

Fasteners

Adhesive-coated steel screws, bolts and studs

Technical delivery conditions

DIN
267
Part 27

Mechanische Verbindungselemente; Schrauben aus Stahl mit klebender 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.

1 Scope and field of application

This standard specifies technical delivery conditions for M5 to M39 adhesive-coated steel screws, bolts and studs ('bolts', for short) with ISO metric screw thread as specified in ISO 261 and assigned to property classes as specified in ISO 898 Part 1.

2 Concepts

For the purposes of this standard, the following definitions apply.

2.1 Adhesive coating

Adhesive coating is a coating applied on the thread of bolts (over their whole circumference) in the form of microencapsulated adhesive, the bonding properties of which are activated by the process of bolting and which serves to prevent the bolts working loose.

2.2 Screw-in torque

The screw-in torque, M_{in} , is the torque measured when a bolt is screwed into a test nut.

2.3 Tightening torque

The tightening torque, M_A , is the torque required to tighten a bolt to a level of stress as given in table 1.

2.4 Breakaway torque

The breakaway torque, M_{LB} , is the torque measured at the moment when the relative motion between test nut and bolt is detected in both stressed and unstressed assemblies.

2.5 Loosening torque

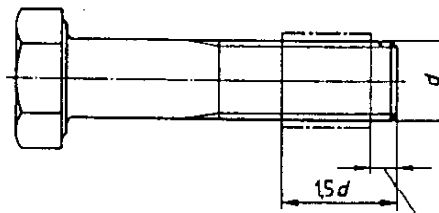
The loosening torque, M_{out} , is the torque measured after the breakaway point when unscrewing adhesive-coated bolts.

3 Dimensions and designation

3.1 Standard coating

Unless otherwise specified, the coating shall cover a zone, measured from the bolt end, of length equal to $1,5d \pm 2P$ for P smaller than 1 and $1,5d \pm P$ for P equal to or greater than 1.

The first two or three turns of thread should be free from coating material to facilitate bolting.



2 or 3 turns of thread
left uncoated

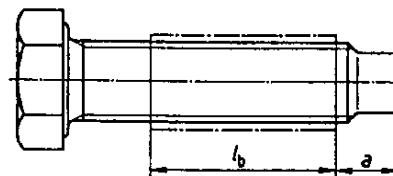
d = nominal bolt thread diameter

P = pitch

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

3.2 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 (see figure 2), both dimensions shall be indicated in the standard designation (cf. subclause 3.3), both dimensions being subject to a tolerance equal to $\pm 2P$ for P smaller than 1, and to $\pm P$ for P equal to or greater than 1.



l_b = length of coated zone

a = distance of coated zone from bolt end

P = pitch

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

For lengths of engagement exceeding $1d$ and property classes below 8.8, the coating length is to be specified as a function of the property class to permit disassembly. The correct coating length may be determined by testing, where necessary.

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3.3 Designation

Bolts provided with an adhesive coating as specified in this standard shall be identified by inclusion of the symbol MK.

Examples of designation

Designation of an adhesive-coated (MK) M12 hexagon head bolt as specified in DIN 933, of nominal length, $l = 80$ mm, assigned to property class 8.8:

Bolt DIN 933 – M12 × 80 – 8.8 – MK

Designation of an M12 hexagon head bolt as specified in DIN 933, of nominal length, $l = 80$ mm, assigned to property class 8.8 and provided with an adhesive coating (MK) 30 mm in length, with $a = 10$ mm (30 × 10):

Bolt DIN 933 – M12 × 80 – 8.8 – MK 30 × 10

4 Requirements

4.1 General

When bolts are tested in accordance with subclause 5.2, the specifications regarding M_{LB}/M_A ratio and M_{out} given in table 1 shall be complied with.

4.2 Requirements to be met by bolts when tested under stress

Table 1. Torques and torque ratios (at ambient temperature)

Thread size ¹⁾		Tightening torque, M_A ²⁾ , in Nm, for bolts of property class			Minimum M_{LB}/M_A ratio	Maximum loosening torque, M_{out} , in Nm
		5.6	5.8	6.8		
M5			2,6			
M6			4,5		1	6,5
M8	M8 × 1		11		1	10
M10	M10 × 1,25		22		1	26
					1	55
M12	M12 × 1,25, M12 × 1,5		38		1	95
M14	M14 × 1,5		60		1	160
M16	M16 × 1,5		90		1	250
M18	M18 × 1,5, M18 × 2		128		1	335
M20	M20 × 1,5, M20 × 2		176		1	500
M22	M22 × 1,5, M22 × 2		240		1	800
M24	M24 × 2		310		1	1050
M27	M27 × 2		460		1	1300
M30	M30 × 2		620		1	1700
M33	M33 × 2		825		1	2400
M36	M36 × 3		1100		1	3000
M39	M39 × 3		1400		1	4000

¹⁾ For thread sizes smaller than M5 and larger than M39, the torques and torque ratios shall be agreed between supplier and purchaser.

²⁾ M_A has been determined on the basis of an overall friction coefficient of 0,12, assuming a 90% utilization of the minimum yield stress or 0,2% proof stress for the relevant lowest property class.

4.3 Requirements for bolts when tested not under stress

When bolts are tested in accordance with subclause 5.3, the specifications regarding $M_{L,B}$ and M_{out} given in table 2 shall be complied with.

