

Fasteners
Technical delivery conditions
Prevailing torque type nuts

DIN
267
Part 15

Mechanische Verbindungselemente; technische Lieferbedingungen, Muttern mit Klemmteil

Supersedes October 1971 edition

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.

This standard takes into account the specifications given in International Standard ISO 2320 — 1983. It was however not possible to adopt the international specifications without modifications at the present time, as ISO 2320

- lacks data for nuts with fine thread (see DIN 267 Part 23),
- requires harmonization of the proof loads for nuts with coarse thread with DIN ISO 898 Part 2,
- differentiates between LF nuts and NF nuts (see Explanatory notes),
- does not conform to the editorial requirements for a national standard.

This standard does not stand in contradiction to international specifications already in existence or proposed, nor to the amendments to these still required.

1 Field of application

The property classes, mechanical and performance properties and the methods of test listed in this standard apply to prevailing torque type nuts

- with nominal thread diameters from 3 to 39 mm;
- with ISO metric thread as specified in the DIN 13 standard series;
- with styles as specified in the appropriate product standards in which reference is made to this standard;
- made from alloy or non-alloy steel;
- for applications at temperatures from
 - 50 to + 120 °C for nuts with a non-metallic insert,
 - 50 to + 300 °C for all-metal non-plated nuts,
 - 50 to + 230 °C for all-metal plated nuts.

This standard does not apply to nuts that have to meet particular requirements regarding e.g.

- weldability;
- corrosion resistance;
- lower and higher application temperatures which require special materials or coatings.

Note. A standard is in preparation to cover the requirements on the ratio of the torque to the clamp load on prevailing torque type nuts.

2 Concept

For the purposes of this standard, prevailing torque type nuts are steel nuts (all-metal one-part or combined nuts with metallic or non-metallic insert), in which increased friction in the thread prevents the nut loosening itself.

The increased friction is created by the appropriate design of the prevailing torque element in the nut and generates axial and/or radial clamping in the mating bolt and nut thread pitches. The torque required to turn the nut on a bolt, measured during the turning process without axial load, is the additional torque attributable to friction (fixing or removal torque).

Prevailing torque type nuts as specified in this standard correspond to type NF proposed in ISO 2320 (see Explanatory notes).

3 Designation

The specifications of DIN ISO 898 Part 2 and of DIN 267 Part 23 shall apply for the designation of the property classes of prevailing torque type nuts that fulfil all the requirements of these standards.

Table 1 below gives the recommended nut/bolt assemblies.

Table 1. Nut/bolt assemblies

| Property class of nut | Property class of mating bolt |
|-----------------------|-------------------------------|
| 5, 6 | up to 5.8 or 6.8 |
| 8 ¹⁾ | up to 8.8 |
| 10 ¹⁾ | 8.8, 9.8, 10.9 |
| 12 ¹⁾ | 10.9, 12.9 |

¹⁾ If, in exceptional cases, a hardened and tempered all-metal nut is mated with a bolt which has not been hardened and tempered, the locking properties can change substantially.

Note. ISO 2320 — 1983, in conformity with ISO 898 Part 2 (see DIN ISO 989 Part 2), gives property class 9 for nuts to be mated with property class 9.8 bolts as specified in ISO 898 Part 1 (see DIN ISO 898 Part 1). The application of these two property classes in Germany is not intended. If however property class 9 is required in international trade, the appropriate specifications of ISO 2320 or of DIN ISO 898 Part 2 shall apply.

Continued on pages 2 to 11

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4 General requirements

4.1 Material

The bodies of the nuts shall be made of steel with the chemical composition given in table 2.

Table 2. Chemical composition limits

| Property class | Chemical composition, in % by mass (check analysis) | | | |
|-----------------------------------|--|------------|-----------|-----------|
| | C max. | Mn min. | P max. | S max. |
| 5 ¹⁾ , 6 ¹⁾ | 0,50 | — | 0,110 | 0,150 |
| 8 | 0,58 | 0,25 | 0,060 | 0,150 |
| 10 ²⁾ | 0,58 | 0,30 | 0,048 | 0,058 |
| 12 ²⁾ | 0,58 | 0,45 | 0,048 | 0,058 |

1) Nuts assigned to these property classes may be manufactured from free cutting steel, unless otherwise agreed between manufacturer and user. The following maximum contents of sulfur, phosphorus and lead are permissible where free cutting steel is used:

- sulfur, ~~0,34~~ 0,34 %;
- phosphorus, 0,12 %;
- lead, 0,35 %.

2) For these property classes alloying elements may be added to develop the mechanical properties of the nut.

4.2 Heat treatment (hardening and tempering)

4.2.1 Nuts with coarse thread

Hardening and tempering is not necessary for (property) class 5 nuts. It can be necessary to harden and temper class 8 nuts in order to develop the mechanical properties listed in table 3.

Classes 10 and 12 nuts shall be hardened and tempered.

4.2.2 Nuts with fine thread

It can be necessary to harden and temper class 6 nuts in order to develop the mechanical properties listed in table 4. Class 8, 10 and 12 nuts shall be hardened and tempered.

