



Safeguard Against Loosening

Adhesive coatings



“Adhesive coatings create a high level of protection against independent loosening”



ADHESIVE COATINGS

Safeguard Against Loosening

Adhesive coatings are the most secure preliminary coatings for threaded parts with increased safety requirements.

Threadlocking

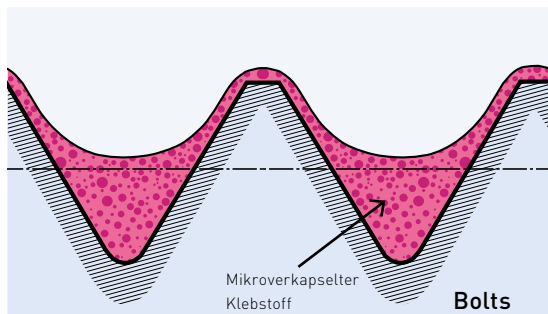
Screw connections generally fail due to a loss of preload force. The main cause for this is the loss of the preload force due to independent loosening.

Increased Security

Independent loosening is caused by all kinds of dynamic loads, such as vibrations or temperature changes. Too small of a clamping force and poorly fitting surfaces allow for relative movements, which increase the risk of independent loosening.

These alternating loads lead to short-term friction-free states, which moves the screw relative to the nut. In sum, these tiny movements lead to a screw connection becoming loose.

Independent loosening can be prevented by using suitable screw securing means. Adhesive coatings are one type of securing. These adhesive coatings are always all-around coatings. These act primarily as anti-loosening safeguards, which comply with the standard DIN 267 - part 27.



Functional Principle

The coatings consist of the smallest microcapsules. When screwing the coated threaded parts into the counter-thread, the microcapsules are destroyed due to pressure and shear loads.

The curing then starts immediately after assembly. A sufficient functional strength is usually achieved after 6 hours. The full curing is achieved after 24 hours.

Adjustment and tightening processes should occur within 5 minutes. Otherwise, the already curing polymerization microstructure can be damaged.

Advantages of Adhesive Coatings

- Reliable safeguard against loosening
- Additionally sealing
- Dry, dry to handle and ready for use at any time
- No equipment, e.g. dosing devices
- Can be used for all materials
- For virtually all surfaces
- Insensitive to oil and grease after curing
- Process reliability
- Captive component of the connection element
- Simple and safe assembly
- Cannot be forgotten

ADHESIVE COATINGS

Product Properties

precote®

precote® offers solutions for securing and sealing. The products developed specifically for the pre-coating of internal and external threads are based on the unique microencapsulation technology, which uses an acrylate system.

The adhesive applied to the thread remains inactive prior to use and is dry to handle. The adhesive is first activated when being screwed in, cures at room temperature and offers a reliable lock and/or seal.

Different applications can be realized with three different types. Other products are available by request for customer-specific applications.



precote® 30 (yellow)

The thread sealant and medium-strength thread lock.
Thread friction coefficient of 0.1 – 0.15.
Temperature resistant -60° – 150° C.
Easy to disassemble.

precote® 80 (red)

Universal, high-strength thread lock.
Thread friction coefficient > 0.25.
Temperature resistant -60° – 170° C.
Also suitable for sealing tasks.

precote® 85 (turquoise)

Universal, high-strength thread lock with low thread friction coefficient of 0.1 – 0.15.
Temperature resistant -60° – 150° C.
Also suitable for sealing tasks.

Scotch - Grip™ 2353

Scotch - Grip™ 2353 is a microencapsulated screw lock adhesive based on epoxy resin, which was specifically developed for the pre-coating of screws. After the coating, the adhesive remains inactive until it is activated by the capsule breakage when screwed in and then cures at room temperature.



Scotch - Grip™ 2353

Universal, high-strength thread lock.
Thread friction coefficient 0.13 – 0.19.
Temperature resistant -30° – 110° C.
Also suitable for sealing tasks.

