Technical delivery conditions for fasteners

Part 28: Self-locking steel screws, bolts and studs

DIN 267-28

ICS 21.060.10

Supersedes March 1990 edition.

Mechanische Verbindungselemente – Teil 28: Schrauben aus Stahl mit klemmender Beschichtung – Technische Lieferbedingungen

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Foreword

This standard has been prepared by Technical Committee *Schrauben mit klebenden oder klemmenden Beschichtungen* of the *Normenausschuss Mechanische Verbindungselemente* (Fasteners Standards Committee).

Amendments

This standard differs from the March 1990 edition in that it has been completely revised.

Previous edition

DIN 267-28: 1990-03.

All dimensions are in millimetres.

1 Scope

This standard specifies requirements and methods of test for sizes M 3 to M 16 self-locking steel bolts, screws and studs ('bolts', for short), with ISO metric screw thread as in DIN ISO 261, assigned to property classes as in DIN EN ISO 898-1, for use at service temperatures ranging from –50 °C to +120 °C and, in special applications, up to 150 °C or 200 °C.

This standard does not cover bolts with a coating that contains friction-reducing agents or to which such agents have been subsequently applied, or the application of which requires additional machining.

2 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

Continued on pages 2 to 6.

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original should be consulted as the authoritative text.

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DIN 50011-12	Artificial climates in technical applications – Air temperature as a climatological quantity in controlled-atmosphere test installations
DIN EN 20273	Fasteners – Clearance holes for bolts and screws (ISO 273 : 1979)
DIN EN ISO 898-1	Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs (ISO 898-1 : 1999)
DIN EN ISO 4032	Hexagon nuts, style 1 – Product grades A and B (ISO 4032 : 1999)
DIN EN ISO 4753	Fasteners – Ends of parts with external ISO metric screw thread (ISO 4753 : 1999)
DIN EN ISO 7089	Plain washers – Normal series – Product grade A (ISO 7089 : 2000)
DIN EN ISO 8673	Hexagon nuts, style 1, with metric fine pitch thread – Product grades A and B (ISO 8673 : 1999)
DIN ISO 261	ISO general purpose metric screw threads – General plan (ISO 261 : 1998)

3 Concepts

3.1 Self-locking bolt

Bolt (screw or stud) provided with an adhesive coating applied to the thread which, when the bolt is tightened, is designed to prevent disengagement. The bolt may either be coated over its whole circumference or the coating applied locally, in the form of strips or spots.

3.2 Screw-in torque

Torque measured when a bolt is driven into a test nut (designated by M_{in}).

3.3 Input torque

Torque required to tighten a bolt to a level of stress as given in table 1 (designated by M_A).

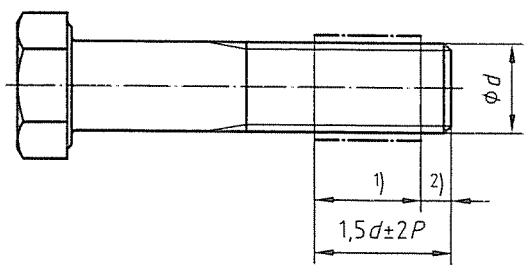
3.4 Loosening torque

Torque measured after the breakaway point when unscrewing bolts with a locking coating (designated by M_{out}).

4 Dimensions and designation

4.1 Standard coating

Unless otherwise specified, the coating shall cover a zone, measured from the bolt end, of length equal to 1,5 $d \pm 2\ P$*). The first two or three turns of thread should be free from coating material to facilitate bolting. Coating residue in these turns is permitted unless this adversely affects bolting.



Key:

d Nominal thread diameter

1) Zone to be covered by the coating.

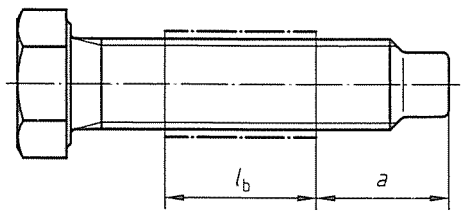
2) Two or three turns of thread left uncoated.

Figure 1: Length and position of coated zone on bolts with standard coating

*) P = pitch.