4.2.3 Case hardening

Case hardening is not permitted for any property class.

5 Finish

The specifications of the individual product standards (dimensional standards) shall apply for the finish of prevailing torque type nuts.

5.1 Surface coating

The specifications of DIN 267 Part 9 shall apply where an electroplated coating is desired.

5.2 Lubricant

The nuts can be given an appropriate lubrication, if required, in order to meet the specified performance requirements. The lubricant shall not cause any irritation on the skin, nor emit an unpleasant odour. Only such lubricants as retain their lubricating properties after six months' indoor storage shall be used.

Nuts supplied with a lubricant shall be clean and dry to the touch.

If the lubricant is subsequently removed by the customer, the mechanical and performance properties of the nut can be changed.

5.3 Thread

The thread on the nuts, with the exception of the prevailing torque element of the thread, shall comply with DIN 13 Part 15. In the case of nuts with a metallic or non-metallic insert, it shall be possible to screw the GO side of the thread gauge freely by hand as far as the insert. In the case of all-metal nuts with a deformed prevailing torque element, it shall be possible to screw the GO side of the thread gauge freely for at least one full turn of the thread.

6 Mechanical properties 机械性能

The mechanical properties specified in table 3 and table 4 shall apply for testing at ambient temperature.

Table 3. Nuts with coarse thread
(Property classes as specified in DIN ISO 898 Part 2)

| Thread diameter mm | | Property class | | | | | | | | | | | |
|-----------------------|-------------|--|------------------------|-------------|--|------------------------|-------------|--|------------------------|-------------|--|------------------------|-----|
| | | 5 | | | 8 | | | 10 | | | 12 | | |
| | | Proof stress S_p N/mm ² | Vickers hardness HV | | Proof stress S_p N/mm ² | Vickers hardness HV | | Proof stress S_p N/mm ² | Vickers hardness HV | | Proof stress S_p N/mm ² | Vickers hardness HV | |
| min. | min. max. | | min. | min. max. | | min. | min. max. | | min. | min. max. | | | |
| over | up to | | | | | | | | | | | | |
| - | 4 | 520 | 130 | 302 | 800 | 170 | 302 | 1040 | 272 | 353 | 1150 | 295 | 353 |
| 4 | 7 | 580 | | | 810 | 170 | | 1040 | | | 1150 | | |
| 7 | 10 | 590 | | | 830 | 188 | | 1040 | | | 1160 | | |
| 10 | 16 | 610 | | | 840 | 188 | | 1050 | | | 1190 | | |
| 16 | 39 | 630 | | | 146 | 920 | | 233 | | | 353 | | |

Table 4. Nuts with fine thread
(Property classes as specified in DIN 267 Part 23)

| Thread diameter mm | | Property class | | | | | | | | | | | |
|-----------------------|------|--|------------------------|------|--|------------------------|------|--|------------------------|------|--|------------------------|-----|
| | | 6 | | | 8 | | | 10 | | | 12 | | |
| | | Proof stress S_p N/mm ² | Vickers hardness HV | | Proof stress S_p N/mm ² | Vickers hardness HV | | Proof stress S_p N/mm ² | Vickers hardness HV | | Proof stress S_p N/mm ² | Vickers hardness HV | |
| min. | max. | | min. | max. | | min. | max. | | min. | max. | | | |
| over | to | | | | | | | | | | | | |
| 7 | 10 | 770 | 188 | 302 | 1040 | 272 | 353 | 1100 | 295 | 353 | 1230 | 295 | 353 |
| 10 | 16 | 780 | | | 1050 | | | 1110 | | | 1260 | | |
| 16 | 33 | 870 | 233 | 302 | 1030 | 272 | 353 | 1100 | 295 | 353 | - | - | - |
| 33 | 39 | 920 | | | 1090 | | | 1180 | | | - | | |

Note. The minimum hardnesses specified in tables 3 and 4 are mandatory for hardened and tempered nuts (see sub-clause 4.2) and for nuts on which it is not possible to carry out a proof load test, e.g. for nuts exceeding M 24.