Other Uses

In addition to bonding, sealing against oil, water and fuel also occurs. After the complete curing, the adhesive is a reliable screw lock against independent loosening. Due to the high strength, it is only possible to disconnect the cured connection with difficulty.

Coating, Construction and Assembly Instructions

Coating Layer and Assembly

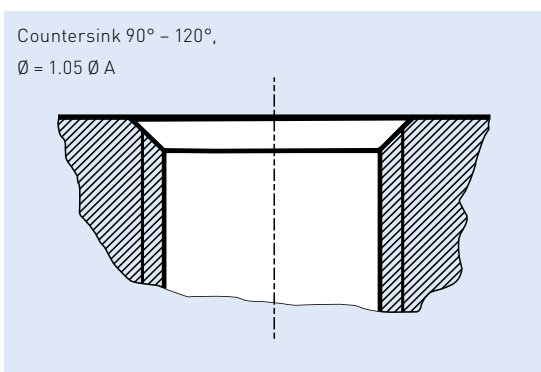
Coating layer according to standard

Unless defined otherwise, the coating layer and length are applied according to DIN 267-27. According to this standard, the coating has a length of about 1x the screw diameter A. The first two to three thread turns are free of the coating to make it easier to screw in.

Assembly

The assembly of precote® or Scotch – Grip™-coated screw occurs mechanically or manually with conventional tools.

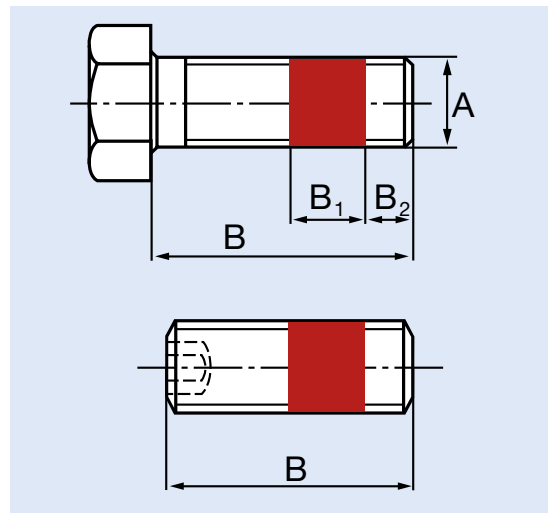
The female thread must be free of dust, oil and grease and requires a countersink (90° – 120°) or at least 1.05 x the nominal diameter to prevent a peeling of the coating when screwing in.



Required countersink pursuant to DIN 76

Other Useful Information

- precote® and Scotch – Grip™ are 2-component adhesives and do not require either an air seal or metal ions for curing.
- precote® and Scotch – Grip™ coatings can also be used in conjunction with plastic screws. However, the achievable breakaway torques with plastic screws is less than with steel screws.
- Contamination of the coatings is to be avoided, for example from oil.
- A necessary top coat, for example with an integrated lubricant for defined frictional coefficients, should be applied after the precote® coating.
- For sealing applications, at least 4 thread turns must be coated and installed overlapping to achieve a reliable sealing effect.



Coating layer and length pursuant to DIN 267-27
Length B min 10 mm
Length B1 corresponds to approx the diameter of A
Length B2 about 2 – 3 thread turns