4.2 Non-standard coating

If, for design reasons, a different length, l_b, or distance from the bolt end, *a*, of the coated zone is required (cf. figure 2), both dimensions shall be indicated in the designation (cf. subclause 4.3), with l_b being given a tolerance equal to ± 2 *P*.



Key:

l_b Length of coated zone

a Distance of coated zone from bolt end

Figure 2: Length and position of coated zone on bolts with non-standard coating

4.3 Designation

The designation of self-locking bolts conforming to this standard shall include the following items, given in the order below:

a) symbol 'KL' to denote a self-locking bolt;

b) service temperature (for bolts suitable for use at temperatures up to 150 °C or 200 °C);

c) values of l_b × *a*, in mm, where appropriate.

Examples of designation

EXAMPLE 1:

Designation of an M 12 self-locking steel bolt (KL), with a nominal length, *l*, of 80 mm (80), of property class 8.8 (8.8), for use at temperatures up to 150 °C:

Bolt DIN... – M 12 × 80 – 8.8 – KL

EXAMPLE 2:

Designation of an M 12 self-locking steel bolt (KL), with a nominal length, *l*, of 80 mm (80), with long dog point (LD) as in DIN EN ISO 4753, of property class 8.8 (8.8), with a length, l_b, of 30 mm and a distance from the bolt end, *a*, of 10 mm (30 × 10), for use at temperatures up to 150 °C:

Bolt DIN... – M 12 × 80 – LD – 8.8 – KL – 30 × 10

EXAMPLE 3:

Designation of an M 12 self-locking steel bolt (KL), with a nominal length, *l*, of 80 mm, with long dog point (LD) as in DIN EN ISO 4753, of property class 8.8 (8.8), with a length, l_b, of 30 mm and a distance from the bolt end, *a*, of 10 mm (30 × 10), for use at temperatures up to 200 °C (200):

Bolt DIN... – M 12 × 80 – LD – 8.8 – KL – 200 – 30 × 10

5 Requirements

5.1 Torques

5.1.1 Requirements for bolts when tightened

When bolts are tested in accordance with clause 6, the requirements for M_{out} specified in table 1 shall be complied with.

Table 1: Torques at ambient temperature and at temperatures of 150 °C and 200 °C (bolt tightened)

Thread size		Maximum screw-in torque, M_{in}, in Nm	Tightening torque, M_A[1]), in Nm, for bolts of property class		Minimum loosening torque, M_{out}, in Nm	
			5.6 and 5.8	8.8, 10.9 and 12.9	First disengagement	Third disengagement
M 3		0,43	0,6	1,2	0,1	0,08
M 4		0,9	1,3	2,8	0,12	0,1
M 5		1,6	2,6	5,5	0,18	0,15
M 6		3	4,5	9,5	0,35	0,23
M 8	**M 8 × 1**	6	11	23	0,85	0,45
M 10	**M 10 × 1,25**	10,5	22	46	1,5	0,75
M 12	**M 12 × 1,25, M 12 × 1,5**	15,5	38	79	2,3	1,6
M 14	**M 14 × 1,5**	24	60	125	3,3	2,3
M 16	**M 16 × 1,5**	32	90	195	4,0	2,8

NOTE: Torques for thread sizes not included in this table are to be agreed upon.

[1]) M_A has been determined on the basis of an overall coefficient of friction, μ_{ges}, of 0,12, assuming a 90 % utilization of the minimum yield stress (property classes 5.6 and 5.8) or 0,2 % proof stress (property classes 8.8, 10.9 and 12.9) for the relevant lowest property class. It shall be applied only during the first engagement of the bolt.

6 Testing

6.1 General

When bolts are tested in accordance with subclauses 6.2 and 6.3, the requirements specified in subclause 5.1.1 shall be complied with.

6.2 Determination of torques

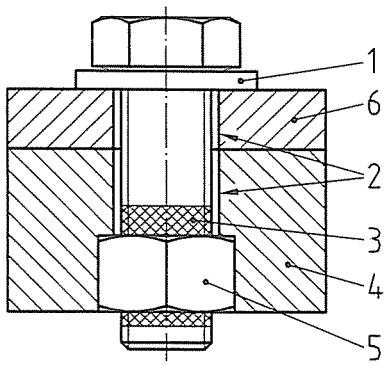
The test assembly shall be as shown in figure 3 or 4. The bolt to be tested shall be passed through a washer conforming to DIN EN ISO 7089, free from grease, with a minimum hardness of 200 HV, and a bright finish, and either through two distance blocks (cf. figure 3) or a spacer sleeve (cf. figure 4), and tightened by screwing into a nut at a rate of 30 min^{-1}, until the relevant M_A value is reached. The thickness of the blocks or spacer sleeve shall be selected so that the nut thread is in complete contact with the coated zone. During engagement, the maximum screw-in torque shall be measured.

