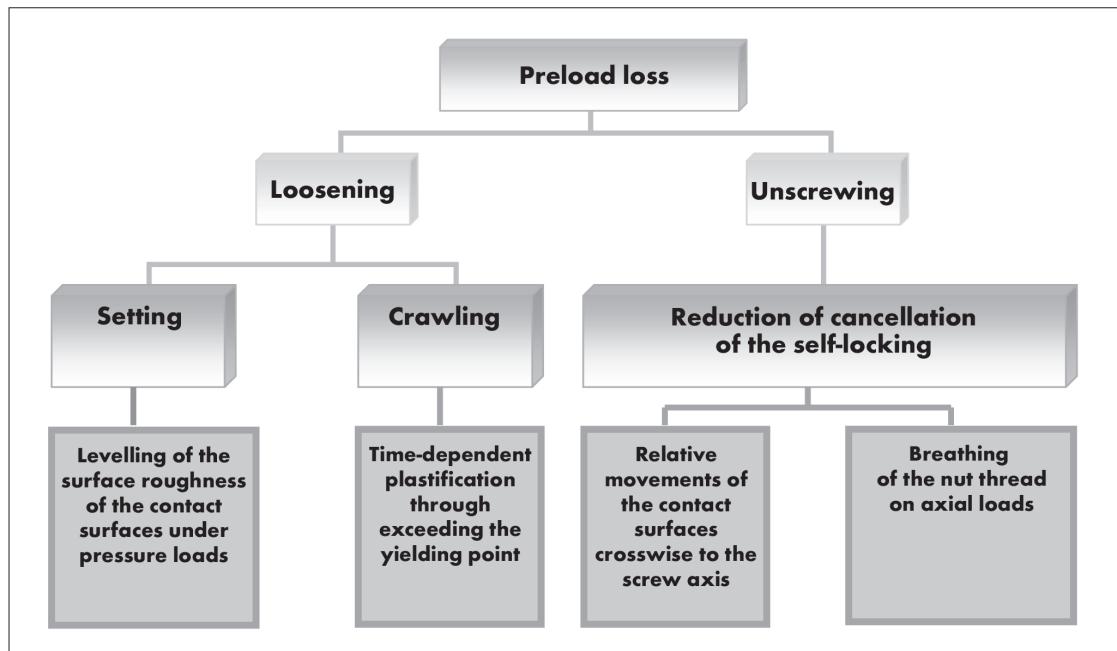


7. SECURING ELEMENTS

7.1 General

To select the right securing element it is necessary to consider the screw assembly as a whole. In particular, the hardness of the materials that are to be braced and any dynamic loads that may have an effect on the screw assembly must be considered when choosing a securing element.

7.2 Causes of preload force loss



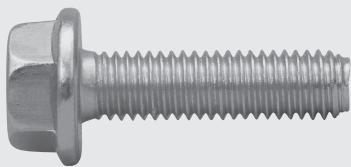
7.3 Methods of functioning

7.3.1 Securing against loosening

Screw assemblies can be prevented from loosening by means of suitable construction measures. This may mean using expansion screws or long screws, or increasing the preload force through screws with greater strength. In the latter case in particular, attention must be paid to the surface pressing on the support. A flanged screw, or moulding a suitable hard washer to the head, or using such a washer, reduces the surface pressure and prevents loosening.



Sems screw



Flange screw



Lock screw



Ribbed washer



Self-locking screw with serrated bearing

7.3.2 Securing against loosening

Loose-proof fasteners effectively prevent automatic unscrewing under the heaviest dynamic loads. With the exception of slight unavoidable setting amounts the preload force in the connection is retained. Retention methods to prevent unscrewing are divided into

- locking at the bearing
- bonding in the thread

Locking at the bearing takes place by means of the locking teeth that embed into the bearing material in the direction of unscrewing by means of tapered edges, or by means of symmetrical securing ribs that retain the preload force effectively on hard and soft materials.

With bonding in the thread it is possible to work with anaerobically bonding liquid plastic retention devices, or to use screws with micro-encapsulated adhesives. Screws with micro-encapsulated precoat are standardised in accordance with DIN 267/Part 27.



Disc-lock washer



Micro-encapsulation



Liquid adhesives

7.3.3 Securing against loss

This group of securing devices comprises products that initially are unable to prevent automatic loosening, but after a more or less large preload force loss prevent complete unscrewing, so that the connection does not fall apart.



