosion, the clamping sleeves should be tensioned in case of high clamping/release cycle frequencies to a maximum of 0.75 F.

C: Required functional installation space
Spieth clamping sleeves must be clamped using the controlled application of force. The clamping force cannot be applied in relation to the clamping path. To prevent premature blocking, a "free" functional path "C" must be provided.

Automated operation
In the case of automated operation, for example, using hydraulic actuation, a variety of influencing variables can cause the actual values of the system to deviate from the catalogue values. For this application scenario, we strongly recommend that you verify the force or torque values required. In this application, care must be taken to ensure that the installation is completely free of axial play. To avoid fatigue failure and due to the danger of fretting corrosion, in case of high clamping/release cycle frequencies, the clamping sleeves should be tensioned at a maximum of 0.75xF.

General
If it is not possible to apply the clamping force F, the following formula is used for approximate determination of the torque M_{red} which can be transmitted with the given clamping force $F_{giv.}$ (<F).

$$M_{red} = \frac{M\ (F_{giv.} - 0.05\ F)}{0.95\ F}\ [Nm]$$

To ascertain the necessary clamping force for a transmittable torque $M_{red} < M$ an approximation is possible using the following formula:

$$F_{req.} = \frac{M_{red} \cdot 0.95\ F}{M} + 0.05\ F[N]$$

M = Transmittable torque (catalogue value) [Nm]
M_{red} = Reduced transmittable torque [Nm]
F = Max. perm. clamping force (catalogue value) [N]
F_{ae} = Required axial force [N]
$F_{req.}$ = Required clamping force [N]
$F_{giv.}$ = Given clamping force (<F) [N]

NOTE

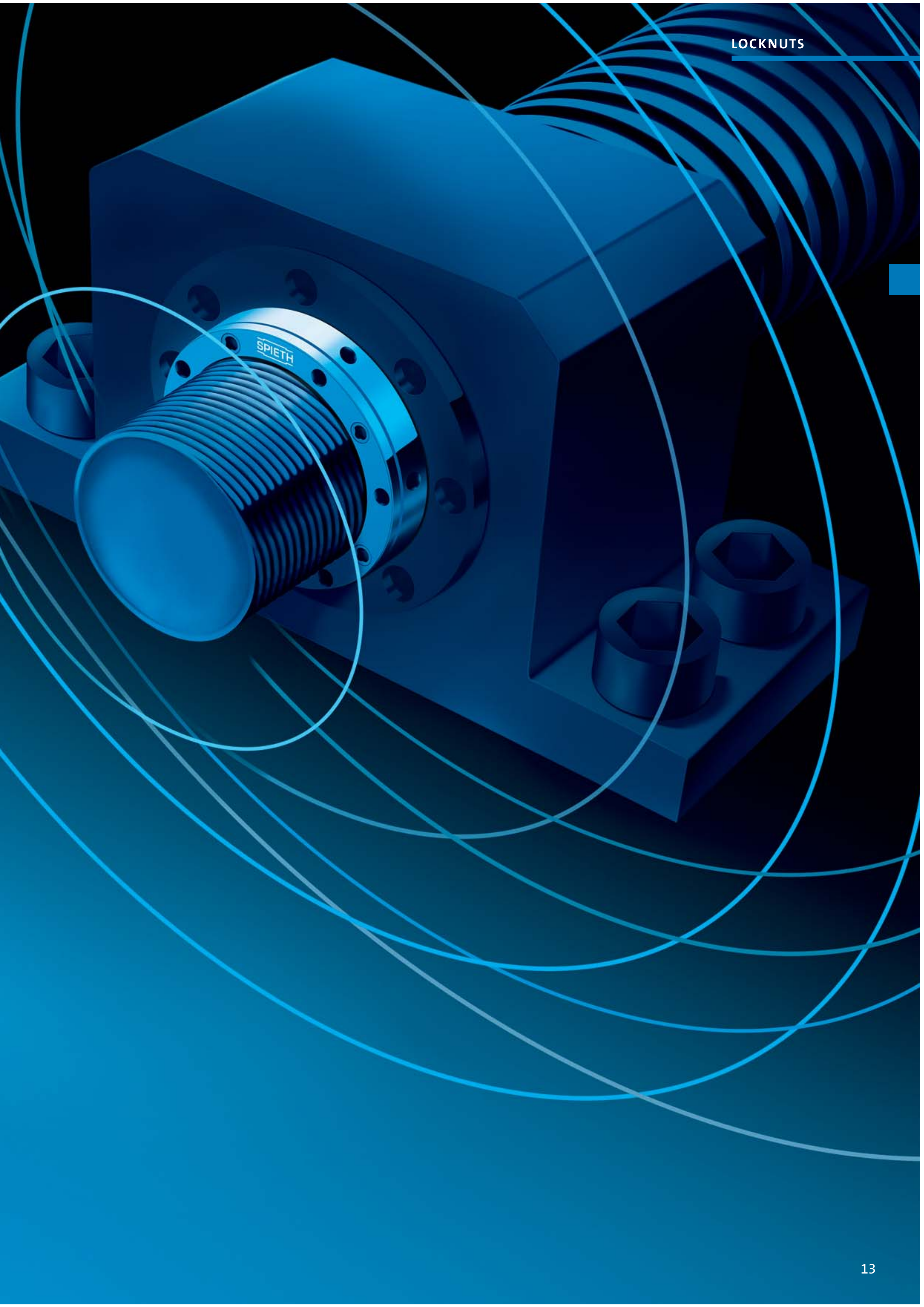
During the clamping process, the clamping sleeve reduces in length by some tenths of a mm (depending on the size of the clamping sleeve, the clamping force and the real dimensions of the clamping sleeve and connected components), dragging the clamped part in the direction of clamping. The resulting axial displacement of the clamped part can be up to 0.5 times the clamping path. When positioned against a thrust collar or similar, the axial thrust produces an intensive face contact with the clamped part. AK and IK series clamping sleeves can be supplied in a low-thrust version. However, the retention force of these versions only achieves 0.5 times the values listed in the table.

For clamping sets with integrated clamping screws, this effect is theoretically cancelled as the actuating force is applied symmetrically. Due to the actual dimensions of all components, however, allowance must be made for a slight residual thrust in an undefined direction.

HOLDING PRECISLY IN POSITION WHEN THINGS GET GOING

Spieth locknuts – precision nuts by design.
With exceptional precision and uniform clamping forces at the thread flanks, Spieth locknuts can be exactly adjusted to perform demanding duties in mechanical engineering. Thanks to perfect functionality, they cope without difficulty with the increasing levels of dynamic stress and power densities inherent in modern machinery designs – and are therefore designed to deliver maximum economy.

Locknuts demonstrate their strength when things really get going: They ensure optimum concentricity of spindles. The locknut owes its unique capability to a combination of manufacturing precision and the diaphragm locking system developed by Spieth. The relevant functional components such as the load thread, locking thread and end face are inseparable components of the nut body and are manufactured to a high degree of precision as a clamping device. The diaphragm lock ensures that this precision is preserved when assembled in your application result and that it is also retained throughout its operation.


SPIETH

4 UNIQUE FEATURES – NUMEROUS BENEFITS

Secure
The locking system enables the application of high clamping forces to ensure that the nut is friction-locked onto the spindle thread. The load is applied to the thread across 360° symmetrically and evenly. The locking force and working load act in the same direction and cannot cancel each other out. This is the requirement for the highest locking effect while at the same time preserving the connecting components.

Self-centering
The locking procedure is designed to exert a self-centring effect for the nut on the spindle thread. This is the prerequisite for ensuring a coaxial end position of the nut relative to the spindle and for a vertical orientation of the end face with respect to the connection assembly. For demanding applications, this effect can be used in a separate installation step specifically to minimise thread join play.

Precise
All functional surfaces that determine precision are manufactured in a single set-up. And in contrast to other locking concepts, the precision is retained by design once it has been created, even during installation and operation.

Consistent rigidity
Irrespective of the degree of pretension in the nut, the closed distribution of locking force ensures an intensive application of the thread flanks in the direction of the working load. The assembly process creates an elastic pretension in the join of the thread pairing, as a result of which the bearing area of the thread flanks and the rigidity of the join are significantly increased. Damaging micro-movements, caused by strong impulses or abrupt changes in the direction of force, are drastically reduced.

BENEFITS TO YOU

Competitiveness through technological leadership – a strategy that calls for an economical increase in power density, efficiency and accuracy. Locknuts create the foundation for this.

Lower resource input
- No additional grooves or locking plates required.
- Free, infinitely variable and exact positioning.
- Fast, precise installation results.
- Simple to dismantle thanks to back-sprung diaphragm.

More success
- Optimum locking effect.
- High degree of run-out accuracy, even in the assembled state.
- High dynamic loading capacity.
- High dynamic rigidity.
- Dynamically balanced structure.
- Suitable for high speeds.

Series MSR large

Series MSR standard

Series MSR from size M10

FIELDS OF APPLICATION

Spieth locknuts are precision nuts fitted with an integrated premium thread lock.
They are used in all areas of mechanical engineering. Precision, safety, rigidity and ease of use are key aspects in the design of a threaded connection. Spieth nuts are the first choice whenever at least one of these aspects is required.

APPLICATION EXAMPLES

- In machining, forming and cutting machine tools.
- In handling and automation equipment.
- In materials handling.
- In general drive engineering and transmissions.
- In fixture construction.
- In packaging machinery.
- In compressors and pumps.
- In printing presses and paper-making technology.
- In textile machines.
- In woodworking machines.
- In press manufacturing.
- In process engineering applications for mixing, crushing and centrifuging.
- For metrology, control and test engineering.

Series MSA

Series MSF

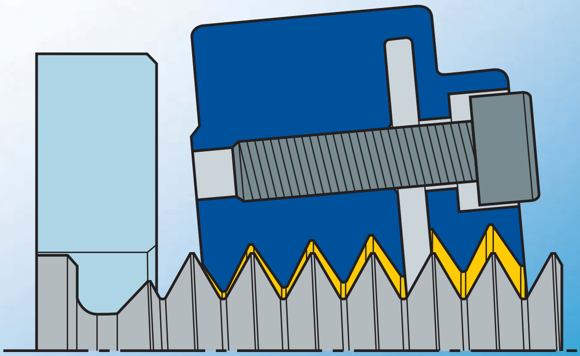
Series MSW

Series MSW > M70

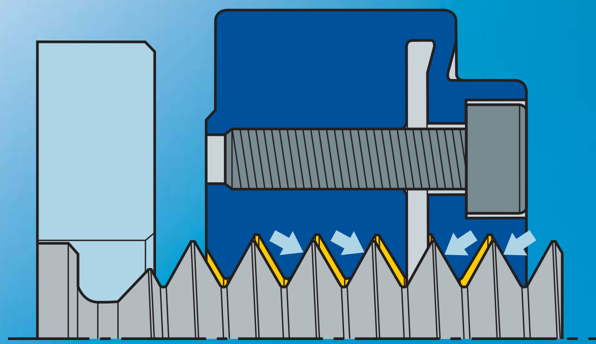
FUNCTIONAL PRINCIPLE

In this example, based on a type MSF locknut.