After a period of at least 15 seconds, the bolt shall be loosened by turning it through 360°, followed by a further turn through 360° at a maximum rate of 30 min^{-1}, and the maximum loosening torque measured. The bolt shall then be fully unscrewed and engaged again, without subjecting the assembly to stress (i.e. without tightening the bolt).

For tests at a temperature of 150 °C or 200 °C, the assembly shown in figure 4 should be used, with washers as in DIN EN ISO 7089.

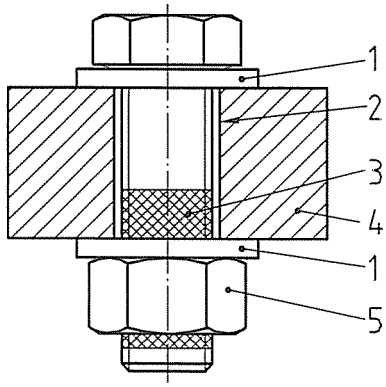
For tests at elevated temperatures, the bolts shall be tightened, heated for one hour to reach test temperature, exposed to the relevant test temperature for three hours, and then tested within ten seconds following removal from the oven.

When using the test assembly with spacer sleeve, either the bolt or the nut may be turned.



Key:
1 Washer as in DIN EN ISO 7089
2 Medium series clearance hole as in DIN EN 20273
3 Coating
4 Distance block, with a hardness exceeding 35 HRC
5 Nut as in DIN EN ISO 4032 or DIN EN ISO 8673
6 Distance block, with a hardness exceeding 35 HRC

Figure 3: Test assembly with distance blocks



Key:
1 Washer as in DIN EN ISO 7089
2 Medium series clearance hole as in DIN EN 20273
3 Coating
4 Spacer sleeve, with an external diameter equal to not less than $2 \times d$ and a hardness exceeding 35 HRC
5 Nut as in DIN EN ISO 4032 and DIN EN ISO 8673

Figure 4: Test assembly with spacer sleeve

6.3 Test equipment

6.3.1 Torquemeter

For torque measurement, a torquemeter, accurate to within 2 % of the upper limit of the given torque range, shall be used.

In cases of arbitration, the device shall be chosen so that all values can be read off in the upper half of the measuring range.

6.3.2 Test nut

For bolts with coarse pitch thread, a nut as in DIN EN ISO 4032, and for bolts with fine pitch thread, a nut as in DIN EN ISO 8673 shall be used.

The nut shall meet the following requirements.

a) The property class shall at least be equal to that of the bolt.

b) The thread shall be produced to 6H tolerance (subject to agreement, the nut may be produced to a closer tolerance).

c) The thread surface shall be bright or blackened.

d) The thread of the nut shall be free from oil, grease, and burrs.

Test nuts shall be used once only.

6.3.3 Oven

For thermal stability tests, an oven of accuracy class 2 as specified in DIN 50011-12 shall be used.

7 Instructions for use

7.1 Service temperature

Self-locking bolts are normally designed for use at temperatures ranging from –50 °C to + 120 °C and, in special applications, up to 200 °C.

7.2 Sealing function

Adhesive coatings are not only designed to secure bolt/nut assemblies, but may also have a certain sealing effect. Details for requirements and testing are subject to agreement.

7.3 Bolt/nut assembly

7.3.1 Nut thread

There are no special requirements with regard to the surface roughness of the nut thread surface. The thread, however, must be free from silicone, molybdenum disulfide and similar separating fluids. Nuts shall be free from burrs. Coated bolts shall not be used together with nuts and threaded holes without a countersunk.

7.3.2 Re-use of bolts

Self-locking bolts, except adjusting bolts, are designed for single use only.

8 Storage

Self-locking bolts shall be stored so that their properties (when tested) are maintained for at least four years.