All-metal lock nut



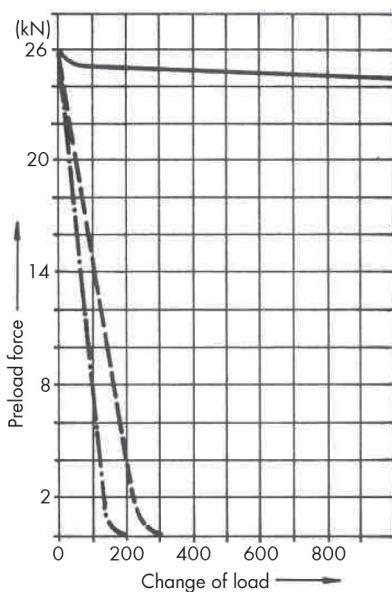
Lock nut with plastic ring



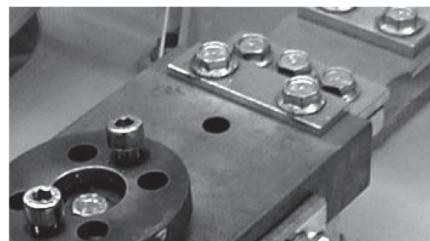
Optisert insert

7.4 How securing elements work

The action of a securing element can be tested on a vibration test stand (Junker test).



- Secured screw
- - - Secured with spring washer
- · - Unsecured screw



The test results in three categories.

7.4.1 Ineffective securing elements

The products listed below have no securing effect whatsoever, either with regard to loosening, or with regard to unscrewing. Use with screws in strength class ≥ 8.8 is not advised.

- Spring washers DIN 127, DIN 128, DIN 6905, DIN 7980
- Wave washers DIN 137, DIN 6904
- Toothed washers DIN 6797, DIN 6906
- Serrated lock washers DIN 6798, DIN 6907
- Tab washers with external tab or two tabs DIN 432, DIN 463
- Hex castle nuts DIN 935, DIN 937 with cotter pins DIN 94

7.4.2 Loss-proof fasteners

The category of loss-proof fasteners comprises products that initially are unable to prevent automatic loosening, but after an unspecified large preload force loss prevent complete unscrewing, so that the connection does not fall apart. This category includes, for example, nuts with a polyamide ring insert (lock nuts), all-metal lock nuts or screws with a thread clamping insert in accordance with DIN 267/Part 28.

7.5 Measures for securing screws

7.5.1 Loosening

Securing type	Functional principle	Securing element	Information on application		
Loose-proof			Screws/nuts	Washers	
			Strength class	Hardness class	
	Reduce the surface pressure if braced together	Washer in accordance with DIN EN ISO 7089 DIN EN ISO 7090 DIN 7349 DIN EN ISO 7092 DIN EN ISO 7093-1	200 HV	300 HV	
			8.8/8 10.9/10 A2-70/A2-70	Yes No Yes	Yes Yes No
	Elastic if braced together	Heavy-duty locking washer in accordance with DIN 6796, profiled locking washer serrated contact washer	To reduce setting max. 20 μm elastic force has to be aligned to the preload force.		

Thread grooving screws also belong to the group of loss-proof fasteners.

7.4.3 Loose-proof fasteners

Loose-proof fasteners effectively prevent automatic unscrewing under the heaviest dynamic loads. With the exception of slight unavoidable setting amounts, the preload force in the connection is retained. Retention methods to prevent unscrewing are divided into

- locking at the bearing
- bonding in the thread

Locking at the bearing takes place by means of the locking teeth that embed into the bearing material in the direction of unscrewing by means of tapered edges, or by means of symmetrical securing ribs that retain the preload force effectively on hard and soft materials.

With bonding in the thread it is possible to work with anaerobically bonding liquid plastic retention devices, or to use screws with micro-encapsulated adhesives. Screws with micro-encapsulated pre-coating are standardised in accordance with DIN 267/Part 27.

7.5.2 Automatic unscrewing

Securing type	Functional principle	Securing element	Information on application
Unscrewing-proof	Blocking, in part braced together	Lock screw, lock nuts	To be used where screw connections with high preload forces are exposed to changing transverse loads. Not on hardened surfaces.
		Profiled locking washers Tapered washer pair Ribbed washer Profile ring (material A2)	Hardness of the contact surface must be lower than that of the contact surface of the screw and nut and of the elements that are tightened. Securing elements are only effective if they are arranged directly under the screw head and the nut. For electrical applications.
	Adhesive	Micro-encapsulated adhesive in accordance with DIN 267-27	To be used where screw connections with high preload forces are exposed to changing transverse loads and hardened surfaces do not permit the use of locking fasteners. Temperature-dependent. Use with electrical applications not recommended. If adhesives are used the threads must not be lubricated.
		Liquid adhesive	The temperature limits for the adhesives that are used must be observed. Use with electrical applications not recommended. If adhesives are used the threads must not be lubricated.
Loss-proof	Clamping	Nuts with clamp DIN EN ISO 7040, DIN EN ISO 7042, Inserts DIN 8140 Screws with plastic coating in the thread in accordance with DIN 267-28	To be used where the primary aim of the screw assemblies is to retain a residual preload force and to secure the connection against falling apart. The temperature dependency must be noted for nuts and screws with a plastic insert. With electrical applications there may not be any chip formation through all-metal nuts.