7 Proof loads, test clamp loads and prevailing torques

Table 5. Nuts with coarse thread

| Thread size | Thread pitch mm | Nominal stress area A_s mm ² | Proof load, in N ¹⁾ ($A_s \times S_p$) | | | | | | Test clamp load, in N ²⁾ | | | | | | Prevailing torques, in N m | | | | | |
|-------------|--------------------|---|--|---------|-----------|-----------|---------|---------|-------------------------------------|---------|------|------|------|-----|----------------------------|------|------|-------------------------|------|------|
| | | | Property class | | | | | | Property class | | | | | | 5 and 8 | | | 10 and 12 ³⁾ | | |
| | | | 5 | 8 | 10 | 12 | 5 | 8 | 10 | 12 | 5 | 8 | 10 | 12 | max. | min. | max. | min. | max. | min. |
| M 3 | 0,5 | 5,03 | 2 600 | 4 000 | 5 200 | 5 800 | 1 430 | 2 190 | 3 130 | 3 660 | 0,43 | 0,12 | 0,08 | 0,6 | 0,15 | 0,1 | | | | |
| M 4 | 0,7 | 8,78 | 4 550 | 7 000 | 9 160 | 10 000 | 2 500 | 3 820 | 5 470 | 6 390 | 0,9 | 0,18 | 0,12 | 1,2 | 0,22 | 0,15 | | | | |
| M 5 | 0,8 | 14,2 | 8 250 | 11 500 | 14 800 | 16 300 | 4 050 | 6 170 | 8 850 | 10 400 | 1,6 | 0,29 | 0,2 | 2,1 | 0,35 | 0,24 | | | | |
| M 6 | 1 | 20,1 | 11 700 | 16 300 | 20 900 | 23 100 | 5 730 | 8 700 | 12 500 | 14 600 | 3 | 0,45 | 0,3 | 4 | 0,55 | 0,4 | | | | |
| M 8 | 1,25 | 35,6 | 21 600 | 30 400 | 38 100 | 42 500 | 10 400 | 15 900 | 22 800 | 26 600 | 6 | 0,85 | 0,6 | 8 | 1,15 | 0,8 | | | | |
| M 10 | 1,5 | 58,0 | 34 200 | 48 100 | 60 300 | 67 300 | 16 500 | 25 300 | 36 100 | 42 200 | 10,5 | 1,5 | 1 | 14 | 2 | 1,4 | | | | |
| M 12 | 1,75 | 84,3 | 51 400 | 70 800 | 88 500 | 100 300 | 24 000 | 36 700 | 52 500 | 61 400 | 15,5 | 2,3 | 1,6 | 21 | 3,1 | 2,1 | | | | |
| M 14 | 2 | 115 | 70 200 | 96 000 | 120 800 | 136 900 | 32 800 | 50 000 | 71 600 | 84 000 | 24 | 3,3 | 2,3 | 31 | 4,4 | 3 | | | | |
| M 16 | 2 | 157 | 95 800 | 131 900 | 164 900 | 186 800 | 44 800 | 68 200 | 97 500 | 114 000 | 32 | 4,5 | 3 | 42 | 6 | 4,2 | | | | |
| M 18 | 2,5 | 192 | 121 000 | 176 600 | 203 000 | 230 400 | 54 800 | 86 200 | 119 000 | 140 000 | 42 | 6 | 4,2 | 56 | 8 | 5,5 | | | | |
| M 20 | 2,5 | 245 | 154 400 | 225 400 | 259 700 | 294 000 | 69 800 | 110 000 | 152 000 | 178 000 | 54 | 7,5 | 5,3 | 72 | 10,5 | 7 | | | | |
| M 22 | 2,5 | 303 | 190 900 | 278 800 | 321 200 | 363 600 | 86 200 | 136 000 | 189 000 | 220 000 | 68 | 9,5 | 6,5 | 90 | 13 | 9 | | | | |
| M 24 | 3 | 353 | 222 400 | 324 800 | 374 200 | 423 600 | 100 500 | 159 000 | 220 000 | 256 000 | 80 | 11,5 | 8 | 106 | 15 | 10,5 | | | | |
| M 27 | 3 | 459 | 289 200 | 422 300 | 486 500 | 550 800 | 772 200 | 206 000 | 286 000 | 334 000 | 94 | 13,5 | 10 | 123 | 17 | 12 | | | | |
| M 30 | 3,5 | 561 | 353 400 | 516 100 | 594 700 | 673 200 | 94 500 | 253 000 | 350 000 | 408 000 | 108 | 16 | 12 | 140 | 19 | 14 | | | | |
| M 33 | 3,5 | 694 | 437 200 | 638 500 | 735 600 | 832 300 | 117 000 | 312 000 | 432 000 | 505 000 | 122 | 18 | 14 | 160 | 21,5 | 16,5 | | | | |
| M 36 | 4 | 817 | 514 700 | 751 600 | 866 000 | 980 400 | 138 000 | 368 000 | 509 000 | 594 000 | 136 | 21 | 16 | 180 | 24 | 17,5 | | | | |
| M 39 | 4 | 976 | 614 900 | 897 900 | 1 035 000 | 1 171 000 | 165 000 | 440 000 | 608 000 | 710 000 | 150 | 23 | 18 | 200 | 26,5 | 19,5 | | | | |

1) The proof loads comply with DIN ISO 898 Part 2.

2) The test clamp loads are equal to 75 % of the proof loads for the bolts as specified in DIN ISO 898 Part 1 for the appropriate property class; in the case of property class 5, property class 5.8 was used as a basis for diameters up to M 24 and property class 4.6 for sizes larger than M 24.

3) Prevailing torques from M 18 shall only apply for property class 10.

