

Original version of the design guide



Für	Baureihen	Bauteile		
Spieth locknuts (precision locknuts)	MSW until M70	MSW 20.28	MSW 20.40	MSW 25.28
		MSW 25.40	MSW 30.28	MSW 30.44
		MSW 35.28	MSW 35.44	MSW 40.28
		MSW 40.44	MSW 45.28	MSW 45.44
		MSW 50.32	MSW 50.46	MSW 55.46
		MSW 60.46	MSW 65.46	MSW 70.46

The Design Guide is also available for download at www.spieth-me.de. In case of any questions, please contact Spieth-Maschinenelemente GmbH & Co. KG directly.

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About the design guide for Spieth Locknuts

This design guide enables safe and efficient handling of Spieth locknuts and provides valuable information on choice, dimensioning, and assembly of your locknut connection.

Notices

This design guide is based on the operating instructions whose recommendations and notices must be followed for dimensioning and design.

Please visit www.spieth-me.de for design guide and operating instructions.

For machine documentation you can use component-specific design and/or assembly data sheets as a template. These are also available at www.spieth-me.de.

The basic requirement for working safely is compliance with all safety notices. They can be identified by the following symbols:

Caution!

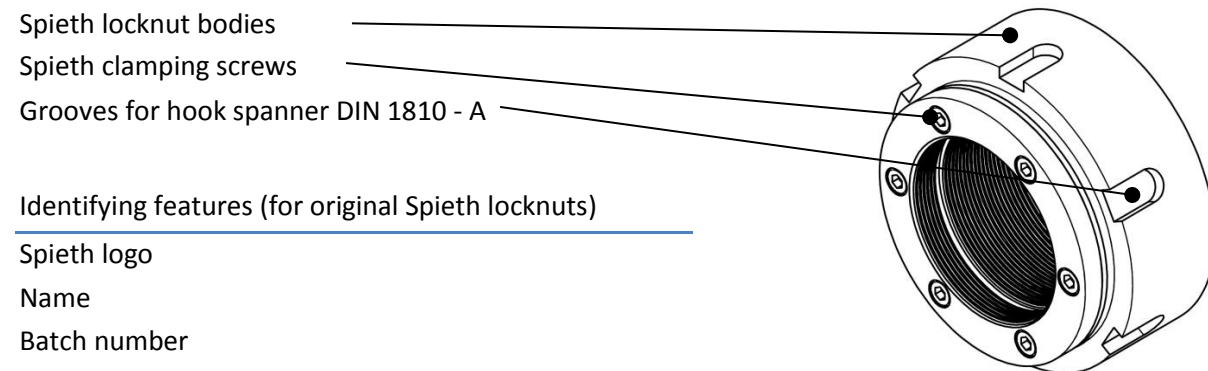
In addition to the notices in these instructions, local accident prevention guidelines and national health and safety regulations also apply.

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1 Description of Spieth Locknuts

1.1 Structure



Identifying features (for original Spieth locknuts)

Spieth logo

Name

Batch number

Locking torque M_s for clamping screws

Fig 1: Schematic representation similar to Spieth MSW series locknuts

The Spieth MSW series locknuts are assemblies consisting of locknut bodies and clamping screws. The thread inside the locknut body is interrupted by a groove, separating the locknut body into a load and a locking part. A diaphragm connects load and locking part.

1.2 Mode of action

Spieth locknuts are precision locknuts. Due to their design they provide a maximum of precision, combined with utmost locking properties.

Spieth MSW series locknuts have been designed as all-purpose precision locknuts (e.g., for locking high-quality fastenings, shaft bearings, or spindle bearings).

Despite their compact design and the high axial loads occurring here, Spieth-locknuts guarantee permanent pretension and a rigid and precisely aligned contact with the bearing for an immaculately supported spindle.



Fig. 2: Illustration similar to Spieth MSW locknuts

Spieth MSW series locknuts are frictionally engaged one-piece locknuts. Load part and locking part of the locknut body approach each other purely along an axis via the elastic diaphragm. Actuating the tensioning / clamping screws arranged in axial direction causes load part and locking part to approach each other purely along an axis. Since the locking part has been designed as a stable ring, a 360° tessellation using several thread turns is used to achieve a frictionally engaged clamping on the shaft thread. Tessellation converts the bolt force directly into a contact force evenly distributed across the entire circumference. Owing to system characteristics, this automatically aligns the end face at a right angle.