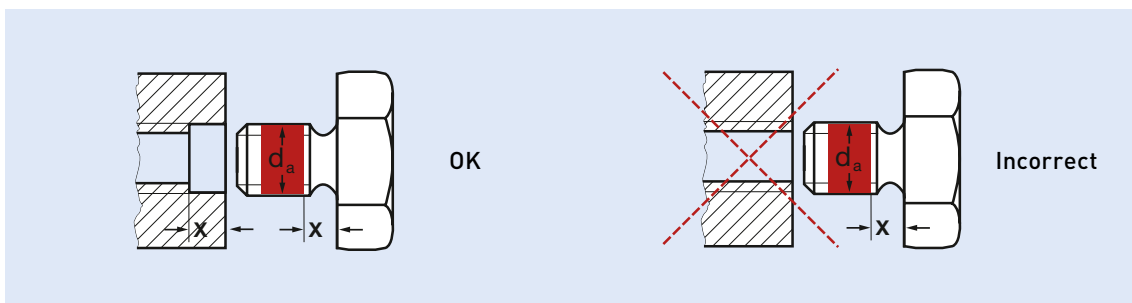
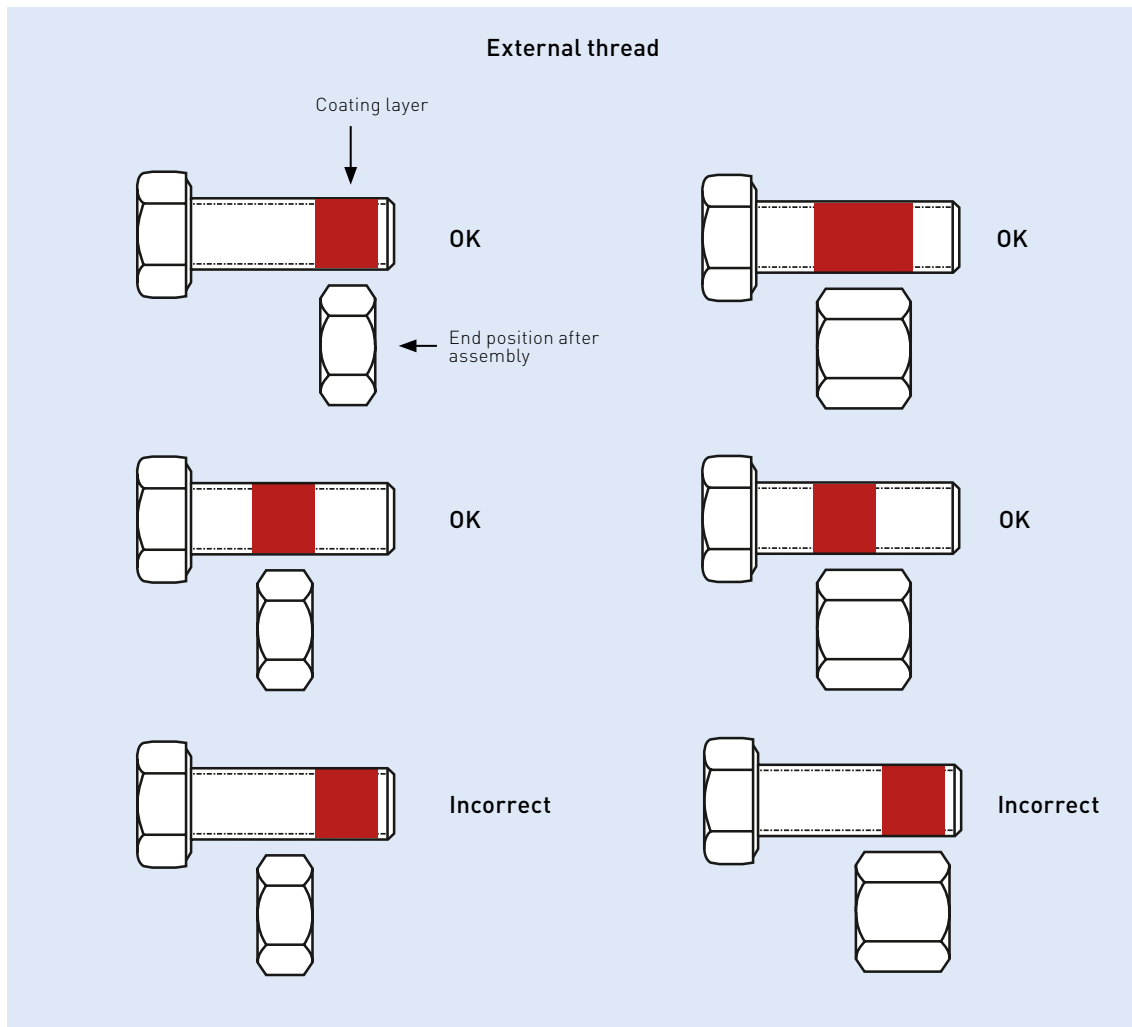
Coating Layer According to Function

To ensure the proper function, it must be ensured that the coating is in the correct position. The standard-compliant coating layer is not always in the correct place for the function.