Table 6. Nuts with fine thread

| Thread size | Nominal stress area A_s mm ² | Proof load, in N ⁽¹⁾ ($A_s \times S_p$) | | | | Test clamp load, in N ⁽²⁾ | | | | Prevailing torques, in N m | | | | | |
|-------------|--|---|-----------|-----------|---------|--------------------------------------|---------|---------|---------|----------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------------|
| | | Property class | | | | Property class | | | | 6 and 8 | | | 10 and 12 3) | | |
| | | 6 | 8 | 10 | 12 | 6 | 8 | 10 | 12 | First fixing max. | First removal min. | Fifth removal min. | First fixing max. | First removal min. | Fifth removal min. |
| M 8 X 1 | 39,2 | 30 200 | 40 800 | 43 100 | 48 200 | 11 200 | 17 000 | 24 400 | 28 500 | 6 | 0,85 | 8 | 1,15 | 0,8 | |
| M 10 X 1 | 64,5 | 49 700 | 67 100 | 71 000 | 79 300 | 18 400 | 28 000 | 40 200 | 46 900 | 10,5 | 1,5 | 14 | 2 | 1,4 | |
| M 10 X 1,25 | 61,2 | 47 100 | 63 600 | 67 300 | 75 300 | 17 500 | 26 600 | 38 100 | 44 500 | 10,5 | 1,5 | 14 | 2 | 1,4 | |
| M 12 X 1,25 | 92,1 | 71 800 | 96 700 | 102 200 | 116 000 | 26 200 | 40 000 | 57 300 | 67 000 | 15,5 | 2,3 | 21 | 3,1 | 2,1 | |
| M 12 X 1,5 | 88,1 | 68 700 | 92 500 | 97 800 | 111 000 | 25 100 | 42 300 | 62 100 | 64 100 | 15,5 | 2,3 | 21 | 3,1 | 2,1 | |
| M 14 X 1,5 | 125 | 97 500 | 131 200 | 138 700 | 157 500 | 35 600 | 54 400 | 78 000 | 91 000 | 24 | 3,3 | 31 | 4,4 | 3 | |
| M 16 X 1,5 | 167 | 130 300 | 175 300 | 185 400 | 210 400 | 47 600 | 72 700 | 104 000 | 121 000 | 32 | 4,5 | 42 | 6 | 4,2 | |
| M 18 X 1,5 | 215 | 187 000 | 221 500 | 236 500 | — | 61 600 | 97 500 | 134 000 | — | 42 | 6 | 56 | 8 | 5,5 | |
| M 18 X 2 | 204 | 177 000 | 210 100 | 224 400 | — | 58 100 | 91 800 | 127 000 | — | 42 | 6 | 56 | 8 | 5,7 | |
| M 20 X 1,5 | 272 | 236 600 | 280 200 | 299 200 | — | 75 200 | 122 000 | 169 000 | — | 54 | 7,5 | 72 | 10,5 | 7 | |
| M 20 X 2 | 258 | 224 500 | 265 700 | 283 800 | — | 73 500 | 116 000 | 161 000 | — | 54 | 7,5 | 72 | 10,5 | 7 | |
| M 22 X 1,5 | 333 | 289 700 | 343 000 | 366 300 | — | 94 500 | 150 000 | 207 000 | — | 68 | 9,5 | 90 | 13 | 9 | |
| M 22 X 2 | 318 | 276 700 | 327 500 | 349 800 | — | 90 600 | 143 000 | 198 000 | — | 68 | 9,5 | 90 | 13 | 9 | |
| M 24 X 2 | 384 | 334 100 | 395 500 | 422 400 | — | 110 000 | 172 000 | 239 000 | — | 80 | 11,5 | 106 | 15 | 10,5 | |
| M 27 X 2 | 496 | 431 500 | 510 900 | 534 600 | — | 84 000 | 223 000 | 309 000 | — | 94 | 13,5 | 123 | 17 | 12 | |
| M 30 X 2 | 621 | 540 300 | 639 600 | 683 100 | — | 105 000 | 280 000 | 386 000 | — | 108 | 16 | 140 | 19 | 14 | |
| M 33 X 2 | 761 | 662 100 | 783 800 | 837 100 | — | 128 000 | 343 000 | 474 000 | — | 122 | 18 | 160 | 21,5 | 15,5 | |
| M 36 X 3 | 865 | 795 800 | 942 800 | 1 021 000 | — | 146 200 | 389 000 | 538 000 | — | 136 | 21 | 180 | 24 | 17,5 | |
| M 39 X 3 | 1 030 | 947 600 | 1 123 000 | 1 215 000 | — | 174 000 | 463 000 | 641 000 | — | 150 | 23 | 200 | 26,5 | 19,5 | |

1) The proof loads comply with DIN 267 Part 23.

2) The test clamp loads are equal to 75 % of the proof loads for bolts as specified in DIN ISO 898 Part 1 for the appropriate property class, in the case of property class 6, property class 5.8 was used as a basis for sizes up to M 24 X 2 and property class 4.6 for sizes larger than M 24 X 2.

3) Prevailing torques from M 18 X 2 shall only apply for property class 10.

8 Testing

8.1 Proof load test

DIN ISO 898 Part 2 shall apply as appropriate for the proof load test.

