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## **Mechanical properties of fasteners —**

### **Part 7:**

Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm

*Caractéristiques mécaniques des éléments de fixation —*

*Partie 7: Essai de torsion et couples minimaux de rupture des vis de diamètre nominal de filetage de 1 mm à 10 mm*



Reference number  
ISO 898-7:1992(E)

## ISO 898-7:1992(E)

**Foreword**

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 898-7 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Sub-Committee SC 1, *Mechanical properties of fasteners*.

ISO 898 consists of the following parts, under the general title *Mechanical properties of fasteners*:

- Part 1: *Bolts, screws and studs*
- Part 2: *Nuts with specified proof load values — Coarse thread*
- Part 5: *Set screws and similar threaded fasteners not under tensile stresses*
- Part 6: *Nuts with specified proof load values — Fine pitch thread*
- Part 7: *Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm*

Annex A of this part of ISO 898 is for information only.

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## Mechanical properties of fasteners —

### Part 7:

Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm

#### 1 Scope

This part of ISO 898 specifies a torsional test for the determination of the breaking torque of bolts and screws with nominal diameters 1 mm to 10 mm with property classes 8.8 to 12.9 in accordance with ISO 898-1. The test applies to bolts and screws with thread less than M3 for which no breaking and proof loads are indicated in ISO 898-1, as well as to short bolts and screws with nominal diameters 3 mm to 10 mm which cannot be subjected to a tensile test.

The minimum breaking torques are not valid for hexagon socket set screws.

#### 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 898. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 898 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 898-1:1988, *Mechanical properties of fasteners — Part 1: Bolts, screws and studs.*

#### 3 Torsional test

##### 3.1 Principle

Determination of the breaking torque by clamping the bolt or screw to be tested into a test device.

##### 3.2 Apparatus

**3.2.1 Test device for torsional test**, such as is shown in figure 1.

**3.2.2 Torquemeter**, with a scale which shall not exceed the quintuple of the respective minimum breaking torque. The maximum inaccuracy of the torquemeter shall be  $\pm 7\%$  of the minimum breaking torque to be tested.

##### 3.3 Test conditions

The bolt or screw shall be exclusively subjected to torsion whereby the respective minimum breaking torque according to table 2 shall be reached before rupture occurs. The test result shall not be influenced by head friction or by thread friction.

##### 3.4 Procedure

Clamp the bolt or screw into the test device over at least two full threads, having a free thread length of at least one thread diameter present between the head of the bolt or screw and the threaded insert (see figure 1). Apply the torque in a continuously increasing manner.

**4 Minimum breaking torques**

The following formula applies to the determination of the minimum breaking torques:

$$M_{B \min} = \tau_{B \min} \cdot W_{p \min}$$

with

$$W_{p \min} = \frac{\pi}{16} \cdot d_{3 \min}^3$$

and

$$\tau_{B \min} = X \cdot R_{m \min}$$

where

$M_{B \min}$  is the minimum breaking torque (see table 2);

$\tau_B$  is the torsional strength;

$W_p$  is the polar moment of resistance;

$d_{3 \min}$  is the minimum value of the minor diameter of the external thread;

$R_m$  is the tensile strength; and

$X$  is the strength ratio  $\tau_B/R_m$  (see table 1).

**5 Evaluation of the torque test**

The tested bolt or screw is regarded as having passed the torque test if no rupture occurs before the minimum breaking torques specified in table 2 are reached.