If the screw with coating is screwed into a blind hole thread too far where the functional coating is not located at the correct location, then the adhe-

sive distributes across too many thread turns and loses its functionality.

The same applies to screwing on a nut. If screwed beyond the coating here, the functional coating loses its effect.



Red = coating layer of the functional coating
Location of the nut = expected location of the nut after assembly

Torque Testing Without Pre-Load

Only for monitoring production, according to DIN 267 part 27, or for components that cannot build up any preload force, such as set screws.

1. The tolerance compliance of the nut is checked prior to testing.
2. Assemble the screw into the nut at a maximum of 30rpm making sure that the coating area is completely covered. The maximum screw-in torque M_{Ein} is measured.

3. Allow the adhesive to curing at room temperature (23 +/- 5° C) for 24 hours.
4. Remove the nut at a maximum of 30rpm measuring the breakaway torque M_{LB} and the maximum loosening torque M_{OUT} .

**Test torques without pre-load in Nm for screws
(pursuant to DIN 267-27)**

Screw ISO 6g	Screw-in torque M_{in} max. (Nm)	Breakaway torque M_{LB} min. (Nm)	Loosening torque M_{OUT} max. (Nm)
M3	0.1	0.2	1.5
M4	0.2	0.4	3.0
M5	0.5	1	6.5
M6	0.8	1.8	10
M8	1.5	4	26
M10	3	10	55
M12	5	16	95
M14	9	22	160
M16	11	35	250
M18	12	40	335
M20	14	45	500
M22	16	65	800
M24	18	90	1050
M27	21	120	1300
M30	25	165	1700
M33	28	210	2400
M36	30	280	3000
M39	35	330	4000

M_{in} Screw-in torque

M_{LB} Breakaway torque

M_{OUT} Loosening torque

Torque testing without pre-load to monitor production pursuant to DIN 267, part 27.

Torque Testing with Pre-Load

1. The tolerance compliance of the nut is checked prior to testing.
2. Assemble the screw into the nut, bearing against a clean and dry 200 HV washer and sleeve at a maximum of 30rpm per DIN 125 part 2. Tighten to the specified torque making sure that the nut is completely in the coated area.
3. Allow the adhesive to cure at room temperature (23 +/- 5° C) for 24 hours.
4. Remove the nut at a maximum of 30rpm measuring the breakaway torque and the loosening torque. The resulting determined ratio M_{LB} / M_A may not fall below the value specified in the table under laboratory conditions. The loosening torque may not exceed the specified value.

**Test torques with pre-load in Nm for screws
(pursuant to DIN 267-27)**

Screw ISO 6g	Test tightening torque $M_A^{a,b}$		Loosening torque M_{OUT} max. (Nm)	Ratio M_{LB} / M_A
	5.6/5.8	8.8/10.9/12.9		
M3	0.6	1.2	1.5	≥ 0.9
M4	1.3	2.8	3.0	
M5	2.6	5.5	6.5	
M6	4.5	9.5	10	
M8	11	23	26	
M10	22	46	55	
M12	38	79	95	
M14	60	125	160	
M16	90	195	250	
M18	128	280	335	
M20	176	390	500	
M22	240	530	800	
M24	310	670	1050	
M27	460	1000	1300	
M30	620	1350	1700	
M33	825	1850	2400	
M36	1100	2350	3000	
M39	1400	3000	4000	

