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BRITISH STANDARD

BS 7715:1994

Specification for

Prevailing torque type bolts, screws and studs with non-metallic prevailing torque elements incorporated into the thread

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the General Mechanical Engineering Standards Policy Committee (GME/-) to Technical Committee GME/9, upon which the following bodies were represented:

BEAMA Ltd.
British Constructional Steelwork Association Ltd.
British Industrial Fasteners' Federation
British Railways Board
British Steel Industry
British Steel Industry (Wire Section)
Gauge and Tool Makers' Association
Ministry of Defence
Society of Motor Manufacturers and Traders Limited
Washer Manufacturers' Association of Great Britain

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Contents

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Foreword

This British Standard has been prepared under the direction of the General Mechanical Engineering Policy Committee. It includes performance properties for prevailing torque type bolts, screws and studs with non-metallic prevailing torque features.

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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 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.

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1 Scope

This British Standard specifies the coatings, dimensions, materials, lubrication and performance requirements for prevailing torque type bolts, screws and studs, with non-metallic prevailing torque elements incorporated into the thread, when tested at an ambient room temperature between 15 °C and 30 °C.

It applies to bolts, screws and studs:

a) with ISO metric coarse pitch M4 to M24 threads in conformance with BS 3643-2:1981;

b) with specific strength requirements conforming to either BS 6104-3:1981, BS 6105:1981 or BS EN 20898-1:1992 as appropriate;

c) with threads of tolerance class 6 g or 4 h in conformance with BS 3643-2:1981;

d) for application into a mating component with a thread of tolerance class 6H in conformance with BS 3643-2:1981;

e) for use within the temperature range – 50 °C to + 120 °C;

f) with specific torque/clamping force requirements in conformance with BS 7371-2:1993.

The torque/clamping force requirements do not apply to set screws and similar threaded fasteners with physical properties in conformance with BS 6104-3:1981.

NOTE 1 Capability to provide a pressure or liquid seal is not within the requirements of this standard.

NOTE 2 Performance at temperatures outside the operating range is not within the requirements of this standard.

NOTE 3 Performance of bolts, screws and studs for which a lubricated coating is not permissible is not within the requirements of this standard.

2 References

2.1 Normative references

This British Standard incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this British Standard only when incorporated in it by updating or revision.

2.2 Informative reference

This British Standard refers to another publication that provides guidance. The edition of this publication current at the time of issue of this standard is given on the inside back cover but reference should be made to the latest edition.

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1
prevailing torque type bolts, screws and studs

bolts, screws and studs which are frictionally resistant to rotation due to an integral prevailing torque feature and not because of compressive load developed against a bearing force

3.2
prevailing torque developed by bolts, screws or studs

torque necessary to rotate the bolt, screw or stud in a mating threaded component while in motion and with no axial load

3.3
clamping force

force which is applied by the bearing face of the fastener against a mating component after application of a specified tightening torque

4 Protective coatings

Finished parts shall conform to the appropriate coating standard applicable to the fastener to which the non-metallic prevailing torque element is attached.

NOTE 1 Prevailing torque bolts, screws or studs which do not have or need supplementary lubrication may not satisfy the requirements of this standard unless the lubrication is an integral property of the specified coating. Protective coatings may be applied either before or after the application of the prevailing torque feature at the discretion of the supplier.

NOTE 2 Cavities formed to accept prevailing torque elements may have no protective coating or corrosion resistance.

5 Prevailing torque element dimensions

The prevailing torque feature dimensions shall be as shown in Figure 1 and Figure 2.

Dimension *l*x shall be selected so that a minimum of two pitches of the screw thread measured from the end of the bolt, screw or stud are free from the prevailing torque feature in order to ensure ease of engagement.