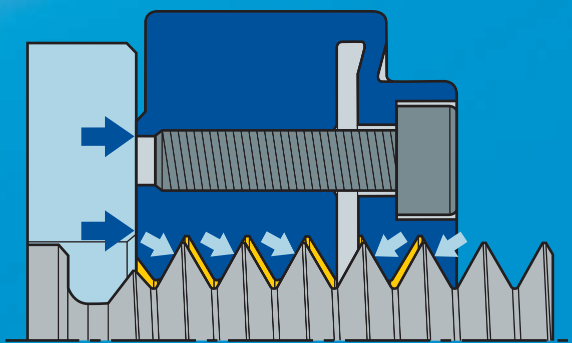
The principle is illustrated in a simplified diagram with enlarged thread flank play.



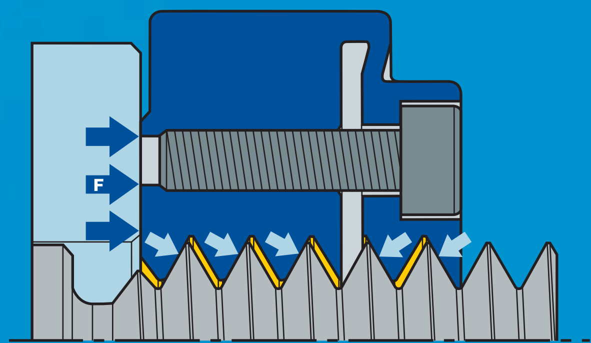
1. Screwing on the locknut
As with every threaded connection, there is a degree of mating play when the nuts are screwed on. As a result, the nut may be aligned with a parallel and/or angled axial offset relative to the spindle axis; in other words, the contact surface of the nut may be at an incline.



2. Spieth locknuts: Self-centring and self-aligning thanks to play restriction
Unique: Spieth locknuts are automatically self-centring and eliminate mating play (thread flank play) as far as possible. Thanks to play restriction, the locknut centres itself and the contact surface of the engages at right angles to the spindle axis.

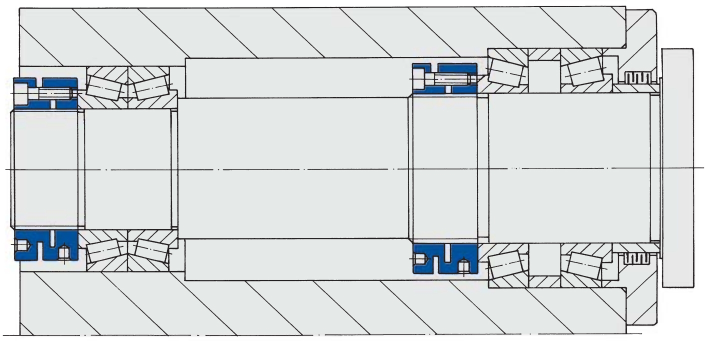


3. Tightening and locking
The locknut is tightened with the required level of preliminary torque. The lock screws are then locked with the specified level of locking torque. This ensures optimum contact at the thread flanks and maximum concentricity.



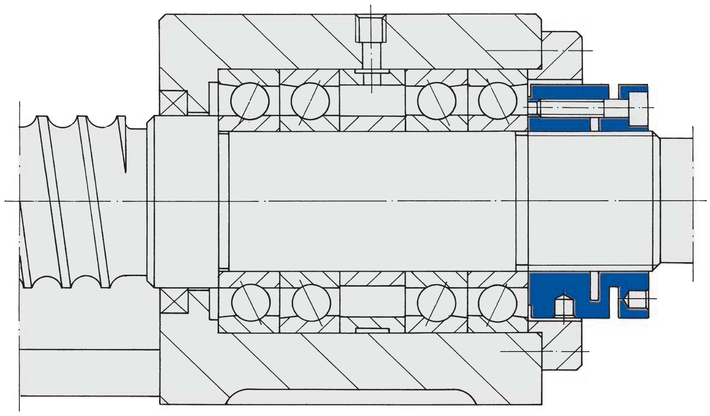
4. Higher levels of operational safety
Spieth benefit: The previously set locking forces are not cancelled by the working load, but are superimposed and therefore reinforced. Put simply: the forces act in the same direction and are therefore added to each other. The optimum solution that delivers improved safety.

ASSEMBLY EXAMPLES



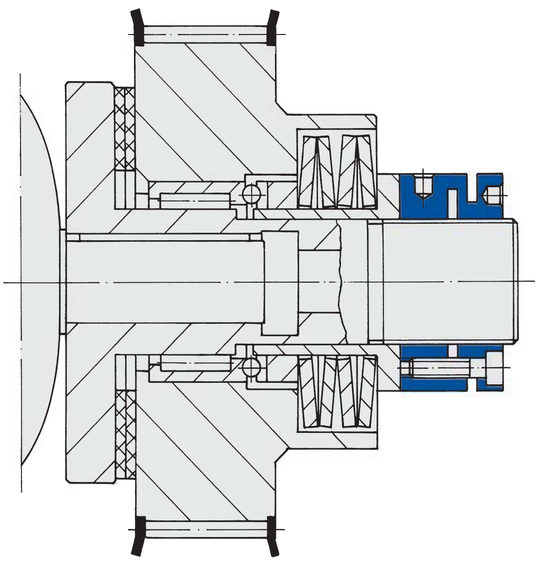
Example 1: Tapered roller bearing

In tapered roller bearings, run-out accuracy, a high level of axial rigidity and dynamic safety create a major contribution to perfect bearing operation: Radial stress applied to the tapered roller bearing generates axial forces (axial rigidity). Due to a lack of axial pretension (no axial friction), the intrinsic safety of the locknut is extremely important.



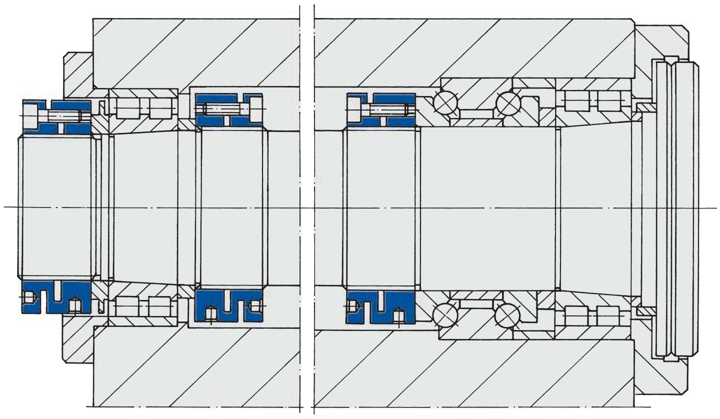
Example 2: Ball roller spindle

The use of a locknut gives the bearing of the ball roller spindle a high degree of axial rigidity. Under highly dynamic operating conditions, the high degree of dynamic safety of the locknut represents a major advantage.

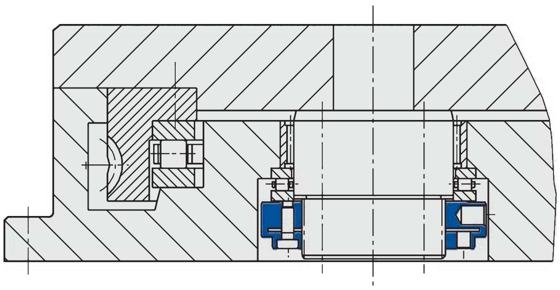


Example 3: Friction clutch

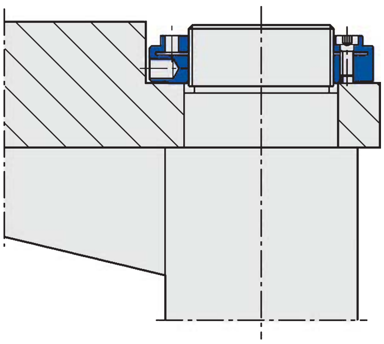
A locknut is used here to provide precise and infinitely variable adjustment of the pretension of the spring on a friction clutch. The reliable locking function is of particular impor-



Example 4: Main spindle bearing
The locknut ensures a high level of axial rigidity and excellent concentricity on the main spindle bearing in a turning lathe.

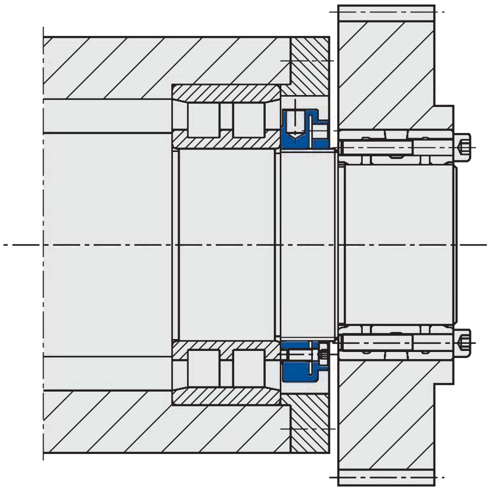


Example 5: Round axis
Not a millimetre is lost in the axial direction and, despite this, there is no need to sacrifice run-out accuracy, axial rigidity or a high degree of dynamic safety.



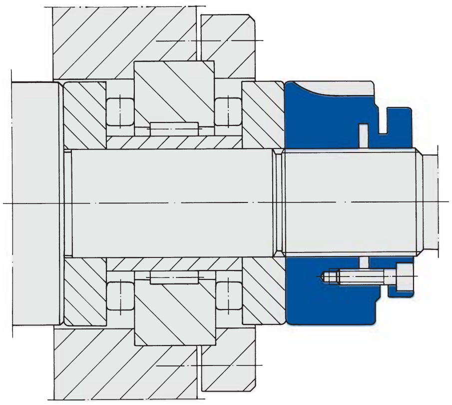
Example 6: Table structure
Due to the flat design, countersunk installation is possible without causing any interfering contours in the table surface. Straining of the structure due to a tilting locknut caused by thread flank play, or even opening under dynamic load are not possible due to the characteristic properties of the locknut.