M_A tightening torque

M_{LB} breakaway torque

M_{OUT} Loosening torque

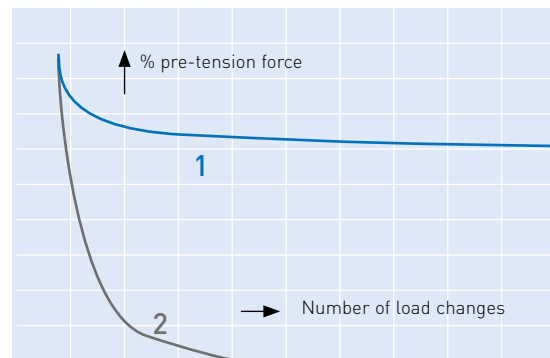
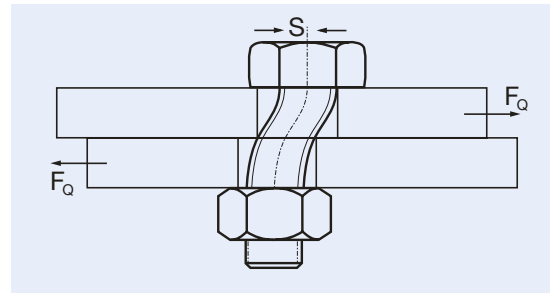
a) Determined based on a total friction coefficient $\mu_{ges} \approx 0.12$ with 90% utilization of the minimum values of the yield strength (5.6 / 5.8) resp. the yield point (8.8/10.9/12.9) of the lowest strength class.

b) The table values for 5.6 / 5.8 apply for INOX screws according to DIN EN ISO 3506-1 and DIN267-13.

Testing the Vibration Strength

Two plates braced against each other with a screw are subjected to a forced vibration (relative movement). Unsecured screws completely loosen within a short period of time.

1. precote® or Scotch-Grip™-coated screws with an adhesive coating have a high clamping force after the usual setting losses, because the screw is adhered and cannot loosen.
2. After a few load changes, uncoated screws lose the pre-load, the connection loosens, the screw loosens and can get lost.

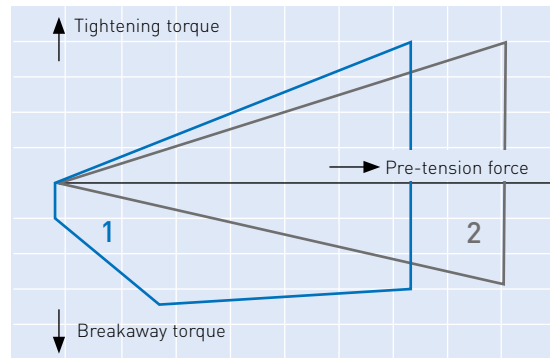


Preload force under continuous load (schematic representation)

Friction value measurement

When tightening a screw, torque and pre-tension force increase depending on the thread friction value. Depending on the friction value, different pre-tension forces are generated with the same tightening torque.

1. precote® or Scotch-Grip™-coated screws with an adhesive coating are secured against loosening. The breakaway torque reaches over 90% of the tightening torque (high-strength). The adhesive residue in the thread generates little friction when loosening.
2. For uncoated screws, the breakaway torque reaches about 70 to 80% of the tightening torque. There is no resistance when loosening. The torque and the pre-tension force reach a zero point.



Torque curve (schematic representation)

OVERVIEW

Properties

precote® / Scotch-Grip™ 2353

The following table provides an overview of the benefits and properties of the adhesive products precote® and Scotch-Grip™ 2353.