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2 Choice for Your Use Case

The material's yield strength with a safety margin of 1.6 is used for the admissible static axial load.

In general, a locknut is compatible with a bearing load if it can absorb the permanent axial limit load which is specified on the bearings and based on the yield strength.

Please note:

The details about the maximum load capacity of all Spieth products are based on the material's yield strength. The reason for this is that Spieth-Maschinenelemente GmbH & Co. KG only accepts elastic deformation of its products. In particular with precision locknuts, ductile deformation causes a loss of pretensioning and/or safety and therefore means that the connection failed. With products from other manufacturers, calculations are often based on tensile strength so a direct comparison of performance data is not possible.

Table 1: Application-relevant data of Spieth locknuts

Order No.	Name	Geometry	Load capacity	Precision
		Thread \emptyset d_1 5H x pitch [-]x[mm]	Adm. stat. axial load $F_{ax,stat}$ [kN]	Axial run-out t_{plan} (=IT4) [μ m]
K-10402001	MSW 20.28	M20x1.5	80	6
K-10402002	MSW 20.40	M20x1.5	156	6
K-10402501	MSW 25.28	M25x1.5	102	6
K-10402502	MSW 25.40	M25x1.5	196	6
K-10403001	MSW 30.28	M30x1.5	123	6
K-10403002	MSW 30.44	M30x1.5	273	6
K-10403501	MSW 35.28	M35x1.5	144	7
K-10403502	MSW 35.44	M35x1.5	320	7
K-10404001	MSW 40.28	M40x1.5	165	7
K-10404002	MSW 40.44	M40x1.5	367	7
K-10404501	MSW 45.28	M45x1.5	184	7
K-10404502	MSW 45.44	M45x1.5	410	7
K-10405001	MSW 50.32	M50x1.5	267	7
K-10405002	MSW 50.46	M50x1.5	488	7
K-10405501	MSW 55.46	M55x1.5	504	8
K-10406001	MSW 60.46	M60x1.5	551	8
K-10406501	MSW 65.46	M65x1.5	598	8
K-10407001	MSW 70.46	M70x1.5	645	8

Axial loads $F_{ax,stat}$ apply for shaft threads with a tolerance of 6g or higher and a minimum material strength of 700 N/mm².

In case of dynamic loads, approx. 75% of the static axial load $F_{ax,stat}$ is admissible.

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3 Design of Spieth Locknuts

Spieth MSW series locknuts are made of steel with high stability (approx. 225 N/mm²). The surface is bronzed with fine-turned, bare functional surfaces.

The contact surface is produced in one process together with the thread to ensure a maximum of shape and position tolerances.

The metric ISO thread is produced as per the "fine" tolerance class (tolerance zone 5H, DIN 13 Part 21 ... 25) and needs to cover the entire thread length of the shaft thread.

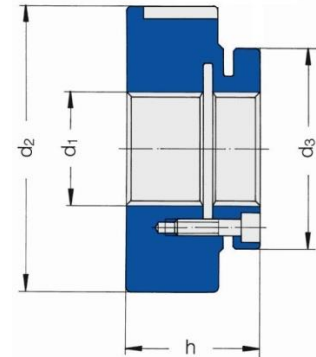


Fig. 3: Sectional view Spieth locknut > M80

Caution!

The locknut is deformable in the axial direction and must therefore be handled with care. The clamping screws may only be tightened when the locknut has been screwed completely onto the spindle thread. Otherwise, inadmissible ductile deformation may occur and render the locknut unusable.

Caution!

Only use Spieth locknuts with original Spieth clamping screws; otherwise, malfunctions with far-reaching consequences of loss may result in which case Spieth-Maschinenelemente GmbH & Co. KG assumes no liability or warranty.