ASSEMBLY EXAMPLES



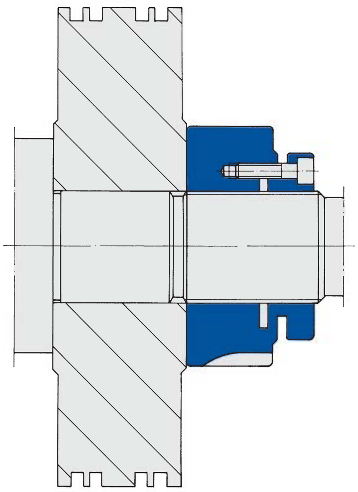
Example 7: Tooling spindle

The low installation height of the MSF locknut makes it possible to create a compact drive side of the spindle. This configuration saves valuable installation space and minimises destructive rotating bending stress. At the same time, the benefits of a Spieth high-precision locknut are fully exploited.



Example 8: Feed drive system

The installation using a locknut reliably transmits the high load-bearing capacity and axial rigidity of the needle axial cylindrical bearing to the feed drive system. The excellent locking properties provided by the locknut are of major importance under dynamic stress.



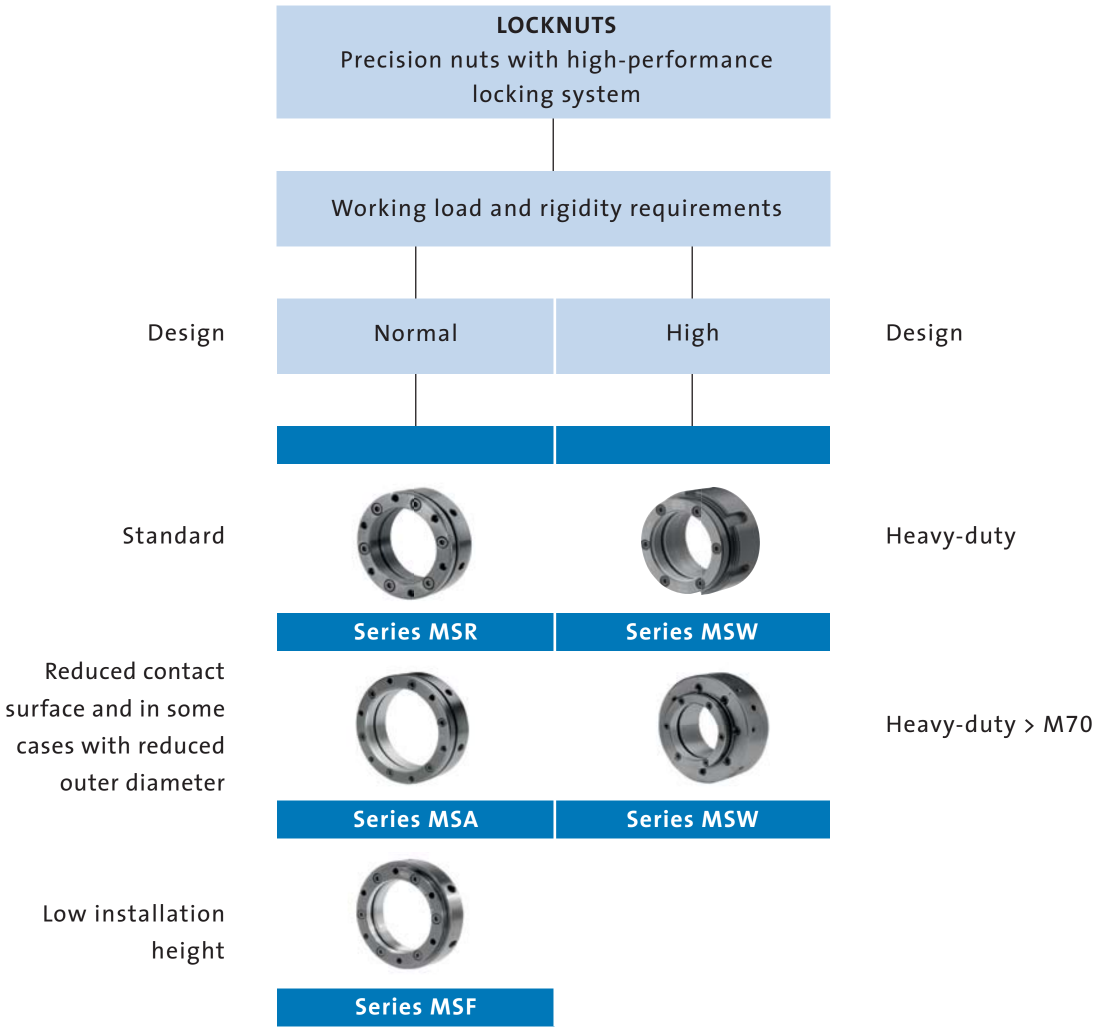
Example 9: Piston fixture

The piston fixture utilizes all the technical benefits of locknuts: Load-bearing capacity, axial rigidity and excellent locking properties.

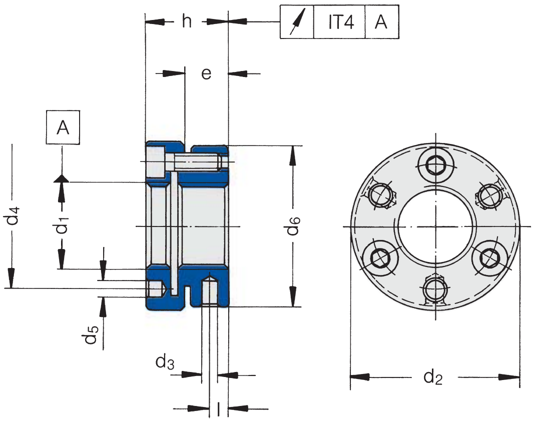
SPIETH **LOCKNUTS: THE RIGHT CHOICE**

We'll provide you with the perfect locknuts for your application. We'll also help you choose the right one – with expert advice from our specialists.

Series MSR – MSA, MSF and MSW
- Excellent axial rigidity and loading capacity under high levels of dynamic stress.
- Simple connecting components, no grooves, locking plates etc.
- Axial position of the contact surface can be easily and precisely adjusted.
- Even in the installed state, exact run-out accuracy, which can be further improved with adjustment.



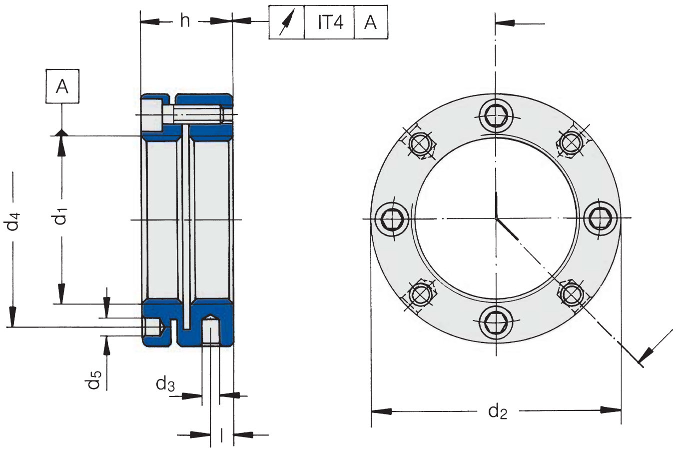
SPIETH LOCKNUTS SERIES **MSR**



The admissible operating loads specified in the table are guideline values calculated with a safety factor of 1.6

- under static stress relative to the minimum yield point,
- under dynamic stress relative to the minimum alternate strength.

Order No.	Dimensions in mm									Clamping screws			Calculation factor	Calculation factor	Perm. axial stress		Moment of inertia
	d_1	d_2	d_3 1)	d_4	d_5 1)	d_6	h	l	e	ISO 4762	M_A	No.	A	B	dyn.	stat.	J
	ISO-5H	h11	H11		H11	h11					Nm		mm	N	kN	kN	kg cm^2
MSR 10.0,75	M10x0.75	24	2.5	17	3.2	22	14	3	6.5	M3	2	3	0.672	2457	12	16	0.025
MSR 10.1	M10x1	24	2.5	17	3.2	22	15	3	6.5	M3	2	3	0.703	2457	12	15	0.027
MSR 12.1	M12x1	26	3	19	3.2	25	14	3	6.5	M3	2	3	0.819	2438	14	19	0.037
MSR 12.1,5	M12x1.5	26	3	19	3.2	25	15	3	6.5	M3	2	3	0.881	2438	13	18	0.040
MSR 14.1,5	M14x1.5	32	4	22.5	4.3	30	16	3	7	M4	2.9	3	0.997	2995	17	22	0.096
MSR 15.1	M15x1	33	4	23.5	4.3	31	16	3	7	M4	2.9	3	0.992	2984	19	25	0.108

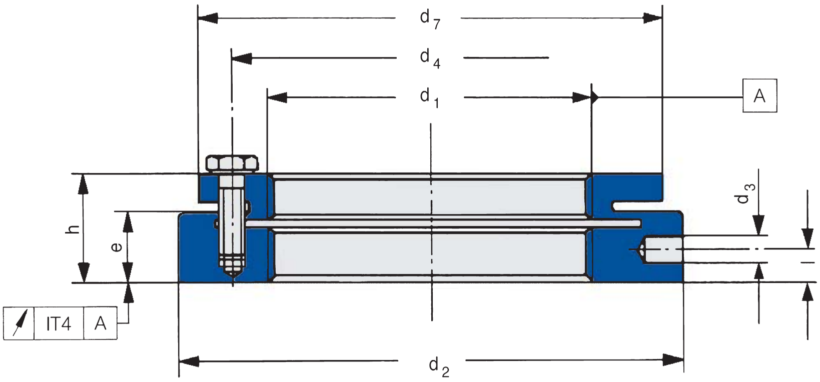


Order No.	Dimensions in mm							Clamping screws			Calculation factor	Calculation factor	Perm. axial stress		Moment of inertia
	d_1	d_2	d_3 1)	d_4	d_5 1)	h	l	ISO 4762	M_A	No.	A	B	dyn.	stat.	J
	ISO-5H	h11	H11		H11				Nm		mm	N	kN	kN	kg cm^2
MSR 16.1,5	M16x1.5	34	4	24.5	4.3	18	5	M4	2.9	4	1.112	3962	17	22	0.147
MSR 17.1	M17x1	35	4	25.5	4.3	18	5	M4	2.9	4	1.108	3947	19	25	0.164
MSR 18.1,5	M18x1.5	36	4	26.5	4.3	18	5	M4	2.9	4	1.228	3931	19	25	0.183
MSR 20.1	M20x1	40	4	30.5	4.3	18	5	M4	2.9	4	1.281	3900	22	29	0.283
MSR 20.1,5	M20x1.5	40	4	30.5	4.3	18	5	M4	2.9	4	1.344	3900	18	28	0.283
MSR 22.1,5	M22x1.5	40	4	30.5	4.3	18	5	M4	2.9	4	1.459	3869	23	32	0.270
MSR 24.1,5	M24x1.5	42	4	32.5	4.3	18	5	M4	2.9	4	1.575	3838	25	35	0.323
MSR 25.1,5	M25x1.5	45	5	36.5	4.3	20	6.5	M4	2.9	4	1.633	3822	33	47	0.488
MSR 26.1,5	M26x1.5	45	5	36.5	4.3	20	6.5	M4	2.9	4	1.690	3806	34	49	0.479
MSR 28.1,5	M28x1.5	46	5	38.5	4.3	20	6.5	M4	2.9	4	1.805	3775	36	53	0.504