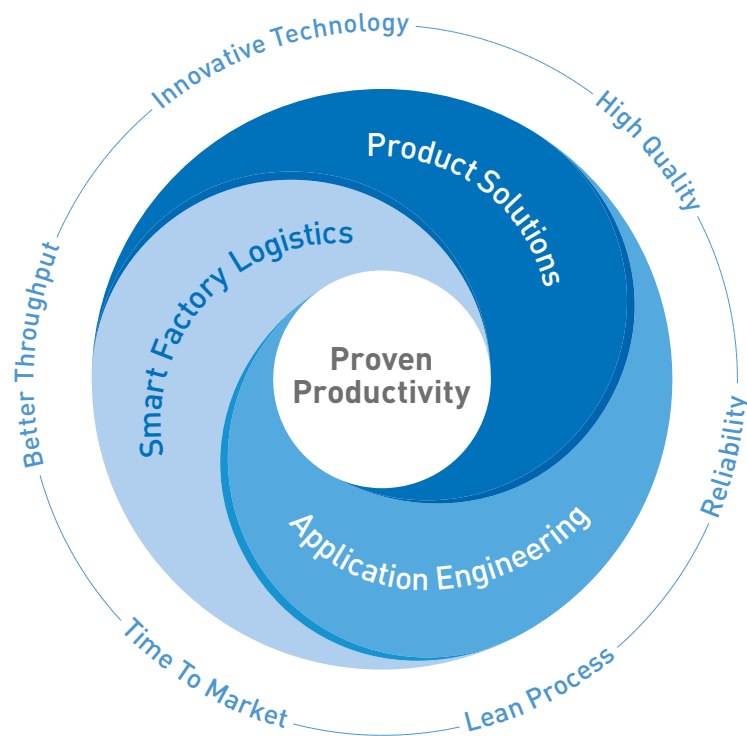
Total overview
Screws bigger than M3
Nuts M4 to M22

Coating	precote® 30	precote® 80	precote® 85	Scotch-Grip™ 2353
Color	yellow	red	turquoise	blue
Chemical basis	Acrylate	Acrylate	Acrylate	Epoxy resin
Temperature range	-60 to 150° C	-60 to 170° C	-60 to 170° C	-30 to 110° C
Strength	Medium	High	High	High
Hand-tight after about	15 min	15 min	15 min	No information
Functionally strong after about	6 h	6 h	6 h	6h
Final strength after	24 h	24 h	24 h	24 h
Thread friction coefficient $\mu_{\text{thrd.}}$ *	0.10 to 0.15	> 0.25	0.10 to 0.15	0.13 to 0.19
Seal	up to 250 bar	up to 400 bar	up to 400 bar	No information
Application	Particularly suited for internal recess drive screws and for the electrical industry. Very often used for its sealing properties.	The universal type for all threaded parts with very high locking effect. Suited for increased usage temperatures and insensitive to humidity.	Particularly suited for all screw connections that are tightened with a controlled thread friction coefficient.	Reliable screw locking against independent loosening in the temperature range of up to 90° C and in the short term up to 110° C.
Shelf life	4 years at room temperature, stored dry			

*All specifications related to screws M10 ISO4017-8.8, black oxide
Nuts M10 ISO4017-10 black oxide
Value < M10 and > M10 correspond to DIN 267-27

PROVEN PRODUCTIVITY – A PROMISE TO OUR CUSTOMERS

The strategy for success



From years of cooperation with our customers we know what achieves proven and sustainable impact. We have identified what it takes to strengthen the competitiveness of our customers. Therefore we support our customers in three strategic core areas.

Firstly, when finding optimal **product solutions**, that is in the evaluation and use of the best fastening part for the particular function intended in our customers' products.

Secondly, from the moment in which our customers begin to develop a new product, our **application engineering** delivers the smartest solutions for all possible fastening challenges.

And thirdly, optimising our clients' productions in a smart and lean way with **Smart Factory Logistics**, our methodology, with intelligent logistics systems and tailor-made solutions.

Understood as a promise to our customers, "Proven Productivity" contains two elements: Firstly, that it demonstrably works. And secondly, that it sustainably and measurably improves the productivity and competitiveness of our customers.

And this for us is a philosophy which motivates us every day to always be one step ahead.

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