

# Mechanical properties of fasteners —

## Part 7: Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm

The European Standard EN 20898-7:1995 has the status of a  
British Standard

**NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW**



# Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GME/9, Bolts, nuts and accessories, upon which the following bodies were represented:

BEAMA Ltd.  
 British Constructional Steelwork Association Ltd.  
 British Industrial Fasteners Federation  
 British Steel Industry  
 British Steel Industry (Wire Section)  
 Gauge and Tool Makers' Association  
 National Association of Fastener Stockholders  
 Society of Motor Manufacturers and Traders Ltd.  
 Washer Manufacturers, Association of Great Britain

The following bodies also participated in the preparation of the standard, through subcommittees and panels:

British Stainless Steel Association  
 British Turned-parts Manufacturers' Association  
 Galvanizers' Association  
 Institute of Metal Finishing  
 Metal Finishing Association  
 National Centre of Tribology

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 July 1995

© BSI 07-1999

The following BSI references relate to the work on this standard:  
 Committee reference GME/9  
 Draft for comment 90/80108 DC

ISBN 0 580 24385 0

## Amendments issued since publication

Amd. No.	Date	Comments

# Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
1 Scope	3
2 Normative reference	3
3 Torsional test	3
4 Minimum breaking torques	4
5 Evaluation of the torque test	4
Annex A (informative) Explanatory note	5
Annex ZA (normative) Normative references to international publications with their relevant European publications	5
Figure 1 — Example of a device for the torsional test	3
Table 1 — Strength ratio $X$	4
Table 2 — Minimum breaking torques	4
List of references	Inside back cover

## National foreword

This British Standard has been prepared by Technical Committee GME/9 and is the English language version of EN 20898-7:1995 *Mechanical properties of fasteners — Part 7: Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm* published by the European Committee for Standardization (CEN). It is identical with ISO 898-7:1992, published by the International Organization for Standardization (ISO). EN 20898-7:1995 was produced as a result of international discussions in which the United Kingdom took an active part.

### Cross-reference

Publication referred to	Corresponding British Standard
ISO 898-1:1988	BS EN 20898 <i>Mechanical properties of fasteners</i> Part 1:1992 <i>Specification for bolts, screws and studs</i>

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

---

ICS 21.060.10

Descriptors: Fasteners, breaking torque, bolts, specification, mechanical properties, testing, torsion testing

English version

Mechanical properties of fasteners —  
Part 7: Torsional test and minimum torques for bolts and  
screws with nominal diameters 1 mm to 10 mm

(ISO 898-7:1992)

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  
(ISO 898-7:1992)

Mechanische Eigenschaften von  
Verbindungselementen —

Teil 7: Torsionsversuch und  
Mindest-Bruchdrehmomente für Schrauben  
mit Nenndurchmessern 1 mm bis 10 mm  
(ISO 898-7:1992)

This European Standard was approved by CEN on 1995-01-04. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

**CEN**

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

**Central Secretariat: rue de Stassart 36, B-1050 Brussels**

## Foreword

This European Standard has been taken over by the Technical Committee CEN/TC 185, *Threaded and non-threaded mechanical fasteners and accessories*, from the work of ISO/TC 2, *Fasteners*, of the International Organization for Standardization (ISO).

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 1995, and conflicting national standards shall be withdrawn at the latest by July 1995.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

NOTE Normative references to international publications are listed in Annex ZA (normative).

## 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 to quintuple of the respective minimum breaking torque. The minimum 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.