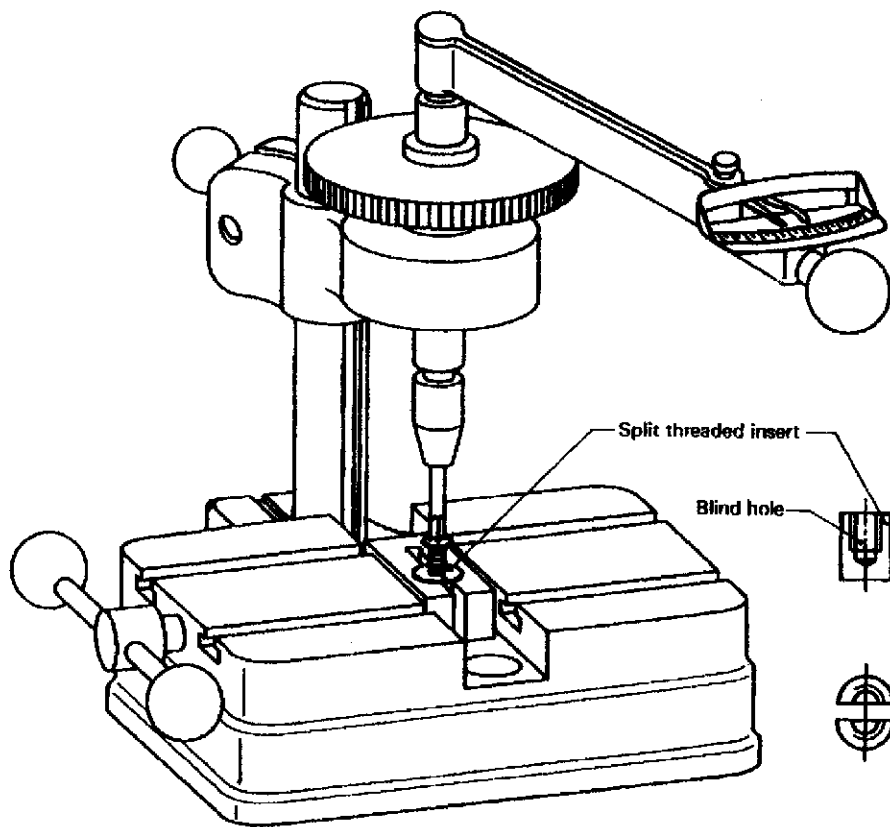


Figure 1 — Example of a device for the torsional test

Table 1 — Strength ratio  $X$ 

Property class	8.8	9.8	10.9	12.9
Ratio $X$	0,84	0,815	0,79	0,75

Table 2 — Minimum breaking torques

Thread	Pitch mm	Minimum breaking torque <sup>1)</sup>			
		$M_{B \min}$ N·m			
		Property class			
		8.8	9.8	10.9	12.9
M1	0,25	0,033	0,036	0,040	0,045
M1,2	0,25	0,075	0,082	0,092	0,10
M1,4	0,3	0,12	0,13	0,14	0,16
M1,6	0,35	0,16	0,18	0,20	0,22
M2	0,4	0,37	0,40	0,45	0,50
M2,5	0,45	0,82	0,90	1,0	1,1
M3	0,5	1,5	1,7	1,9	2,1
M3,5	0,6	2,4	2,7	3,0	3,3
M4	0,7	3,6	3,9	4,4	4,9
M5	0,8	7,6	8,3	9,3	10
M6	1	13	14	16	17
M7	1	23	25	28	31
M8	1,25	33	36	40	44
M8 x 1	—	38	42	46	52
M10	1,5	66	72	81	90
M10 x 1	—	84	92	102	114
M10 x 1,25	—	75	82	91	102

1) These minimum breaking torques are valid for bolts and screws with the thread tolerances 6g, 6f and 6e.

## Annex A (informative)

### Explanatory note

ISO 898-1 contains property classes for bolts and screws but only indicates minimum breaking loads and proof loads for threads equal to or greater than M3 because in the case of smaller bolts and screws the influence of the thread tolerances and the tolerances of the test device is such that an exact determination of breaking loads and proof loads is not possible.

Also since bolts and screws with threads greater than M3 up to approximately M10 often cannot be subjected to a tensile test (or proof load test) due to their short lengths, minimum breaking torques have been specified for bolts and screws M1 to M10 (including the fine pitch threads M8 × 1, M10 × 1 and M10 × 1,25) which allow an evaluation of the functional properties of the bolts and screws. For the

time being, minimum breaking torques can be specified for property classes 8.8 to 12.9 only, because for lower property classes the test results are widely scattered and therefore more studies are required.

The indicated minimum breaking torques are to be applied without taking account of friction and the type of test device is optional according to this part of ISO 898. Figure 1 is only an example of a suitable test device.

The minimum breaking torques have been determined on the basis of cross-sections resulting from the minimum values of the minor diameter of the thread tolerance 6g. Tests have shown that the torques can also be used for bolts and screws with thread tolerances 6f and 6e.

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