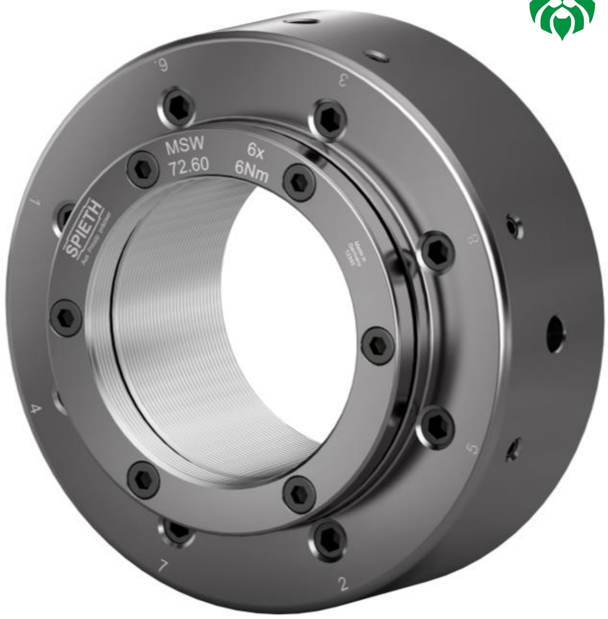
Original version of the design guide



For	Series	Components
Spieth locknuts (precision locknuts)	MSW from M72	MSW 72.60 MSW 85.60 MSW 105.66 MSW 125.72 MSW 140.78

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; we can also e-mail them.

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

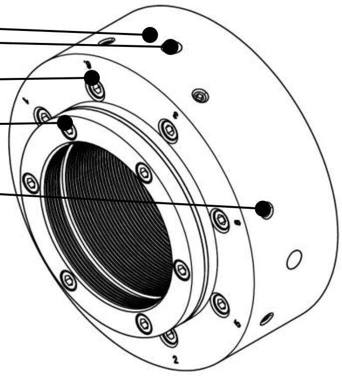
Spieth locknuts bodies

Radial boreholes for pin spanner DIN 1810 - B

Spieth pretensioning bolts

Spieth clamping screws

Locking thread pin



Identifying feautures (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.

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 Ø d_1 5H x pitch [-]x[mm]	Adm. stat. axial load $F_{ax,stat}$ [kN]	Axial run-out t_{plan} (=IT4) [µm]
K-10407201	MSW 72.60	M72x1.5	749	8
K-10408501	MSW 85.60	M85x2	1050	10
K-10410501	MSW 105.66	M105x2	1100	10
K-10412501	MSW 125.72	M125x2	1600	12
K-10414001	MSW 140.78	M140x3	2000	12

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.

3 Design of Spieth Locknuts

Spieth MSW series locknuts are made of steel with high stability (approx. 650N/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.

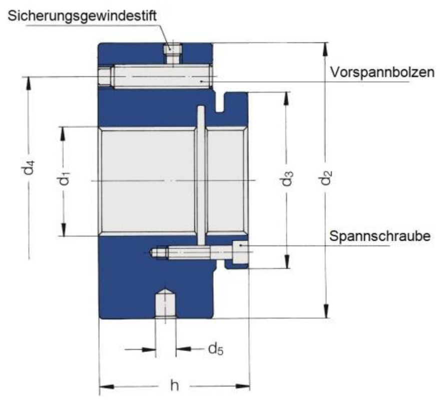


Fig. 3: Sectional view Spieth locknut > M80

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 Ø d_1 5H x pitch [-]x[mm]	Outer Ø d_2 [mm]	Length h [mm]	Weight m [kg]	Moment of inertia J [kg cm²]
MSW 72.60	M72x1.5	135	60	3.800	10712.916
MSW 85.60	M85x2	160	60	5.317	21037.878
MSW 105.66	M105x2	190	66	8.177	46439.753
MSW 125.72	M125x2	215	72	10.691	80101.528
MSW 140.78	M140x3	240	78	14.864	138178.262

4 Dimensioning of Locknut Connection

Bolting torque M_B 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.

5 Design of Connecting Components

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.

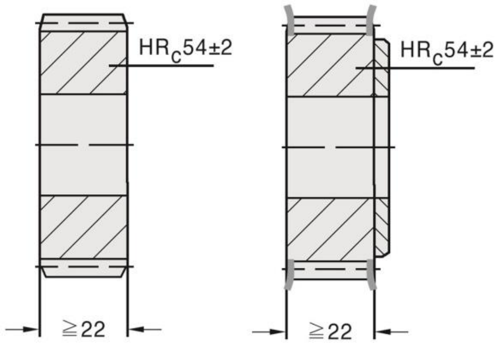


Fig. 4: Design of Connecting Components

6 How to Assemble Spieth Locknuts

6.1 Precision- centering & aligning and tightening 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.

Then apply the clamping nut on the planar support. Use a commercial-grade hook spanner DIN 1810 Shape B (see Table 3 for size recommendations).

Lock the locknut on the shaft by tightening the clamping screws stepwise and crosswise (written on the component and/or in Table 3). This interlocks the thread flanks of the locknut's locking part and load part with the shaft thread.