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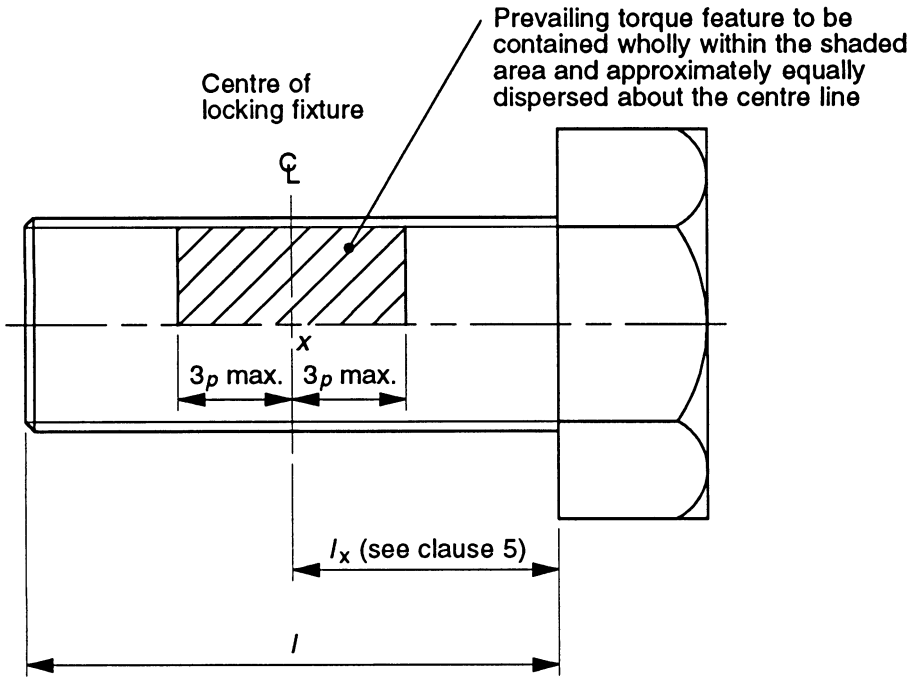
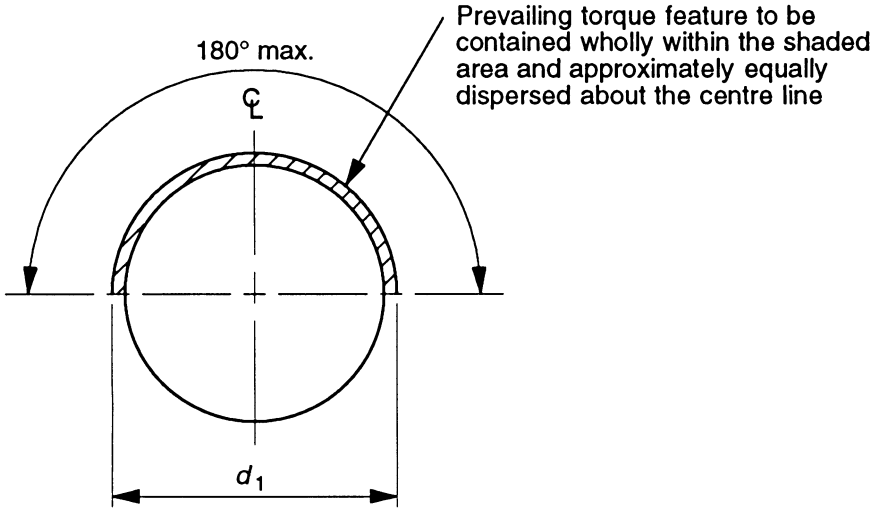


l = Length of bolt

l_x = Distance from under head to centre of locking feature

p = Pitch of thread

Figure 1 — Position of prevailing torque feature



$d_1 < d$ h as specified for fine series threads in BS EN 20273: 1991

Figure 2 — Diameter of prevailing torque feature

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6 Materials and lubrication

6.1 Materials

The material used to produce the bolts, screws and studs with non-metallic prevailing torque features shall be in accordance with the specified property class in BS 6104-3:1981, BS 6105:1981 or BS EN 20898-1:1992, as appropriate.

The prevailing torque feature shall be made from a resilient non-metallic material and shall adhere to, or be inserted in, the metallic surface.

6.2 Lubrication

NOTE Bolts, screws or studs finished in accordance with BS 7371-1:1991 and requiring no lubrication may be lubricated at the discretion of the supplier.

Bolts, screws or studs finished in accordance with BS 7371-1:1991 with a finish which requires lubrication shall be lubricated.

Supplementary lubrication, if applied, shall conform to BS 7371-2:1993.

7 Mechanical properties and performance

7.1 Mechanical properties

The mechanical properties of the bolt, screw or stud after application of the prevailing torque feature product shall conform to the specified property class in accordance with BS 6104-3:1981, BS 6105:1981 or BS EN 20898-1:1992, as appropriate.