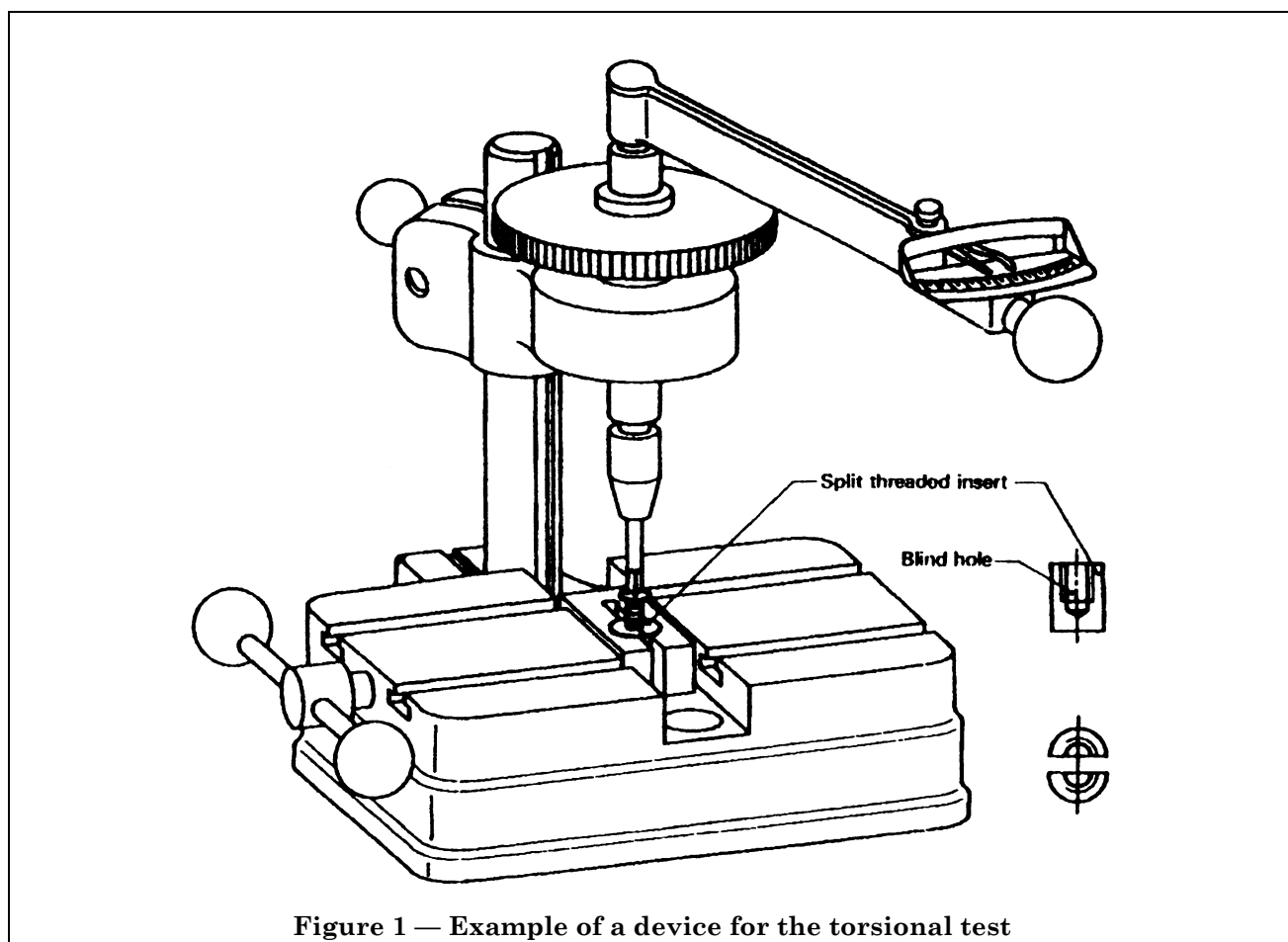


Figure 1 — Example of a device for the torsional test

### 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

$$W_{p \min} = \frac{\pi}{16} \cdot d_3^3 \min$$

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.

Table 1 — Strength ration  $X$

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

<sup>a</sup> 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.

## Annex ZA (normative)

### Normative references to international publications with their relevant European publications

This European 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 publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

Publication	Year	Title	EN	Year
ISO 898-1	1988	<i>Mechanical properties of fasteners — Part 1: Bolts, screws and studs</i>	EN 20898-1	1991

.....

# List of references

See national foreword.

.....

---

---

# **BSI — British Standards Institution**

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

## **Revisions**

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.  
Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

## **Buying standards**

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

## **Information on standards**

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.  
Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.  
Tel: 020 8996 7002. Fax: 020 8996 7001.

## **Copyright**

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager.  
Tel: 020 8996 7070.