Table 2: Design-relevant data of Spieth locknuts

Name	Shaft side (thread)	Access side (available space)		Mass-related properties	
	Thread \varnothing d_1 5H x pitch [-]x[mm]	Outer \varnothing d_2 [mm]	Length h [mm]	Weight m [kg]	Moment of inertia J [kg cm ²]
MSW 20.28	M20x1.5	42	28	0.184	0.486
MSW 20.40	M20x1.5	52	40	0.473	1.74
MSW 25.28	M25x1.5	47	28	0.213	0.742
MSW 25.40	M25x1.5	62	40	0.647	3.41
MSW 30.28	M30x1.5	52	28	0.247	1.09
MSW 30.44	M30x1.5	68	44	0.846	5.54
MSW 35.28	M35x1.5	60	28	0.319	1.8
MSW 35.44	M35x1.5	73	44	0.957	7.41
MSW 40.28	M40x1.5	65	28	0.345	2.43
MSW 40.44	M40x1.5	75	44	0.926	7.98

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Name	Shaft side (thread)	Access side (available space)		Mass-related properties	
	Thread \emptyset d_1 5H x pitch [-]x[mm]	Outer \emptyset d_2 [mm]	Length h [mm]	Weight m [kg]	Moment of inertia J [kg cm ²]
MSW 45.28	M45x1.5	70	28	0.382	3.14
MSW 45.44	M45x1.5	90	44	1.361	16.4
MSW 50.32	M50x1.5	75	32	0.5	4.78
MSW 50.46	M50x1.5	95	46	1.551	21.3
MSW 55.46	M55x1.5	100	46	1.627	23.6
MSW 60.46	M60x1.5	100	46	1.525	24.8
MSW 65.46	M65x1.5	110	46	1.851	35.9
MSW 70.46	M70x1.5	115	46	1.963	42.2

4 Dimensioning of Locknut Connections

Pretensioning torque M_V of the locknut induces pretension on the bearing of the associated machine part. According to the recommendations of the bearing manufacturer, add the recommended pretension to the operating load and ensure that the sum of these two forces stays below the locknut's admissible static axial load. Normally, a design of the shaft thread as per tolerance class "medium" (tolerance zone 6g, DIN 13 Part 21 ... 25) suffices. To leverage the locknuts' capabilities with higher accuracy requirements, we recommend designing the shaft thread as per tolerance class "fine" (tolerance zone 4h, DIN 13 Part 21 ... 25).

The rigidity of the shaft influences the locknut's required assembly pretension and locking force. All the details about pretensioning and locking processes have been established using a solid shaft. If a hollow shaft is used, the resulting pretension and locking forces may deviate. In case of doubt, please contact Spieth-Maschinenelemente GmbH & Co. KG.

Normally, the contact surfaces of the bearing inner rings comply with the requirements of a precise connection. For spacer sleeves and/or other special connecting components, we recommend designing the end face as per the bearing manufacturers' requirements in terms of roughness depth and form and location tolerances. This can help to avoid unwanted surface subsidence and associated pretension loss.

The overall rigidity of the connection between bearing, locknut, and shaft is influenced by a large number of parameters. They include not only characteristic material values but also the actual dimensions of the components used. Therefore, connection rigidity and resulting suitable revolution speed for locknuts depend on the case at hand. In case of any questions, please contact Spieth-Maschinenelemente GmbH & Co. KG.

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5 How to Assemble Spieth Locknuts

5.1 Precision-centering and aligning Spieth Locknuts

Reduce the assembly clearance by slightly tightening all clamping screws. This automatically centers the locknut and aligns the end face in a right angle to the shaft axis.

Use a commercial-grade screwdriver, a screw bit or a spanner with hexagon socket as drive geometry for removing the locknut's clearance and for tightening it.

The low tightening torque of the clamping screws while eliminating play has no influence on the acting axial load.

5.2 Tightening Spieth Locknuts

Tightening the locknut axially interlocks the connecting components. Normally, pretensioning torque M_V is based on the bearing's pretension force F_V , specified by the manufacturer. If custom pretension force is given for the thread drive, adjust pretensioning torque M_V of the locknut accordingly.

For custom pretensioning (e.g., a bearing or a hub), calculate required pretensioning torque M_V according to Formula 1 in Section 9 for your custom use case and enter it in Table 3.