Certain prevailing torque features reduce the stress area of the bolt, screw or stud and provision shall be made to ensure that the specified mechanical properties are maintained.

NOTE The stripping strength of the joint is also reduced.

7.2 Prevailing torque

The prevailing torque developed by the feature during the first fixing, or any subsequent fixings or removals, shall not exceed the maximum prevailing torque specified in Table A.1 when tested as specified in Annex A. The torques developed by the feature during the first and fifth removals shall not be less than the minimum prevailing torques specified in Table A.1 when tested as specified in Annex A.

7.3 Torque/clamping force

Torque clamping force requirements shall be assessed in accordance with BS 7371-2:1993.

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Annex A (normative) Torque testing

A.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 device shall be chosen so that all readings fall within the upper half of the torque range.

Manual torque wrenches may be used for measurement of torque, but for referee purposes, an automatic electronic sensing device shall be used.

A.2 Test washers/spacers

A.2.1 *Properties*

Test spacers shall be made from steel with a surface hardness of 500 HV to 600 HV and a core hardness of 450 HV to 490 HV and shall be unplated.

The faces shall be flat and parallel within ± 4 % of the specific minimum thickness. The surface roughness of the abutment faces shall not exceed 3.2 μm (see BS 1134-2). Test spacers shall be designed such that when assembled into the test equipment, rotation is prevented during tightening of bolt.

A.2.2 *Dimensions*

The inside diameter of the test spacer shall be in accordance with Table A.1. The thickness of the spacer shall be calculated to ensure that the prevailing torque feature is fully engaged in the test nut during the whole test measurement sequence, but shall not be less than the minimum thickness shown in Table A.1.

Table A.1 — Spacer dimensions

Dimensions in millimetres

Nominal thread diameter	Internal maximum	Diameter minimum	Minimum spacer thickness
M4	4.9	4.8	2
M5	5.9	5.8	2
M6	7.1	6.9	3
M8	9.5	9.3	4
M10	11.5	11.3	5
M12	14	13.8	6
M14	16	15.8	6
M16	18	17.8	6
M18	20.5	20.3	6
M20	22.7	22.5	6
M24	26.7	26.5	6

A.3 Test nuts

A.3.1 *Properties*

The test nuts shall be to property class 8 of BS EN 20898-2:1992 manufactured from steel hardened to 450 HV at the surface. The nuts shall be threaded to a 6 H tolerance class in conformance with BS 3643-2:1981.

A.3.2 *Dimensions*

The test nut shall be of sufficient length to contain nine full thread pitches and a chamfer of at least one full thread pitch at each end.

A.4 Test procedure

A.4.1 *General*

Conduct the prevailing torque test at ambient temperature between 15 °C and 30 °C.

Measure all prevailing torque measurements by a torque measuring device (see **A.1**) with a screw in motion and with the full length of the prevailing torque feature in contact with the test nut thread.

A.4.2 *Bolts and screws*

Using a suitable test spacer (see **A.2**), assemble the sample screw in a test nut, as detailed in **A.3**. Ensure that the screw is advanced in the nut until all prevailing torque feature threads are in full contact with the test nut thread. Measure the maximum torque occurring while the screw is being advanced through the next 360° of rotation. For the screw to be acceptable, check that this torque does not exceed the maximum prevailing torque value as specified for the applicable screw in Table A.2.

Continue tightening until the screw is seated against the test spacer and the tightening torque specified in Table A.2 is achieved. Ensure that the thickness of the test nut is such that seating of the screw occurs when the feature is still fully in contact with the test nut thread. Prevent the test spacer from turning during screw tightening.

Slacken the screw by the application of reverse torque until the tensile load has been reduced to zero. Measure the minimum torque occurring while the screw is being removed through the next 360° of rotation. For the screw to be acceptable, check that this torque is not less than the first removal prevailing torque specified for the applicable screw in Table A.2 nor greater than the maximum prevailing torque. After the first removal prevailing torque has been measured, back off the screw until the feature is disengaged from the nut thread.

Reassemble the screw to the specified tightening torque and remove four more times. On each removal, ensure that the feature is disengaged from the nut thread.

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During the fifth removal, measure the minimum torque occurring while the screw is being removed through the first 360° rotation after the tensile load has been reduced to zero. For the screw to be acceptable check that this torque is not less than the fifth removal prevailing torque value as specified in Table A.2. In addition, check that at no time during these four subsequent tightenings and slackenings does the torque exceed the maximum prevailing torque value specified in Table A.2.