Table 2. Torques (at ambient temperature)

Thread size ¹⁾		Torques, in Nm		
		M_{in} max	$M_{L,B}$ min	M_{out} max
M5		1	1	6,5
M6		1,5	1,8	10
M8	M8 × 1	3	4	26
M10	M10 × 1,25	5,5	10	55
M12	M12 × 1,25, M12 × 1,5	7,5	16	95
M14	M14 × 1,5	11	22	160
M16	M16 × 1,5	14	35	250
M18	M18 × 1,5, M18 × 2	19	40	335
M20	M20 × 1,5, M20 × 2	22	45	500
M22	M22 × 1,5, M22 × 2	30	65	800
M24	M24 × 2	36	90	1050
M27	M27 × 2	42	120	1300
M30	M30 × 2	49	165	1700
M33	M33 × 2	55	210	2400
M36	M36 × 3	60	280	3000
M39	M39 × 3	70	330	4000

¹⁾ For thread sizes smaller than M5 and larger than M39, the torques shall be agreed between supplier and purchaser.

5 Testing

For testing compliance with the requirements specified in tables 1 and 2, bolt/nut assemblies are to be subjected to a test with the assembly under stress (cf. subclause 5.2), this serving as a basis for acceptance.

For routine in-production testing, a second method where the assembly is not subjected to stress is acceptable (cf. subclause 5.3).

5.1 Test equipment

5.1.1 Torquemeter

For torque measurement, a device (e.g. torquemeter), accurate to within 2% for 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.

5.1.2 Test nut

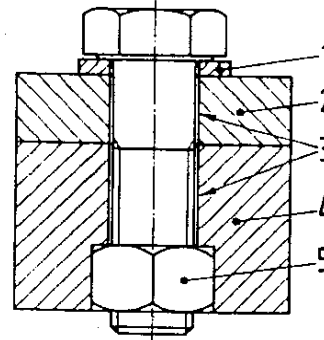
The test nut shall meet the following requirements.

- The property class shall at least be equal to that of the bolt.
- The nut shall have a height equal to $0,8d$ to $0,9d$ and be countersunk at 120° .
- The thread shall be produced to 6H tolerance and the thread surface be bright or blackened.
- The thread of the nut shall be free from oil or grease, and burr.

Test nuts shall be used once only.

5.2 Testing with bolt under stress

The test assembly shall be as shown in figure 3. The bolt to be tested shall be passed through a washer to DIN 125 Part 2, free from grease, with a hardness of 300 HV or more and a bright finish, and two distance blocks, and tightened by screwing into a test nut at a rate of 5 min^{-1} , until the relevant torque M_A is reached. The thickness of the blocks shall be selected so that the nut thread is in complete contact with the coated zone.



- 1 Washer
- 2 Distance block, with hardness exceeding 35 HRC
- 3 Medium series clearance hole as in ISO 273
- 4 Distance block, with hardness exceeding 35 HRC
- 5 Test nut

Figure 3. Test assembly

After a cure time of 24 hours at $23^\circ\text{C} \pm 5\text{K}$, the test assembly shall be disassembled by unscrewing the bolt from the nut at a maximum rate of 5 min^{-1} . The breakaway and the loosening torque shall be measured and the ratio between them determined.

5.3 Testing with bolt not under stress

The bolt to be tested shall be screwed into a test nut at a maximum rate of 5 min^{-1} so that the nut thread is in complete contact with the coated zone, and the maximum screw-in torque shall be measured.

5.4 Testing for corrosion resistance

The resistance of bolts to the action of corrosive media shall be tested as follows.

A test assembly (cf. subclauses 5.1 and 5.2) shall be left to cure for 24 hours and then conditioned at a given temperature in a given test medium for one week, conditioning temperatures and test media being as follows:

- general purpose oils, lubricants and hydraulic oils: 120°C ;
- fuels: ambient temperature;
- refrigerants, water and glycol: 90°C ;
- brake fluid: 90°C .

For other media, the conditioning temperatures shall be the subject of agreement.

After conditioning, it shall be checked whether the requirements specified in tables 1 and 2 are complied with.

6 Instructions for use

6.1 Service temperature

Adhesive-coated bolts are normally designed for use at temperatures from -50°C to $+90^\circ\text{C}$, use at other temperatures being subject to agreement.

6.2 Bolt/nut assembly**6.2.1 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 burr. Coated bolts shall not be used together with nuts and threaded holes without countersunk thread.

6.2.2 Tightening procedure

Tightening of the bolt and, where required, checking of the tightening torque should be completed within five minutes, since thereafter the bonding properties of the adhesive start to take full effect. Any other requirements shall be the subject of agreement.

6.3 Disassembly

Bolts with slotted head and hexagon socket thin head cap screws assigned to a property class less than 8.8 might not be capable of being unscrewed after the adhesive has cured.

6.4 Re-use of bolts

Although adhesive-coated bolts are designed for single use only (i.e. on disassembly and reassembly a new bolt is to be used), nuts may be re-used if their thread is cleaned (with a tap), but use of a new nut is also recommended.

7 Condition of bolts on delivery

Adhesive-coated bolts shall be free from oil or grease, any other surface finish being subject to agreement.

8 Storage life

Adhesive-coated bolts shall be protected against moisture, and be stored so that their properties (when tested) are maintained for at least two years.

Changes in colour of the coating may be disregarded as long as the properties (when tested) remain unaffected.

Standards referred to

DIN 125 Part 2	Product grade A washers with a hardness of 300 HV designed for use with hexagon head bolts and nuts
DIN 933	M1,6 to M52 hexagon head screws threaded up to the head; product grades A and B
ISO 261 : 1973 *)	ISO general purpose metric screw threads; general plan
ISO 273 : 1973 *)	Fasteners; clearance holes for bolts and screws
ISO 898-1 : 1988 *)	Mechanical properties of fasteners; bolts, screws and studs

International Patent Classification

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*) Obtainable from *Beuth Verlag GmbH (Auslandsnormenverkauf)*, Burggrafenstraße 6, D-1000 Berlin 30.