Order No.	Dimensions in mm							Clamping screws			Calculation factor	Calculation factor	Perm. axial stress		Moment of inertia
	d_1	d_2	d_3 [1)]	d_4	d_5 [1)]	h	l	ISO 4762	M_A	No.	A	B	dyn.	stat.	J
	ISO-5H	h11	H11		H11				Nm		mm	N	kN	kN	kg cm^2
MSR 30.1,5	M30x1.5	48	5	40.5	4.3	20	6.5	M4	2.9	4	1.921	3744	38	57	0.588
MSR 32.1,5	M32x1.5	50	5	42.5	4.3	22	7	M4	2.9	4	2.037	3713	44	64	0.743
MSR 35.1,5	M35x1.5	53	5	45.5	4.3	22	7	M4	2.9	4	2.210	3666	47	66	0.914
MSR 38.1,5	M38x1.5	58	5	48.5	4.3	22	7	M4	2.9	4	2.449	3619	50	75	1.340
MSR 40.1,5	M40x1.5	58	5	50.5	4.3	22	7	M4	2.9	4	2.500	3588	49	66	1.250
MSR 42.1,5	M42x1.5	60	5	52.5	4.3	22	7	M4	2.9	4	2.617	3557	49	66	1.410
MSR 45.1,5	M45x1.5	68	6	58	4.3	22	6.5	M4	2.9	6	2.789	5265	53	84	2.490
MSR 48.1,5	M48x1.5	68	6	59.5	4.3	25	9	M4	2.9	6	2.962	5195	70	94	2.630
MSR 50.1,5	M50x1.5	70	6	61.5	4.3	25	9	M4	2.9	6	3.079	5148	71	94	2.910
MSR 52.1,5	M52x1.5	72	6	63.5	4.3	25	9	M4	2.9	6	3.196	5101	72	96	3.210
MSR 55.1,5	M55x1.5	75	6	66.5	4.3	25	9	M4	2.9	6	3.369	5031	72	96	3.690
MSR 55.2	M55x2	75	6	66.5	4.3	25	9	M4	2.9	6	3.430	5031	78	96	3.690
MSR 58.1,5	M58x1.5	82	6	72.5	5.3	26	9	M5	6	6	3.541	8077	103	161	5.810
MSR 60.1,5	M60x1.5	84	6	74.5	5.3	26	9	M5	6	6	3.655	8001	105	163	6.320
MSR 60.2	M60x2	84	6	74.5	5.3	26	9	M5	6	6	3.718	8001	104	163	6.320
MSR 62.1,5	M62x1.5	86	6	76.5	5.3	28	10.5	M5	6	6	3.774	7925	123	186	7.330
MSR 65.1,5	M65x1.5	88	6	78.5	5.3	28	10.5	M5	6	6	3.948	7811	129	177	7.710
MSR 65.2	M65x2	88	6	78.5	5.3	28	10.5	M5	6	6	4.007	7811	127	177	7.710
MSR 68.1,5	M68x1.5	95	8	83	5.3	28	9.5	M5	6	6	4.121	7696	133	223	11.000
MSR 70.1,5	M70x1.5	95	8	85	5.3	28	9.5	M5	6	6	4.238	7620	136	203	10.500
MSR 70.2	M70x2	95	8	85	5.3	28	9.5	M5	6	6	4.297	7620	134	203	10.500
MSR 72.1,5	M72x1.5	98	8	86	6.4	28	8.5	M6	10	6	4.354	10692	124	170	11.800
MSR 75.1,5	M75x1.5	100	8	88	6.4	28	8.5	M6	10	6	4.525	10530	121	160	12.300
MSR 75.2	M75x2	100	8	88	6.4	28	8.5	M6	10	6	4.583	10530	126	160	12.300
MSR 80.2	M80x2	110	8	95	6.4	32	11	M6	10	6	4.873	10260	162	258	22.000
MSR 85.2	M85x2	115	8	100	6.4	32	11	M6	10	6	5.168	9990	170	262	25.700
MSR 90.2	M90x2	120	8	108	6.4	32	11	M6	10	6	5.453	9720	178	265	29.600
MSR 95.2	M95x2	125	8	113	6.4	32	11	M6	10	6	5.744	9450	185	268	34.000
MSR 100.2	M100x2	130	8	118	6.4	32	11	M6	10	6	6.033	9180	193	271	38.800
MSR 105.2	M105x2	135	8	123	6.4	32	11	M6	10	6	6.321	8910	203	274	44.100
MSR 110.2	M110x2	140	8	128	6.4	32	11	M6	10	6	6.616	8640	212	280	49.800
MSR 115.2	M115x2	145	8	133	6.4	36	13	M6	10	6	6.900	8370	248	329	64.200
MSR 120.2	M120x2	155	8	140	6.4	36	13	M6	10	6	7.193	8100	272	408	89.700
MSR 125.2	M125x2	160	8	148	6.4	36	13	M6	10	6	7.474	7830	281	412	99.700
MSR 130.3	M130x3	165	8	153	6.4	36	13	M6	10	6	7.895	7560	285	405	111.000
MSR 140.3	M140x3	180	10	165	6.4	36	12	M6	10	8	8.475	9360	302	476	161.000
MSR 150.3	M150x3	190	10	175	6.4	36	12	M6	10	8	9.050	8640	325	489	193.000
MSR 160.3	M160x3	205	10	185	8.4	40	14	M8	25	8	9.633	14520	377	552	301.000
MSR 170.3	M170x3	215	10	195	8.4	40	14	M8	25	8	10.213	13200	399	560	353.000
MSR 180.3	M180x3	230	10	210	8.4	40	14	M8	25	8	10.789	11880	420	648	478.000
MSR 190.3	M190x3	240	10	224	8.4	40	14	M8	25	8	11.362	10560	444	656	550.000
MSR 200.3	M200x3	245	10	229	8.4	40	14	M8	25	8	11.948	9240	467	578	545.000

[1)] The number of holes corresponds to the number of clamping screws.

SPIETH LOCKNUTS SERIES **MSR**

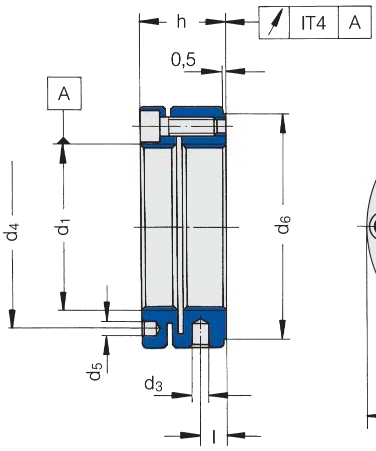


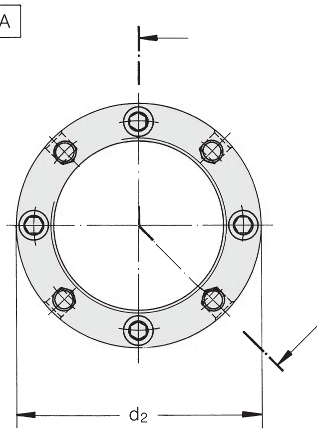
Order No.	Dimensions in mm: d_1	d_2	d_3 [1]	d_4	d_7	h	l	e	Clamping screws: ISO 4017	ISO 4014	M_A	No.	Calculation factor A	Calculation factor B	Perm. axial stress stat.	Moment of inertia J
	ISO-5H	h11	H11		h11						Nm		mm	N	kN	kg cm²
MSR 210.3	M210×3	270	12	232	250	44	13	27	M8		25	8	12.515	5280	598	926
MSR 220.3	M220×3	282	12	242	260	44	13	27	M8		25	8	13.097	5148	626	1090
MSR 230.3	M230×3	295	12	252	270	44	13	27	M8		25	8	13.677	5016	664	1280
MSR 240.3	M240×3	308	12	262	280	44	13	27	M8		25	8	14.256	4884	703	1510
MSR 250.3	M250×3	322	12	272	290	44	13	27	M8		25	8	14.833	4752	752	1790
MSR 260.3	M260×3	336	12	282	300	44	13	27	M8		25	10	15.408	5775	800	2100
MSR 270.3	M270×3	350	12	292	310	44	13	27	M8		25	10	15.982	5610	849	2460
MSR 280.3	M280×3	364	12	302	320	44	13	27	M8		25	10	16.578	5445	897	2870
MSR 290.3	M290×3	376	12	312	330	44	13	27	M8		25	10	17.149	5280	925	3230
MSR 300.3	M300×3	390	12	322	340	44	13	27	M8		25	10	17.717	5115	973	3730
MSR 310.4	M310×4	400	14	337	360	54	16	32		M10	49	10	18.437	7860	1098	5290
MSR 320.4	M320×4	412	14	347	370	54	16	32		M10	49	10	19.008	7598	1130	5900
MSR 330.4	M330×4	424	14	357	380	54	16	32		M10	49	10	19.578	7336	1163	6560
MSR 340.4	M340×4	436	14	367	390	54	16	32		M10	49	10	20.176	7074	1194	7270
MSR 350.4	M350×4	450	14	377	400	54	16	32		M10	49	10	20.743	6812	1253	8220
MSR 360.4	M360×4	466	14	387	410	54	16	32		M10	49	12	21.309	7860	1333	9460
MSR 370.4	M370×4	478	14	397	420	54	16	32		M10	49	12	21.905	7546	1366	10400
MSR 380.4	M380×4	490	14	407	430	54	16	32		M10	49	12	22.468	7231	1399	11400

[1] The number of holes corresponds to the number of clamping screws.

The admissible operating loads specified in the table are guideline values calculated with a safety factor of 1.6 under static stress relative to the minimum yield point.