To reduce subsidence in general, first tighten the locknut with an increased pretensioning torque $M_V = (1.2 \text{ to } 1.5) \cdot M_V$ against the planar support and then undo it before then using the relevant pretensioning torque M_V .

To tighten the locknut (if it is accessible radially), you need a commercial-grade hook spanner DIN 1810 Shape A (see Table 3 for size recommendations).

If the locknut is accessible only axially (because of your available space), use the grooves for a tool customised to your shaft geometry.

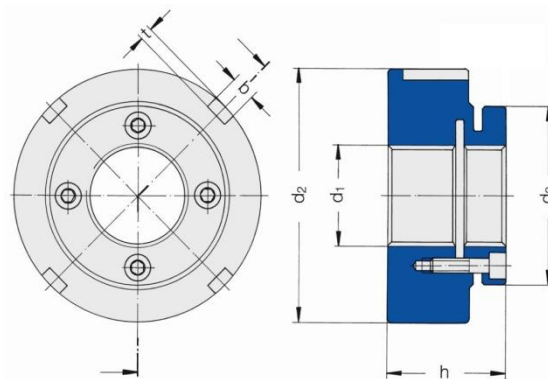


Fig. 4: Sectional view of Spieth locknut > M80

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Table 3: Assembly-related data for tightening Spieth locknuts to pretension the bearings

Name	Tool for grooves	Grooves for tool		Your custom use case (please fill in all applicable fields)			
	Hook spanner DIN 1810 [-]	Width x Depth x Length [mm]	Amount x angle [-]x[°]	Required pretension F _v [kN]	Factor A [mm]	Factor B [N]	Calculated pretensioning torque M _v [Nm]
MSW 20.28	A 40-42	6x2.5x10.5	4x90		1.344	1560	
MSW 20.40	A 52-55	7x3x12.5	4x90		1.344	936	
MSW 25.28	A 45-50	7x3x12.5	4x90		1.633	1560	
MSW 25.40	A 58-62	8x3.5x14	4x90		1.633	936	
MSW 30.28	A 52-55	7x3x12.5	4x90		1.921	1560	
MSW 30.44	A 68-75	8x3.5x14	4x90		1.921	936	
MSW 35.28	A 58-62	8x3.3x14	4x90		2.21	1560	
MSW 35.44	A 68-75	8x3.5x14	4x90		2.21	936	
MSW 40.28	A 58-62	8x3.3x14	6x60		2.5	1560	
MSW 40.44	A 68-75	8x3.5x14	6x60		2.5	936	
MSW 45.28	A 68-75	8x3.3x14	6x60		2.789	2340	
MSW 45.44	A 80-90	10x4x19	6x60		2.789	1404	
MSW 50.32	A 68-75	8x3.3x14	6x60		3.079	2340	
MSW 50.46	A 95-100	10x4x19	6x60		3.079	1404	
MSW 55.46	A 95-100	10x4x19	6x60		3.369	2286	
MSW 60.46	A 95-100	10x4x19	6x60		3.655	2286	
MSW 65.46	A 110-115	10x4x19	6x60		3.948	2286	
MSW 70.46	A 110-115	10x4x19	6x60		4.238	2286	

5.3 Locking Spieth Locknuts

Lock the locknut by tightening the clamping screws stepwise and crosswise until you have reached specified locking torque M_S (written on the component and/or in Table 4). This interlocks the thread flanks of the locknut's locking part and load part with the shaft thread. Intense clamping of the thread flanks during the locking process causes a high level of axial rigidity on the locknut.

This slightly reduces the pretension. However, the degree of this end face strain relief is reproducible and is easily compensated by using a pretensioning torque M_V to be calculated as per Formula 1 (see Section 9).