Table 3: Assembly-related data for tightening the clamping screws to fasten Spieth locknuts

Name	Tool for radial boreholes	Radial boreholes for tool	Clamping screws		Locking torque T_L		
	Hook spanner DIN 1810 [-]	Amount x Ø n x d_5 [-]x[mm]	Tool ISK size [-]	Amount x thread [-]x[-]	1. Step (= 50%) T_{L050} [Nm]	2. Step (= 75%) T_{L075} [Nm]	Final torque (=100%) T_{L100} [Nm]
MSW 72.60	A 135-145	4x8	4	6xM5	3	4.5	6.0
MSW 85.60	A 155-165	4x8	5	6xM6	5	7.5	10.0
MSW 105.66	A 180-195	4x10	5	6xM6	5	7.5	10.0

Name	Tool for radial boreholes	Radial boreholes for tool	Clamping screws		Locking torque T_L		
	Hook spanner DIN 1810 [-]	Amount x Ø n x d_5 [-]x[mm]	Tool ISK size [-]	Amount x thread [-]x[-]	1. Step (= 50%) T_{L050} [Nm]	2. Step (= 75%) T_{L075} [Nm]	Final torque (=100%) T_{L100} [Nm]
MSW 125.72	A 205-220	4x10	5	6xM6	5	7.5	10.0
MSW 140.78	A 230-245	4x10	5	8xM6	5	7.5	10.0

6.2 Pretensioning and locking pretensioning bolts

Pretensioning the nut axially interlocks the connecting components. Normally, bolting torque M_B is based on the bearing's pretension F_V specified by the manufacturer. If custom pretension is given for the thread drive, adjust bolting torque M_B of the pretensioning bolts accordingly.

For custom pretensioning (e.g., a bearing or a hub), calculate required bolting torque M_B according to Formula 1 in Section 10 for your custom use case and enter it in Table 5.

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

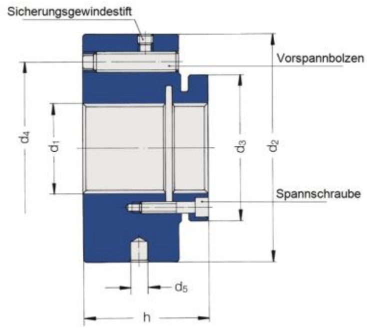


Fig. 5: Sectional view of Spieth locknut > M80

Table 4: Geometric data for tightening and locking the locknuts' pretensioning bolts

Name	Pretensioning bolts				Locking thread pins
	Tool ISK size [-]	Amount x thread [-]x[-]	Pin Ø d_6 [mm]	Divided circle Ø d_4 [mm]	Tool ISK size [-]
MSW 72.60	5	8xM10	7	105	3
MSW 85.60	6	8xM12	8.5	124	4
MSW 105.66	6	9xM12	8.5	150	4
MSW 125.72	8	9xM16	12	172	4
MSW 140.78	8	9xM16	12	196	4

Table 5: Assembly-related data for tightening and locking the locknuts' pretensioning bolts

Your use case—please fill in all applicable fields:							
			Calculated bolting torque T_B				
Name	Required pretension F_V [kN]	Factor A [mm]	1. Step (= 50%) M_{B050} [Nm]	2. Step (= 75%) M_{B075} [Nm]	Final torque (= 100%) M_{B100} [Nm]	Increased torque M_{Be} [Nm]	Max. admissible torque $M_{B,max}$ [Nm]
MSW 72.60		0.92064					34
MSW 85.60		1.09913					60
MSW 105.66		1.09913					60
MSW 125.72		1.42613					140
MSW 140.78		1.42613					140

Use a commercial-grade screwdriver, a screw bit or a spanner with hexagon socket as drive geometry (as for removing the nut's play) to lock the pretensioning bolt using locking thread pins.

7 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.

8 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 the pretensioning bolts by undoing the locking thread pins.
- 2. Declamping: Slightly undo pretensioning bolts; then declamp them stepwise in the specified order.
- 3. Undo: Slightly undo clamping screws; then declamp them stepwise and crosswise.
- 4. 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.

If non-original Spieth spare parts are used, Spieth-Maschinenelemente GmbH & Co. KG assumes no liability or warranty.

9 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.

10 Calculating Bolting Torque T_B of Spieth Locknuts

Calculating bolting torque T_B takes into account the friction in the thread and on the contact surface. It is based on a friction coefficient of $\mu_D = 0.13$. As the friction ratio occurring on the contact points depends on a variety of factors, the calculated values are a non-committal recommendation.

$$M_B = \frac{F_V \cdot (4 \cdot A + \mu_D \cdot d_6)}{n \cdot 1000} \qquad \text{(Formula 1)}$$

with	T_B	[Nm]	Bolting torque of the pretensioning bolt
	F_V	[N]	Required axial pretensioning force of the screw connection
	A	[mm]	Constant; includes calculation factors for the relevant thread (catalogue value)
	μ_D	[-]	Friction coefficient for contact surface of pretensioning bolt (approximated value $\mu_D = 0.13$)
	d_6	[mm]	Pin Ø d_6 of pretensioning bolt (catalogue value)
	n	[-]	Number of pretensioning bolts