SPIETH LOCKNUTS SERIES **MSA**





Order No.	Dimensions in mm								Clamping screws			Calculation factor	Calculation factor	Perm. axial stress		Moment of inertia
	d_1	d_2	d_3 [1)]	d_4	d_5 [1)]	d_6	h	l	ISO 4762	M_A	No.	A	B	dyn.	stat.	J
	ISO-5H	h11	H11		H11					Nm		mm	N	kN	kN	kg cm^2
MSA 20.1	M20x1	35	4	27.5	3.2	31	17	5	M3	2	5	1.281	3938	23	31	0.142
MSA 25.1,5	M25x1.5	40	4	32.5	3.2	36	19	6.5	M3	2	5	1.633	3859	35	49	0.265
MSA 30.1,5	M30x1.5	45	5	37.5	3.2	41	19	6.5	M3	2	5	1.921	3780	39	56	0.400
MSA 35.1,5	M35x1.5	53	5	45.5	4.3	48	22	7	M4	2.9	4	2.210	3666	47	66	0.904
MSA 40.1,5	M40x1.5	58	5	50.5	4.3	54	22	7	M4	2.9	4	2.500	3588	50	68	1.240
MSA 45.1,5	M45x1.5	64	6	54	4.3	59	23	7	M4	2.9	5	2.789	4388	58	78	1.890
MSA 50.1,5	M50x1.5	69	6	59	4.3	64	24	8	M4	2.9	6	3.079	5148	63	85	2.560
MSA 55.1,5	M55x1.5	73	6	64	4.3	69	24	8	M4	2.9	6	3.369	5031	59	79	3.000
MSA 60.1,5	M60x1.5	78	6	69	4.3	74	24	8	M4	2.9	6	3.655	4914	61	81	3.760
MSA 65.1,5	M65x1.5	83	6	74	4.3	79	24	8	M4	2.9	7	3.948	5597	94	124	4.610
MSA 70.1,5	M70x1.5	93	8	83	5.3	88	27	9	M5	6	6	4.238	7620	136	178	9.090
MSA 75.1,5	M75x1.5	98	8	88	5.3	93	27	9	M5	6	6	4.525	7430	138	183	10.900
MSA 80.2	M80x2	103	8	93	5.3	98	28	10	M5	6	6	4.873	7239	148	196	13.400
MSA 85.2	M85x2	112	8	100	6.4	106	30	10	M6	10	6	5.168	9990	172	228	21.300
MSA 90.2	M90x2	117	8	105	6.4	111	30	10	M6	10	6	5.453	9720	174	230	24.700
MSA 95.2	M95x2	122	8	110	6.4	116	30	10	M6	10	6	5.744	9450	176	232	28.400
MSA 100.2	M100x2	130	8	118	6.4	123	32	11	M6	10	6	6.033	9180	205	271	38.600
MSA 105.2	M105x2	135	8	123	6.4	128	32	11	M6	10	6	6.321	8910	207	274	43.900
MSA 110.2	M110x2	140	8	128	6.4	133	32	11	M6	10	6	6.616	8640	212	280	49.500
MSA 120.2	M120x2	155	8	140	6.4	145	36	13	M6	10	6	7.193	8100	308	408	89.100
MSA 130.3	M130x3	165	8	153	6.4	155	36	13	M6	10	6	7.895	7560	306	405	110.000
MSA 140.3	M140x3	180	10	165	6.4	170	36	12	M6	10	8	8.475	9360	359	476	160.000
MSA 150.3	M150x3	190	10	175	6.4	180	36	12	M6	10	8	9.050	8640	369	489	192.000
MSA 160.3	M160x3	205	10	185	8.4	195	40	14	M8	25	8	9.633	14520	417	552	300.000
MSA 170.3	M170x3	215	10	195	8.4	205	40	14	M8	25	8	10.213	13200	423	560	352.000
MSA 180.3	M180x3	230	10	210	8.4	220	40	14	M8	25	8	10.789	11880	489	648	476.000
MSA 190.3	M190x3	240	10	224	8.4	230	40	14	M8	25	8	11.362	10560	495	656	548.000
MSA 200.3	M200x3	245	10	229	8.4	235	40	14	M8	25	8	11.948	9240	436	578	543.000

[1)] The number of holes corresponds to the number of clamping screws.

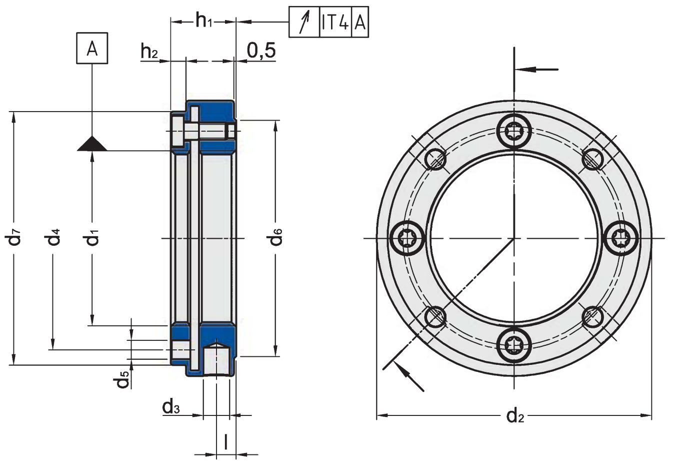
The MSA series locknuts with reduced contact surface and in some cases smaller outside diameters relative to the MSR series are particularly suited for mounting angular ball bearings and cylinder roller bearings of ISO diameter series 9.

The admissible operating loads specified in the table are guideline values calculated with a safety factor of 1.6

- under static stress relative to the minimum yield point,
- under dynamic stress relative to the minimum alternate strength.

SPIETH LOCKNUTS SERIES **MSF**

For applications with limited installation space.

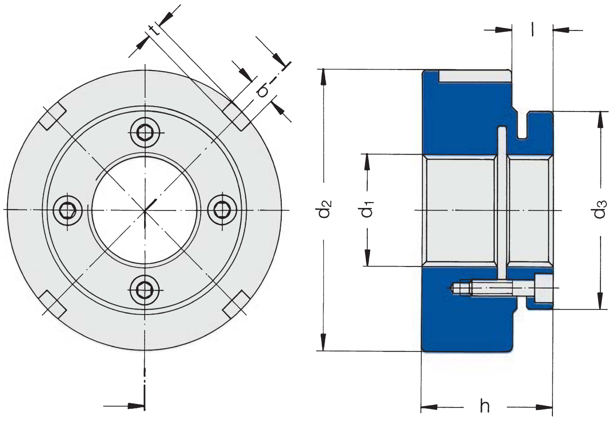


Order No.	Dimensions in mm										Clamping screws cheese head clamping screws			Calculation factor	Perm. axial stress	Moment of inertia J
	d_1	d_2	d_3 1)	d_4	d_5 1)	d_6	d_7	h_1	h_2	l	(Torx)	M_A	No.	A	Stat. Fa	
	ISO-5H	h11	H11		H11		h11				Size	Nm		mm	kN	kg cm^2
MSF 25.1,5	M25x1.5	48	5	36	4.3	39	43	14	3.5	4	20	2.9	4	1.633	26	0.338
MSF 30.1,5	M30x1.5	53	5	41	4.3	44	48	15	3.5	4.5	20	2.9	4	1.921	40	0.624
MSF 35.1,5	M35x1.5	58	5	46	4.3	49	53	15	3.5	4.5	20	2.9	4	2.210	49	0.876
MSF 40.1,5	M40x1.5	63	6	51	4.3	54	58	15	3.5	4.5	20	2.9	4	2.500	57	1.190
MSF 45.1,5	M45x1.5	70	6	56	4.3	59	63	15	3.5	4.5	20	2.9	6	2.789	60	1.700
MSF 50.1,5	M50x1.5	75	6	61	4.3	64	68	16	3.5	5	20	2.9	6	3.079	80	2.390
MSF 55.1,5	M55x1.5	80	6	66	4.3	69	73	16	3.5	5	20	2.9	6	3.369	120	3.020
MSF 55.2	M55x2	80	6	66	4.3	69	73	16	3.5	5	20	2.9	6	3.430	116	3.020
MSF 60.1,5	M60x1.5	89	6	74	5.3	77	82	18	5	5.25	25	6	6	3.655	131	5.340
MSF 60.2	M60x2	89	6	74	5.3	77	82	18	5	5.25	25	6	6	3.719	126	5.340
MSF 65.1,5	M65x1.5	94	8	79	5.3	82	87	18	5	5.25	25	6	6	3.948	144	6.510
MSF 65.2	M65x2	94	8	79	5.3	82	87	18	5	5.25	25	6	6	4.008	139	6.510
MSF 70.1,5	M70x1.5	99	8	84	5.3	87	92	18	5	5.25	25	6	6	4.238	155	7.550
MSF 70.2	M70x2	99	8	84	5.3	87	92	18	5	5.25	25	6	6	4.297	150	7.550
MSF 75.1,5	M75x1.5	106	8	89	6.4	94	99	20	6	5.75	30	10	6	4.525	178	11.200
MSF 75.2	M75x2	106	8	89	6.4	94	99	20	6	5.75	30	10	6	4.587	172	11.200
MSF 80.2	M80x2	111	8	94	6.4	99	104	20	6	5.75	30	10	6	4.873	186	13.400
MSF 90.2	M90x2	121	8	104	6.4	109	114	20	6	5.75	30	10	6	5.453	214	18.100
MSF 100.2	M100x2	131	8	114	6.4	119	124	20	6	5.75	30	10	6	6.033	242	24.000

1) The number of holes corresponds to the number of clamping screws.

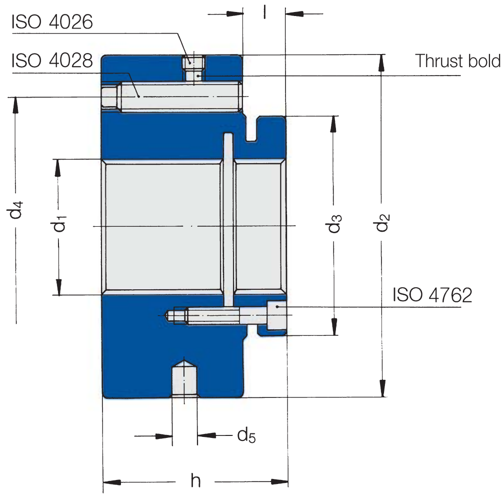
The admissible operating loads specified in the table are guideline values calculated with a safety factor of 1.6 under static stress relative to the minimum yield point.