The nut to be tested shall be assembled on a test bolt or a hardened mandrel such that at least 3 threads protrude through the nut. For referee purposes, a hardened mandrel shall be used in the axial test (see figure 1).

The maximum prevailing torque occurring during assembly shall be recorded.

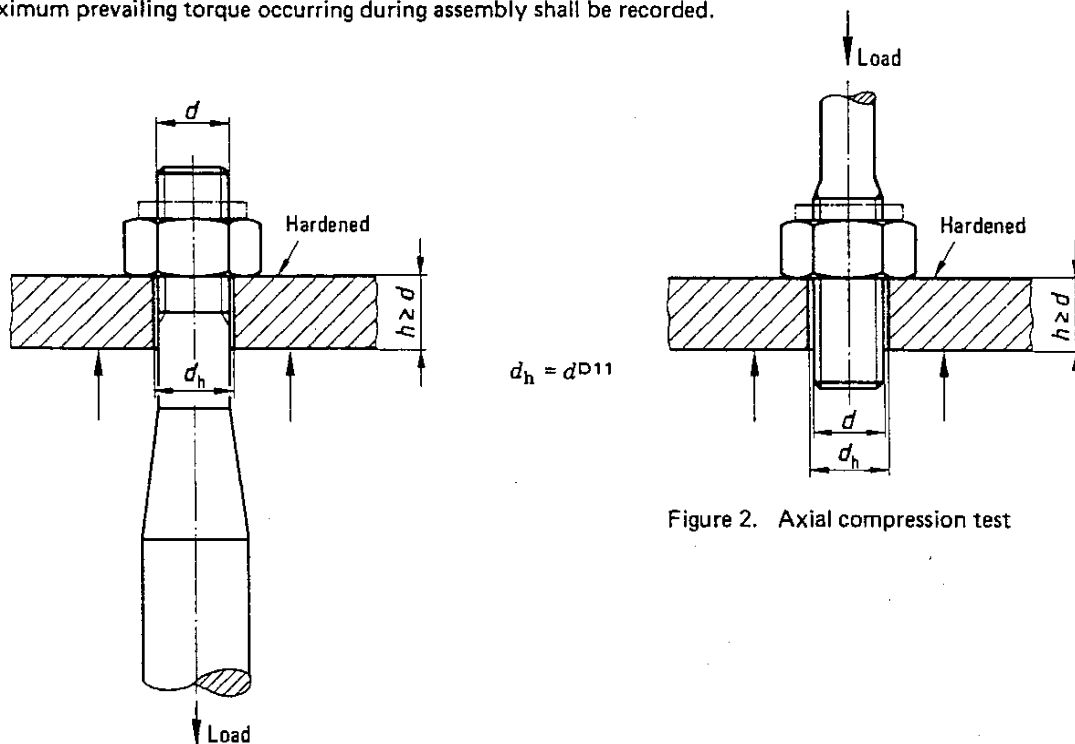


Figure 1. Axial tensile test

The proof load specified in clause 7 shall be applied axially to the nut and shall be maintained for 15 seconds. The nut shall resist this test load without thread stripping or rupture.

The prevailing torque after stressing shall not be greater than that occurring during assembly. Measurement is commenced after the nut has been loosened a half-turn.

The bolt used in the proof load test shall lie within thread tolerance class 6g as specified in DIN 13 Part 15. The proof load (loadability) of the bolt shall be greater than the proof load specified for the nut to be tested.

The hardness of the test mandrel shall lie within the range 45 to 50 HRC. The thread on the test mandrel shall lie within tolerance class 5h, with the exception of the major diameter, which should lie in the lower quarter of tolerance class 6g.

8.2 Hardness test

DIN ISO 898 Part 2 shall apply as appropriate for hardness testing, that is Vickers hardness testing in accordance with DIN 50 133 Part 1.

The hardness may be measured on the nut bearing surface for the purposes of routine inspection. The hardness shall be taken as the mean value of three measurements spaced 120° apart. In cases of dispute, the hardness test shall be carried out on a longitudinal section through the central axis of the nut with impressions placed as close as possible to the major diameter of the nut thread.

If the hardness is tested in the Brinell test (see DIN 50 351) or in the Rockwell test (see DIN 50 103 Part 1), DIN 50 150 shall apply for the conversion. The Vickers hardness test shall be regarded as the referee test in cases of dispute.

8.3 Inspection of surface condition

DIN 267 Part 20 shall apply for the inspection of the surface condition (permissible surface discontinuities).

8.4 Testing the shear strength

The widening test as specified in DIN 267 Part 21 shall apply for testing the shear strength.

8.5 Prevailing torque test

Two programmes for testing the prevailing torque (test programmes A and B) are included in this standard.

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8.5.1 Test programme A

Test programme A is recommended for the routine inspection of lots as supplied.

The prevailing torque test shall be conducted at room temperature using a torque wrench and with the aid of a device for measuring the clamping load on the bolt (see subclause 8.5.3.3).