To avoid overheating of the test assembly, allow sufficient time to elapse between the torque application cycles.

Check that the speed of installation and removal of the nut does not exceed 30 r.p.m. and is continuous and uniform.

Clean the test nut between the tests so as to ensure all prevailing torque feature material and lubricant is removed. Clean and examine the test spacer for conformance to **A.2**.

A.4.3 ***Headless set screws and studs***

Using a suitable thread stop, assemble the sample screw in a test nut, as detailed in **A.3**.

Advance the screw in the nut until all prevailing torque feature threads are in full contact with the test nut thread. Measure the maximum torque occurring while the screw is being advanced through the next 360° of rotation. For the screw to be acceptable, check that this torque does not exceed the maximum prevailing torque value as specified for the applicable screw in Table A.2.

Continue tightening until the screw is seated against the thread stop and the tightening torque specified in Table A.2 is achieved. Ensure that the thickness of the test nut is such that seating of the screw occurs when the feature is still fully in contact with the test nut thread. Prevent the thread stop from turning during screw tightening.

Slacken the screw by the application of reverse torque until the compressive load has been reduced to zero. Measure the minimum torque occurring while the screw is being removed through the next 360° of rotation. For the screw to be acceptable, check that this torque is not less than the first removal prevailing torque specified for the applicable screw in Table A.2 nor greater than the maximum prevailing torque. After the first removal prevailing torque has been measured, back off the screw until the feature is disengaged from the nut thread.

Reassemble the screw to the specified tightening torque and remove four more times. On each removal, ensure that the feature is disengaged from the nut thread.

During the fifth removal, measure the minimum torque occurring while the screw is being removed through the first 360° rotation after the compressive load has been reduced to zero. For the screw to be acceptable, check that this torque is not less than the fifth removal prevailing torque value as specified in Table A.2. In addition, check that at no time during these four subsequent tightenings and slackenings does the torque exceed the maximum prevailing torque value specified in Table A.2.

Clean the test nut between tests so as to ensure all prevailing torque feature material and lubricant is removed.

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Table A.2 — Performance requirements

Torque dimensions are in newton metres

Nominal thread diameter	Maximum tightening torque for the following classes:					Maximum prevailing torque for the following classes:	Maximum prevailing torque for the following classes:	Minimum prevailing torque	
	4.6	4.8	5.8	8.8	10.9	4.6, 4.8, 5.8	8.8, 10.9	First removal	Fifth removal
M4	1.2	1.5	2	3.4	4.8	0.7	1.2	0.15	0.1
M5	2.3	3.1	3.9	6.7	9.5	1.25	2.1	0.25	0.15
M6	4	5.3	6.6	11.3	16	2.4	4	0.4	0.25
M8	10	13	16	26.5	38	4.8	8	0.7	0.45
M10	—	—	—	55	78	—	14	1.2	0.8
M12	—	—	—	95	137	—	21	1.8	1.2
M14	—	—	—	150	218	—	31	2.4	1.6
M16	—	—	—	230	330	—	42	3.3	2.2
M18	—	—	—	345	470	—	56	4.4	3
M20	—	—	—	470	655	—	72	5.7	3.8
M24	—	—	—	750	1 000	—	106	9	6

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List of references (see clause 2)

Normative references

BSI publications

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BS 3643, *ISO metric screw threads.*
BS 3643-2:1981, *Specification for selected limits of size.*
BS 6104, *Mechanical properties of fasteners.*
BS 6104-3:1981, *Specification for set screws and similar threaded fasteners not under tensile stresses.*
BS 6105:1981, *Specification for corrosion-resistant stainless steel fasteners.*
BS 7371, *Coatings on metal fasteners.*
BS 7371-1:1991, *Specification for general requirements and selection guidelines.*
BS 7371-2:1993, *Specification for torque/clamping force relationship.*
BS EN 20273:1992, *Fasteners. Clearance holes for bolts and screws.*
BS EN 20898, *Mechanical properties of fasteners.*
BS EN 20898-1:1992, *Bolts, screws and studs.*
BS EN 20898-2:1992, *Nuts with specified proof load values.*

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 1134, *Assessment of surface texture.*
BS 1134-2:1990, *Guidance and general information.*

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