SPIETH LOCKNUTS SERIES **MSW**



Order No.	Dimensions in mm							Clamping screws			Calculation factor	Locknut-specific allowance	Perm. axial stress		Moment of inertia
	d_1 ISO-5H	d_2 c11	d_3	h	l	b [1]	t	ISO 4762	M_A Nm	No.	A mm	B N	dyn. kN	stat. kN	J kg cm^2
MSW 20.28	M20x1.5	42	38	28	11	6	2.5	M4	2.9	4	1.344	1560	57	80	0.486
MSW 20.40	M20x1.5	52	42	40	11	7	3	M4	2.9	4	1.344	936	110	156	1.740
MSW 25.28	M25x1.5	47	43	28	11	7	3	M4	2.9	4	1.633	1560	68	102	0.742
MSW 25.40	M25x1.5	62	47	40	11	8	3.5	M4	2.9	4	1.633	936	131	196	3.410
MSW 30.28	M30x1.5	52	48	28	11	7	3	M4	2.9	4	1.921	1560	77	123	1.090
MSW 30.44	M30x1.5	68	52	44	11	8	3.5	M4	2.9	4	1.921	936	172	273	5.540
MSW 35.28	M35x1.5	60	53	28	11	8	3.5	M4	2.9	4	2.210	1560	88	144	1.800
MSW 35.44	M35x1.5	73	60	44	11	8	3.5	M4	2.9	4	2.210	936	195	320	7.410
MSW 40.28	M40x1.5	65	58	28	11	8	3.5	M4	2.9	6	2.500	1560	97	165	2.430
MSW 40.44	M40x1.5	75	62	44	11	8	3.5	M4	2.9	6	2.500	936	215	367	7.980
MSW 45.28	M45x1.5	70	63	28	11	8	3.5	M4	2.9	6	2.789	2340	105	184	3.140
MSW 45.44	M45x1.5	90	70	44	11	10	4	M4	2.9	6	2.789	1404	234	410	16.400
MSW 50.32	M50x1.5	75	68	32	11	8	3.5	M4	2.9	6	3.079	2340	147	267	4.780
MSW 50.46	M50x1.5	95	75	46	11	10	4	M4	2.9	6	3.079	1404	268	488	21.300
MSW 55.46	M55x1.5	100	80	46	12	10	4	M5	6	6	3.369	2286	272	504	23.600
MSW 60.46	M60x1.5	100	85	46	12	10	4	M5	6	6	3.655	2286	294	551	24.800
MSW 65.46	M65x1.5	110	90	46	12	10	4	M5	6	6	3.948	2286	314	598	35.900
MSW 70.46	M70x1.5	115	95	46	12	10	4	M5	6	6	4.238	2286	333	645	42.200

[1] The number of grooves for hook spanner DIN 1810-A corresponds to the number of clamping screws.



Order No.	Dimensions in mm								Clamping screws			Perm. axial stress	
	d_1	d_2	d_3	h	l	d_4	d_5		ISO 4762	M_A	No.	dyn.	stat.
	ISO - 5H	c11					ø H11	No.		Nm		kN	kN
MSW 72.60	M72x1.5	135	95	60	14	105	8	4	M5	6	6	468	749
MSW 85.60	M85x2	160	110	60	14	124	8	4	M6	10	6	807	1050
MSW 105.66	M105x2	190	136	66	15	150	10	4	M6	10	6		1100
MSW 125.72	M125x2	215	154	72	16	172	10	4	M6	10	6		1600
MSW 140.78	M140x3	240	176	78	17	196	10	4	M6	10	8		2000

Order No.	Set screws					Lock screws		Alu thrust bolt		
	ISO 4028 - 45H	d_6	M_D [2)]	No.	Calculation factor A	ISO 4026	No.	ø	Length	No.
		mm	Nm		mm			mm	mm	
MSW 72.60	M10x45	7	34	8	0.92064	M6x8	8	4.5	3	8
MSW 85.60	M12x45	8.5	60	8	1.09913	M8x8	8	6	3	8
MSW 105.66	M12x50	8.5	60	9	1.09913	M8x8	9	6	4	9
MSW 125.72	M16x55	12	140	9	1.42613	M8x8	9	6	4	9
MSW 140.78	M16x60	12	140	9	1.42613	M8x8	9	6	4	9

[2)] Manufacturer's max. permissible tightening torque.

The admissible operating loads specified in the table are guideline values calculated with a safety factor of 1.6

- under static stress relative to the minimum yield point,
- under dynamic stress relative to the minimum alternate strength.

The locknut is deformable in the axial direction and must therefore be handled with care. The clamping screws should only be tightened when the locknut has been screwed completely onto the spindle thread. If these instructions are ignored, inadmissible plastic deformation could render the locknut unusable.

Assembly

1. Carefully clean the locknut and connecting components and wet slightly with low-viscosity machine oil that does not contain friction-reducing additives.
2. Screw the locknut onto the spindle thread, but without making contact with the end face (Fig. 1).
3. Tighten the clamping screws evenly in diagonal sequence while turning the locknut forwards and backwards. Stop tightening when flank play is almost eliminated (Fig. 2).
4. Now tighten the locknut against the end contact surface initially by exerting a higher level of preliminary torque. Then release again and finally tighten using the prescribed degree of torque (Fig. 3). This sequence prevents subsequent seizure at the contact surfaces (thread flanks, end contact surfaces).
5. Then secure the locknut by evenly tightening the clamping screws. In applications that impose strict requirements in terms of spindle concentricity, it is possible to adjust the concentricity after testing by tightening the clamping screws individually. This eliminates any unilateral tensions caused by minimal axial run-out errors in the connecting components.

Dismantling

First slightly relieve the tension of the clamping screws in diagonal sequence. Only then should the clamping screws be fully released. This prevents all of the tension of the diaphragm from acting on the last clamping screw to be released and causing it to jam.

Once a locknut has been secured on a spindle thread, after removal it may only be used again on the same spindle. Adjustments carried out between the spindle and locknut can otherwise lead to problems if the locknut is used on a different spindle.

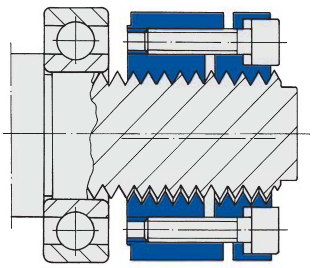


Fig. 1

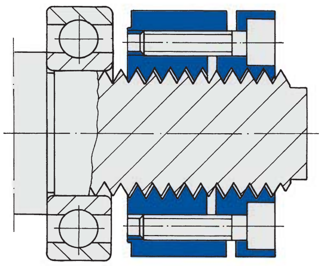


Fig. 2

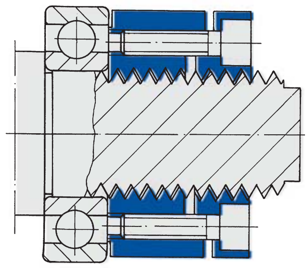


Fig. 3

Assembly

1. Carefully clean the locknut and connecting components and wet slightly with low-viscosity machine oil that does not contain friction-reducing additives.
2. Screw the locknut onto the spindle thread, but without making contact with the end face. The set screws should not protrude from the end face. (Fig. 4).
3. Tighten the clamping screws evenly in diagonal sequence while turning the locknut forwards and backwards. Stop tightening when flank play is almost eliminated (Fig. 5).
4. Now screw the locknut until it makes contact with the end face. Then tighten the clamping screws evenly to fix the lock.
5. Then tighten the set screws against the contact surface step by step in the sequence shown at a higher level of preliminary torque. Loosen them again and finally tighten them using the prescribed preliminary torque (Fig. 6). This sequence prevents subsequent seizure at the contact surfaces (thread flanks, end contact surfaces).
6. Finally tighten the lock screws and check the clamping screws again for the prescribed preliminary torque and adjust if necessary.

Dismantling

1. Release the lock screws, then slightly loosen the set screws in the sequence shown before fully releasing them.
2. First slightly relieve the tension of the clamping screws in diagonal sequence. Only then should the clamping screws be fully released. This prevents all of the tension of the diaphragm from acting on the last clamping screw to be released and causing it to jam.

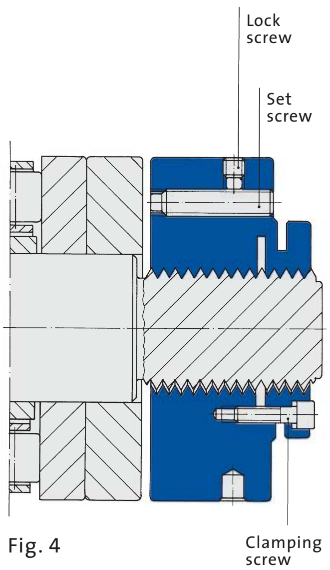


Fig. 4

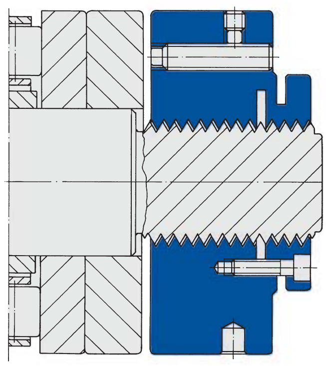


Fig. 5

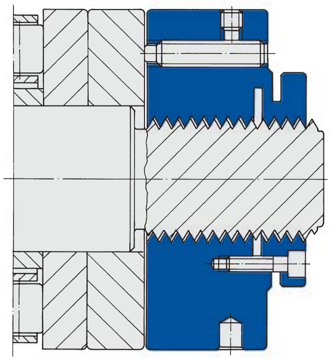


Fig. 6

GENERAL DESIGN

The locknuts are made of burnished steel. The metric ISO thread is manufactured to tolerance class "fine" (tolerance zone 5H, DIN 13 parts 21 ... 25) in a single work process with the end face of the locknut. All locknuts are fitted with integrated clamping screws to lock the thread. Radial installation is carried out with the aid of a hook spanner DIN 1810 shape A or shape B.

MSW DESIGN

These locknuts are generally required to withstand high pretension forces. In the upper dimension range, these pretension forces can no longer be achieved in practice using the locknut's own pretension moment due to the size of the friction radii. For this reason, the MSW locknut series is divided into 2 different versions: Up to locknut size MSW 70.46, axial pretension is set by using the preliminary torque of the locknut. From size MSW 72.60 upwards, this is done using the tightening torque of the integrated set screws.

CLAMPING SCREWS

Cheese-head screws with a hexagon socket ISO 4762 (DIN 912) or hexalobular socket cheese head screws (similar to TORX) with strength class 12.9, as well as hexagon bolts ISO 4014 and ISO 4017 with strength class 10.9 are used.

M_A: Tightening torque per clamping screw
The tightening torque is based on a friction coefficient of $\mu = 0.14$. As the effective friction coefficients depend on a range of factors which are often beyond the control of the manufacturer, the values specified here should only be regarded as non-binding recommendations.