A test bolt (see subclause 8.5.3.3) together with a test washer (see subclause 8.5.3.4) shall be inserted in the device for measuring the clamping load on the test bolt. The nut to be tested shall then be assembled on the bolt so that at least 2 full bolt threads protrude through the nut. Nut tightening may be either manually using a torque wrench or using a torque-sensing power device (see also Appendix A). The maximum prevailing torque occurring while the nut is being advanced through the next 360° of nut rotation shall be measured. This torque shall not exceed the first fixing prevailing torque value specified in clause 7.

Tightening shall be continued until the nut is seated against the test washer. The length of the test bolt shall be such that seating of the nut occurs when a length equivalent to four to seven thread pitches of the test bolt protrudes through the top of the nut, measured from the end of the bolt. The nut shall then be tightened until a tensile load equal to the clamp load, as specified in clause 7, is developed in the bolt. The test washer shall be prevented from turning.

The nut shall then be slackened until the tensile load in the bolt has been reduced to zero. The minimum prevailing torque occurring while the nut is being slackened through the next 360° of rotation shall be measured. This torque shall be not less than for the first fixing prevailing torque value as specified in clause 7.

8.5.2 Test programme B

Test programme B is an extended test programme in comparison with test programme A. It is recommended for original inspection and shall also be used for referee inspection for lot acceptance.

Firstly the procedure described in test programme A shall be carried out. After the first fixing prevailing torque has been measured, the nut shall be slackened until the prevailing torque element is disengaged from the bolt thread.

The nut shall then be reassembled and removed four more times. On each assembly, the nut shall be advanced sufficiently to allow a length equivalent to four to seven thread pitches to protrude through the nut, without applying a test clamp load. On each removal, the prevailing torque element shall be disengaged from the bolt thread.

During the fifth removal, the minimum prevailing torque occurring while the nut is being slackened through the first 360° of rotation shall be measured. This torque shall be not less than the prevailing torque value specified in clause 7. In addition, at no time during these four additional refixings and removals shall the torque exceed the maximum first fixing prevailing torque value as specified in clause 7.

To avoid overheating of the test assembly, sufficient time shall elapse between the torque application cycles. The speed of installation and removal of the nut shall not exceed 30 min⁻¹ and shall be continuous and uniform.

8.5.3 Test equipment

8.5.3.1 Torque measuring device

The torque measuring device (torque wrench or power device) shall be accurate to 2 % of the maximum specified torque range of the device. For referee purposes, the measuring device shall be chosen so that all readings fall within the upper half of its torque range.

8.5.3.2 Load measuring device

The load measuring device used in testing the actual friction shall measure the clamp load developed in the test bolt as the nut is tightened to $\pm 5\%$. The clearance hole in the measuring device shall have the same nominal diameter and the same tolerance as that of the test washer.

8.5.3.3 Test bolt

For sizes up to M 24, the bolt used in testing the prevailing torque shall have a thread produced by rolling. Tolerance class 6g shall apply for the thread; in accordance with DIN 267 Part 9, the zero line (h position) shall not be exceeded where there is an electroplated protective coating. Thread length shall be sufficient to allow 4 to 7 thread pitches to protrude through the nut when the nut is seated against the test washer and to leave at least 2 full threads free within stressed portion (see Appendix A). The bolt end shall be chamfered as specified in DIN 78. The surface of the bolt thread shall be without discontinuities and free of any contamination which may affect an accurate determination of the actual friction developed by the nut.

A property class in accordance with DIN ISO 898 Part 1 which corresponds with that assigned to the nut shall be chosen for the test bolt, e.g. nut: 8; bolt: 8.8. The surface finish of the bolt shall also correspond with that of the nut, normally electroplated in accordance with DIN 267 Part 9. Where nuts with a protective coating other than zinc or phosphate are to be tested, a bolt with a zinc-phosphate and oiled finish shall be used. In referee tests the nut and bolt shall have the same surface finish.

A new test bolt shall be used for testing each nut.

The use of test mandrels is subject to prior agreement.

8.5.3.4 Test washer

No special properties are specified for the test washer. If necessary, these shall be agreed between customer and supplier, e.g. for tightening tests.

Other counter plates (e.g. perforated metal strips) may be used instead of washers.

8.6 Testing the ratio of torque to clamping load

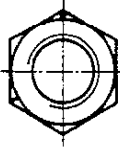
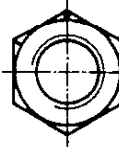

If a test for the ratio of torque to clamping load is desired, all details of this test, e.g. definition of the test washer, shall be agreed between customer and supplier. A standard is in preparation.

9 Marking

DIN ISO 898 Part 2 shall apply as appropriate for the marking of prevailing torque type nuts, i.e. nuts of size M 5 and larger and assigned to property classes over 8 shall be legibly and durably marked to identify property class and manufacturer. Marking on the bearing surface is not permitted.