Table 4: Assembly-related data for tightening the clamping screws to lock the locknuts

Name	Tool	Clamping screws Amount x thread [-]x[-]	Locking torque M_S		
	ISK size [-]		1. Step (= 50%) M_{S050} [Nm]	2. Step (= 75%) M_{S075} [Nm]	Final torque (=100%) M_{S100} [Nm]
MSW 20.28	3	4xM4	1.5	2.2	2.9
MSW 20.40	3	4xM4	1.5	2.2	2.9
MSW 25.28	3	4xM4	1.5	2.2	2.9
MSW 25.40	3	4xM4	1.5	2.2	2.9
MSW 30.28	3	4xM4	1.5	2.2	2.9
MSW 30.44	3	4xM4	1.5	2.2	2.9
MSW 35.28	3	4xM4	1.5	2.2	2.9
MSW 35.44	3	4xM4	1.5	2.2	2.9
MSW 40.28	3	6xM4	1.5	2.2	2.9
MSW 40.44	3	6xM4	1.5	2.2	2.9
MSW 45.28	3	6xM4	1.5	2.2	2.9
MSW 45.44	3	6xM4	1.5	2.2	2.9
MSW 50.32	3	6xM4	1.5	2.2	2.9
MSW 50.46	3	6xM4	1.5	2.2	2.9
MSW 55.46	4	6xM5	3.0	4.5	6.0
MSW 60.46	4	6xM5	3.0	4.5	6.0
MSW 65.46	4	6xM5	3.0	4.5	6.0
MSW 70.46	4	6xM5	3.0	4.5	6.0

Use a commercial-grade screwdriver, a screw bit or a spanner with hexagon socket as drive (as for eliminating the locknut's play) to lock the locknut.

6 Operating Spieth Locknuts

Spieth locknuts provide permanently precise pretensioning and positioning of the bearing on a threaded spindle. Visually inspecting the locknuts and/or checking the clamping screws during general maintenance tasks means maintenance-free operation.

7 Disassembling Spieth Locknuts

If handled correctly, Spieth locknuts can be reused several times. Due to the adjustments made, once a locknut has been locked onto a spindle thread you can only reuse it on the same thread after they have been disassembled.

Caution!

Unlock all the clamping screws stepwise and crosswise to avoid overstraining the screws. Otherwise, the screws may fracture or the locknut or its adjoining components may be damaged.

To disassemble, proceed in reverse assembly order.

- 1. Unlock: Unlock by undoing the clamping screws stepwise and crosswise.
- 2. Undo: Undo locknut from system using suitable tools.
- 3. Unscrew: Unscrew locknut by hand from threaded spindle.

If used as intended the diaphragm will open the interlocked thread flanks during unlocking. This restored joint play makes it easy to unscrew the locknut manually without damaging the threaded spindle.

Please note:

Following complete disassembly, slightly (manually) tighten the loosened clamping screws until they are flush. In any case, avoid tightening the clamping screws without a fully covered nut thread.

To enable later reuse, clean, preserve, and store Spieth locknuts correctly. If non-original Spieth spare parts are used, Spieth-Maschinenelemente GmbH & Co. KG assumes no liability or warranty.

8 Disposing of Spieth Locknuts

You can easily reorder Spieth locknuts by entering the component designation imprinted on the nut body and the batch number.

Locknut body and clamping screws of a Spieth locknuts are made of steel. At the end of their operating life, clean metal parts and dispose of as scrap metal.

Please note:

For environmental reasons, please comply with applicable statutory regulations and guidelines when disposing of these products.

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9 Calculating Pretensioning Torque M_V of Spieth Locknuts

Calculating pretensioning torque M_V takes into account the friction in the nominal thread and on the contact surface. It is based on a friction coefficient of $\mu_A = 0.1$. As the friction ratio occurring on the contact areas depends on a variety of factors, the calculated values are a non-committal recommendation.

Furthermore, Factor B mentioned above, specified in Table 3, and specific to the locknut, is taken into account for compensating end face strain relief.

$$T_P = \frac{(F_V + B) \cdot (A + \mu_A \cdot r_A)}{1000} \quad \text{(Formula 1)}$$

with	M_V	[Nm]	Pretensioning torque of the locknut
	F_V	[N]	Required axial pretensioning force of the screw connection
	B	[N]	Allowance specific for locknut, compensates end face strain relief of the locking process
	A	[mm]	Constant; includes calculation factors for the relevant thread (catalogue value)
	μ_A	[-]	Friction coefficient for the end face of the locknut (approximated value $\mu_A = 0.1$ steel/steel)
	r_A	[mm]	Effective friction radius for end face of the locknut

Please note:

Visit www.spieth-me.de to use our online calculator and easily calculate your pretensioning torque M_V