CONNECTING COMPONENTS

The metric bolt thread must normally be manufactured to tolerance class "medium" (tolerance zone 6g, DIN 13 parts 21 ... 25), for higher precision requirements, to tolerance class "fine" (tolerance zone 4h, DIN 13 parts 21 ... 25).

The contact surfaces of the connecting components are essential to optimum functioning and must be manufactured with particular care and precision. To avoid surface seizure, all contact surfaces should be finished with a low level of surface roughness.

CONNECTING COMPONENTS MSW > M70

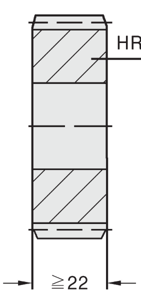


Fig. 1

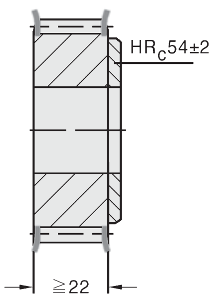


Fig. 2

For this locknut size, the axial pretension applied by the hardened threaded pins requires a specially configured thrust collar to absorb the extremely high local pressure loads. This thrust ring must be hardened. The reason for the prescribed minimum height is to ensure distribution of locally occurring pressure forces to the following end contact surface. In certain cases, an already existing machine component, such as a gear, may be able to assume the function of the thrust collar (Fig. 1+2).

SETTING THE AXIAL PRETENSIONING FORCES

The axial pretension of a screw connection often plays a decisive role for successful function, and must therefore be set with particular accuracy. However, in most assembly workshops, direct measurement of this variable is not possible, raising the need for indirect methods of setting. For this purpose, the locknut preliminary torque corresponding to the required pre-tensioning force is calculated. This factor can be determined using the following equation:

The locking process places the spindle thread under stress and in this case brings about intensive surface contact (= high axial rigidity). At the same time, this serves to relieve tension on the end contact surface of the locknut. This effect can easily be compensated by increasing preliminary torque accordingly during installation. This higher preliminary torque is ascertained using the allowance B relative to the required pre-tensioning force F_V.

General

$$M_V = \frac{(F_V + B) \cdot (A + \mu_A \cdot r_A)}{1000} \text{ [Nm]}$$

M_V = Pre-tensioning torque of the locknut [Nm]

F_V = Required axial pretension force of the threaded connection [N]

B = Locknut-specific allowance [N], compensates face end relief due to the locking process

A = Constant [mm], includes the calculation factors for the respective thread width (catalogue value)

μ_A = Frictional coefficient for the end contact surface of the locknut Approximate value $\mu_A = 0.1$ steel/steel

r_A = Effective friction radius for the end contact face of the locknut [mm]

From locknut size MSW > M70

The tightening torque for the set screw is determined according to the following formula:

$$M_D = \frac{F_V \cdot (4 \cdot A + \mu_D \cdot d_6)}{n \cdot 4000} \text{ [Nm]}$$

M_D = Tightening torque per set screw [Nm]

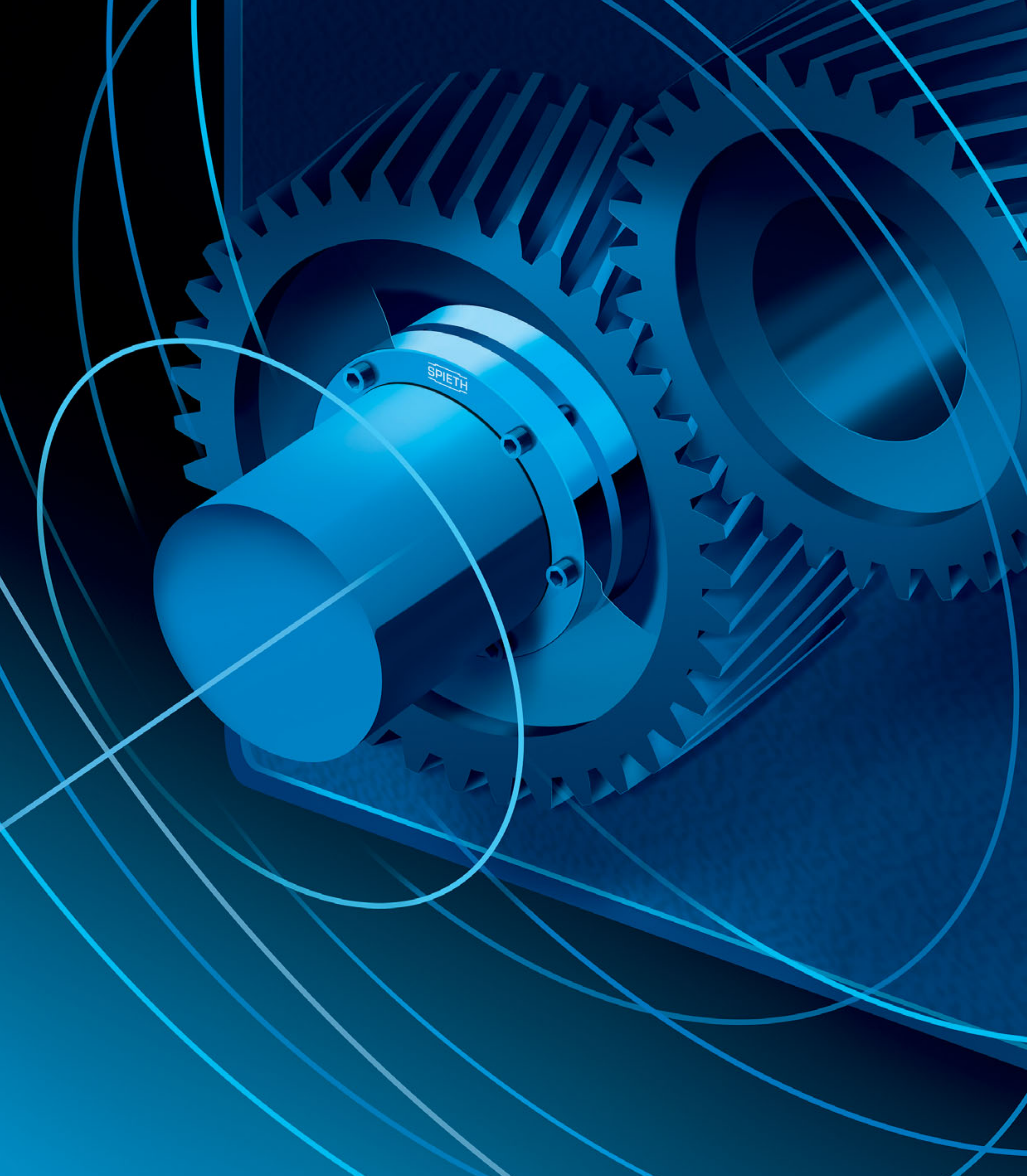
F_V = Required axial pretension force of the threaded connection [N]

A = Constant [mm], includes the Calculation factors for the respective thread width (catalogue value)

μ_D = Frictional coefficient for the end contact face of the set screw Approximate value = 0.13

d_6 = Dog point dia. of the set screw [mm] (catalogue value)

n = number of set screws



GUARANTEEING YOU GREATER PRODUCTIVITY

SPIETH

Aus Prinzip präziser

GREATER PRECISION BY DESIGN

Spieth company headquarters and production department in Esslingen, Germany.

In-house production guarantees utmost precision.
When it comes to precision, Spieth sets the benchmark - and this certainly pays dividends in practice. Across the globe. For over 50 years. We are a leading technical innovator and provider of solutions in the area of mechanical and systems engineering. When it comes to ensuring the absolute quality of mechanical connecting, bearing and locking solutions for drive and guide components, leading manufacturers rely on us. Not least because we control the entire manufacturing process from start to finish.

Precision is a fundamental principle here at Spieth.
The unique Spieth principle embodied by all our products ensures that everything runs smoothly in practice. With our precision mechanical elements such as clamping sets, guide bushings, precision self-locking nuts and clamping nuts, we are continuously setting new standards in terms of precision, function, durability, ease of installation and cost-effectiveness. And being the kind people we are, we always try to improve on what we have achieved. Cooperating closely with our customers, we continuously develop our products – with a high degree of flexibility to meet ever-changing requirements and rising demands.

Guide bushings

Clamping sets
New: Concentricity better than 8 µm

Locknuts

Expert on-site advice.
As experts in the area of connections, we can offer specific advice from our technical service department and sales engineers. For complex assignments, we work closely with the customer to come up with the perfect solution, if necessary, on-site.

Radial plain bearings

Guide gibs
New: Tungsten-carbide coating

Clamping nuts

ENGINEERING EXPERTISE FOR OUR CUSTOMERS – DOWN TO THE FINEST DETAIL, EVEN WITH OUR SPECIAL SOLUTIONS

Spieth Elements – Precision-made in Germany.
When it comes to precision, durability, availability and minimum input of resources during installation and production at our customers, Spieth offers a range of services and expertise like no other. Which also explains why we maintain control over the production of our products. We continue to manufacture all precision parts ourselves here in Germany – using the very latest manufacturing, test and inspection processes. Only in this way can we be certain that they fully satisfy our exacting quality standards and those of our customers. A comprehensive works-standard portfolio of products available directly from stock guarantees you precision down to the finest detail.

Customer support by Spieth experts.
In addition to the exception al functionality and quality of our products, we offer comprehensive support from our experienced sales engineers – from concept phase all the way to practical implementation. This allows us to provide you with solutions that meet your current requirements while at the same time giving you the option to plan for the next stage of development.

Flexibility based on experience – in dialogue with customers.
By engaging in a continuous dialogue with customers from the most diverse industries and applying our accumulated expertise, we are in a position to provide products and services offering a high degree of added value. This experience pays dividends for you in practice.

Our service.
We can advise on how to optimise the integration of connecting elements into your system and how to ensure reliable functionality in the connection environment.

The difference between the original and plagiarism: Special solutions.

As the original manufacturer of Spieth products, we can apply the expertise and experience of our specialists to create bespoke solutions based on the renowned Spieth diaphragm system. The development process involves the use of modern simulation technologies and practically-oriented testing methods. By combining theoretical scientific findings with practical experience of numerous industries, our processes and developments are trailblazing. Numerous national and international patents bear witness to Spieth engineering expertise.