9.1 Marking the property class

Table 7.

| Property class | | 5 and 6 | 8 | 10 | 12 |
|---------------------|--------------------------|------------|---|---|---|
| Optional marking by | code number | No marking | 8 | 10 | 12 |
| | symbol (clock system) | |  |  |  |

9.2 Marking of left-hand thread

For a left-hand thread, an arrow in the direction of fixing or the letter L shall be applied.

Where production is by chip removal, a groove over the corners of the hexagon is optionally permitted for left-hand thread (see also DIN ISO 898 Part 2).

Appendix A

Methods of test for prevailing torque type hexagon nuts

A.1 Field of application

This appendix describes a method for measuring the torque and the performance characteristics of prevailing torque type hexagon nuts using a manual torque wrench or another mechanically driven device which will permit a correspondingly slow fixing and removal of the nuts.

A.2 Test apparatus

A.2.1 Hand torque wrench

The hand torque wrench used in the test shall be suited for the specified range of test torques.

A mechanically driven device with a maximum speed of 30 min^{-1} capable of measuring the test torque is optional.

A.2.2 Test equipment

The test requires a device for holding the test bolt, the nut and the test washer and for measuring the clamping load developed as the nut is tightened. Figure A.1 shows a schematic illustration of such a device.

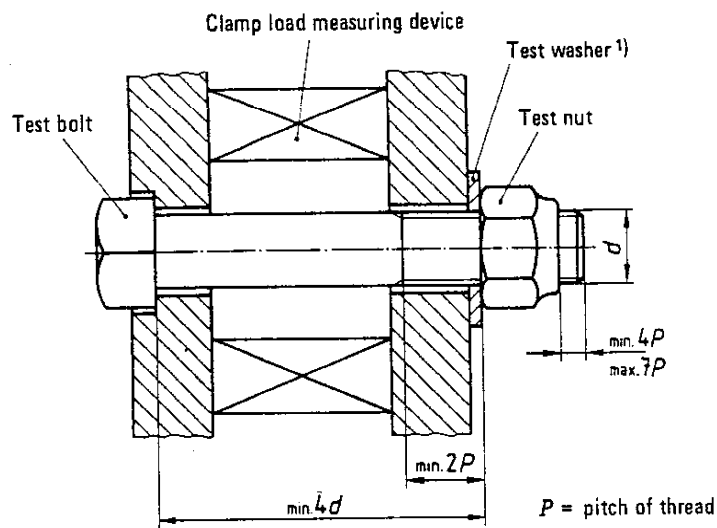


Figure A.1 Test equipment

1) The washer shall be prevented from turning.

Standards referred to

| | |
|--------------------|---|
| DIN 13 Part 15 | ISO metric screw threads; fundamental deviations and tolerances for screw threads from 1 mm diameter |
| DIN 78 | Thread ends and lengths of projection of bolt ends for ISO metric screw threads in accordance with DIN 13 |
| DIN 267 Part 9 | Fasteners; technical delivery conditions; electroplated components |
| DIN 267 Part 20 | Fasteners; technical delivery conditions; surface irregularities on nuts |
| DIN 267 Part 21 | Fasteners; technical delivery conditions; widening test on nuts |
| DIN 267 Part 23 | Fasteners; technical delivery conditions; property classes of nuts with fine thread (ISO classes) |
| DIN 50 103 Part 1 | Testing of metallic materials; Rockwell hardness testing, scales C, A, B, F |
| DIN 50 133 Part 1 | Testing of metallic materials; Vickers hardness testing, proof load range 49 to 980 N (5 to 100 kp) |
| DIN 50 150 | Testing of steel and cast steel; conversion tables for Vickers hardness, Brinell hardness, Rockwell hardness and tensile strength |
| DIN 50 351 | Testing of metallic materials; Brinell hardness test |
| DIN ISO 898 Part 1 | Mechanical properties of fasteners; bolts screws and studs |
| DIN ISO 898 Part 2 | Mechanical properties of fasteners; nuts with specified proof load values |
| ISO 2320 – 1972 | Prevailing torque type steel hexagon locknuts; mechanical and performance properties |
| ISO 2320 – 1983 | Prevailing torque type steel hexagon nuts; mechanical and performance properties |

Previous editions

DIN 267 Part 15: 10.71

Amendments

The following amendments have been made in comparison with the October 1971 edition:

- a) The content of the standard has been aligned with the proposed new international specifications and with DIN ISO 898 Part 2.

See Foreword and Explanatory notes.

Explanatory notes

The first edition of DIN 267 Part 15 was published in October 1971 and took account of the results of international standards work done up to that time on the mechanical and performance requirements on what were then called locknuts in which increased friction in the thread prevents the nut loosening itself. A corresponding and technically identical international standard was then published in 1972 (ISO 2320 – 1972). Both standards proved their worth during the subsequent period and were widely applied for locknuts for the property classes of which International Recommendation ISO/R 898 II – 1968, adopted on the national level as DIN 267 Part 4 (October 1971 edition), applied. However, after the standards has been published certain reservations were expressed regarding the time-consuming and expensive method of testing the overtightening torque of the nuts to be tested. In addition, the wish was expressed to revise Standard ISO 2358 – 1972 (adopted in DIN 980), which could only be considered an outline standard for the main groups of prevailing torque type nuts, viz.