THE SPIETH PRINCIPLE: THE UNIFORM DISTRIBUTION OF FORCE ALL-ROUND

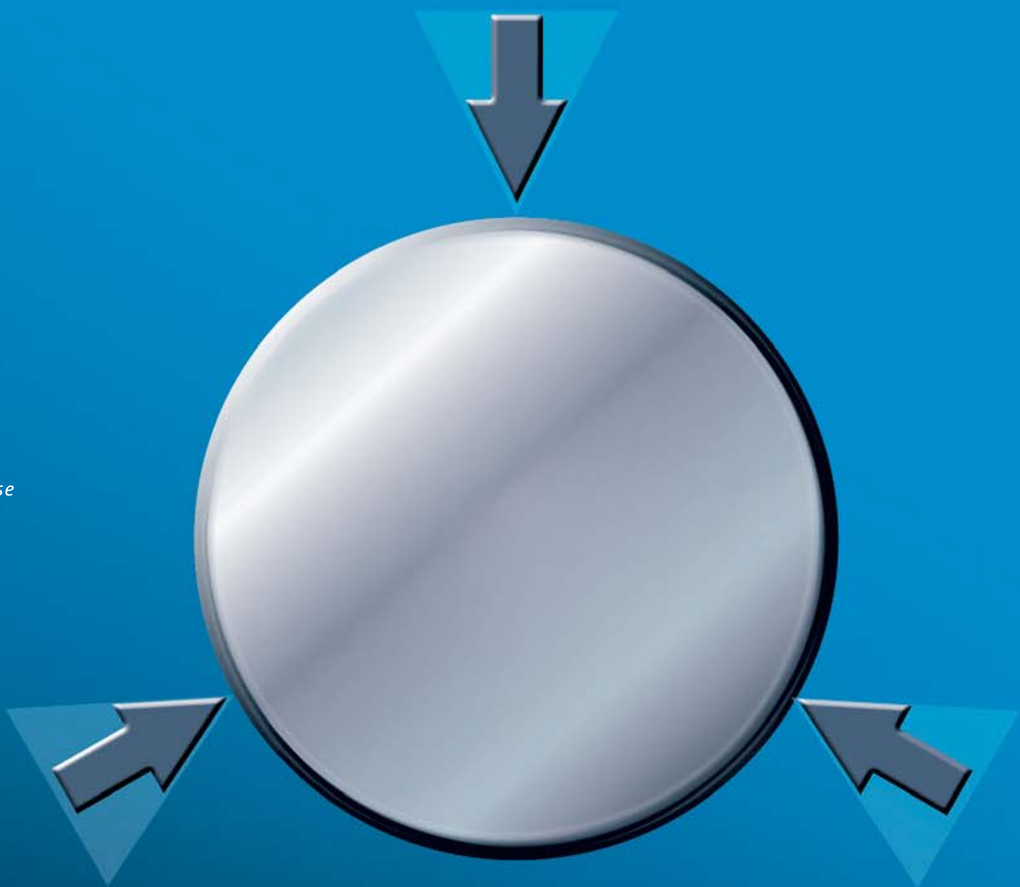
Everything runs smoothly – with the power of the Spieth principle. Developed by company founder Rudolf Spieth and further refined down to the smallest detail over a period of 50 years, this intelligent functional principle forms the basis for perfect and efficient solutions for mechanical connecting, clamping, guiding, bearing and locking in the mechanical and systems engineering fields. Guaranteeing ultimate precision and economical results.

Uniform distribution of clamping forces all-round.

The Spieth principle simply involves the uniform application of force – frictional force to be precise: Rather than being concentrated at a few single points, the clamping forces of our mechanical connecting elements engage all round and are thus uniformly distributed.

With unique benefits in practical applications:

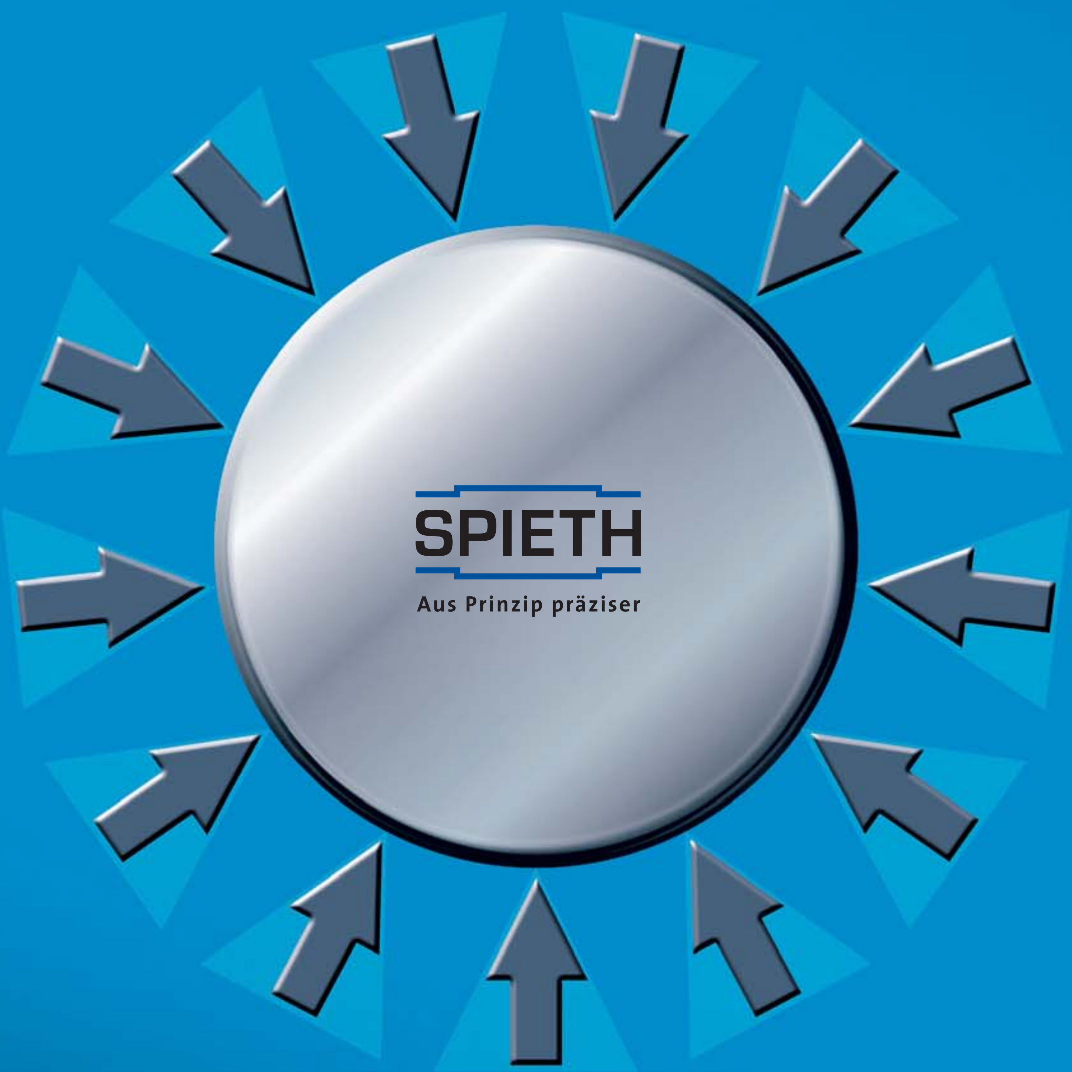
- High concentricity with no balance problems thanks to the dynamically balanced and self-centring structure – without grooves and slots.
- A secure shaft-hub connection that can be released and re-used an unlimited number of times.
- Time-saving assembly and dismantling.
- Secure bearing function of locknuts: Uniform all-round clamping of thread flanks ensures high dynamic locking properties and exceptional axial rigidity. Thread flank play can be reduced to zero, resulting in absolutely level contact surfaces and run-out accuracy even in the assembled state.



Conventional solutions: Application of force at single points – less efficient, less precise and less safe.

- Secure, convenient application of high axial forces with clamping nuts. Can be used on rotating spindles.
- Perfect adjustment of play to suit radial plain bearings and guide gibs and, with additional clamping function, to suit guide bushings.

Our customers can rely 100 percent on the Spieth principle – for optimum mechanical and systems engineering performance.



The Spieth principle: uniform all-round friction locking – efficient, highly precise and secure.

THERE IS A SOLUTION TO EVERY CHALLENGE – WITH THE SPIETH CONNECTION EXPERTS

Spieth – exactly the right solution for challenging applications in mechanical and systems engineering.

For economical, safe operation.
Our products may seem inconspicuous, but they deliver powerful performances: In a wide range of applications. they are the key that enables the smooth, economical and safe operation of highly complex systems and machinery. And in situations where conventional products have reached their limits, solutions by Spieth that can meet the most stringent demands of modern machinery frequently come into play.

Thanks to their special characteristics and the unique Spieth principle, our products perform a wide range of duties with extreme precision, reduce failure rates and extend machinery run times.

Expertise in efficient connections.
Spieth is your solution partner offering comprehensive expertise when it comes to:

- transmitting torque, radial forces and axial forces or generating axial clamping forces,
- realising cylindrical or even sliding surfaces,
- bedding of linear, rotating or screwing movements,
- meeting high accuracy specifications and realising particular installation and dismantling benefits,
- locking threads,
- creating connections, which can be quickly and easily released and simply adjusted and readjusted.

Special versions available on request.
Special solutions are our speciality. To do this, we bring the experience acquired in numerous industries to bear along with the necessary technological expertise and understanding to meet your individual requirements.

Regardless of the challenges you need to overcome: With Spieth at your side, you will find the optimum, safe and therefore economical solution.

PRODUCT RANGES

PROPERTIES	Lock-nuts	Clamping sets	Guide bushings	Guide gibs	Radial plain bearings	Clamping nuts
Transmission of torque		●	○			
Transmission of radial forces		●	●	●	●	
Transmission of axial forces	●	●	○			●
Generation of axial clamping forces	●					●
Sliding surface cylindrical			●		●	
Sliding surface even				●		
Bedding of linear movements			●	●		
Bedding of rotating movements					●	
Bedding of screwing movements			●			
Fulfils high accuracy requirements	●	●	●	●	●	●
Exceptional assembly and dismantling benefits	●	●	●	●	●	●
Locking thread	●					●
Connection quickly and easily released	●	●	○			●
Simple to adjust and readjust	●	●	●	●	●	●

● Function provided ○ Function optional

AT SPIETH, PRECISION STANDS FOR SCOPE. AND VARIETY

When it comes to the precision of our products, we are extremely meticulous. That's because at the end of the day, our manufacturing tolerances are in the micron range. The entire Spieth product range – from clamping sets to guide gibs – can be measured against our own high standards and those of our customers.

For this reason, we constantly use modern testing stations to ensure the premium quality of our products even during production. The extensive range of precision products by Spieth includes several thousand variants for a broad spectrum of applications and is available worldwide through our partners and from the company headquarters in Germany. A permanent inventory of all standard parts ensures prompt and flexible delivery at an attractive price. And virtually all components we have every manufactured are still available today as special elements.