- a) one-part nuts;
- b) combined metal nuts with metallic insert;
- c) combined metal nuts with non-metallic insert.

To some extent, the dimensions specified for these nuts did not conform with practical requirements, in particular with regard to automatic assembly and to the more precise measurements required for this.

Since, in the meantime, the necessity of revising the general property classes for nuts had arisen, the entire problem was studied within Technical Committee ISO/TC 2 without abandoning the previous principles governing the property classes specified in ISO/R 898 II. This led to the publication of International Standard ISO 898/2 – 1980 which was adopted as national Standard DIN ISO 898 Part 2 in March 1981. The appendix to DIN ISO 898 Part 2 gives information on the background to the modified property classes.

International Standard ISO 898/2 supplied the basis for a revision of ISO 2320 and for the preparation of new ISO product standards dealing with prevailing torque type nuts. Once the preliminary work has been completed, the international documents were published in January 1982 dealing with the following items:

- a) mechanical and performance properties of locknuts (revision of ISO 2320);
- b) nuts with non-metallic insert
 - hexagon nuts, style 1 (ISO/DIS 7040);
 - hexagon nuts, style 2 (ISO/DIS 7041);
 - hexagon flange nuts (ISO/DIS 7043);
- c) all-metal nuts
 - hexagon nuts, style 2 (ISO/DIS 7042);
 - hexagon nuts, style 1 (ISO/DIS 7719);
 - hexagon nuts, style 2 (ISO/DIS 7720);
 - hexagon flange nuts (ISO/DIS 7044).

DIN ISO drafts were not published for all these drafts since, for instance, there is no interest nationally for all-metal nuts as specified in ISO/DIS 7719 and ISO/DIS 7720, nor for nuts with non-metallic insert as specified in ISO/DIS 7041.

More or less independently of the proposed ISO product standards, DIN 267 Part 15 was revised, technically harmonized with ISO 2320 and aligned with national concerns. Although it is not identical in all points with the ISO Standard, this new version of DIN 267 Part 15 can be considered equivalent to the ISO Standard. The technical identity of the two documents ensures interchangeability in all cases. Specifications for nuts with fine thread have been included to supplement the ISO Standard.

The national product standards dealing with prevailing torque type nuts (this definition was chosen in place of the previous definition "locknuts" for reasons of legal liability) affected by the new version of DIN 267 Part 15, are at present still undergoing conversion to the new specifications. It is, however, already possible to apply the standard for nuts as specified in DIN 980 and DIN 982, without dimensional changes being necessary for these nuts despite the increased proof loads specified in DIN ISO 898 Part 2. Restrictions had already been placed on the nuts specified in DIN 985, and these apply to a greater degree now and make it advisable that the standard is no longer applied to new designs, as was already recommended in the September 1977 edition.

The following DIN Standards are proposed on the basis of the ISO drafts referred to:

- DIN 6924 Prevailing torque type hexagon nuts, non-metallic insert
(comparable and interchangeable with ISO 7040 and superseding DIN 982 and part of DIN 980)
- DIN 6925 Prevailing torque type hexagon nuts, all-metal nuts
(comparable and interchangeable with ISO 7042 and superseding part of DIN 980)
- DIN 6926 Prevailing torque type hexagon nuts with flange, non-metallic insert
(comparable and interchangeable with ISO 7043; not previously standardized on the national level)
- DIN 6927 Prevailing torque type hexagon nuts with flange
(comparable and interchangeable with ISO 7044; not previously standardized on the national level)

Standard DIN 985 will still be retained, in addition to the four standards on prevailing torque type nuts listed above, to cover demand for replacement parts and to cover existing documents, as nuts specified in DIN 985 are not interchangeable in all cases with those specified in DIN 6924. The previous (lower) proof load values specified in DIN 267 Part 4 shall apply for the nuts.

International Standard ISO 2320 makes the following distinction:

- NF (normal friction) nuts
These usually have a zinc electroplated finish plus a chromate or phosphate conversion coating with or without supplementary lubricants to meet the ratio of torque to clamp load.
- LF (low friction) nuts
These usually have a finish which is either cadmium electroplated with a supplementary extreme pressure (EP) lubricant or phosphate coated (zinc or manganese) with a rust preventive oil containing an extreme pressure lubricant in order to meet the torque tension requirements.

This distinction was not adopted in this standard, since only NF nuts are usual and standardized in Germany and the specifications only apply to NF nuts.

The method of test for the assessment of mechanical properties of prevailing torque type nuts has been simplified and distinguished according to test programme A (routine inspection of lots) and according to test programme B (original inspection and in referee cases). The standard has thereby been made easier to use.

DIN-Mitteilungen 60, 1981, No. 9, pp. 566 and 567 give a comprehensive report of the national and international situation relating to the questions of the standardization of prevailing torque type hexagon nuts (previously termed locknuts). Reference is made to this report.

International Patent Classification

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